PROGRAM REVIEW

DEPARTMENT OF COMPUTER SCIENCE
UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

JANUARY 13-15, 2009

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1 Introduction

This report is the result of a self-study conducted over the last year of our department and its undergraduate and graduate degree programs. The larger questions we were asked to answer were:

- What do you do?
- Why do you do it?
- How well do you do it?
- What difference does it make whether you do it or not?
- How well does what you do relate to why you say you do it?

The format of our response largely follows the structure suggested by the Office of the Provost and the Graduate School. The report consists of the following sections, in this order:

- Program Overview
- Curricula
- Faculty
- Research
- Students
- Leadership, Administrative Support, Facilities and Equipment, Institutional Relationships
- The Future

In addition, several appendices provide detailed information and data to support the main document. Four of the appendices provide the results of a survey we sent to our current and past undergraduate and graduate students. Throughout the rest of this document, we refer to it as simply *the survey.* Comments representative of the majority of students have been included in various sections of the document. In addition, comments representing minority views that indicate specific problems are also discussed.

2 Program Overview

2.1 Mission

The Department of Computer Science at UNC Chapel Hill is the second oldest free-standing Ph.D. granting CS department. Since its founding in 1964 by Frederick P. Brooks, Jr., we have pursued the dual missions of research and education.

We see our research mission as pushing forward the state of the art in a few areas of computer science. Historically we have limited our research coverage in order to achieve critical mass in our research clusters and to promote peaks of excellence with a relatively small faculty size. Our research tends to be applied but includes a substantial theoretical component in support of the application. We focus on solving real problems, and this has led to extensive collaboration with researchers outside computer science. Recently we have somewhat diversified our areas of research, adding bioinformatics, computer security, computer vision, and robotics as new areas closely allied with existing strengths.

Our teaching mission has historically concentrated on graduate education, but we now also offer an undergraduate BS degree program and a significant set of introductory and perspective courses for the broader undergraduate population.

Within our graduate programs, the MS program trains practitioners for the computer industry and for other industries to which computing is central, while our Ph.D. program provides researchers for industry, academia, and government laboratories. Both degree programs provide exposure to current research and emphasize communication and writing. Doctoral students also receive instruction in teaching computer science, and teach a complete course as part of their requirements. Our graduate program has 125 – 160 students in a given year and has awarded over 800 MS and 200 PhD degrees to date.

Our undergraduate BSCS major was formally started in 2002, although we previously participated in the Computer Science option of the Mathematical Sciences Curriculum administered through the Mathematics department. In moving to our BSCS curriculum we raised the grade requirements needed to gain entrance to the BSCS and to graduate successfully. We also added more upper level computer science courses. This has resulted in a small program producing high quality graduates. However, the requirements leave little flexibility for the students in the major. Our BS program typically has 50 – 75 students.

In 2006, UNC implemented a major change in undergraduate curricula emphasizing "fundamental skills facilitating future learning, broad experience with methods and results of approaches to knowledge, and the integration of these skills and experiences across traditional disciplinary and spatial boundaries". In the context of these changes and in view of the central role of computing in many diverse fields, we believe there is now increased interest in and opportunity for computer science as a minor or as a BA degree program, offering more flexibility in its combination with a second major or area of application. Consequently we have created a CS minor, while our proposal for the BA is still under consideration by the university.

2.2 Demand

Demand may be measured by our degree production, course registrations, and demand for our students on graduation.

Degree production

The following table shows degree production over the last 5 years.

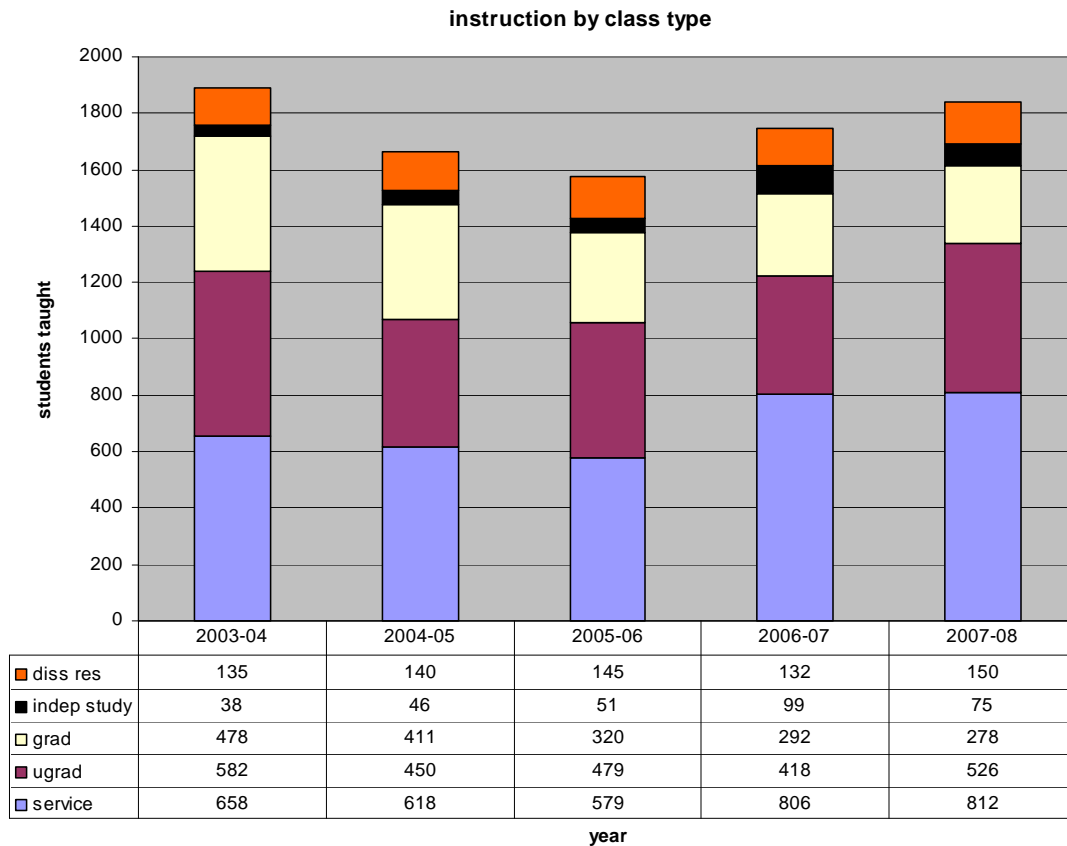| Year	BSCS	MS	PhD
2003-04	39	38	12
2004-05	29	28	15
2005-06	27	35	17
2006-07	23	28	14
2007-08	22	26	10
Total (5 years)	140	155	68

Our undergraduate BSCS program was started in 2002, just as the dot-com bubble began to burst. Our undergraduate degree statistics over the last five years follow national trends in declining enrollments in computer science. However we believe that interest is increasing due to strong projections for domestic demand in computer science, and increasing recognition that outsourcing is a worldwide search for talent more than a cost reduction measure, i.e. demand will remain strong for talented computer scientists. This year we are seeing increased enrollment in the lower level classes of the major.

The degree production in our graduate programs shows variability which results from differences in the sizes of incoming classes. These are set primarily by the availability of research funding (essentially all of our graduate students receive full-time support, and over 80% of that support is in the form of research funding or fellowships). Over the last ten years 298 MS and 109 PhDs were awarded. Thus MS production has remained steady at about 30 MS per year over the last decade, while PhD production increased markedly from 8 PhDs per year to nearly 14 PhDs per year in the last five years of the last decade.

Course demand

The following chart shows the number of students taught by type of class. The detailed breakdown of undergraduate and graduate students is not entirely accurate since upper-level undergraduate (500-level) and lower-level graduate courses (600-level) are attended by a mixture of undergraduate and graduate students but are classified here as undergraduate and graduate courses respectively.

After several years of decline in total number of students taught, a trend driven primarily by a decrease in the undergraduate major and the transfer of one of our large service courses into the business school, the last two years have shown significant increases in undergraduate instruction. This academic year (2008-09) we project a substantial increase that will put us well ahead of the 2003-04 level.

instruction by class type

	2003-04	2004-05	2005-06	2006-07	2007-08
■ diss res	135	140	145	132	150
■ indep study	38	46	51	99	75
□ grad	478	411	320	292	278
■ ugrad	582	450	479	418	526
■ service	658	618	579	806	812

year

Early experience with our minor option, in place for 2 years, indicates that the number of non-majors in our advanced undergraduate classes has increased significantly. For example, our upper-level undergraduate algorithms course has attracted 15% - 25% non-majors in recent offerings.

We have also observed increasing interest in our non-major service courses. These include basic fluency with information technology, introductory programming, and "Computers and Society", a course examining the cultural, social, philosophical, and economic implications of information technology on individuals, groups, and society. Our service courses also include popular first year seminars, in which groups of 20 students are introduced to computer science concepts through such means as computer animation and Lego robotics.

Demand for graduates
Our graduates at all levels are in great demand. Our undergraduates who enter industry typically have the highest average starting salaries in the university, as documented in Appendix B. Others are accepted into strong graduate programs in computer science, or go on to professional schools in medicine, law, or business.

Our graduate students have no trouble finding positions. Appendix D shows a list of our graduates and their initial jobs. We are a natural feeder for the high tech industry in the Research Triangle Park where many of our graduates work. Excellent students from all over the world come here for graduate education and then remain in the state.

2.3 Interdisciplinary activities and outreach

Many of our research projects focus on difficult and challenging computer science problems whose solutions will do some good, often outside computer science. As a result, we work on many of our interdisciplinary research projects with other departments, other universities, or with industry. Some examples follow:

- The weekly meetings of the *bioinformatics* group include researchers from genetics, biostatistics, and pharmacy, among others.
- The *Computer Integrated Systems for Microscopy and Manipulation* (CISMM) group includes physicists, biologists, chemists, applied mathematicians, and a variety of biomedical researchers.
- The *medical imaging* group has faculty with adjunct or joint appointments in the medical school, including the Biomedical Research Imaging Center, and the departments of radiology, radiation oncology, psychiatry, surgery, and biomedical engineering, among others.
- The *networking group* works with researchers from the department of statistics.
- Research on *physically-based modeling and simulation* includes applied mathematicians from the department of mathematics.

One of the greatest enablers of interdisciplinary work is joint meeting space close to all collaborators. We are fortunate that we are centrally located among the science and mathematics departments and very near to the medical school. As a consequence, all of our collaborators on campus are within a 10 minute walk from our department, where meetings are often convened. The newly completed Frederick P. Brooks Computer Science building extends our facilities and makes available significant new meeting spaces for collaborations. For off-campus collaborators, the main impediment is the lack of available parking for visitors.

Our curriculum includes courses with interdisciplinary components, including *Visualization in the Sciences (COMP 715, Physics 715, and Materials Science 715), Data Mining: Concepts, Algorithms and Applications (COMP 790-90, Genetics 713),* and *Research Administration for Scientists (COMP 918).*

Section 4 documents faculty with adjunct or joint appointments into and out of our department. We have a substantial number of adjunct faculty in our department from other departments, universities, and industry. We are interested in building more extensive collaborations with industry.

Outreach
Since many of our research efforts strive to improve another discipline, these are all examples of the department's engagement in outreach activities.

Other examples include the work of Gary Bishop and his students in enabling technologies that create hardware and software to assist people with disabilities. These are used worldwide and have been the subject of several awards for engaged scholarship. For example the Tar Heel Reader web site is used in 67 countries world wide to help teach reading. After just 6 months over 1800 small books have been created and have been read over 160,000 times. Anecdotally we hear of many kids who are reading now who did not read 6 months ago because of the site.

We also host high school students regularly to introduce them to our research, and we are also involved in service learning activities in which students in our courses teach elementary computing skills in communities in which such skills are missing.

2.4 Inter-institutional perspective

Over the years US News and World report has consistently ranked our program among the top twenty programs nationally[1], even as the number of Ph.D. granting departments has grown rapidly to more than 200 CS and CE departments in the US and Canada. US News and World Report also ranks some research areas, but they change over time. The last time Computer Graphics and HCI was included as a specialty (in 1999), we were ranked first. The 1995 National Academy survey ranked our department 29th in the U.S, and is due to be updated soon.

As mentioned before, long ago we made the decision to focus our research on a few areas within computer science, and to establish peaks of excellence in those areas. Since we remain a small department (we are less than 1/3 the size of some of the top departments in the country), we believe this still to be the correct strategy. However, we are diversifying and adapting our research areas over time, and are striving to achieve critical mass in these new directions of emphasis.

Our recent hiring goals target not only the new research areas of bioinformatics, computer security, computer vision and robotics, but also strengthen the existing research peak in medical image processing. While we have had success recruiting top faculty to our department in our recent hires, the overall tenure track faculty count has not increased (in fact it has decreased slightly). Modest faculty growth is critical to this department in order to advance in or even maintain our ranking (our peer departments are not standing still).

2.5 Previous evaluations

Our most recent program review took place in 1999. The review team included Professors James Morris (CMU), Barbara Liskov (MIT), Rich Riesenfeld (Utah) and William Wulf (Virginia), along with internal member Prof. Lee Pedersen from the UNC chemistry department. The recommendations of the review committee were:

1. Significant design and planning for a modern undergraduate major should be started.
2. An expansion of a research area, perhaps networking, should be undertaken
3. An external/internal search for a new chair should be started.
4. The college and department should form a partnership for guiding computer education at the university

The undergraduate major was created in 2002. Three additional faculty positions were created at the start of the undergraduate degree program (the faculty as a whole are responsible for all our degree programs – we do not have a "graduate faculty" and an "undergraduate faculty"). In the same year we hired in networking, computer vision, and computer graphics. These hires resulted in expansion of the computer graphics area, and expansion of the networking group. A long-standing history of collaboration with biomedical researchers resulted in the allocation of an additional position to the department from the university-wide genomics initiative. We hired a

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[1] This year there were eight departments tied at rank 20, including ours, so that really puts us among the top 27 programs.

new faculty member in the area of bioinformatics and data mining and became a participant in a new Ph.D. program in Bioinformatics and Computational Biology.

Finding a new chair proved to be difficult and Steve Weiss held the job for another 5 years until July 2004, when Jan Prins took over.

The partnership for computer education has not yet fully realized its potential; additional thoughts on this are offered in Section 8 (The Future).

3 Curricula

3.1 *Undergraduate Curriculum*

Mission statement

In conjunction with the overall missions of the University and the System, the academic undergraduate programs in the Department of Computer Science at UNC Chapel Hill have this mission:

> *Our programs will prepare the undergraduate student for a career in computing or a related field, or for graduate school in computer science or computer engineering, or for professional schools including law, medicine, and business. We seek to develop in our students a broad understanding of the theoretical and mathematical principles of computation, and their practical realization in physical devices and systems. We seek to develop in our students critical thinking skills for analyzing and solving computational problems; in addition, we seek to develop their abilities to work productively in teams. Finally, all graduates will be exposed to current computer science research. We intend to do this by bringing research results into almost all courses, and by offering students the opportunity to participate in our research programs.*

The department serves the undergraduate population at UNC through these curricular programs:

- Bachelor of Science in Computer Science
- Bachelor of Arts in Computer Science (pending)
- Minor in Computer Science
- Industrial Internship program
- Non-major service courses in computing and related technology

Each of these components is detailed in the sections following. For each section we present our goals, our means of measuring progress towards these goals, and the structure of the related curricular offerings and programs.

Computer Science Major
The department has established these goals and outcomes for the computer science major:

1. **Mastery of Knowledge Core in CS**.
   Students demonstrate an understanding of major concepts, theoretical perspectives, empirical findings and historical trends in the core of CS.

   Progress towards this goal is demonstrated by the exam scores of the classes taught.

2. **Preparation for Graduate School and Professional Technical Employment**.
   Students are successful in gaining technical employment in computing or related fields, or in gaining admission to high quality graduate programs, either in computing or related professions.

   Progress towards this goal is measured by annual UNC surveys of graduates, asking about employment and salaries; we do a periodic departmental survey of our graduates as

well, asking about the level of preparation they received from the department for their job or graduate studies.

3. **Critical Thinking Skills in CS.**
   Students demonstrate the use of critical and creative thinking skills in their approach to analyzing and solving computational problems.

   This goal is achieved through our honors program and with several team-based courses in which large semester-long projects are undertaken for local clients.

4. **Application of knowledge and critical thinking**
   Students demonstrate the application of their knowledge, research skills and critical thinking in the completion of a significant research project.

   This goal is pursued via our honors program, our new industrial co-op program, team project courses, and through individual independent research and study projects.

We currently offer the BS degree, and are seeking approval for a BA degree as well. Both programs share these goals, with slight differences in degree of emphasis. The BA program in particular has less emphasis on preparation for graduate school in Computer Science; it does, however, seek to provide preparation for graduate school in other areas where technical knowledge in some depth will be useful.

Course Titles
The following courses are offered at the major level, either by our department, or cross listed with other departments. We will refer to these in describing both the BS and BA majors.

COMP 401 Foundation of Programming
COMP 410 Data Structures
COMP 411 Computer Organization
COMP 416 Introduction to WWW Programming
COMP 426 Advanced WWW Programming
COMP 590 Enterprise Computing in WWW
COMP 431 Internet Services and Protocols
COMP 455 Theory of Computation
COMP 520 Compilers
COMP 521 Files and Databases
COMP 523 Software Engineering Laboratory
COMP 524 Programming Language Concepts
COMP 530 Operating Systems
COMP 535 Computer security
COMP 541 Digital Logic and Computer Design
COMP 550 Algorithm Analysis
COMP 575 Introduction to Computer Graphics
COMP 580 Enabling technology
COMP 585 Serious games
COMP 590 Topics in Computer Science
COMP 715 Visualization in the Sciences
MATH 381 Discrete Math
MATH 566 Numerical Analysis

STOR[1] 215 Introduction to the Decision Sciences

3.1.1 Bachelor of Science

The BS in computer science was started in 2002. We had been teaching much of the curriculum for more than a decade prior to that, but as a major in Mathematical Sciences curriculum.

Required Courses
COMP 401, 410, 411, and 550
MATH 231, 232, 233 (calculus sequence), 381 (discrete math), and 547 (linear algebra)
PHYS 116 and 117 (calculus-based)
STAT 435 (probability and statistics)

Six courses from the computer science Distribution Requirement list (below), with at least one course in each of the programming languages group, systems group, theory group, and applications group, with no more than one course from the interdisciplinary group.

Distribution Requirement
The following courses may be used to satisfy the Distribution Requirement:

Theory Group (At least 1 course)	• MATH 566: Numerical Analysis • COMP 455: Models of Languages and Computation
Systems Group (At least 1 course)	• COMP 431: Internet Protocols and Services • COMP 530: Introduction to Operating Systems • COMP 541: Digital Logic and Computer Design • INLS 578: Protocols and Network Management
Programming Languages Group (At least 1 course)	• COMP 520: Compilers • COMP 524: Programming Language Concepts • COMP 523: Software Engineering Laboratory
Applications Group (At least 1 course)	• COMP 416: Introduction to WWW Programming • COMP 426: Advanced WWW Programming • COMP 521: Files and Databases • COMP 575: Introduction to Graphics

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[1]STOR is Statistics and Operations Research.

Interdisciplinary Group (At most 1 course)	• MATH >520: Any MATH course numbered greater than 520 • OR 415, 445, 515: Appropriate courses from Operations Research • LING 540: Appropriate courses from Linguistics • INLS 485, 509, 512: Appropriate courses from Information & Library Science • BMME 410, 430, 440: Appropriate courses from Biomedical Engineering

Other computing-related courses than those listed in the interdisciplinary group can be counted as an interdisciplinary course, with the (advance) approval of the Director of Undergraduate Studies in the Department of Computer Science.

Of special note are the requirements that:

- Completion of PHYS 116 and 117, MATH 231, 232, 233, and 381 (or OR 215), COMP 401, 410, and 411, with a grade of C or better in each course is required for admittance into the computer science major.
- In order to graduate, students must amass a GPA of 2.0 or higher and receive no grade lower than a C- in the nine required junior/senior courses: COMP 550, MATH 547, STAT 435, and the six required Distribution courses.

Additional requirements beyond the College requirements
The liberal arts focus of the College of Arts and Sciences prescribes a broad general education, which separates our BSCS from typical programs in an engineering school. For our BSCS program, the College requirements are further extended with

- Completion of the Foreign Language requirement through level 4.
- Four additional non-computer science electives (at least one from the humanities/fine arts, at least one from the social sciences, and at least one from the natural sciences).

3.1.2 Bachelor of Arts (proposed)

We are in the process of creating a major leading to the degree of Bachelor of Arts in Computer Science. The program as described here has been approved by the Dean of the College of Arts and Sciences, and is currently going through the approval process of the UNC system.

Compared to our BS major, we require fewer science and math courses for the BA. We allow space in the BA program for a student to pursue a broader and richer exposure to the traditional liberal arts, specifically in areas where computing is having an enabling impact. Correspondingly, the BA encourages cross-disciplinary study by allowing a cluster of courses from other departments that teach a computing application area.

A student in the proposed BA program, in addition to fulfilling the degree requirements of the general college, will satisfactorily complete the following courses (with a grade average of C or better, and no grade below C- in COMP courses):

MATH 231 (Calculus)
MATH 381 or STOR 215 (Discrete structures)
STOR 155 or STAT 435
2 courses in lab science (a sequence, or intro semesters in 2 different sciences)
COMP 401 (Second programming course, with lab 4hrs) [1]
COMP 410 (Data structures)
COMP 411 (Machine organization)
6 additional courses:
1 COMP from the languages group
1 COMP from the systems group
1 COMP from the applications group
3 courses approved by the undergraduate studies committee in COMP and/or related disciplines
(e.g. biology, business, information and library science, math, physics)

We are essentially lifting the requirement for MATH 547, MATH 232 and 233, and COMP 550, thereby freeing 4 course slots, thus allowing BA students to take a broader selection of liberal arts courses.

Distribution requirement
The COMP courses beyond the specific required ones are drawn from the same groups as the BS program, with the addition that the Interdisciplinary group has a broader range of courses drawn from areas of computing application in the liberal arts:

Interdisciplinary group (examples only—other courses accepted with permission)
        E-commerce in the Business School
        BMME, CHEM, BIO, genetics
        Operations Research
        Mathematics beyond MATH 520
        Linguistics
        Journalism, Art (multimedia)
and others as we identify them

This "group" is really a requirement that the student select a course with computing content related to an application of computing. Approval for the selection comes from the Undergraduate Studies committee in our department.

Constraints
In order for a student to graduate with the BA major, he or she must earn a C average in the courses taken, with no grade below a C- in each COMP course. To be considered for a degree with honors, a student must have an overall grade point average of 3.2 (or 3.6 for highest honors), take an additional course beyond the 14 shown above (an Honors Project section of COMP 396), and perform satisfactorily on an honors oral examination.

3.1.3 Computer Science Minor

The minor in computer science was created and approved in 2005.   The goals of this program are:

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[1] COMP 110/116, Introductory Programming is prerequisite to COMP 401. However, we expect most potential COMP majors to have had the equivalent of COMP 110/116 before entering UNC.

1. Preparation for Graduate School and Professional Employment.
Students will be successful in gaining employment in fields where an understanding of the basics of digital information and information processing is advantageous, or in gaining admission to high quality graduate programs where knowledge of the basis for our digital information based society is an advantage.

Progress towards this goal is measured by annual UNC surveys of graduates, asking about employment and salaries; we do a periodic departmental survey of our graduates as well, asking about the level of preparation they received from the department for their job or graduate studies.

2. Critical Thinking Skills.
Students demonstrate the use of critical and creative thinking skills in their approach to analyzing and solving problems. This goal is achieved through mastery of basic programming, and with several team-based courses in which large semester-long projects are undertaken for local clients.

To get a minor in computer science a student must complete 5 courses as follows:

COMP 401
COMP 410 or COMP 411
Any three additional courses above COMP 400.

- Students with the appropriate pre-requisites (for example, from a MATH major) may include MATH 381/STOR 215 and MATH 566 towards (3) above (however, please take note of the last point below)
- Grade of C or better in at least 12 hours of the minor courses
- Including "Topics" courses, such as COMP 590 and 390, requires approval of the Undergraduate Studies committee in the Computer Science department.
- Alternatives to these requirements must be approved by the Undergraduate Studies committee.
- No course may be counted for both the computer science minor and any major.

We are already seeing encouraging interest in the minor. For example, our fall 2008 enrollment in COMP 550 (Algorithm Analysis) was 20 students, with half of them being majors in other departments (and hence taking the class as a CS minor or simply out of interest).

3.1.4 Industrial Internship Program

In 2007 we received approval for our industrial internship program for majors, although recent attempts to create the first use of this program have run into obstacles.

While internship programs are common in engineering schools, they are unknown at UNC-CH; ours is the first. We believe that experiential learning is a critical component of an undergraduate computer science education, and this program offers an opportunity for a significant amount of it in a realistic setting. It also makes us more competitive with other universities where computer science is found in an engineering context.

Our students are allowed to take a 7 month internship to include the summer and either the fall or spring semester working in an organization on an appropriate assignment. The internships are positions with both local and national companies.

While on the internship, the student is considered a full-time student at UNC-Chapel Hill, making him or her eligible for

- On campus housing
- Student health services
- Athletic tickets
- Access to library, gym and campus network facilities
- Retained priority for course registration

For students on financial aid, the financial aid is suspended for the duration of the internship, but resumes when the student returns to a regular class schedule.

The student registers for a 3-credit course and pays tuition at that rate. Fees depend on whether or not the student is a North Carolina resident. The 3-hour course will count toward the 120 hours required for graduation and the six courses needed for the Computer Science degree, but not toward any of the specific distribution group requirements. Based on the particulars of the internship, the student may petition that the course be counted toward one of the group requirements.

To complete the course, the student is required to write a paper and give a presentation on the work experience when he/she completes the internship.

3.1.5 Non-major Service Courses

Basic Computing Technology and Practice
The computer science department teaches several courses that are intended to serve the general student population of the university instead of specifically our majors. We believe that understanding some basics about our digital information-based society -- how digital technology functions, its common uses, and its implications on human interactions – is fundamental knowledge that is important for all students regardless of major discipline. To this end we teach the following courses, and try to offer enough sections to absorb the demand.

COMP 101 Fluency in Information Technology
COMP 102 Computer-mediated Communication
COMP 110 Introduction to Programming
COMP 116 Introduction to Scientific Programming
COMP 121 Introduction to Functional Programming
COMP 185 Serious Games
COMP 371 Language and Computers (LING 301)
COMP 380 Computers and Society
COMP 381 Computers and Society (for students with programming knowledge)
COMP 396 Independent Study

After several years of lowered enrollments early in this decade, demand for our service courses has been surging in the past 3 years. We currently cannot meet the demand for COMP 380 even though we offer 2 or 3 sections of size 40 each semester; COMP 110 and 116 have high demand as well, and the only way we can meet that demand is to offer very large sections (on the order of 100 to 150 students each).

First Year Seminars

The department also offers several courses as part of the First Year Seminar (FYS) program created by the College of Arts and Sciences. FYS courses are taken by first year undergraduate students and are limited to 20 students per seminar. The format is discussion-based and emphasizes hands-on activities, including writing, oral presentations, and creative projects such as digital movie making or robot building. FYS courses expose new students early in their college careers to the flavor of computer science and the research going on at UNC.

On average we offer three[1] of the following FYS courses each academic year (consult our course descriptions in Appendix H for more detail)

COMP 050 Computers Make It Possible
COMP 051 Entrepreneurship
COMP 056 The World Wide Web: What, How & Why
COMP 060 Robotics with LEGO®
COMP 061 3D Animation with Computers
COMP 065 Folding, From Paper to Proteins
COMP 066 Random Thoughts
COMP 070 Computability, Unsolvability, and Consciousness
COMP 080 Enabling technology (assistive technology for persons with disabilities)

3.2 Graduate Curriculum

The M.S. and Ph.D. programs are research oriented. Of course, Ph.D. students must engage heavily in research, and we have recently changed the curriculum to enable them to begin research earlier than before. In addition, we also strongly encourage all of the M.S. students to work with a faculty member on a research project. To facilitate this, we allow up to six hours of academic credit for independent M.S. research. A small number of M.S. students also opt to write a thesis.

The Department welcomes applicants with undergraduate degrees from all disciplines, but some experience in computer science is required. Over the last decade, we have raised the expectations to now include mathematics, programming, machine organization, data structures, algorithm analysis, theory of computation, digital logic, and numerical methods. Excellent students who are lacking some of these prerequisites can take them as remedial courses once here. We expect the typical student to take one or two remedial courses.

We redesigned the curriculum over the 2006 and 2007 academic years with the goal of engaging all graduate students in research as early in their programs as possible, ideally beginning in the first semester. The changes include both course requirements for the M.S. and the Ph.D., as well as the process of advancement to the Ph.D. program.

The formal requirements for the M.S. and Ph.D. degrees are outlined below, while descriptions of the courses are given in Appendix H.

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[1] Our average exceeds the required level of two seminars per year by 50%. Our seminars are popular and we are fortunate thus far to have had great teachers leading these courses.

3.2.1 The M.S. program

The M.S. requires thirty credit hours, of which up to six may be transferred from elsewhere (a Graduate School rule), and can include up to six hours of thesis credit. Master's theses are now rare but many M.S. students work on research projects and write papers or reports describing the results. Although a student may orient course work to a specialty of interest, we mandate breadth of knowledge by requiring students to take at least one course in each of three major categories: theory, systems, and applications.

All Master's students must pass an oral or written examination; most opt for the written exam. The oral exam is given by a committee composed of three faculty members. The current form of the written exam is a paper of wide breadth, with an extensive survey of the literature relevant to the topic. The paper is written under the supervision of a faculty member and typically undergoes multiple revisions. The paper is then read and must be approved by a second faculty member. The second reader may also request changes and may perhaps wish to read the paper twice. However the process is designed so that the burden on the second reader is typically a single pass.

Each student is required to have programmed and documented a product-quality program product. This means that the student must demonstrate experience in the design, development, and documentation of a software product of significant size and complexity (preferably as part of a team). Evaluation of this requirement on the survey of graduates is generally positive but mixed, with 14 agreeing that it was useful (2 strongly), 6 disagreeing (3 strongly), and 11 neutral.

Terminal M.S. students usually finish in two years, taking three courses per semester and serving as a teaching or research assistant. Some who have taken two graduate courses during their undergraduate study can finish in three semesters. We typically do not provide M.S. students financial support for more than four semesters.

3.2.2 The Ph.D. program

Recent changes to our Ph.D. program were designed to facilitate a very early start on research for our new students. We decided to pursue this goal for several reasons, among them the more competitive nature of the academic job market, which requires candidates to have many more publications than those of graduates of a decade ago. This goal of earlier (and more) publication appears to be shared by our graduates. There were several survey comments on this topic. One says

> "Many positives from the program, however two things that hampered me are the lack of professional development for academics and the lack of focus on publications (so, my CV was not competitive until after I was a postdoc and published a lot)."

Additionally, we wanted to be able to better evaluate the research potential of second-year students as part of our process of advancement to Ph.D. studies. Finally, many of our students come with a Masters degree from another university.

Although we do not place much weight on a student's stated degree intent during the admissions process (that intent changes with experience, some students indicate Ph.D. to maximize chances of financial support, etc.), we require Ph.D. intending students to qualify by the end of their

second year. Support beyond four semesters is not typically provided to students who have not been approved to continue for a Ph.D.

The evaluation of the potential of Ph.D. intending students is done using multiple measures, and approval to continue is granted or denied by vote of the full faculty after discussion during a faculty meeting. Probably of most importance is testimony from faculty members who have taught or worked with the candidate. Of course, course grades are also an important measure. We have tried using the results of written and oral exams as another indicator of potential, but were not satisfied because they did not necessarily measure the will, as well as the capacity, to do independent research.

In order to evaluate research potential, we require Ph.D. intending students to present the results of their work to a group of three faculty members. Two weeks before the presentation, the student must submit a written report (essentially the length and style of a conference paper) to the three examiners. The format of the presentation begins with a public and widely announced talk, similar to one that would be given at a conference. This is followed by questions from the whole audience and public questions from the group of three designated examiners. Finally, the examiners may question the candidate in a closed session for up to an hour. The committee of three is chosen by the chair of the Examinations Committee, and the faculty member who advised the student may not be a member. However, the advisor may sit in on the exam. The evaluation of the three examiners is presented during the meeting of the full faculty.

Ph.D. intending students are required to make a first presentation near the end of the third semester. If the student does not receive approval to proceed to the PhD, he or she may make a second and final attempt during the fourth semester.

There are course requirements for the Ph.D. In addition to three or four courses in the primary area of research, we require six courses in diverse areas to ensure breadth of knowledge.   The formal rules are somewhat involved, but the gist is that students must take two courses in each of the following categories: theory and formal thinking, systems and hardware, and application. We allow course from outside of computer science that either support the student's research directly, or the field of CS in general. These are often courses in disciplines such as mathematics, but may also be in areas, such as genetics, that are associated with the specific dissertation topic.

The survey of graduates covers several versions of the course requirements, not just the recent set. However, respondents generally felt that the requirements were reasonable (12 strongly agree, 16 agree, 3 are neutral, and only two disagree).

The faculty believes that teaching is an important role of a PhD, not only if the graduate enters academia, but also in the corporate laboratory environment. To train students in the craft, we offer a course in teaching. After taking it, PhD students are required to teach a full semester class.   Often the graduate student will teach a section of introductory programming, but sometimes a more advanced undergraduate course, such as computer graphics or programming languages.

Ph.D. candidates must write a formal dissertation proposal and present it at a meeting of the student's committee. The committee of at least five members is selected by the student and the advisor, but the composition must follow university rules. The committee may approve the proposal, or ask the student to revise it. Approval is followed by an oral exam, typically at a second meeting. The exam is meant to evaluate the student's knowledge, primarily in the area of the dissertation. At some universities the proposal and the exam are both held during the same

session. We do not follow that practice because we believe that the proposal meeting is one in which all parties are working together to craft the best research plan possible, which is difficult if the student is concerned about the pending exam.

Course offerings

A full list of courses offered by the Department is included in Appendix H. The table below show the courses offered and enrollment for the last five years. Undergraduate-only courses are numbered 0 – 400, upper level undergraduate courses and lower level graduate courses are available for undergraduate or graduate credit and are numbered 500 – 699. Courses available only for graduate credit have numbers from 700 up. COMP 590, 790, and 990 are special topics courses whose contents vary by semester and instructor.

Two trends may be observed in course registrations. The first is that registration in general graduate courses has dropped in numbers. This is because we now encourage first-year graduate students to register for readings and research courses to begin exploring research. The second trend is a more even distribution of students throughout the course offerings. The new breadth requirement, which is based on areas rather than a handful of specific courses, has likely caused this.

In the survey, we asked former and current graduate students whether the courses they wanted to take were offered. Former graduate students overwhelmingly agreed (45 of 47), but there was a bit more disagreement among the current students (64 agree, 7 disagree, and 11 are neutral). The comments are not very helpful because the reasons for disagreement vary widely and include: lack of theory courses, no machine learning, and low frequency of offering of some courses.

The following table lists the enrollments in courses offered over the last five years.

Course #	Title	03/04	04/05	05/06	06/07	07/08
50	FYS: Computers Make it Possible	-	-	44	-	-
51	FYS: Technology and Entrepreneurship	-	-	-	15	19
52	FYS: Make a Difference	-	13	-	-	-
60	FYS: Robotics with LEGO	19	-	18	18	19
61	FYS: 3D Animation with Computers	19	20	-	17	-
65	FYS: Folding, From Paper to Proteins	-	15	-	-	-
66	FYS Random Thoughts	-	10	7	-	-
70	FYS: Philosophy	16	20	-	-	-
80	FYS: Enabling Technology	-	-	-	-	21
101	Computers: Power Tools for the Mind	171	227	50	-	41
110	Introduction to Programming	322	211	238	387	308
116	Introduction to Scientific Programming	17	37	71	117	135
380	Computers and Society	93	97	173	205	225
392	Practicum	-	-	-	1	1
396	Independent Study in Computer Science	7	9	3	20	13
401	Foundation of Programming	46	30	68	93	99
410	Data Structures	58	65	80	55	57
411	Computer Organization	58	34	46	38	57
416	Introduction to WWW Programming	69	55	29	49	
426	Advanced WWW Programming	45	19	16	20	18

Course #	Title	03/04	04/05	05/06	06/07	07/08
431	Internet Services and Protocol	37	21	29	9	14
455	Models of Languages and Computation	62	46	35	24	30
486	Applications of Natural Language Processing	-	1	-	-	-
520	Compilers	-	-	-	13	-
521	Files and Databases	43	-	11	18	4
523	Software Engineering Laboratory	30	29	22	22	30
524	Programming Language Concepts	-	-	12	15	15
530	Operating Systems	15	20	20	14	14
541	Digital Logic and Computer Design	-	7	12	12	-
550	Algorithms and Analysis	32	52	34	25	37
575	Introduction to Computer Graphics	29	24	19	14	17
590	Topics: Enabling Technology	7	-	3	-	-
590	Topics: Digital Computer Design	-	-	-	-	-
590	Topics: Mobile Computer Peer to Peer	1	-	-	-	-
590	Topics: Misc.	24	20	12	14	14
590	Topics: Computer Hardware	9	-	-	-	-
590	Topics: Enterprise Computing	11	11	10	-	3
590	Topics: Intrusion Detection	3	3	-	-	-
590	Topics: Enterprise Systems	-	1	-	-	-
590	Topics: Artificial Intelligence	-	-	15	-	-
590	Topics: and Network Security	-	-	8	-	-
590	Topics: Bioinformatics	-	-	-	5	-
590	Topics: Serious Games	-	-	-	2	8
590	Topics: Robotics	-	-	-	1	-
590	Topics: Bioalgorithms	-	-	-	1	-
590	Topics: Topics in Computer Security	-	-	-	4	-
631	Computer Networks	-	-	29	2	2
633	Parallel and Distributed Computing	28	-	20	-	14
651	Computational Geometry	29	15	26	-	28
662	Scientific Computation	-	11	8	13	4
665	Images, Graphics, and Vision	23	25	18	21	6
715	Visualization in Sciences	-	8	2	12	14
723	Software Design and Implementation	-	36	21	-	8
730	Operating Systems	13	-	9	10	2
734	Distributed System	29	16	7	9	6
735	Distributed and Concurrent Algorithms	-	9	-	8	-
737	Real-Time Systems	6	-	4	-	4
740	Computer Architecture and Implementation	21	23	30	4	9
744	VLSI Systems Design	1	4	-	-	-
750	Algorithm Analysis	19	34	10	14	-
752	Mechanized Mathematical Inference	-	-	-	2	-
763	Semantics and Program Correctness	-	-	-	-	-
764	Monte Carlo Method	-	2	1	1	-
766	Visual Solid Shape	10	-	7	-	7
768	Physically Based Modeling and Simulation	18	7	-	-	18
770	Computer Graphics	21	11	17	2	-
775	Image Processing and Analysis	16	6	13	5	-
776	Computer Vision in Our 3D World	16	8	12	-	17

Course #	Title	03/04	04/05	05/06	06/07	07/08
790	Topics	8	-	-	-	-
790	Topics: Medial Representations	-	-	-	5	-
790	Topics: Enabling Technology	5	6	4	-	-
790	Topics: Network-based Intrusion	-	15	-	-	-
790	Topics: OS Implementation	-	-	-	5	-
790	Topics: Graphics Hardware	10	-	7	-	3
790	Topics: Robot Motion Planning	13	12	12	14	16
790	Topics: Extreme Programming	16	-	22	-	-
790	Topics: Real Time OS	-	-	-	4	-
790	Topics: Distributed Collaboration	-	11	-	8	-
790	Topics: Visualization in the Sciences	11	-	-	-	-
790	Topics: Robotics	-	-	-	17	-
790	Topics: Real-time Sched. Theory	5	-	-	6	-
790	Topics: Application Optimization in Bio	9	1	-	-	-
790	Topics: Admin for Scientists/Research Admin	8	-	-	-	-
790	Topics: Clockless Circuits	6	-	7	-	5
790	Topics: Mobile Computing	5	-	-	-	-
790	Topics: Data Driven Moel in CS/XBOX Science	-	7	-	4	-
790	Topics: Topics in Networking	17	-	-	7	-
790	Topics: 3D Photography / 3D Urban Modeling	-	10	-	5	-
790	Topics: Computing Using GPUS	7	17	6	20	-
790	Topics: Serious Games	-	-	-	10	12
790	Topics: Topics in Computer Security	-	-	-	-	7
790	Topics: Vision and Image Analysis	-	-	-	-	16
825	Logic Programming	-	-	-	-	-
831	Internet Architecture and Performance	6	-	7	-	2
832	Multimedia Networking	10	12	-	5	3
841	Advanced Computer Architecture	-	-	-	6	-
870	Advanced Image Synthesis	-	12	-	29	-
872	Exploring Virtual Worlds	-	6	-	7	3
875	Recent Advances in Image Analysis	11	-	13	-	4
892	Practicum	13	12	15	16	
911	Professional Writing in Computer Science	38	41	25	8	8
915	Technical Communication in Computer Science	23	17	11	17	15
916	Seminar in Professional Practice	7	-	6	-	-
917	Seminar in Research	-	-	5	-	-
990	Research Seminar in Computer Science	4	1	8	-	1
991	Reading and Research	20	163	39	72	61
993	Master's Thesis	6	5	7	5	4
994	Doctoral Dissertation	129	143	138	128	132

3.3 Changes under consideration

As the surveys show in Appendices I-L, overall the students are happy with the curricula and the requirements. Nonetheless, they raise specific issues that expose some of the weaknesses of our program, which we mention here.

Introductory undergraduate courses in the major. One student complained that many undergraduate courses are rather "light." Several mentioned that there is much variance in what is taught in some of the mandatory courses based on who is teaching these courses. We believe this is partly true: our current introductory programming courses often repeat information, and one of them, the data structure course, focuses on the use of data structures provided by standard libraries rather than their implementation. To remedy this problem, we are revamping the introductory courses.

One of them, Comp 110, is a Java-based introductory programming course targeted at students who have no programming experience. Currently, it is taught by both teaching assistants and faculty members, and what is covered indeed varies tremendously. We have recently standardized this course based on the class notes, slides and software of one of the faculty members after an extensive review of this material by the undergraduate committee.

The first course for students with programming experience is Comp 401. This is a Java-based course that currently covers the use of data structures. The next course is 410, and it currently covers design patterns, testing methods, and software principles. Based on student feedback with offerings of these courses and their previous incarnations, we propose to put in Comp 401 design patterns and other advanced programming ideas, and more importantly, the use of these concepts in compelling graphical interfaces. This course will thus cover "programming in the large," involving a large number of classes and interfaces, and simple data structures. The next course, Comp 410, will cover "programming in the small" of complex data structures, and will focus on the implementation rather than use of these data structures.

Advanced undergraduate courses. Several students have complained that offerings of undergraduate operating systems and compilers are not frequent enough and that the database course is too light. We intend to increase the frequency of these courses, and also intend to create some new upper-level undergraduate courses in computer security and parallel computing. We will try to engage a faculty member to take on the challenge of creating a modern and challenging database course. One possible approach is a future bioinformatics faculty hire with a strong background in databases. Similarly, a future hire in computer security may also have a focus strongly allied to databases, operating systems, or programming languages. We are investigating incentive mechanisms for faculty to undertake the extensive course development efforts required, as well as to encourage more faculty to teach such courses.

Graduate writing and software product requirement. One of the distinguishing characteristic of our graduate program is the insistence that students create a complex technical document and software product. These two requirements can be met by taking writing/software engineering courses. They can also be satisfied using software and documents created outside the classroom. However, there is no standard approach for evaluation. As a result, while most students like the idea of these requirements, some have complained that the hurdles imposed on them were very low or non-existent. We plan to, therefore, consider these requirements in more depth, and either scrap them or impose uniform standards for them.

Ph.D. entrance exam. In the last ten years, we have had three different exams for admission into the Ph.D. program. The first, called the CCE, was a course specific written test. The second, called the Quals, was a more abstract oral exam focusing on creativity rather than expertise in a specific field. In this exam, the candidate answered questions chosen by faculty members, drawing on basic material in the set of courses taken by the student. The latest examination, called the PRP, is an exam on oral and written presentations of research undertaken by the candidate. While the student surveys show that students have liked each version of the exam

more than the previous one, our experience shows some weaknesses in the current exam. Some faculty members feel their longer term impressions are more meaningful than those created in these exams. We have also found that there is much variance in the amount of help students get from their advisors in the written document they submit. Finally, students are expected to take the exam in their third semester. Some faculty members feel it is unrealistic to expect meaningful research in such a short time. Therefore we are considering ways to remedy these problems by, for instance, eliminating the requirement for a written document.

4 Faculty

The faculty for the 2008-09 academic year is shown below. A brief resumé covering activities in the past five years is given for each faculty member in Appendix M. The state funds all of our tenure-track faculty plus three non tenure-track faculty members as well as a fraction of the associate chairman for administration (indicated with asterisks). All other non tenure-track faculty members are funded from grants, contracts, or gifts to the Department. Adjunct faculty members are supported by their home departments.

Tenure-Track Faculty

Professors (19)
    James Anderson
    Sanjoy Baruah
    Gary Bishop
    Frederick P. Brooks, Jr., Kenan Professor (Fixed term 50%)
    Prasun Dewan
    Henry Fuchs, Federico Gil Professor and Adjunct Professor of Biomedical Engineering
    John Halton (Fixed term 50%, retiring 6/30/09)
    Kevin Jeffay, Gillian Cell Distinguished Professor and Director of Undergraduate Studies
    Anselmo Lastra, Director of Graduate Studies
    Ming Lin, Beverly W. Long Distinguished Professor
    Dinesh Manocha, Phi Delta Theta/Matthew Mason Distinguished Professor
    Stephen Pizer, Kenan Professor and Adjunct Professor of Radiology, Radiation Oncology, and Biomedical Engineering
    David Plaisted
    Jan Prins, Chair
    Michael Reiter, Lawrence M. Slifkin Distinguished Professor
    John Smith
    Jack Snoeyink
    P. David Stotts, Jr., Associate Chair for Academic Affairs
    Stephen Weiss (Fixed term 50%, retiring 6/30/10)

Associate Professors (6)
    Kye Hedlund
    Ketan Mayer-Patel, Director of Graduate Admissions
    Leonard McMillan
    Fabian Monrose
    Montek Singh
    Wei Wang

Assistant Professors (4)
    Ron Alterovitz
    Jasleen Kaur
    Svetlana Lazebnik
    Marc Niethammer

Non Tenure-Track Faculty

Jan-Michael Frahm, Research Assistant Professor
Diane Pozefsky, Research Professor
Tim Quigg*, Lecturer and Associate Chair for Administration and Finance
F. Donelson Smith, Research Professor
Martin Styner, Research Assistant Professor
Russell Taylor II*, Research Professor of Computer Science, Physics, and the Curriculum of
    Applied and Materials Science
Leandra Vicci*, Lecturer and Director of the Applied Engineering Laboratory
J.M. Walsh*, Senior Lecturer and Director of General Studies (retiring 12/31/08)
Greg Welch, Research Associate Professor
Mary Whitton, Research Associate Professor

Retired Faculty

Peter Calingaert, Professor Emeritus
Gyula Mago, Professor Emeritus
Donald Stanat, Professor Emeritus
William Wright, Research Professor Emeritus

Visiting and Adjunct Faculty

Stephen Aylward, Adjunct Associate Professor
    Associate Professor, UNC Radiology
Elizabeth Bullit, Adjunct Professor
    Van L. Weatherspoon, Jr. Distinguished Professor of Surgery (UNC)
Nick England, Adjunct Research Professor
    President, 3rdTech, Inc.
Mark Foskey, Adjunct Research Assistant Professor
    Research Assistant Professor, UNC Department of Radiation Oncology
Robert Fowler, Adjunct Professor
    Director of HPC Research, Renaissance Computing Institute (RENCI)
Guido Gerig, Adjunct Professor
    Professor of Computer Science, Scientific Computing and Imaging Institute, Director of
    Center for Neuroimage Analysis, University of Utah
Morgan Giddings, Adjunct Associate Professor
    Associate Professor, UNC Departments of Microbiology & Immunology and Biomedical
    Engineering
Chris Healey, Adjunct Associate Professor
    Associate Professor of Computer Science, N.C. State
M. Gail Jones, Adjunct Professor
    Professor of Science Education, N.C. State
Sarang Joshi, Adjunct Associate Professor
    Associate Professor, Department of Bioengineering, University of Utah
Hye-Chung Kum, Adjunct Assistant Professor
    Research Assistant Professor, UNC School of Social Work
J. Stephen Marron, Adjunct Professor
    Amos Hawley Distinguished Professor, UNC Department of Statistics and Operations
    Research
Steven Molnar, Adjunct Associate Professor
    Senior Architect, NVIDIA Corporation
Frank Mueller, Adjunct Associate Professor

Associate Professor, North Carolina State University
Andrew Nobel, Adjunct Professor
    Professor, UNC Department of Statistics and Operations Research
Lars Nyland, Adjunct Associate Professor
    Senior Architect, NVIDIA Corporation
Maria Papadopouli, Adjunct Assistant Professor
    Assistant Professor, University of Crete
John Poulton, Adjunct Research Professor
    Senior Engineer, Rambus, Inc.
Julian Rosenman, Adjunct Professor
    Professor, UNC Radiation Oncology
Diane Sonnenwald, Adjunct Associate Professor
    Associate Professor, The Swedish School of Information & Library Science, Göteborg
    University & University College of Borås, Sweden
Richard Superfine, Adjunct Professor
    Bowman and Gordon Gray Professor of Physics and Astronomy (UNC)
Alexander Tropsha, Adjunct Professor
    Professor and Chair, UNC School of Pharmacy
Sean Washburn, Adjunct Professor
    Distinguished Professor and Chair, UNC Physics and Astronomy

Postdoctoral Researchers
Jur van den Berg
Seon-Joo Kim
Sharif Razzaque
Christopher Zach

4.1 Overall assessment of the faculty

Faculty distribution by rank and age
Figures 1.1 and 1.2 depict rank and age distributions, respectively, for our tenure-track faculty. As seen in Figure 1.1, we are a rather top-heavy department, with 19 full professors, six associate professors, and four assistant professors. In addition, we also have ten non-tenure track faculty members, comprised of lecturers and research professors. Their age distribution roughly follows that of the tenure-track faculty.
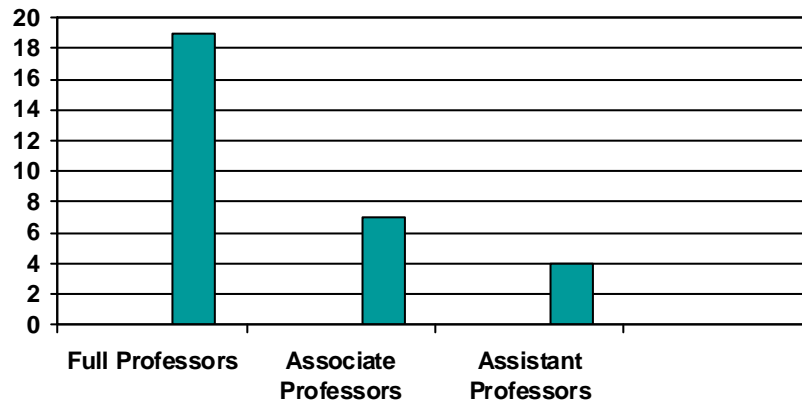
FIGURE 1.1: TENURE-TRACK FACULTY DISTRIBUTION BY RANK
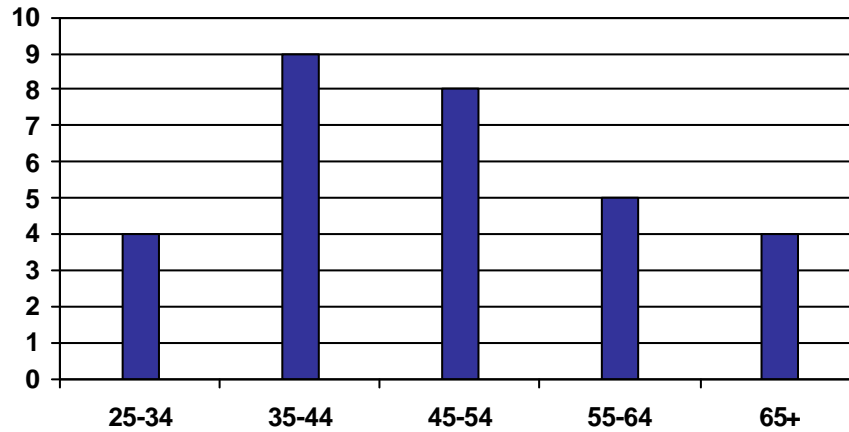
FIGURE 1.2: TENURE-TRACK FACULTY DISTRIBUTION BY AGE

As of January 1, 2009 we will have 26 tenure-track faculty (this number does not include the faculty who have converted to 50% fixed-term as part of phased retirement). We had 27 tenure track faculty in 2002 and have remained at or below that level since, despite enrollment growth at UNC. In the last five years we have had three departures:

> Maria Papadopouli, assistant professor, now at FORTH, Crete,
> Marc Pollefeys, associate professor, now full professor at ETH Zurich,
> Guido Gerig, professor, now at the University of Utah

Over the last five years we also had three retirements (two of which are still in progress through a phased retirement program)

> Jeannie Walsh, senior lecturer, retiring 12/31/08
> John Halton, professor, retiring 6/30/09
> Steve Weiss, professor, retiring 6/30/10

In addition Fred Brooks converted from a tenure-track faculty member to a renewable 50% fixed-term appointment.

The group of retiring faculty includes two of our best undergraduate instructors, and their absence will no doubt impact the department. On the other hand we also had some excellent hires in the past five years:

Svetlana Lazebnik (7/1/07), assistant professor in Computer Vision
Mike Reiter (7/1/07), distinguished professor in Computer Security
Marc Niethammer (1/1/08), assistant professor in Medical Image Processing
Fabian Monrose (7/1/08), tenured associate professor in Computer Security
Ron Alterovitz (1/1/09), assistant professor in Medical Robotics

Faculty diversity
Our department has made significant progress towards increasing diversity since our last program review ten years ago. Despite our small size, our overall faculty now meets or exceeds the national proportions of most underrepresented groups among new Ph.D. graduates. Among our tenure-track faculty are four females, eight Asian-Pacific Islanders, one Hispanic and one African-American. Five of these individuals were hired in the last ten years (and two in the last two years). Additionally, our non tenure-track faculty members include three women and one Asian-Pacific Islander. As part of our recruitment process, we actively recruit underrepresented populations. Within the department we try to provide a supportive environment for everyone, recognizing minority-specific issues.

Faculty salaries
Pay raises for Department faculty are determined by the chair and are based on research, teaching, service, and major events such as tenure, promotion, or major award, as well as equity considerations. The department is allocated a fixed raise pool from which all raises must be funded. So giving one faculty member a large raise (to compete with an external offer or otherwise) necessarily means that others must get a smaller raise.

Faculty salaries as of Jan 1, 2009 are compared in the table below to salaries reported by the (preliminary) Taulbee Survey for the same date. The Taulbee survey uses the 1995 National Research Council (NRC) ranking of computer science graduate programs to organize their results. In that ranking we are positioned at number 29. The following table summarizes tenure-track faculty compensation by faculty seniority and department rank (in groups of 12) relative to our tenure-track faculty compensation. For example, the table indicates that UNC's median full professor salary is 11.4% less than the median full professor salary in departments ranked 13-24 by the NRC.

	NRC rank 1-12		NRC rank 13-24		NRC rank 25-36	
	mean	median	mean	median	mean	median
Assistant	-1.6%	-4.7%	-5.1%	-8.3%	+1.9%	+0.3%
Associate	+2.0%	+6.1%	-1.8%	+4.2%	+7.4%	+10.8%
Full	-1.5%	-3.5%	-10.5%	-11.4%	+1.8%	+2.1%

We are hiring new faculty at about the market rate[1], and our associate professors' compensation tracks compensation among top departments well thanks to competitive pay raises over the last few years. However senior faculty compensation lags top departments, particularly in median salary. This is largely because long-term pay raises at UNC have not kept pace with raises elsewhere, and there were no funds set aside for promotions (this has changed recently).

4.2 Teaching

Teaching is an integral part of our mission. We hire, tenure, and promote those who have the desire and demonstrated ability to teach well in addition to promoting, encouraging, and supporting good teaching. Our official tenure and promotion policy rates teaching and research as equally important in making these decisions: A faculty member must be excellent in either teaching or research and at least very good in the other to be recommended for tenure or promotion. Teaching also plays a major part in determining faculty pay raises.

In surveying current and past students about our teaching, we received many comments indicating that our courses are both demanding and relevant. Here are two examples:

> "The course load was challenging, but I feel like I learned a lot because of it."

> "I've really been super satisfied with the CS department. The faculty are enthusiastic, the courses are challenging (but you do well if you put in enough effort), and there's plenty to learn."

But we also found some criticisms

> "Most undergraduate courses were a little 'light.' Operating Systems (Jeffay), Graphics (McAllister), etc were exceptions and were excellent."

We are currently addressing the criticism of the previous comment about 'light' undergraduate courses by revising the required courses (see Section 3.3).

Distribution of teaching load
Our normal teaching load for research-active faculty with external support is one course (graduate or undergraduate) per semester. In addition, faculty members supervise independent research projects, engage in thesis and dissertation advising, and develop new courses. Faculty who do not have an active research program teach two courses per semester. Some research and adjunct faculty teach regularly, while others do so only occasionally.

The courses are assigned to faculty through a matching procedure administered by the Associate Chairman for Academics. Each faculty member indicates his or her teaching preferences as well as day and time preferences. Specialized courses which only a few faculty members are able to teach are staffed first. Then the remaining graduate, undergraduate, and service courses are assigned. New faculty are assigned courses in their research area to help ease them into teaching and to help them attract graduate students. The goal of the assignment process is a) to maximize the total preference rating, and b) to spread the undergraduate and service courses among the entire faculty. We specifically do not want to divide our faculty into undergraduate and graduate

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[1] Assistant professor salaries appear lower compared to normative groups because almost all of our assistant professors were hired recently.

instructors, however in practice the shortage of faculty in certain areas compared to our required course offerings has sometimes limited our flexibility in assigning courses. Please refer to Figure 2 for specific distribution and teaching loads over the last five academic years.

To encourage faculty to have a diversified portfolio of courses they teach, we are considering a scheme that assigns different amounts of teaching "credit" for different courses. Faculty can then choose a portfolio that balances their interests with departmental needs.

Teaching by graduate students
Our Ph.D. students are required to teach one course, which is generally an introductory course. Before teaching, each student is required to complete our teaching seminar. Each student instructor is also assigned a faculty mentor who is familiar with the course content. Currently, the mentor makes a class visit to give feedback to the student. There has been some concern that this level of involvement is not enough. Therefore, in the future, we plan to have the mentor review the course syllabus, textbook selection, and exams and exercises. Unlike some departments, where graduate students may teach multiple sections over several years, our students are only required to teach once.

All students receive the same compensation regardless of whether they are a Teaching Assistant or a Research Assistant. Compensation responds to market forces and is adjusted for cost of living.

Evaluation of teaching and efforts to improve teaching
The University sponsors the Carolina Course Review (CCR), a computer-scored questionnaire that also allows open-ended comments. In the department we require the CCR for every course that is taught each semester. Results of faculty evaluations are sent to the individual faculty members and also to the chair, who uses them for faculty development, annual reviews of untenured faculty, and in tenure, promotion, and salary recommendations.

Assistant professors and associate professors are formally reviewed at least every three years by the departmental teaching evaluation committee. The review is done by two or three faculty and student members. It involves class visitations, interviews with current and former students, and discussions with the faculty member. The resulting report is both an evaluation and, if necessary, a set of recommendations for improvement. Full professors are reviewed at least every five years under a new post-tenure review procedure instituted in 1998.

The quality of teaching in this Department is very good; survey results are quite positive. But there are still areas for improvement both for specific faculty members and for certain courses. We work with the UNC Center for Teaching and Learning (CTL) on improvement of teaching.

Per-faculty-member teaching activities

Teaching and research supervision activities for each faculty member over the past five academic years are listed in Figures 2 and 3 below. Individual course development information can be found directly following the CV of each faculty member in Appendix M.

Tenure track faculty	Students taught in courses			Individual instruction	
	service	under-graduate	graduate	Independ. study	dissertation research
Anderson, James	0	37	104	12	25
Baruah, Sanjoy	0	103	44	2	7
Bishop, Gary	45	89	40	15	20
Brooks, Frederick	0	0	88	3	33
Dewan, Prasun	0	72	75	1	13
Fuchs, Henry	57	0	17	7	25
Gerig, Guido	0	0	48	7	28
Halton, John	28	0	62	0	0
Hedlund, Kye	0	485	26	0	0
Jeffay, Kevin	1	165	9	19	25
Lastra, Anselmo	0	49	69	5	37
Lazebnik, Svetlana	0	0	33	5	0
Lin, Ming	0	33	72	32	37
Manocha, Dinesh	0	0	97	36	51
Mayer-Patel, Ketan	0	159	36	8	19
McMillan, Leonard	41	121	24	10	27
Niethammer, Marc	0	4	0	1	0
Papadopouli, Maria	0	1	5	4	0
Pizer, Stephen	0	26	81	10	65
Plaisted, David	17	139	54	5	8
Pollefeys, Marc	0	39	57	12	34
Prins, Jan	0	31	101	6	11
Reed, Daniel	0	0	0	0	8
Reiter, Michael	0	7	10	4	0
Sahni, Jasleen	0	29	28	5	25
Singh, Montek	0	44	97	3	14
Smith, John	0	183	0	1	0
Snoeyink, Jack	124	74	67	9	44
Stotts, David	355	0	136	5	31
Wang, Wei	0	27	83	12	27
Weiss, Stephen	75	180	130	0	1

Instructors and research faculty	Students taught in courses			Individual instruction	
	service	under-graduate	graduate	Indep. study	dissertation research
Frahm, Jan-Michael	0	0	0	3	0
Pozefsky, Diane	159	150	25	17	0
Quigg, Timothy	0	0	17	0	0
Smith, F. Donelson	0	21	90	0	0
Styner, Martin	0	0	0	3	5
Taylor, Russell	0	0	49	11	27
Vicci, Leandra	0	0	0	0	0
Walsh, Jeannie	668	379	0	17	0
Welch, Gregory	39	0	0	2	22
Whitton, Mary	108	0	0	10	27
Graduate students and adjunct faculty	1377	218	0	7	6

FIGURE 2: COURSE INSTRUCTION, AY 2003 - 2008*

Advising and mentoring of students and postdoctoral fellows

Undergraduate majors are advised by the faculty in the department, with essentially all faculty having a few advisees. Kevin Jeffay, Director of Undergraduate Studies, is always available to advise the students, and tracks all undergraduate majors to identify emerging problems and opportunities proactively. Gary Bishop is the advisor within the University College of Arts & Sciences for students who intend to declare a computer science major.

Our graduate students are assigned an academic advisor upon entering our graduate program (this may not be always be a faculty member in the student's area of research interest, for load balancing reasons). There are variations in the quality of advising, particularly when degree program rules change.

Postdoctoral students are advised by the faculty member(s) who hire them. Figure 3 summarizes faculty Ph.D. and postdoctoral research supervision.

4.3 Service

Committee service is expected of all tenure-track faculty, with lower service loads given to junior faculty (they are typically offered a place on the admissions committee so they may acquaint themselves with the applicant pool). Most faculty members serve on two or three committees. Currently-active committees include: Admissions and Fellowships, Building and Grounds, Curriculum and Planning, Colloquium, Departmental Facilities, Examinations, Graduate Studies, Library, Publicity, Teaching Evaluation, and Undergraduate Studies. Committee loads are uneven; we are investigating a scheme to provide "credit" in proportion to the efforts involved.

	# completed dissertations advised	other doctoral committee service	supervision of postdoctoral fellows
Anderson, Jim	5	2	0
Baruah, Sanjoy	2	7	6
Bishop, Gary	2	17	0
Brooks, Fred	4	7	0
Dewan, Prasun	2	4	1
Fuchs, Henry	2	4	0
Gerig, Guido	3	12	0
Halton, John	0	0	0
Hedlund, Kye	0	0	0
Jeffay, Kevin	3	9	1
Joshi, Sarang	2	8	0
Kaur, Jasleen	1	3	0
Lastra, Anselmo	6	14	1
Lin, Ming	5	8	9
Manocha, Dinesh	5	14	7
Mayer-Patel, Ketan	3	10	0
McMillan, Leonard	2	14	0
Pizer, Steve	9	8	0
Plaisted, David	1	2	0
Pollefeys, Marc	1	6	6
Prins, Jan	1	10	1
Singh, Montek	1	2	0
Smith, John	0	1	0
Snoeyink, Jack	6	8	0
Stotts, David	2	3	0
Taylor, Russ	5	3	1
Wang, Wei	3	4	0
Weiss, Stephen	0	2	0
Welch, Greg	4	3	0

FIGURE 3: PH.D. AND POST-DOC SUPERVISION, AY 2004 - 2008

5 Department research

Department research is discussed in detail on pages 7 through 78 of the Department brochure and at http://www.cs.unc.edu/Research, so we will just provide a few highlights here. We see our research mission as pushing forward the state of the art in a few areas of computer science. Long ago we decided to limit our research coverage in order to achieve critical mass in a few key areas and to promote centers of excellence. Our research tends to be applied, but with a substantial theoretical component in support of the application. Our research is typically done in teams of faculty, staff, and students working together as colleagues. Many of our research groups focus on solving real-world problems (often in other disciplines) which has involved us in extensive collaborations with researchers outside computer science. The collaborative nature of the research environment in our department is appreciated by our students. As noted by two alumni of our program:

> "…the collaborative environment at UNC was fantastic and important to what I looked for in jobs."

> "I loved my time at UNC, it was by far the hardest 2 years of my life, the workload was incredible. The best part was that people worked together as teams, everybody was friendly and willing to help each other out. I wouldn't trade that for any other university. I really felt like I was part of a big family at UNC. I would do anything possible for other members of the family. My advisors pushed me hard, but gave me support anytime I needed it."

Research plays a key role where raises, nominations for awards, and distinguished professorships are concerned. It also aids our department's visibility within the University.

5.1 Research areas

The research areas listed below capture the current goals and directions of departmental research.

Animation & Simulation: Models and methods to simulate various dynamic systems in the physical world and in nature and animate their motion efficiently. Projects include automatic simplification of dynamic systems, efficient simulation of solids, fluid, hair, cloth, other deformable bodies, natural phenomena, and medical procedures, modeling of artistic toolboxes, and contact handling problems.

Assistive Technology: Research focuses on the development of free software for people with special needs. Commodity computer components are adapted to create specialized tools and toys that are affordable and accessible to special-needs people.

Asynchronous Circuits and Systems: The asynchronous approach seeks to design systems without the constraints of global synchronization (clocking), and is fast emerging as an attractive solution to meet the critical challenges of managing design complexity and lowering power consumption. Research in this area focuses on design automation for rapidly producing large-scale implementations from high-level system descriptions.

Bioinformatics: Research in this area focuses on developing and deploying computational methods to solve biological problems. The primary goal is to increase our understanding of biological processes.

Computer Security: Research in this area focuses on preventing or detecting misuse or interference with computer systems. Network monitoring and intrusion detection, survivable distributed systems, and security for emerging technologies are areas of particular focus.

Computer Vision: Research topics in this area include real-time 3D reconstruction from video, object recognition, and the organization of large image databases.

Data Mining: Research in this area focuses on developing theory and algorithms for analyzing and summarizing large amounts of data into useful information and knowledge.

Distributed Collaboration: Research in this area focuses on systems that enable distributed users to collaborate with each other, possibly in real time. A variety of topics have been explored recently including distributed virtual reality, collaboration architectures, collaborative programming, collaborative access control, and collaboration with users with hearing and sight disabilities.

Energy-Efficient Architectures: Conserving energy consumption is critical to prolonging battery life in mobile devices. Approaches at the circuit, architectural and software levels of abstraction are being explored, with an emphasis on dynamic exploitation of energy-accuracy tradeoffs. Current research explores energy-efficient graphics architectures.

Geometric Algorithms and their Application: Research in this area includes geographic information systems, structural molecular biology, and computational geometry.

Graphics Hardware: Novel architectural approaches are being investigated for high-performance rendering of realistic imagery, including global effects. A recent focus is on power-aware graphics.

High-Performance Computing: Inward-looking research in this area is aimed at programming languages and run-time systems to better support parallel computation and memory-hierarchy-aware computation. Outward looking research seeks to apply algorithms, parallel programming models, and hardware computational accelerators to problems in scientific simulations such as n-body systems (with or without collisions) and fluid dynamics, as well as combinatorial problems in bioinformatics.

Human-Computer Interfaces: Research in this areas is concerned with invention and evaluation of HCI techniques including: interfaces that augment visual displays with, for instance, sound and haptic displays for expanded or alternative modes of interaction (enabling technology); and interfaces that exploit game controller and hand-held computer capabilities for serious games and distributed applications. Human-perception and device costs and characteristics provide foundations for our interfaces.

Image Presentation and Analysis: Research topics being investigated in this area include geometric and statistical analysis of shape and images, with a focus on medical imaging.

Mechanical Theorem Proving: Research in this area is concerned with the development of automatic theorem proving techniques that are both powerful and fast, as well as applications of these techniques.

Multimedia Systems: Research in this area focuses on supporting distributed applications that deal with several different media types, including voice, video, and data. Recent research has examined issues in representing, encoding, and transferring data efficiently.

Networking: Networking research examines the design of a wide range of protocols at the network, transport, and application layers. A special focus on empirically-driven evaluations makes networking research at UNC quite unique. Most of the evaluations are driven by large-scale monitoring and measurement on production networks, the results of which are used to feed a realistic Internet-scale traffic generation setup in a laboratory test-bed.

Real-Time Systems: Research in this area focuses on applications with timing constraints. Multi-core platforms have been a major focus of recent research, with an emphasis on operating-system abstractions and implementations and associated scheduling and synchronization support.

Rendering: Research in this area focuses on software and algorithms for generation of photorealistic images at interactive rates. Some research issues include management of large-scale models, real-time ray-tracing and shadow generation, visibility culling, cache-friendly mesh layout, spatial encoding, etc.

Robotics: The major focus in this area is algorithmic robotics and its application to medicine, virtual prototyping, computer animation, assembly and disassembly, design automation, manufacturing, and virtual environments. Some of the research challenges include motion planning of deformable robots, collision avoidance and group coordination among numerous agents, real-time navigation in dynamic and deformable environments, planning under motion and sensing uncertainty, and completeness of planning algorithms.

Solid Modeling and CAD/CAM: Algorithms and techniques are being investigated to perform efficient and accurate geometric computation for modeling graphical objects. These include computation of Voronoi diagrams, medial axis, swept volumes, proximity queries, and complex shapes defined by Boolean operations.

Virtual Environments: The focus of this area is the invention, implementation, deployment, and evaluation of immersive and non-immersive virtual environment and augmented reality technologies and systems. Technology research includes hardware and software for single and multi-view displays, wide-area tracking, interaction, and networked graphics. Systems, which are usually built on commercial or open-source game engines, are developed with the dual goals of being effective for specific applications, and demonstrating that effectiveness.

Visualization: Visualization research focuses on the mapping and display of scientific, medical, and bioinformatics data to enable rapid and accurate understanding of details in context. This includes interactive 3D graphics, force-feedback, and audio technologies combined to form tools that control microscope lab experiments in real time, as well as data-mining tools that extract and display trends in high-dimensional data.
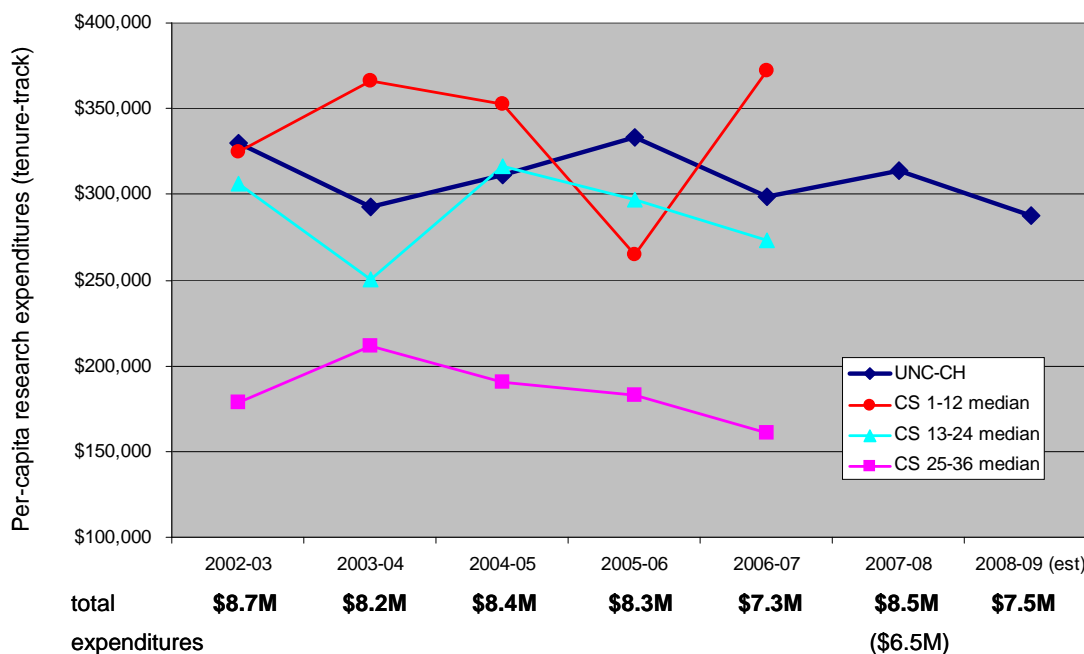
5.2 Research productivity

Our research productivity is high. Our faculty list on average 16 refereed articles in journals and 31 refereed conference and/or workshop publications in total over the last five years, and continue to receive national and international awards for research accomplishments, which are listed in detail below. They also serve as chairs for major professional conferences and as members of the program committees of many others. Support for our research remains strong, with external funding averaging around $8M per year (see below). Our department has generally been second within the college of Arts and Sciences in externally funded research expenditures at about $300K per year per tenure-track faculty member.

Our work is having an impact. A number of technologies developed in the department have been commercialized through start-up companies like 3rd Tech and Morphormics, as well larger companies like Intel and Microsoft. The products of our research are being used in computational genetics, structural biology, and nano-scale microscopy.

Contracts, grants, and gifts
Appendix G lists all contracts and grants to the Department over the last five years along with the PI, funding agency, the amount, and period of the award. Note that this list does not include any contract or grant outside the department that supports research in the department unless a separate subaccount to the department was created. More detailed support information for the last five years can be found in the CVs of the individual faculty in Appendix M.

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09 (est)
total expenditures	$8.7M	$8.2M	$8.4M	$8.3M	$7.3M	$8.5M	$7.5M
						($6.5M)	

The preceding chart shows our total and per-capita research expenditures for the last five academic years. The per-capita (tenure-track) figures are compared with median research expenditures of departments in the top three groups in the Taulbee survey. The rankings reflect the NRC (1995) ranking in which UNC CS ranks 29. The Taulbee survey figures are only complete through AY 2006-07. We know our own research expenditures in AY 2007-08 and the AY 2008-09 expenditures are our estimate. The 2007-08 expenditures include $2M for the

purchase of the BASS supercomputer, which, when excluded, show a net decrease in funding available to support research personnel.

From this data we see that the department has a consistent record of funding at a level typical for top departments in the country, and well above its Taulbee peer group. On the other hand we note an overall decrease in funding in the last few years. Although we are hopeful that new areas may garner an increased amount of funding as they mature, a long-term decrease of the sort of experienced in the last few years may require us to decrease the size of the graduate student body by 10%-20%.

Sabbatical leaves
UNC has no automatic sabbatical program. Funded sabbaticals are competitive and require a formal proposal from the faculty member and letter of support (plus a ranking if there is more than one applicant) from the chairman. A funded leave pays the faculty member's full salary for one semester (or half salary for a full year) with – in theory, at least – the faculty member's regular salary returning to his or her department for use in hiring a visitor. In years past there was a reasonable chance of receiving a funded leave, however the expected number of sabbaticals a faculty member can expect to receive over a thirty year career is now less than one, with an average around 15 leaves that are University-funded each year in the University as a whole. Cuts in graduate student funding have forced us to use the salary of on-leave faculty for student support; we have not been able to hire a visiting faculty member on lapsed faculty salary for more than a decade. Within the past five years, two of our faculty members were awarded W.N. Reynolds Fellowships: Jack Snoeyink in 2006 and Ming Lin in 2004. Partial salary was returned for Gary Bishop who received a Kauffman Entrepreneurial Fellowship in 2007, for Jan Prins who was awarded an Institute of Arts & Humanities Fellowship for Academic Leadership in 2006, and for Ming Lin who was awarded a University Award for the Advancement of Women in Spring 2008.

A second form of leave, officially called a Research and Study Assignment (R&SA), offers the faculty member one semester at full pay and no teaching or administrative duties, but the department receives no replacement funding. Thus the department must fill in for the absent faculty member's teaching, advising, and administration without additional resources. These leaves are more readily available; we are allocated four R&S Assignments per year, but average about one faculty member on R&S Assignment each semester. While R&S Assignments are technically competitive within the Department, there has never been greater demand than we could accommodate. Within the past five years, only six R&S Assignments have been taken. All assistant professors and untenured associate professors are assured an R&SA before their tenure/promotion review.

In addition to funded leaves and R&SAs, we also provide, more informally, for reduced teaching and administrative loads in certain circumstances. Faculty members who undertake substantial course development may have some of this work counted as teaching. And faculty members with grant support can buy out of teaching for a semester.

5.3 Faculty honors and awards in the last five years

2007/2008 Academic Year:
Gary Bishop – Kauffman Entrepreneurial Fellowship; Engaged Scholars
Jan-Michael Frahm – CVPR Best Demo Award
Kevin Jeffay – Chaired Professorship (Gillian T. Cell Distinguished Professor)
Svetlana Lazebnik – 2008 Junior Faculty Development Award
Ming Lin –Term Chaired Professorship (Beverly W. Long Distinguished Professor); Carolina Women's Center Scholar; Best Course Notes Award; 2007 Best Paper Award, ACM VRST Conference
Dinesh Manocha – Best Paper Award, ACM VRST Conference (November 2007); Best Paper Award, Computer-Aided Design Conference (June 2008)
Russell Taylor – 2007 UNC Computer Science Student Association Teaching Award
Wei Wang – Philip & Ruth Hettleman Prize for Artistic and Scholarly Achievement; Best Student Paper Award, 2008 IEEE International Conference on Data Engineering
Steve Weiss – WCHL Village Pride Award
Greg Welch – 2007 UNC Computer Science Student Association Teaching Award

2006/2007 Academic Year:
Dinesh Manocha – Chaired Professorship (Phi Delta Theta/Matthew Mason Distinguished Professor); IndySort Winner at 2006 ACM SIGMOD Conference
Diane Pozefsky – 2 patents: Calendar-enhanced directory searches including dynamic contact information (August 2006) and Flexible system & method for mirroring data (March 2007)
Jan Prins – Institute of Arts & Humanities Fellowship for Academic Leadership Program
Tim Quigg – Career Excellence in Research Administration Award (Society of Research Administration)
Leandra Vicci – 3 patents (divisional, 3 parts): Methods and systems for controlling motion of and tracking a mechanically unattached probe
Steve Weiss – UNC Thomas Jefferson Award

2005/2006 Academic Year:
Jim Anderson – 2005 UNC Computer Science Student Association Teaching Award; Best Paper Award, 26th IEEE Real-Time Systems Symposium (December 2005)
Naga Govindaraju – 2006 Indy PennySort Trophy
Kevin Jeffay – patent, Method for understanding the use of TCP/IP networks by users and non-parametric generation of synthetic internet traffic
Anselmo Lastra – 2005/2006 UNC Computer Science Student Association Teaching Award
Ming Lin – Best Paper Award, 2005 IEEE Virtual Reality Conference
Dinesh Manocha – Best Paper Award, 2005 IEEE Virtual Reality Conference; Best Paper Award, 2005 Pacific Graphics; 2005 Best Paper, Research and Development Track I/ITSEC; 2006 ACM SIGMOD PennySort Benchmark Award
Maria Papadopouli – 2006 UNC Junior Faculty Development Award
Montek Singh – 3 patents: circuits and methods for high capacity asynchronous pipeline, high-throughput asynchronous dynamic pipelines, asynchronous pipeline with latch controllers
Leandra Vicci – patent, Methods and systems for reactively compensating magnetic current loops (November 2005)
Wei Wang – 2005 Microsoft New Faculty Fellow

2004/2005 Academic Year:

Jim Anderson – Computer Science Student Association Teaching Award

Sanjoy Baruah – CSC Favorite Faculty Award runner-up

Gary Bishop – Computer Science Student Association Teaching Award; Ueltschi course
    development grant

Fred Brooks – ACM/IEEE Eckert-Mauchly Award

Guido Gerig – Teaching Award for Comp 254, spring 2004

Kevin Jeffay – CS majors Favorite Faculty Award (May 2004)

Anselmo Lastra – patent, methods and apparatus for rendering images using 3D warping
    techniques

Ming Lin – Best Paper Award, 2005 IEEE VR Conference

P. David Stotts – patent, Facetop: Video Support for Collaboration; patent, SPQR:
    Finding Design Patterns in Source Code

Leandra Vicci – patent, Magnetic-flux conduits

Wei Wang – NSF Faculty Early Career Development Award

2003/2004 Academic Year:

Sanjoy Barauh – Computer Science Student Association Teaching Award

Gary Bishop – Ueltschi course development grant; developed and distributed "Hark the
    Sound," a sound game for blind children; Orange County Disability Awareness Council
    Distinguished Service Award (October 2003)

Guido Gerig – MICCAI 2003 Award, Best Student Paper Image Processing and
    Visualization

Kevin Jeffay – Edward Kidder Graham Outstanding Faculty Award; Edward Kidder
    Graham Advisor of the Year Award (April 2004); ACM SIGCOMM Best Paper Award
    (August 2003)

Jasleen Kaur – 2004 NSF CAREER Award

Ming Lin – Hettleman Prize for Scholarly and Artistic Achievements; Best Paper Award,
    ACM Symposium on Solid Modeling and Applications (2003)

Dinesh Manocha – Best Paper Award, ACM/SIGGRAPH Conference on Solid Modeling
    and Applications

Steve Pizer – patent, Systems and methods for tubular object processing (February 2004)

Tim Quigg – Society of Research Administration International Distinguished Faculty
    Award

6 Students

This section is structured as a series of subsections, each of which corresponds to an issue we were asked to address as part of our student discussion.

6.1 Environment

We take several steps to create a hospitable environment for all our students.

As we have a relatively small undergraduate and graduate population, our classes are fairly small, providing a friendly and intimate environment for learning. Moreover, we make sure students participate in decision making. A graduate student representative with voting rights attends all of our faculty meetings, where most of the department decisions, particularly those pertaining to students, are made. Our teaching award for graduate and undergraduate faculty members is given by students, without any faculty input. Furthermore, the physical layout of the building has several open spaces encouraging interaction among students. Finally, our department has tried to maintain a tradition of being friendly and warm.

To determine how effective we are in creating a hospitable environment, our survey explicitly asked them to address this issue. The vast majority of graduate and undergraduate student felt that we were successful in doing so. The following comment seems to summarize the sentiments of the students:

> "The department is very warm and welcoming and generally encourages risk and provides a support system in case of failure. The culture of this department should be protected *at all costs*. Please take care in hiring and in bringing on students to ensure that the attitudes of respect and care and other-centeredness continue. This is a great place to develop one's intellectual curiosity and to practice "science" but please please please don't lose the human relationship side of the equation as the department moves forward. The relational part of department is what sets it apart (and in my opinion, above) other computer science departments of a similar caliber."

Overall, the detailed comments of the undergraduates were less positive than those of the graduate students, as illustrated by the following comment:

> "UNC CS professors were known to be quirky academics and generally too busy with their own prestigious research to genuinely care about their undergrad students."

Nevertheless, 37 out of 45 respondents strongly agreed or agreed that UNC CS provided a hospitable and nurturing environment.

6.2 Underrepresented populations

Graduate Program. The table below describes the ethnic and gender diversity of the most recent six entering graduate cohorts. The 3.2% of African-Americans in our incoming cohort is somewhat higher than the 1.9% national average for Ph.D. programs [Taulbee survey 2007]. We tend to give underrepresented populations the benefit of doubt in the graduate admission process. In particular, if they have good letters, we will ignore low grades and GRE scores. In addition,

we have been successful in getting two kinds of minority fellowships, AGEP (academic year) and SPGRE (summer), for most of our African American students. Appendix C lists the AGEP and SPGRE holders in the last ten years. Most successfully complete the M.S. program, but very few enter and complete the Ph.D. program. Only one African American student (0.9%) has received a Ph.D. degree in the last ten years.

Incoming graduate students	2003	2004	2005	2006	2007	2008	%
Ethnicity							
Asian	15	12	15	9	13	22	**39.1%**
African-American	1	1	2	2	0	1	**3.2%**
Hispanic	0	0	1	1	0	0	**0.9%**
Native American	0	0	0	0	0	0	**0.0%**
Other	0	0	2	0	0	0	**0.9%**
Caucasian	22	22	29	11	18	21	**55.9%**
Gender							
Female	6	4	7	3	3	8	**14.1%**
Male	32	31	42	20	28	36	**85.9%**
Total	38	35	49	23	31	44	

With respect to other underrepresented groups, our 0.9% Hispanic students entering our graduate program are less the national average of 1.6%. We also find that the 14.1% female students entering our program are less than the national average of 19.6%. However, female students graduate at an improved rate in our program. Over the last 10 years we have graduated 20 female Ph.D.s (18.3%), which is comparable to national rates.

Undergraduate Program. At the undergraduate level, our data is gathered slightly differently. The table below gives ethnic and gender breakdown of all undergraduates who have declared a CS major. The data is obtained in the fall of each academic year, thus each year's census has overlap with previous years. The most recent year reports a much larger cohort than previous years because we now allow students to declare a CS major before completing a lengthy set of core requirements.

Compared to national trends reported in the 2007 Taulbee survey, our gender distribution is essentially the same as reported nationally (Female 12.2%, Male 87.8%). It is disappointing, however, that on a campus in which nearly 2/3 of the undergraduates are women, we don't have higher representation of women in the undergraduate program. We hope more women will be attracted to the minor and the BA degree programs.

Nationally, BS recipients are 3.4% African-American, 0.4% Native American, 14.6% Asian, 5.4% Hispanic, 2.5% other, and 67.3% Caucasian. This is very similar to our census data, however we do not at this time know the precise composition of our undergraduate BS recipients (as opposed to students declaring the BSCS major).

BSCS student census	2004	2005	2006	2007	2008	%
Ethnicity						
Asian	12	11	6	9	26	**14.9%**
African-American	4	3	1	4	13	**5.8%**
Hispanic	2	2	1	1	4	**2.3%**
Native American	0	0	0	0	0	**0.0%**
Other	4	3	0	1	8	**3.7%**
Caucasian	62	54	52	50	97	**73.3%**
Gender						
Female	12	9	5	8	16	**11.6%**
Male	72	64	55	57	132	**88.3%**
Total	84	73	60	65	148	

6.3 Admissions process

Applicants to the graduate program are evaluated on four dimensions: coursework at their undergraduate institution, performance on standardized tests, recommendations from professors and/or work supervisors, and a personal statement. While applicants are asked to specify a degree goal (i.e., MS or Ph.D.), all are considered potential Ph.D. candidates and there are no MS-only admissions.

The central philosophy driving the admissions committee is to admit the strongest students regardless of research interest. However, the committee recognizes the need to match student interests with faculty research and applicants are asked to self-classify their interests into one of 14 categories. This information is used to help shape the distribution of research interests in the cohort of admitted students. Students are required to take and submit a Graduate Record Exam (GRE) score. The Computer Science subject GRE is not required but if submitted by an applicant, it is evaluated as part of the admission decision. International students are required to take the Test of English as a Foreign Language (TOEFL). Successful applicants to the program typically have GPA's above 3.5, GRE quantitative scores in the upper 15th percentile, and some research experience working with faculty outside of the typical classroom curriculum.

The following table summarizes the applicant pool size and characteristics, together with characteristics of the admitted and enrolled class.

| | | APPLICANTS | | | | | ACCEPTED | | | | | | ENROLLED | | | | | | TOTAL GRAD |
| | | | GRE | | | | | GRE | | | | % of | | GRE | | | | % of | ENROLL. |
	YEAR	No.	V	Q	A	GPA	No.	V	Q	A	GPA	Applied	No.	V	Q	A	GPA	Accepted	(FALL)
	1999	443	575	764	708	3.5	106	631	771	731	3.7	24%	47	630	769	722	3.7	44%	141
	2000	553	579	771	720	3.5	74	626	779	751	3.7	13%	25	581	772	743	3.6	34%	125
	2001	566	584	774	723	3.5	93	630	779	742	3.7	16%	41	611	783	732	3.6	44%	133
	2002	744	586	773	724	3.6	90	619	779	764	3.8	12%	45	630	778	766	3.7	50%	152
	2003	529	601	776	733	3.6	77	620	785	756	3.8	15%	35	619	781	747	3.8	45%	152
	2004	547	582	777	730	3.6	71	629	790	751	3.7	13%	36	620	789	744	3.7	51%	147
	2005	382	564	769	710	3.6	80	622	781	735	3.7	21%	49	613	774	733	3.7	61%	155
	2006	349	556	771	750	3.6	54	596	775	773	3.6	15%	23	584	755	767	3.6	43%	133
	2007	319	545	772	652	3.6	77	585	782	512	3.7	24%	30	599	786	--	3.7	39%	124
Average		492	575	772	717	3.6	80	618	780	724	3.7	16%	37	610	776	744	3.7	46%	140
Median		529	579	772	723	3.6	77	622	779	751	3.7	15%	36	613	778	744	3.7	47%	141

6.4 Funding

Essentially all of our graduate students receive full-time support. The support can be in the form of a fellowship (externally funded or funded by the university), a research assistantship (funded by a federal contract or grant), or a teaching assistantship (funded by our instructional budget). The following table details the funding source for our graduate students over the last five years.

	2003-04	2004-05	2005-06	2006-07	2007-08
Student stipend	$14,228	$14,513	$15,075	$15,560	$16,333
Teaching Assistants	26	20	25	25	22
Research Assistants	105	97	103	104	81
Full-Support Fellows	14	17	14	15	13
Total	145	134	142	144	116

We have a fixed sized instructional budget that funds TA positions. TA and RA compensation is the same to avoid creating second class student support and is intended to be competitive with our peer departments. Our TA and RA stipends increase over time due to inflation and the need to offer competitive funding to students. The consequence is a steady erosion in the number of TAs we can support even as the total number of students we are teaching is increasing.

Another trend we see is that the number of research assistants supported declined last year (and this holds true this year as well), as mentioned in the Research section. We believe this is consistent with the national trend in computer science of reduced funding. In addition, we have a policy of not pairing a faculty member and research assistant unless they are both enthusiastic about one another. As a result, a number of available research positions go unfilled in some years.
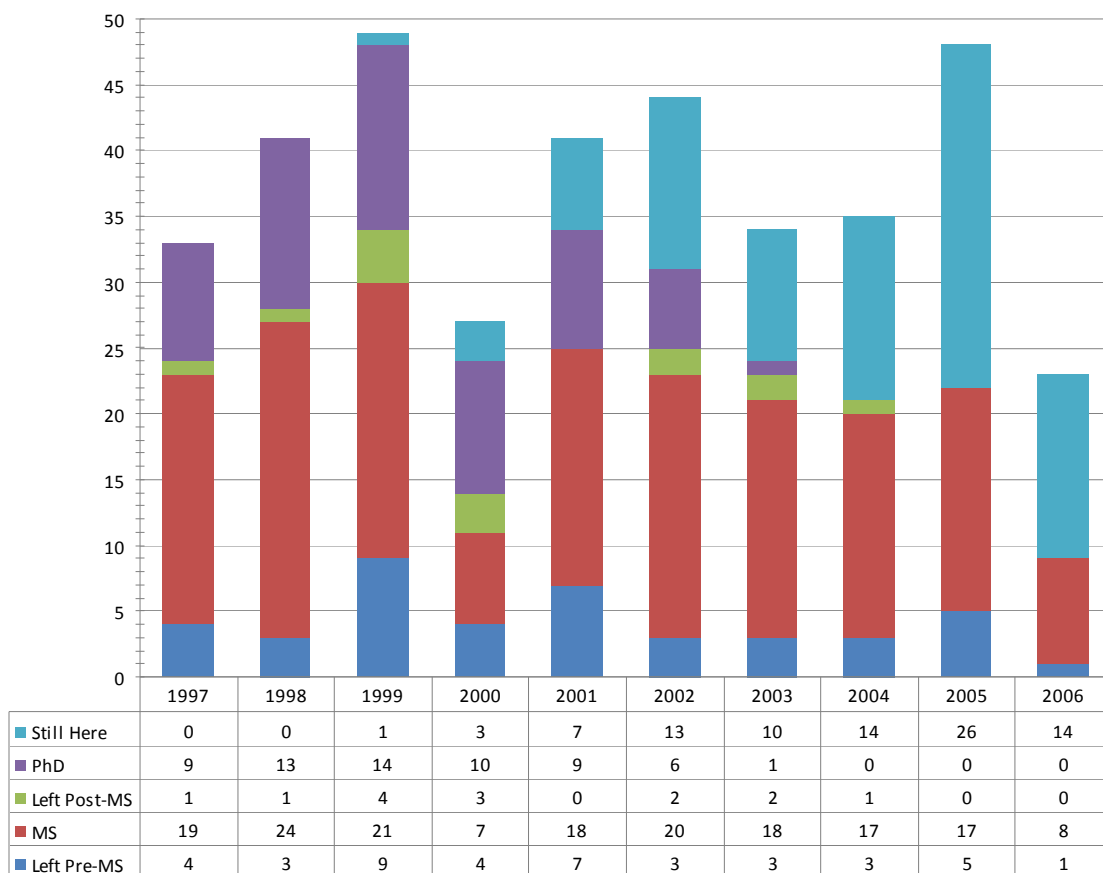
We use TAs in undergraduate courses and graduate courses with large enrollments (over 20). The TA pool also serves as a buffer for our admissions strategy and can absorb some variation in research funding. However the instructional budget is subject to cuts – we were asked to return about $65,000 or about 20%, from the instructional budget this year. The net effect of these factors is that the size of our graduate program has to decrease if the sum of our instructional budget and external support do not increase.

6.5 Evaluation of student progress

Graduate student progress is evaluated by the faculty each semester. During a meeting set aside for just that purpose, we discuss students who have failed to meet guidelines for program milestones, or have encountered other problems. The milestones for PhD students are the doctoral qualifier exam, the written comprehensive exam, timely formation of a dissertation committee, the thesis proposal, and the doctoral oral exam. For MS intending students, we evaluate course grades.

For students graduating in the last 10 years, the average time to MS was 2 years, and the average time to Ph.D. was 6.5 years. The time to Ph.D. is increased by students who took employment and completed their dissertation later.

Graduate Student Outcomes

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Still Here	0	0	1	3	7	13	10	14	26	14
PhD	9	13	14	10	9	6	1	0	0	0
Left Post-MS	1	1	4	3	0	2	2	1	0	0
MS	19	24	21	7	18	20	18	17	17	8
Left Pre-MS	4	3	9	4	7	3	3	3	5	1

To understand the outcomes for students who enter our graduate program, we present the table above, which records the size of the incoming class for each year and partitions it by outcomes for the students in the cohort. In 1997, for example, a total of 33 students were admitted into the graduate program, of which 4 left before completing an MS, 19 left with an MS (either because that was their degree intent or because they did not gain admission to the PhD program), and 10 went on for the PhD. Of those 10, one left without a PhD and the rest obtained a PhD before 2008. In the later years, the top section of the bar represents students still working toward their Ph.D.

The percentage of students leaving the program before the MS is about 10%, which is a disturbing number. This has been a constant feature of the program for a long time and it seems to represent a fraction of the student population who decide graduate school is not really what they expected or were prepared for. On the other hand we have been successful in reducing the Post-MS dropouts to a small fraction through our PhD screening exams that evaluate potential and aptitude of the students for independent research.

Student Accomplishments

Appendix E (Alumni Disinctions) lists accomplishments of our graduates – many of these are of alumni who graduated more than five years ago. We have used several mechanisms to compile significant contributions of our students: (1) our department publishes a newsletter every semester, which lists notable accomplishments of current and past CS faculty, staff and students. We have collected information from the last five years of this newsletter. (2) We have asked faculty to report notable contributions of students known to them. (3) The survey asked students to report their notable accomplishments. (4) We have identified all fellowship recipients over the past ten years. (5) We have identified alumni who were of particular distinction. Appendix E lists achievements of our graduates garnered from these sources.

Student Placements after UNC

The survey asked graduate students to report their placement immediately after leaving UNC and their current positions. Appendix D lists the responses to these questions. For Ph.D. students we have enumerated all initial positions of graduates in the past 10 years. For MS and BS students, we have shown placements of students who self-identified.

The survey also asked if UNC prepared them well for the next stages of their lives. As the survey responses in Appendix I (Graduate program evaluation by alumni) demonstrates, the vast majority either agreed or strongly agreed. The following comment seemed to summarize their feelings:

> "Having a MS from UNC in computer graphics is a defining characteristic of who I am as an individual today. I don't think, sitting on the porch in 100 degree Midwestern heat in a small town in Indiana I ever imagined the life I have been given the chance to lead. UNC allowed me to turn my dreams into goals. It was also the hardest transition in my life--from a small Midwestern town to a leading research university, a huge cultural shift, very stressful, very exciting. I am beyond happy I chose UNC--I rarely face technical issues professionally that I didn't have in some form/fashion in school."

Appendix K (Undergraduate program evaluation by alumni) reports responses of our undergraduate alumni to their placement immediately after leaving, and whether UNC prepared them well for the next stage of their career. As the results of the survey show, most undergraduate students agreed or strongly agreed with the adequacy of their preparation. The following comment seems to summarize their feelings:

> "I felt well-rounded and grounded in the theory and application of computer sciences."

Based on the average of a small number self-reports of starting salaries compiled by the university, in the last five years, our department consistently ranks as the top or nearly top department in the university. Appendix B lists the top three departments in the last three years and the average starting salaries for each.

6.6 Student teaching

In the survey, we were remiss in not asking the undergraduates to distinguish between the teaching/grading of faculty and teaching assistants. However, we did receive a few comments addressing directly the teaching of TAs, all of which are given below. They illustrate that the TAs, by and large, were very effective. In fact, one of teachers, McAllister, singled out for praise in a comment, was a teaching assistant:

> "Allowing too many classes to be taught by teaching assistants with a lot on their plates with doctoral or master's research is detrimental to undergraduate learning. I would guard against this in the future, although I did not think that was an issue during my years at UNC."

> "Even the graduate students were, for the most part, excellent teachers."

> "I think the TA's generally grading the programming assignments were very fair."

> "COMP114 I had a horrible TA but other than that I think it was pretty good."

7 Departmental Support and Facilities

7.1 Leadership

The Department is headed by a chair assisted by two associate chairs, one for administration and finance, and the other for academics. The associate chair for academics is a tenure-track faculty member with administrative duties, while the associate chair for administration and finance has primarily administrative duties but also teaches a research administration course. A departmental organization chart is provided in Appendix A.

Hiring and promotion decisions are made by the chair, although these decisions are always informed by a vote of the faculty. Raise recommendations are also made by the chair, usually in consultation with the associate chair for finance and administration. We are considering the creation of an advisory committee that will provide the chair with a rank ordering of faculty research and teaching as the basis of the decision making process.

7.2 Administrative support

A. Clerical and Administrative Staff Support

The department currently has the following 14 state-funded administrative staff: 3 Accounting Technicians, 5 Administrative Support Associates, 1 Business Officer, 2 Business Services Coordinators, 1 Public Communications Specialist, and 2 Student Services Specialists. We have recently completed a re-organization in terms of this staff. In the past, several administrative assistants supported a small group of faculty or one individual faculty member with all needs – travel, grant proposals, reimbursements, academic needs, etc. We realized that this was inefficient due to the disparity in quality of support: for example, one admin might have been very good at coordinating travel arrangements, but less familiar with proposal development. Thus, a centralized system of specialized support was put into place consisting of

- a *Travel Specialist* who works closely with the accounting technicians, and handles all travel arrangements and reimbursements

- The *Research Support and Communications* (RSAC) team consisting of four staff members that handle all proposal production activities, conference and site-visit hosting, outreach demo coordination, and department publicity.

- The *Faculty Administrative Support Team* (FAST) consisting of three staff members that handle all faculty and academic administration support, as well as manning of the department reception desk.

These teams are proving to be much more effective than the old system, and a vast majority of both faculty and staff are pleased with the new arrangement.

B. Technical staff

We currently have 12 members who make up our facilities staff, who are as follows: 1 IT Director, 1 IT Manager, 2 Networking Analysts, 2 Systems Analysts, 4 Systems Specialists, 1

Technical Support Analyst, and 1 Technical Support Specialist. There is currently one vacancy for a Tech Support position that needs to be filled. At its maximum, we had 16 people on facilities staff, and despite the fact that there are now only 12, each sub-group does a good job of managing its responsibilities. One area where we are stretched at present is UNIX support, mainly because this group took on support of the BASS supercomputer (discussed in more detail below), which is quite time-intensive. Nevertheless, our facilities staff is both hard-working and efficient, evidenced by the fact that they were able to move faculty and staff into the new Brooks building (also discussed later in this section) during the summer in little more than a month.

C. Student staff
There are 7 undergraduate students who work part-time primarily aiding our Information Technology staff with help requests from students, faculty, and other staff members, and 3 work-study students who primarily assist the Research Support and Communications staff.

7.3 Facilities and equipment

Today the department's computing environment includes nearly 800 computers, including workstations, servers, and various special purpose systems. The department operates a centralized machine room that houses major computing facilities, including all departmental shared storage and major computing facilities. A major portion of the machine room is occupied by the biomedical analysis and simulation supercomputer (BASS) with 452 CPU cores, 23040 floating point units for graphics processing, and over 80 TB of disk space.

All offices and labs are wired for 100/1000 Mbps Ethernet over copper and optical fiber for 1 or 10 Gigabit per second operation. The building infrastructure currently supports 100Mbit and gigabit switched fabrics with the ability to extend either to any location within Sitterson Hall and within the new Frederick P. Brooks, Jr. building addition. Gigabit links connect the department to the UNC-CH campus network and the North Carolina Research and Education Network (NCREN), allowing users to access National LambdaRail and the public Internet.

Operating systems are primarily Windows XP and Server 2003, RedHat Enterprise Linux version 5, Mac OS/X, and FreeBSD. Applications include the standard MS Office Suite; CVS and Subversion version control software; ESS Networker backup software; Filemaker Pro database; Remedy problem tracking software; AFS, NFS, and NTFS file systems; various Adobe products for document preparation; Matlab and Mathematica for mathematical processing; Secure-CRT for secure shell (ssh) connections; Firefox web browser; Thunderbird email client; and a large number of other applications.

7.3.1 Laboratories
Graphics and imaging lab. The faculty members of the graphics and image groups share over 3500 sq. ft. of laboratory space, divided over two main areas. Both areas are equipped with a large number of high-performance graphic workstations.

The recently completed graphics/vision lab in the Brooks building is approximately 35x70 feet, with its space designed to be broken up into multiple curtained zones, each with its own lighting, power, and A/C controls. All of the spaces have a Unistrut® grid below the ceiling for mounting equipment (projectors, cameras and lighting) with power and data connections, and there is an

open raceway for cabling just above this grid. There are also plans for a co-located computer/networking room that will have its own cooling support.

A large portion of the new laboratory space is dedicated to the group's work in effective virtual environments. Specialized VE equipment includes head-mounted displays that are used in a 33' x 22' tracked space. Tracking is done using the UNC-developed HiBall™ optical tracker, now a commercial product from the 3rdTech, Incorporated. Two smaller HiBall™ systems are shared in other parts of the lab for research requiring user tracking
The laboratory's scene capture facilities include two DeltaSphere™ rangefinders, one with a visible light laser and another infrared. The DeltaSphere has a range up to 50 feet, with typical error of less than 0.1 inches at 30 feet. The absolute error depends on the surface scanned. Angular resolution is variable; we typically set it at 15-30 samples per degree.

The lab also includes two areas used in telepresence and computer vision research that use the ceiling grid for mounting 1394 Firewire cameras and displays. Resources in these facilities include two transportable, 5-node image acquisition and graphics compute and rendering clusters (acquired as part of our 3D Medical Consultation research funded by the National Library of Medicine), access to over 75 FireWire cameras from Point Grey Research, two 47" Toshiba 1920 x 1080 flat panel displays, and two NewSight auto-stereo displays.

The laboratory also has a 20' x 20' area dedicated to projective display research being used to develop the calibration and display algorithms needed for automatic and continuous display system calibration and rendering. Equipment resources in this research group include more than 10 ProjectionDesign, inFocus, and NEC projectors, 4 Dell XPS notebooks, and 10+ Point Grey Research Dragonfly and Scorpion cameras. Some of these components are currently dedicated to the four 1st-generation intelligent projector units (built without integrated PCs) that we have prototyped under a current NAVY SBIR 1 contract.

Another portion of the new laboratory houses the simulation center, dedicated to various forms of physically based simulation and display. Specialized equipment includes several force-feedback devices (including a six degree-of-freedom unit) used in haptics research; over 50 digital cameras used in the telepresence and computer vision research; 20+ projectors used for projective virtual environment research, and two ultrasound machines, a Faro arm and NDI Optotrak® Certus™ tracker used in the group's medical research. The laboratory is also equipped with several camcorders and two digital video editing systems, a high-quality color printer, and a wide-bed plotter for dissemination of research results.

Applied Engineering Lab. Another important asset of the Computer Science department is the Applied Engineering Laboratory (AEL), which provides facilities and expertise for building prototypes for a variety of microtechnology-based systems. The facility contains a complete machine shop (with milling machine, lathe, etc.), measurement and analysis equipment (oscilloscopes, spectrum analyzers, signal generators, etc.), chip test and rework gear, and chemical handling equipment. The fabrication and test facilities are available for general use by departmental projects.

Networking Lab. The department's networking group also maintains a large lab for network research that currently contains over 140 PC systems running a wide range of production and experimental operating systems, interconnected via dynamically configurable and partitionable networks running at 10, 100, and 1,000 Mbps. The laboratory is also directly connected to the North Carolina Networking Initiative's GigaPOP, a Cisco DPT fiber ring spanning the Research Triangle Park region of North Carolina, operating at speeds of up to OC-48 (2.4 Gbps), and

interconnecting the Triangle with the National LambdaRail. This flexible facility, which has been used to investigate technology for realizing differentiated services based on combinations of active router-queue management and packet scheduling, will be used for virtual presence research.

Additional laboratories house computing facilities for the bioinformatics cluster, the computer security group, the real-time computing group, and the collaboration technology group.

7.3.2 Space in Sitterson and Brooks buildings

Sitterson Hall provides 72,000 ft^2 (gross) in area, about half of which is net usable space for offices, labs and classrooms. Research space in Sitterson was limited, which meant that some projects could not be pursued or else had to wait for others to be finished. Sitterson has only two classrooms – SN014 and SN011 – which forced some computer science classes to meet elsewhere on campus. Faculty offices were in short supply. Some faculty were not in faculty-size offices, while for others we created faculty offices by combining two neighboring student offices.

The new F.P. Brooks building directly adjoins Sitterson Hall and was dedicated in October 2008. The cost was approximately \$12 million, largely funded by the University (through state bonds and overhead receipts) and partially through a fund-raising effort. The naming rights were obtained through a substantial gift by someone who had been a student in our department. The Brooks building adds an additional 32,000 ft^2 (gross), about 60% of which is net usable space, but also resulted in the loss of some space in Sitterson. The Brooks building adds three classrooms – one of which has 80 seats and is controlled by the university registrar (but with priority to CS), while the other two are department-controlled and consist of a 50 seat classroom and a 21 seat seminar room (named in honor of Steve Weiss). There is also a new faculty conference room with seating for 55 that can house all faculty members and other attendees for meetings, enabling the old room where such meetings were held – SN115 – to be used as an additional classroom. There are now four open and two closed conference areas, enough faculty offices of proper size, and student offices. Finally, some old offices in Sitterson are being converted into new laboratory space.

7.4 Institutional relationships

A. Joint/Adjunct Faculty in our Department:
Our department has granted adjunct faculty member status to researchers in a variety of departments at UNC and at other universities as well as in companies. The specific appointments are detailed in section 4.

B. CS Faculty holding joint appointments
Faculty members holding joint or adjunct appointments in other departments or curricula are detailed in section 4.

C. Student Funding:
In the past five years some students in our department have been supported directly by funding from faculty in the following departments:

     Biochemistry

Biology
Biophysics
Genetics
Pharmacy
Radiation Oncology

D. Jointly funded research

A list of departments and institutes involved with us in funded collaborations over the past five years includes:

At UNC-CH

Applied Mathematics
Biomedical Engineering
Biostatistics
Carolina Center for Genome Studies
Carolina Environmental Program
Cell and Molecular Physiology
Chemistry
Comprehensive Cancer Center
Cystic Fibrosis Center
Dental Radiology
Environmental Science and Engineering
Family Medicine
Gene Therapy Center
Genetics
Ibiblio (SILS)
Mathematics
Obstetrics and Gynecology
Operations Research and Statistics
Ophthalmology
Pathology
Pharmacy
Physics
Psychiatry
Radiation Oncology
Radiology
RENCI
School of Social Work
Surgery

Outside UNC-CH

Boeing Corp.
Brigham and Women's Hospital
Brown University Graphics Group
CAIDA, the Cooperative Association for Internet Data Analysis
Carnegie-Mellon University
Cisco Systems, Inc.
Combustion Research and Flow Technology, Inc.
Cornell University
Disability Awareness Coalition (DAC)
Drexel University

Duke University
Duke University Medical Center
Eli Lilly and Co.
ETH (Zurich, Switzerland)
Governor Morehead School for the Blind
Indiana University
InnerOptic Technology, Inc.
Johns Hopkins University
K.U. Leuven
Kitware Inc.
The Lion's Club
Microelectronics Center of North Carolina
National Alliance for Autism Research
National Institute of General Medicine Science
National Institute of Neurologic Disorders and Stroke
National Security Agency
Naval Air Warfare Center
Naval Postgraduate School
North Carolina State University
NVIDIA
Object Video
Orange County Disability Services
Rice University
Sarnoff Corporation
Siemens Medical Systems, Inc.
Texas Advanced Computing Center (University of Texas Austin)
University of California at Berkeley
University of Chicago
University of Illinois at Urbana Champaign
University of Kentucky
University of Maryland at College Park
University of Pennsylvania
University of Utah
US Army Corps of Engineers
Vanderbilt University Medical Center
Wake Forest University

8 The Future

8.1 Teaching mission

One of the recommendations from the 1999 review was that the department and the university form a partnership for guiding computer education at the university. While we successfully launched an undergraduate computer science major, we have perhaps not sufficiently stressed the central role of computing in virtually all disciplines today, and its critical importance in a liberal arts education that provides students with fundamental skills to facilitate future learning.

Increasing demand for our introductory programming classes, and unmet demand in our computers and society class, suggest that students themselves value some degree of computing fluency in a variety of different majors.

We believe the potential contribution of computer science in undergraduate education at UNC has not been fully realized. Various steps should be taken to improve the situation.

1. Our service courses should meet demand to the extent practicable, and should be reviewed to ensure their content is most appropriate. They should be taught to high standards, and such teaching should be rewarded.

2. We should press for the rapid approval of our BA program and raise awareness among the undergraduate population in general of the opportunities provided by a CS minor or a CS BA degree as a way to combine computing skills with an application area (biology, business, environmental science, information science, journalism, the physical sciences, and psychology, to name just a few).

3. We should resolve the obstacles preventing the use of internships as part of our undergraduate BSCS program. We should increase the impact of our research and graduate programs within our BSCS by bringing more materials into advanced undergraduate classes and by increasing the opportunities for undergraduate research experiences.

Implementation of these changes can have an effect beyond increased value of our undergraduate offerings. We may see a trickle-up effect in which non-majors in our service courses follow additional courses and complete one of our undergraduate degree programs. We may also see more involvement of undergraduates in our research, which has proven to be advantageous to all parties involved.

The university projects 16% enrollment growth over the next decade. We believe the changes described above will generate sufficient interest to increase our total hours taught 5% per year over the next five years, i.e. more than 3 times the rate of enrollment growth.

The changes proposed depend on the following:

- Computer Science should be involved along with the School of Information and Library Science (SILS) and others in planning a comprehensive approach to integrating computing into the university's undergraduate curriculum.

- College support in retaining our lecturer position. The Computers and society course requires a full-time instructor since the material changes with every offering to reflect current issues. Quality instruction of this course requires expertise in sociology and philosophy at a level not frequently found among conventional CS faculty. Our instructor for this course retired this fall. It is critical that we be able to rehire into this position by fall 2009.

- TA lines in our instructional budget should track undergraduate hours taught.

8.2 Research mission

As mentioned in the department overview, we have diversified our areas of research, adding bioinformatics, computer security, computer vision, and robotics as new areas closely allied with existing strengths. In order to improve the quality of our research and graduate programs, we must nurture these areas and strengthen them even as we ensure that we maintain critical strength in our core areas.

Our recent hiring was in each of the new areas except bioinformatics. In addition we have also hired in medical image processing, a long-standing specialty in our department, following the departure of Guido Gerig. Still, these hires have not completely kept pace with retirements and departures.
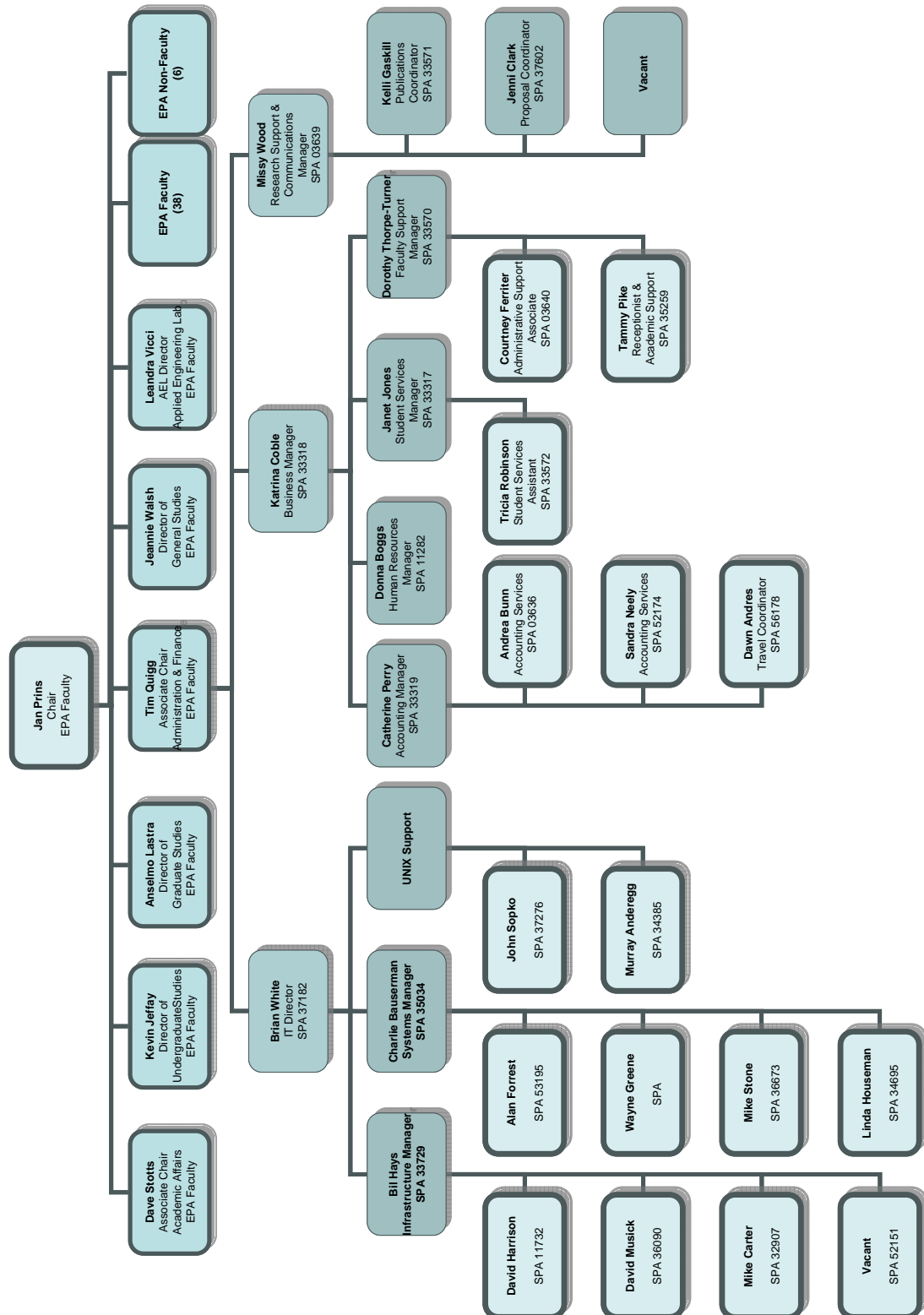
Our short-term hiring priorities for tenure-track faculty are in bioinformatics and computer security.

UNC, like public universities everywhere, is faced with budget cuts. We expect a substantial permanent budget cut in the next fiscal year. At the same time, the university projects a 16% enrollment growth in undergraduate and graduate populations over the next 8 years and expects to receive additional faculty positions to help meet the increased teaching demand. These positions will follow undergraduate instructional needs first, but will also be used to support specific initiatives targeted by the university such as Applied Sciences and Engineering, Biomedical imaging, Energy, Environment, and Quantitative Biology.

As mentioned in the section above, we believe we will be able to significantly expand undergraduate instruction. We are also natural participants in many of the initiatives listed above. Thus we are hopeful that we will be able to obtain the faculty positions we need through a combination of these two mechanisms.

9 Appendices

9.1 Appendix A: Department organizational chart

Jan Prins
Chair
EPA Faculty

Dave Stotts
Associate Chair
Academic Affairs
EPA Faculty

Kevin Jeffay
Director of
UndergraduateStudies
EPA Faculty

Anselmo Lastra
Director of
Graduate Studies
EPA Faculty

Tim Quigg
Associate Chair
Administration & Finance
EPA Faculty

Jeannie Walsh
Director of
General Studies
EPA Faculty

Leandra Vicci
AEL Director
Applied Engineering Lab
EPA Faculty

EPA Faculty
(38)

EPA Non-Faculty
(6)

Brian White
IT Director
SPA 37182

Katrina Coble
Business Manager
SPA 33318

Missy Wood
Research Support &
Communications
Manager
SPA 03639

UNIX Support

John Sopko
SPA 37276

Murray Anderegg
SPA 34385

Charlie Bauserman
Systems Manager
SPA 35034

Alan Forrest
SPA 53195

Wayne Greene
SPA

Mike Stone
SPA 36673

Linda Houseman
SPA 34695

Bil Hays
Infrastructure Manager
SPA 33729

David Harrison
SPA 11732

David Musick
SPA 36090

Mike Carter
SPA 32907

Vacant
SPA 52151

Catherine Perry
Accounting Manager
SPA 33319

Andrea Bunn
Accounting Services
SPA 03636

Sandra Neely
Accounting Services
SPA 52174

Dawn Andres
Travel Coordinator
SPA 56178

Donna Boggs
Human Resources
Manager
SPA 11282

Janet Jones
Student Services
Manager
SPA 33317

Tricia Robinson
Student Services
Assistant
SPA 33572

Dorothy Thorpe-Turner
Faculty Support
Manager
SPA 33570

Courtney Ferriter
Administrative Support
Associate
SPA 03640

Tammy Pike
Receptionist &
Academic Support
SPA 35259

Kelli Gaskill
Publications
Coordinator
SPA 33571

Jenni Clark
Proposal Coordinator
SPA 37602

Vacant

9.2 Appendix B: Undergraduate starting salaries

The following tables report the top three majors with the highest average starting salaries in the university in each year.

2003 Majors	Full-Time Salaries Reported	Mean Annual Salary	Annual Range
1. Computer Science	8	$41,472	$24,000-$60,000
2. Nursing	77	$39,198	$30,000-$65,400
3. Business Administration	114	$38,793	$13,000-$60,000

2004 Majors	Full-Time Salaries Reported	Mean Annual Salary	Annual Range
1. Computer Science	6	$58,500	$46,000-$74,000
2. Business Administration	117	$41,054	$15,000-$60,000
3. Political Science	20	$34,786	$23,000-$55,000

2005 Majors	Full-Time Salaries Reported	Mean Annual Salary	Annual Range
1. Computer Science	7	$51,957	$40,000-$75,000
2. Sociology	5	$34,000	$21,000-$62,000
3. Communication Studies	23	$31,549	$15,000-$73,000

2006 Majors	Full-Time Salaries Reported	Mean Annual Salary	Annual Range
1. Computer Science	4	$60,000	$43,000-$80,000
2. Business Administration	146	$47,534	$15,000-$68,000
3. Communication Studies	20	$31,820	$14,500-$65,000

2007 Majors	Full-Time Salaries Reported	Mean Annual Salary	Annual Range
1. Information Science	3	$59,667	$49,000-$75,000
2. Computer Science	10	$53,850	$35,000-$80,000
3. Business Administration	158	$49,921	$14,400-$75,000

9.3 Appendix C: Minority scholarship support

Summer Pre-graduate Research Experience (SPGRE)

Full Name	Undergrad Institution	Faculty Preceptor	Precept or Dept	Year	Abstract Title
Larnell Lennon	NCSU	William Howell	CS	1988	Application of Expert Systems: Technology to Problem Characterization
Zebrena Blount	ECSU	William Howell	CS	1989	Facilities Information Accessing System
Raymond Hunter	ECSU	William Howell	CS	1989	Facilities Information Accessing System
Michelle L. Jones	Spelman	James Coggins	CS	1992	Mathematical Foundations of Image Geometry
Joseph Fletcher III	Southern Univ.	Leandra Vicci	CS	1993	Design of a Scanning Tunneling Microscope for Nano-Manipulation
Stephanie C. Elder	Clark Atlanta	Fred Brooks	CS	1997	Visualization of an Architectural Design
James Riddick	Norfolk State	Kevin Jeffay	CS	2000	Building a Web-Based Submission Tracking and Reviewing System for Journal Papers
Annette Booker	Norfolk	Gary Bishop	CS	2001	Integral Apollonian Circle Packing and C++
McKenzie M. Slaughter	Hampton	Jack Snoeyink	CS	2002	Model Fitting in the Protein Interactive Theater System
Carl Bailey	Hampton	R. Taylor, D. Marshburn	CS	2003	
Ashley Brooks	Hampton	Gail Jones, Russ Taylor	Educ & CS	2003	Nanoscale Education Project
Edwin Cuc	Texas Southern	R. Taylor, D. Marshburn	CS & Mat Sci	2003	Collecting Z-Slices (Stacks) using IPLab
Jennifer Franks	Hampton	R. Taylor, D. Marshburn	CS & Mat Sci	2003	Multi-Variate Visualization Program
Mikal McMillan	Hampton	Leandra Vicci,	CS	2003	Six-Pole Amplifier for the Three Dimensional Force Microscope
Chinyere Mgbenka	Bowie State	Russell Taylor, D. Marshburn	CS & Mat Sci	2003	3D Stack Collector and IPLab Software for Windows On Hercules Microscope
Angelina Washington	Alabama A&M	Wei Wang, Jun Huan	CS	2003	Identifying Computational Techniques
Tywandre Harris	Elizabeth City State	Russell Taylor	CS	2006	Performance Evaluation of the Video Spot Tracker
James Stigall	St. Paul's College	Gary Bishop	cs	2008	Methods for Educating Visually and Physically Disabled Students Using Technology

Academic year support (via AGEP)

AGEP Funded Computer Science Students 1998-2008

Undergraduates

Name	Academic Year (Fall-Spring)	Faculty Member	
Bryan Crumpler	2000-2001	Frederick Brooks	Computer Science
James Watts	2002-2003	Ketan Mayer-Patel	Computer Science

Graduate Students

Name	Academic Year Funded (Fall-Spring)	Faculty Member	
George Greeene	2002-2003	David Plaisted	Computer Science
George Greene	2003-2004	David Plaisted	Computer Science
Keith Lee	2004-2005	David Stotts	Computer Science
Tristin Celestin	2005-2006	Leonard McMillan	Computer Science
Stephen Guy	2006-2007	Ming Lin	Computer Science
Avery Smith	2006-2007	Kevin Jeffay	Computer Science

Initial Summer Research for Graduate Students

Lavar Askew	Summer of 2006	Dinesh Manocha	Computer Science

9.4 Appendix D: Alumni initial placement

This table details the initial employment of all Ph.D's over the past ten years, and placement of some MS and BS (obtained by self-identification from the alumni survey).

Name/year awarded degree	Initial job after graduation from UNC	Initial Employer (if known, further career information in parentheses)
Ph.D.		
David Chen, Ph.D. 1998	Assistant Professor	University of Houston
Rik Faith, Ph.D. 1998	Member Technical Staff	Data General (Red Hat, NetApp)
Stephen Goddard, Ph.D. 1998	Assistant Professor	University of Nebraska-Lincoln
Mark Livingston, Ph.D 1998	Software engineer	Hewlett-Packard Labs
David Luebke, Ph.D. 1998	Assistant Professor	University of Virginia (NVIDIA Research)
Marc Olano, Ph.D. 1998	Consultant	Silicon Graphics, Inc. (NVIDIA, Assoc Prof. Univ Maryland Baltimore County.)
William Mark, Ph.D. 1999	Post-doc	Stanford University
Kevin Arthur, Ph.D. 2000	Consultant	3rdTech, Inc.
John Keyser, Ph.D. 2000	Assistant Professor	Texas A&M (Worked at Alien Skin Software, Industrial Light & Magic, Synaptics)
Manuel Menezes de Oliveira Neto, Ph.D. 2000	Assistant Professor	SUNY Stony Brook (Assistant Professor, Federal University of Rio Grande do Sul, Brazil)
Brent Insko, Ph.D. 2001	Software architect	3Dlabs (Intel)
Michael Meehan, Ph.D. 2001	Consultant	Internet company (Researcher at Stanford, Stanford law school)

Martin Styner, Ph.D. 2001	Assistant Professor	Duke University (Faculty at University of Bern, Assistant Professor of Psychiatry at UNC-Chapel Hill)
Benjamin Lok, Ph.D. 2002	Post-doc	UNC-Charlotte (Assistant Professor, University of Florida)
Alexandra Bokinsky, Ph.D. 2003	Software consultant	Geometric Tools, Inc.
Gregory Clary, Ph.D. 2003	Software developer	Ericsson
Jessica Crouch, Ph.D. 2003	Assistant Professor	Old Dominion
Christopher Dwyer, Ph.D. 2003	Assistant Professor	Duke University
Mark Harris, Ph.D. 2003	Consultant	NVIDIA Corporation
Yongjik Kim, Ph.D. 2003	Software architect	Google Korea
Aditi Majumder, Ph.D. 2003	Assistant Professor	University of California-Irvine
Pablo Rademacher, Ph.D. 2003	Software consultant	Google Earth
Vasil Roussev, Ph.D. 2003	Assistant Professor,	New Orleans University
Anand Srinivasan, Ph.D. 2003	Researcher	Bell Labs India
Michele Weigle, Ph.D. 2003	Assistant Professor	Old Dominion
Ruigang Yang, Ph.D. 2003	Assistant Professor	University of Kentucky
Paul Yushkevich, Ph.D. 2003	Research Assistant Professor	Radiology, University of Pennsylvania
William Baxter, Ph.D. 2004	Researcher	OLM Digital
Thomas Fletcher, Ph.D. 2004	Assistant Professor	University of Utah
Yonatan Fridman, Ph.D. 2004	Consultant	Medtronic (Verizon)
Shelby Funk, Ph.D. 2004	Assistant Professor	University of Georgia
Naga Govindaraju, Ph.D. 2004	Post-doc	Microsoft
Sean Ho, Ph.D. 2004	Assistant Professor	Trinity Western University

Philip Holman, Ph.D. 2004	Software engineer	SAS Institute
Tom Hudson, Ph.D. 2004	Assistant Professor	UNC-Wilmington
Martin Isenburg, Ph.D. 2004	Research specialist	Lawrence Livermore Labs
Hye-Chung Kum, Ph.D. 2004	Research Assistant Professor	UNC-Chapel Hill
Miguel Otaduy, Ph.D. 2004	Post-doc	ETH Zurich
Erin Parker, Ph.D. 2004	Clinical Assistant Professor	University of Utah
Adam Seeger, Ph.D. 2004	Software consultant	Intel Nanovision
Andrew Thall, Ph.D. 2004	Assistant Professor	Alma College
Paul Zimmons, Ph.D. 2004	Software developer	Electronic Arts
David Gotz, Ph.D. 2005	Post-doc	IBM Research
Karl Hillesland, Ph.D. 2005	Software developer	Electronic Arts (Pixelux Entertainment)
Nguyen-tuong Long Le, Ph.D. 2005	Research specialist	Max Planck Institute
Swaha Miller, Ph.D. 2005	Post-doc	Microsoft
Jaime Navon, Ph.D. 2005	Assistant Professor	Pontificia Universidad Catolica de Chile (Associate Professor, Pontificia Universidad Catolica de Chile)
David Ott, Ph.D. 2005	Post-doc	Intel
Sharif Razzaque, Ph.D. 2005	Post-doc	UNC-Chapel Hill
Michael Rosenthal, Ph.D. 2005	Radiology resident	Brigham & Women's Hospital
Jason Smith, Ph.D. 2005	Research specialist	IBM T.J. Watson Research Lab
Gokul Varadhan, Ph.D. 2005	Consultant	Google
Kelly Ward, Ph.D. 2005	Consultant	Disney
Sung-Eui Yoon, Ph.D. 2005	Assistant Professor	Korea Advanced Institute of Science & Technology

Deepak Bandyopadhyay, Ph.D. 2006	Post-doc	Research and Development at Johnson & Johnson Pharmaceuticals (GSK)
Umamaheswari Devi, Ph.D. 2006	Post-doc	IBM Research
Felix Hernandez, Ph.D. 2006	Consultant	Google
Jun Huan, Ph.D. 2006	Assistant Professor	University of Kansas
Theodore Kim, Ph.D. 2006	Post-doc	UNC-Chapel Hill (Post-doctoral associate, Cornell University)
Andrew Leaver-Fay, Ph.D 2006	Post-doc	University of Washington
Jinze Liu, Ph.D. 2006	Assistant Professor	University of Kentucky
Peter Lorenzen, Ph.D. 2006	Research Specialist	US Department of Veterans' Affairs, Center for Imaging Neurodegenerative Diseases
Kok Lim Low, Ph.D. 2006	Assistant Professor	National University of Singapore
Ajith Mascarenhas, PhD. 2006	Researcher	Sandia National Labs
Olufisayo Omojokun, Ph.D. 2006	Post-doc	Georgia Institute of Technology
Avneesh Sud, Ph.D. 2006	Consultant	Microsoft
Timothy Terriberry, Ph.D. 2006	Research specialist	Argon S.T.
Christopher Weigle, Ph.D. 2006	Post-doc	Oak Ridge National Labs
Bonnie Danette Allen, Ph.D. 2007	Research specialist	NASA, Langley Research Center
Eric Bennett, Ph.D. 2007	Post-doc	Microsoft
David Borland, Ph.D. 2007	Lead programmer	Renaissance Computing Institute

Eric Burns, Ph.D. 2007	Consultant	3D Solve
Gregory Coombe, Ph.D. 2007	Software developer	Google
Nathan Fisher, Ph.D. 2007	Assistant Professor	Wayne State
Justin Hensley, Ph.D. 2007	Consultant	Advanced Micro Devices, Inc.
Guodong Liu, Ph.D. 2007	Researcher	Google
David Lloyd, Ph.D. 2007	Post-doc	Microsoft
Marcelinus Prastawa, Ph.D. 2007	Research Assistant Professor	University of Utah
Alok Shriram, Ph.D. 2007	Software engineer	Microsoft
Joshua Steinhurst, Ph.D. 2007	Assistant Professor	Bucknell University
Aaron Block, Ph.D. 2008	Post-doc	Microsoft
Robert Broadhurst, Ph.D. 2008	Research specialist	Morphormics, Inc
Bradley Davis, Ph.D. 2008	Consultant	Kitware, Inc.
Nico Galoppo, Ph.D. 2008	Post-doc	Intel
Qiong Han, Ph.D. 2008	Research Assistant Professor	University of Kentucky
Seon Joo Kim, Ph.D. 2008	Post-doc	UNC-Chapel Hill
Sang-Uok Kum, Ph.D. 2008	Consultant	Google
E. Scott Larsen, Ph.D. 2008	Consultant	Google
Joshua Levy, Ph.D. 2008	Research specialist	Morphormics, Inc
Yuanxin Liu, Ph.D. 2008	Software engineer	Geomagic, Inc.
Peter Parente, Ph.D. 2008	Post-doc	IBM
Sushant Rewaskar, Ph.D. 2008	Software Engineer	Microsoft
Xueyi Wang, Ph.D. 2008	Assistant Professor	Northwest Nazarene University
Hua Yang, Ph.D. 2008	Consultant	Kitware, Inc.

M.S.		
Jan Borgersen, M.S. 1998	Founder	Internet company
Anshu Sharma, M.S. 1998	Software consultant	Oracle
Benjamin Elgin, M.S. 2000	Consultant	3rdTech, Inc.
Wesley Hunt, M.S. 2000	Game developer	iRock Games
Mark Foskey, M.S. 2001	Research Assistant Professor	Department of Radiology, UNC-Chapel Hill (Research Assistant Professor, Radiation Oncology, UNC-Chapel Hill)
Stefan Sain, M.S. 2001	Researcher	TenFold Corporation
Paul McLaurin, M.S. 2002	Consultant	Numerical Design, Ltd.
Samir Naik, M.S. 2002	Software consultant	Disney Imagineering
Vincent Scheib, M.S. 2002	Game designer	Game company "The Collective" (Studio Gigante, NDL (Emergent Game Technologies); now an architect at Emergent)
Wesley Miaw, M.S. 2003	Post-doc	IBM
Brad Hinson, M.S. 2004	Software architect	Red Hat, Inc.
Dennis Jen, M.S. 2004	Post-doc	Pacific Northwest National Laboratory
Ankur Agiwal, M.S. 2005	Software developer	Microsoft
Patrick Quirk, M.S. 2006	Web developer	SportsMEDIA Tech Corp.
Suddha Basu, M.S. 2007	Web developer	Yahoo!, Inc.
Vinay Bondhugula, M.S. 2007	Software developer	VMware, Inc.
Casey Goodlett, M.S. 2007	Graduate school	University of Utah
Julia Grace, M.S. 2007	Post-doc	IBM Almaden Research Center
Adam Lake, M.S. 2007	Software engineer	Intel Architecture Laboratories
Miranda Steed, M.S. 2008	Consultant	Electrotank

B.S.		
David Kennedy, B.S. 1998	Consultant	Keane, Inc.
Mark Kucera, B.S. 1998	Web developer	Lowe's Corp.
Charles Speight, B.S. 1998	Founder	Internet startup
James Wallace, B.S. 1998	Baseball player	Minor league baseball
Robert McCauley, B.S. 1999	Research specialist	Lockheed Martin Corp, EPA High Performance Computing and Scientific Visualization Lab
Randy Murdock, B.S. 1999	Consultant	Ganymede Software
Joel Sgro, B.S. 1999	Ensign	United States Navy
Ashraf Farrag, B.S. 2000	Post-doc	UNC-Chapel Hill (Medical school)
Jason Luck, B.S. 2000	Software developer	Nortel Networks (Senior software engineer in research and development for Medidata Solutions, Inc.)
Eric Whitney, B.S. 2000	Research and development	IBM (Business school, UNC-Chapel Hill)
Jason Howell, B.S. 2001	Software engineer	Microsoft (Escalation engineer supporting SQL Server 2005/2008 for Microsoft)
Jonathan Pence, B.S. 2001	Software developer	Yardi Systems
Sean Rielly, B.S. 2001	Software developer	Cisco Systems
Christopher Schenck, B.S. 2001	Web developer	ESPN.com
Anthony Davis, B.S. 2002	Graduate school	Georgetown law school (Associate at K&L Gates)
Serge Gagarin, B.S. 2002	Systems analyst	MicroSystems Integration, Inc.
Courtney Ramey, B.S. 2002	Programmer	IBM Global Services (MS and MBA from Boston University)
Brian Sumner, B.S. 2002	Software developer	Startup in Atlanta

Matthew Vross, B.S. 2002	Software developer	Information Systems Solutions, Inc.
Brad Davis, B.S. 2005	Consultant	Amentra, Inc.
Jeff Brubaker, B.S. 2006	Software consultant	Synopsys
Kris Jordan, B.S. 2007	Graduate school	Brown University
Chad Haynes, B.S. 2008	Research lab programmer	Rockefeller University
Meg Sorber, B.S 2008	Researcher	GobalPTM

9.5 Appendix E: Alumni distinctions

UNC-Computer Science Alumni Honors and Awards

Michael Ackerman, PhD, 1971 — Director, Visible Human Project, National Library of Medicine

J. Craig Mudge, PhD, 1973 — Former director Xerox Parc Computer Science Research Lab. Manager, DEC PDP 11/60 minicomputer development. Fellow of the Australian Academy of Technology Sciences and Engineering.

Reid Christenberry, M.S. 1975 — Miami University's first vice president for information technology

Jon Bentley, Ph.D. 1976 — Distinguished member of the technical staff, Avaya Reearch Labs. Author of the celebrated *Programming Pearls* columns and texts. *Dr. Dobb's* Excellence in Programming Award.

Ben Mitchell, M.S. 1976 — Associate vice chancellor for Institutional Affairs and professor of Health Information Management at the University of Mississippi Medical Center

Ken Bell, M.S. 1976 — Senior Vice President and CIO for Orbital Sciences Corporation

John Crawford (MS, 1977) — Intel Fellow, Intel Corp. Chief Architect of Intel i386 and i486 processors, manager of Pentium and Itanium processor development. 1995 Eckert-Mauchly Award for contributions to Computer and Digital Systems architecture.

Diane Pozefsky (PhD, 1979) — IBM Fellow, Director of Storage Networking Architecture, IBM Storage Systems.

Chris Schleter, M.S. 1981 — Manager of Sport Services for the 2000 Olympic Games in Sydney

Mark Hutchinson, B.S. 1981 — Software architect and head developer at EZ-EMC

Nevin Fouts, B.S. 1981 — Associate dean for information technology at Duke University's Fuqua School of Business

Steven Bellovin, Ph.D. 1982 — AT&T Fellow and Prof. of Computer Science at Columbia University; elected to National

	Academy of Engineering; Usenix Lifetime Achievement award for co-creation of USENET; 2007 National Computer Systems Security Award, presented by the National Institute of Standards and Technology and the National Security Agency
Lee Nackman, Ph.D. 1982	Director of architecture for the area of IBM's software business that produces application development tools, Web application servers, and object middleware; Vice-President, Application and Development Tools, IBM
Patrice Kerkoulas, B.S. 1984	Association for Information and Image Management (AIIM) Master of Information Technologies Award
Ann Long Whitmeyer, B.S. 1984	Vice president of Bricker & Associates, Inc.
Sam Black, M.S. 1986	Pixar Animation Studios, voice work for the movie *Monsters, Inc.*
Nelson Yount, B.S. 1986	Chairman's Innovation Award from NCR
R. Kent Dybvig, Ph.D. 1987	Selected as an ACM Distinguished Engineer
Peter Litwinowicz, M.S. 1987	Co-developed the Motion Paint™ system that was used for 8 1/2 minutes of special effects in the film *What Dreams May Come*, which won the 1999 Academy Award for Best Visual Effects; Technical Achievement Award from the Academy of Motion Picture Arts and Sciences
Gib Johnson, B.S. 1987	Vice president in charge of all Florida operations for Broadreach Consulting, Inc.
Susan King Kellogg, B.S. 1987	Associate Dean of Information Technology for the Kenan-Flagler Business School at UNC-Chapel Hill
Andrew Glassner,PhD, 1988	Novelist, writer-director. Author of numerous texts on Computer Graphics. Editor-in-chief of ACM Transactions on Computer Graphics
Jay Blackburn, B.S. 1989	Cofounder of TEKgroup International Inc.
Stuart Faulk, Ph.D. 1989	Director of the National Science Foundation's Software Engineering Research Center (SERC) for the Oregon Associated Universities

Marc Levoy (PhD, 1989)	Director, Digital Michelangelo Project, Professor of Computer Science and Electrical Engineering, Stanford University.
Thom Haynes, M.S. 1989	Awarded the designation of IBM "Master Inventor"; more than 10 issued U.S. patents, 21 issued non-U.S. patents, and several patents that have been identified as being in the top 10 percent of the IBM portfolio
Randy Van Dyke, M.S. 1989	Appointed to the Board of Directors of the Computer Law Association; Chair, Emerging Technologies Committee of the American Intellectual Property Law Association.
Susan Gauch, Ph.D. 1990	Miller Award for Research from University of Kansas School of Engineering
William Oliver, MS, 1990	Chief, Forensic Imaging Section, Office of Armed Forces Medical Examiner
Yen-Ping Shan, Ph.D. 1990	Founder and CEO, iSource Technologies
Ming Ouh-Young, Ph.D., 1990	Chairman, Department of Computer Science and Information Engineering, National Taiwan University.
Scott Leslie, B.S. 1991	Principal systems developer, later software manager, SAS Institute
John Q. Walker, PhD, 1991	Founder, Ganymede Software. Director, NetIQ Corporation. Founder, Zenph Studios
Gopal Gupta, Ph.D. 1992	Named to the editorial board of the *Journal of Logic Programming;* organized the First International Workshop on Practical Aspects of Declarative Languages, held with the ACM Principles of Programming Languages Conference; general chair, 16th International Conference on Logic Programming
David Banks, Ph.D. 1993	Named Hearin-Hess Professor of Engineering at Mississippi State
Ulrich Neumann, Ph.D. 1993	Director of the USC's Integrated Media Systems Center; named Charles Lee Powell Chair in Engineering.
Injong Rhee, Ph.D. 1994	National Science Foundation CAREER Award

Amitabh Varshney, Ph.D. 1994	Received the first IEEE Visualization Technical Achievement Award "in recognition of Seminal Achievements in Scientific Visualization of Molecular Surfaces". Professor of Computer Science at University of Maryland at College Park.
Michael Thomas, B.S. 1995	Outstanding Technical Achievement Award from IBM's Tivoli division
Victoria Interrante, Ph.D. 1996	Faculty Early Career Development Award from the National Science Foundation; 1999 Presidential Early Career Award for Scientists and Engineers. Associate Professor of Computer Science at University of Minnesota.
Michael Capps, M.S. 1996	President of Epic Games, Inc.
Mike Goslin, M.S. 1996	Vice-President, Disney Interactive Media Group
Chenwei Gu, M.S. 1996	Senior business analyst, CapitalOne Financial
Anantha Kancherla, M.S. 1996	Received the Technical Emmy in the "Advanced Media Technology/Video Gaming" category, awarded to Microsoft Direct 3D 9 & 10 for Pioneering Work in Near and Real-Time Fully Programmable Shading via Modern Graphics Processors
Cindy Hong, B.S. 1996	Lighting technical director for Pixar's *Monsters, Inc.* and *Madagascar*
Greg Bollella, Ph.D. 1997	Distinguished Engineer, Sun Microsystems
Mark Mine, Ph.D. 1997	Disney Imagineering
Leonard McMillan, PhD, 1997	Associate Professor, Computer Graphics Group, MIT (now Assoc. Prof. of CS at UNC Chapel Hill).
Rik Faith, Ph.D. 1998	Co-author, "Open-Source Implementation of the SPC-1 Workload," IEEE International Symposium on Workload Characterization, October 2005
Stephen Goddard, Ph.D. 1998	Associate Professor and Chair of Dept of Computer Science and Engineering at University of Nebraska-Lincoln; Program Chair of RTSS 08 and RTAS 06; General Chair of RTAS 07 and RTSS 09; Over $14M in research funding since graduation

Mark Livingston, Ph.D. 1998	ISMAR Program Chair (2007-2008) and Steering Committee (2008-2010); NRL Alan Berman Research Publication Award (2003); IEEE VR Honorable Mention Best Paper (2006)
Alan Liu, Ph.D. 1998	Received the Satava Award at the 2008 Medicine Meets Virtual Reality (MMVR) Conference
David Luebke, Ph.D. 1998	Test of Time Award, Symposium on Interactive 3D Graphics; National Science Foundation CAREER award; Department of Energy Early Career Principal Investigator Award; Lead author, "Level of Detail for 3D Graphics", Morgan Kaufmann Publishers; General Chair and Papers Chair roles in several ACM and IEEE conferences; Distinguished Inventor award, NVIDIA Corporation; multiple papers, patents, and book chapters
Marc Olano, Ph.D. 1998	Promoted to Associate Professor with Tenure at UMBC; was granted seven patents; co-authored *Real-Time Shading* book, AK Peters 2002; invited expert, Khronos Group/OpenGL ARB
Jan Borgersen, M.S. 1998	Panelist, Web Audio Technologies, 2001 Game Developers Conference; Speaker, The Ajax Experience - Boston, 2006
Anshu Sharma, M.S. 1998	Currently Senior Director, Product Strategy for salesforce.com; Founded and ran internal venture-funded Oracle SaaS Platform; Published on Identity Management and Cloud Computing (SaaS) on ZDNet, Sarbanes-Oxley Journal, Security Magazine
Charles Speight, B.S. 1998	Chief Technology Officer for Digital Marketing Services LOB at Acxiom Corp.
James Wallace, B.S. 1998	Co-founder of a technology services business in 2004. Currently serving as Vice President of Operations
William Mark, Ph.D. 1999	National Science Foundation CAREER Award
Robert McCauley, B.S. 1999	Chair, North Carolina System Administrators
John Keyser, Ph.D. 2000	Received teaching awards from Texas A&M: Montague Scholar Award (2003) and

Association of Former Students Distinguished Achievement Award in Teaching (2007)

Carl Mueller, Ph.D. 2000   Nintendo Technology Development, Inc.

Benjamin Elgin, M.S. 2000   Co-inventor on a number of 3rdTech patents relating to the DeltaSphere 3D scanning system

Bradley Timmers, B.S. 2000   Team lead at Medidata of data extraction programmers before transferring to Research & Development; led numerous trainings for developers using Medidata's data model, in the US, Europe, and India

Brent Insko, Ph.D. 2001   Book chapter titled "Measuring Presence: Subjective, Behavioral and Physiological Methods" in *Being There: Concepts, effects and measurement of user presence in synthetic environments.* G. Riva, F. Davide, W.A IJsselsteijn (Eds.) Ios Press, 2003, Amsterdam, The Netherlands.

Martin Styner, Ph.D. 2001   Lead author of "Morphometric analysis of lateral ventricles in schizophrenia and healthy controls regarding genetic and disease-specific factors," Proceedings of the National Academy of Science, 2005, Vol 102, No. 12, March 29, p 4872-4877.

Mark Foskey, M.S. 2001   Lead author on a paper applying deformable registration to prostate cancer research, "Large deformation 3D image registration in image-guided radiation therapy" Phys. Med. Biol. 50, 5869-5892.

Jason Howell, B.S. 2001   Presented a 3 hour Business Intelligence session about SQL Server 2005 at the PASS 2007 conference (US convention of the Professional Association of SQL Server).

Jonathan Pence, B.S. 2001   Development Lead for group within Yardi Systems; started own website development business

Benjamin Lok, Ph.D. 2002   National Science Foundation CAREER Award; IEEE Virtual Reality 2008 Best Paper

Ramesh Raskar, Ph.D. 2002   Recipient of Global Indus Technovators Award

Paul McLaurin, M.S. 2002	Presenter at Gamefest Conference and Austin Game Developers Conference
Samir Naik, M.S. 2002	Technical Director of Virtual Worlds group for MTV/Nickelodeon. Lead technical development for all new virtual worlds initiatives across the Kids & Family division of the company
Vincent Scheib, M.S. 2002	Foundational contributor to Patent pending system Floodgate (owned by Emergent Game Technologies)
Courtney Ramey, B.S. 2002	IBM Certified IT Management Consultant, December 2003; Co-author: "Demand-driven IT service management through enterprise resource planning for IT," published April 2006; patent pending for the IT Service Management Technology
Alexandra Bokinsky, Ph.D. 2003	Company has been contracting for the National Institutes of Health (NIH) for over 8 years developing MIPAV: Medical Image Processing Analysis and Visualization. MIPAV is rapidly becoming recognized as one of the best medical image processing and visualization applications available to the medical community.
Mark Harris, Ph.D. 2003	Served as general chair of Graphics Hardware conference in 2005 and program chair in 2003 and 2006; notable publications: "Scan Primitives for GPU Computing". Sengupta, S., Harris, M., and Owens, J.D. Proceedings of Graphics Hardware 2007. [This paper won the best paper award at GH2007.] "Survey of General-Purpose Computation on Graphics Hardware" [revised]. Owens, J.D., Luebke, D., Govindaraju, N., Harris, M., Krüger, Jens, Lefohn, A.E., and Purcell, T. Computer Graphics Forum, 26, 2007.
Sean Ho, Ph.D. 2004	Leading first-year undergraduate computer science program, Python and Java/C++
Miguel Otaduy, Ph.D. 2004	Book on haptics; assistant professor at URJC Madrid.
Aaron Fulkerson, B.S. 2004	Co-founder, MindTouch, Inc.
David Gotz, Ph.D. 2005	Conference Committee Organizer for IEEE VisWeek in 2007 and 2008
Ankur Agiwal, M.S. 2005	Filed 3 Patents: 1.Software architecture

	providing ad hoc wireless networking capabilities (pending) 2.Wireless mesh networking with multiple simultaneous transmissions by nearby nodes (USPTO# 20080056149) 3. Physical location verification and low power provisioning for wireless network devices (USPTO# 20070081508); author of a networking standard: WiMedia Layer 2 Protocol (WLP Standard, WiMedia Alliance of Intel, Nokia, Samsung, Staccato, Wisair, Alereon, etc.
Deepak Bandyopadhyay, Ph.D. 2006	Paper "Recent Advances in Cheminformatics" was the most-accessed article in J. Chem. Inf. Modeling in 2007.
Jun Huan, Ph.D. 2006	Program Committee Member, 25th IEEE International Conference on Data Engineering; Award Committee Co-Chair, 2008 IEEE International Conference on BioInformation and BioMedicine
Casey Goodlett, M.S. 2007	MICCAI 2008 paper nominated for student award: Casey Goodlett, P. Thomas Fletcher, John Gilmore, Guido Gerig. "Group Statistics of DTI Fiber Bundles Using Spatial Functions of Tensor Measures." *Lecture Notes in Computer Science, Medical Image Computing and Computer-Assisted Intervention*, © Springer-Verlag LNCS vol. 5241, 2008. pp. 1068-1075.
Adam Lake, M.S. 2007	Larrabee SIGGRAPH 2008 paper, Section editor of 3 Game Programming Gems Books, many articles, book chapters, and whitepapers published in domain of computer graphics, Graphics Hardware 2008 Program Co-chair, numerous paper review committee positions for I3D and SIGGRAPH, over 35 patents.

9.6 Appendix F: Graduate student fellowships

This table lists internal and external fellowships awarded 1998 – 2008.

NAME	SUPPORTING AGENCY
Justin Hensley	ATI Industry Fellowship
Nicholas Galoppo	ATI/AMD Industry Fellowship
Nicolas Galoppo	Belgian American Educational Foundation Fellowship
Nick Vallidis	Departmental Alumni Fellowship
Paul Yushkevich	Departmental Alumni Fellowship
Michelle Weigle	Departmental Alumni Fellowship
Phil Holman	Departmental Alumni Fellowship
Miguel Otaduy	Departmental Alumni Fellowship
Olufisayo Omojokun	Departmental Alumni Fellowship
Aaron Block	Departmental Alumni Fellowship
Jun (Luke) Huan	Departmental Alumni Fellowship
Kelly Van Busum	Depauw University Teaching Fellowship
Bjorn Brandenburg	Fulbright Pre-doctoral Fellowship
Miguel Otaduy	Government of the Basque Country Fellowship
Phil Holman	IBM Industry Fellowship
Uma Devi	IBM Industry Fellowship
Uma Devi	IBM Industry Fellowship
Dorian Miller	IBM Industry Fellowship
Kenny Hoff	Intel Industry Fellowship
Erin Parker	Lawrence Livermore National Laboratory Graduate Fellowship
Erin Parker	Lawrence Livermore National Laboratory Graduate Fellowship
Voicu Popescu	Link Foundation Advanced Simulation and Training Fellowship
Brent Insko	Link Foundation Advanced Simulation and Training Fellowship
Aditi Majumder	Link Foundation Advanced Simulation and Training Fellowship
Wei-Chao Chen	Link Foundation Advanced Simulation and Training Fellowship
Benjamin Lok	Link Foundation Advanced Simulation and Training Fellowship
William Baxter	Link Foundation Advanced Simulation and Training Fellowship
Sang-Uok Kum	Link Foundation Advanced Simulation and Training Fellowship
Ruigang Yang	Link Foundation Advanced Simulation and Training Fellowship
Jason Jerald	Link Foundation Advanced Simulation and Training Fellowship
Tabitha Peck	Link Foundation Advanced Simulation and Training Fellowship
Jessica Crawford Crouch	Lucent Technologies Industry Fellowship
Sasa Junuzovic	Microsoft Industry Fellowship
Dannette Allen	NASA Graduate Traineeship
Gennette Gill	National Defense Science and Engineering Graduate (NDSEG) Fellowship
Stephen Olivier	National Defense Science and Engineering Graduate (NDSEG) Fellowship

Alicia Wright	National Defense Science and Engineering Graduate (NDSEG) Fellowship
Andrew Leaver-Fay	National Library of Medicine Bioinformatics Traineeship
Kwangbom Choi	National Library of Medicine Bioinformatics Traineeship
Ning Jin	National Library of Medicine Bioinformatics Traineeship
Jason Jerald	National Physical Sciences Consortium Fellowship
George Greene	National Science Foundation Alliances for Graduate Education and the Professoriate (AGEP) Fellowship
Stephen Guy	National Science Foundation Alliances for Graduate Education and the Professoriate (AGEP) Fellowship
Andrew Leaver-Fay	National Science Foundation Biogeometry Traineeship
Andy Wilson	National Science Foundation Graduate Research Fellowship
Joshua Steinhurst	National Science Foundation Graduate Research Fellowship
Vince Scheib	National Science Foundation Graduate Research Fellowship
Peter Parente	National Science Foundation Graduate Research Fellowship
Aaron Block	National Science Foundation Graduate Research Fellowship
Brandon Lloyd	National Science Foundation Graduate Research Fellowship
Jeremy Wendt	National Science Foundation Graduate Research Fellowship
Gennette Gill	National Science Foundation Graduate Research Fellowship
Kirstin Williams	National Science Foundation Graduate Research Fellowship
Felix Hernandez	National Science Foundation Technology Research Program (ITR) Fellowship
Joshua Steinhurst	NVIDIA Industry Fellowship
Mark Harris	NVIDIA Industry Fellowship
William Baxter	NVIDIA Industry Fellowship
Greg Coombe	NVIDIA Industry Fellowship
Greg Coombe	NVIDIA Industry Fellowship
Scott Larsen	NVIDIA Industry Fellowship
Andrew Chen	Sandia National Laboratories Masters Fellowship
Alexandra Bokinsky	Silicon Graphics Industry Fellowship
Russ Gayle	U. S. Department of Energy Computational Science Graduate Fellowship
Sharif Razzaque	UNC Board of Governors Fellowship
Vince Scheib	UNC Board of Governors Fellowship
Susan Fisher	UNC Board of Governors Fellowship
Mark Lindsey	UNC Board of Governors Fellowship
Lavar Askew	UNC Board of Governors Fellowship
Michael Meehan	UNC Graduate School Dissertation Completion Fellowship
Hye-Chung (Monica) Kum	UNC Graduate School Dissertation Completion Fellowship
John Calandrino	UNC Graduate School Dissertation Completion Fellowship
Andy Wilson	UNC Graduate School Humphreys Fellowship
Ben Elgin	UNC Graduate School Merit Assistantship
Mark Harris	UNC Graduate School Merit Assistantship
Joshua Steinhurst	UNC Graduate School Merit Assistantship

Karl Strohmaier	UNC Graduate School Merit Assistantship
Jingdan Zhang	UNC Graduate School Merit Assistantship
Jeff Schoner	UNC Graduate School Merit Assistantship
Brian Cornell	UNC Graduate School Merit Assistantship
David Feng	UNC Graduate School Merit Assistantship
Rahul Narain	UNC Graduate School Merit Assistantship
David Wilkie	UNC Graduate School Merit Assistantship
Brad Hinson	UNC Graduate School North Carolina Minority Presence Fellowship
Avery Smith	UNC Graduate School North Carolina Minority Presence Fellowship
Joshua Steinhurst	UNC Graduate School Paul Hardin Dissertation Completion Fellowship
Dorian Miller	UNC Graduate School Royster Dissertation Completion fellowship.
Swaha Miller	UNC Graduate School Royster Society of Fellows Dissertation Fellowship
Sharif Razzaque	UNC Graduate School Royster Society of Fellows Dissertation Fellowship
Elizabeth Dolan	UNC Graduate School Royster Society of Fellows Fellowship
Sasa Junuzovic	UNC Graduate School Scholars for Tomorrow Fellowship
James Culp	UNC Graduate School Scholars for Tomorrow Fellowship
Christian Lauterbach	UNC Graduate School Scholars for Tomorrow Fellowship
Sisilla Sookdeo	UNC Graduate School Scholars for Tomorrow Fellowship
Qi Mo	UNC Graduate School Science and Technology Fellowship

9.7 Appendix G: Contracts and grants

Contracts, Grants, and Awards – Dept of Computer Science, 2004-2008

This list shows contracts and grants in to the Computer Science Department that active during the five years 2004 – 2008. It excludes some grants that supported CS researchers but were awarded through other departments, as well as some industry grants. Consult faculty CVs for complete information.

PI and Co-PI(s)	Funding Agency	Project Title	Approx. Amount of Award	Dates of Project
Jim Anderson, Sanjoy Baruah	National Science Foundation	Flexible Fair Scheduling on Multiprocessors	$235,278	9/1/02 - 8/31/05
Jim Anderson	National Science Foundation	Support for Real Time Systems Symposium 2004	$15,000	9/15/04- 8/31/05
Jim Anderson	National Science Foundation	Real-time Fine-grained Adaptivity on Multiprocessors: Acoustic Tracking as a Test Case	$358,300	8/15/04 – 7/31/07
Jim Anderson, Sanjoy Baruah	US Army Research Office	Real-Time Computing on Multicore Platforms	$215,894	9/15/06 – 11/14/08
Jim Anderson	National Science Foundation	CSR--EHS: Real-Time Computing on Multicore Platforms	$200,000	10/1/06 – 9/30/09
Jim Anderson, Sanjoy Baruah	National Science Foundation	Real-Time Synchronization on Multicore Platforms	$118,988	9/15/08 – 8/31/11
Sanjoy Baruah, Jim Anderson	National Science Foundation	Energy-Aware Synthesis of Embedded Systems on Multiprocessor Platforms	$270,000	8/15/03 – 7/31/07
Sanjoy Baruah, Jim Anderson	National Science Foundation	Multiprocessor real-time computing: formal foundations	$400,000	2/1/06 – 1/31/09
Jim Anderson, Sanjoy Baruah	Intel	Real-Time Computing on Multicore Systems	$165,000	5/1/06 – 4/30/09
Jim Anderson	IBM	Real-Time Linux for Multiprocessor Platforms	$18,000	1/1/08 – 12/31/09
Sanjoy Baruah, Jim Anderson	National Science Foundation	Formal foundations of real-time systems analysis	$270,000	9/1/08 – 8/31/11
Fred Brooks	National Science Foundation	Preparation of Two Books on the Science of Design	$488,604	3/1/06 – 2/28/09

Prasun Dewan	National Science Foundation	Log-based Middleware for Pervasive Application Sharing	$15,000	9/15/02 – 8/31/08
Prasun Dewan	National Science Foundation	User-Interface Generation for Mobile and Desktop Computing	$385,924	9/1/03 – 8/31/09
Prasun Dewan	National Science Foundation	Evaluating the Performance of Distributed Synchronous Collaboration Architecture	$289,170	9/1/07 – 8/31/10
Prasun Dewan	National Science Foundation	HCC-Small: Collaborative Mixed-Initiative Access Control	$410,162	9/1/08 – 8/31/11
Jan-Michael Frahm, S. Lazebnik, M. Pollefeys	ASCEND Intel LLC	3D Worlds for Location based Warfighter Assistance	$537,367	10/1/07 – 12/31/08
Jan-Michael Frahm	Honda Research Institute USA, Inc.	Visual Navigation for humanoid robot	$88,176	4/1/08 – 3/31/09
Henry Fuchs, Greg Welch	University of California, Lawrence Livermore National Laboratory	Front Projection Display Wall, Group Tele-Immersion, and Tracking Technologies	$400,000	11/26/01 – 3/31/05
Henry Fuchs, Greg Welch	National Science Foundation	ITR/SI: Real-TIme Long-Distance Terascale Computation for Full Bandwidth Tele-Immersion	$849,222	9/15/01 – 8/31/05
Henry Fuchs, Greg Welch, Herman Towles	Office of Naval Research	Wide Area Visuals for a Simulator in a Box	$1,794,939	4/10/03 – 12/31/08
Greg Welch, Henry Fuchs	National Library of Medicine	Three-Dimensional Tele-Presence for Medical consultation: Extending Medical Expertise Throughout, Between & Beyond Hospitals	$2,640,637	9/30/03 – 3/31/08
Henry Fuchs	National Cancer Institute	Virtual And Augmented Reality Guidance For Hepatic Rfa	$1,576,711	5/17/05 – 4/30/09
Henry Fuchs	University of California, Lawrence Livermore National Laboratory	Front Projection Display Wall Group Teleimmersion Tracking Technologies	$100,000	4/1/05 – 5/31/07

Henry Fuchs, Greg Welch, Herman Towles	Cisco Systems, Inc.	Prototype for Two-station, Four-Person, Proper Eye-Gaze Telepresence System	$814,909	8/1/06 – 10/31/08
Henry Fuchs, Greg Welch	Renaissance Science Corporation	STTR Deployable Intelligent Projection Systems for Training: Enhanced Integrate	$28,756	8/2/07 – 5/27/08
Henry Fuchs, Greg Welch, Andrei State, Herman Towles	US Air Force Office of Scientific Research	Future Analyst Workspace (A-Desk)	$260,000	6/12/08 – 3/11/09
Kevin Jeffay, F.D. Smith	National Science Foundation	Collaborative Research: Rate-Based Resource Allocation Methods for Real-Time Embedded Systems	$119,992	9/1/02 – 8/31/05
Kevin Jeffay	National Science Foundation	Ubiquitous Pixels: Transforming Collaboration and Teaching with Pervasive Wall-Sized Displays	$962,902	8/15/03 – 7/31/08
Kevin Jeffay, F.D. Smith	National Science Foundation	Generation and Validation of Synthetic Internet Traffic	$470,000	8/15/03 – 7/31/07
Kevin Jeffay, F.D. Smith	National Science Foundation	Collaborative Research:CRI:CRD Synthetic Traffic Generation Tools and Resources	$314,066	8/1/07 – 7/31/10
Jasleen Kaur	National Science Foundation	CAREER: Reassessing the Foundations of Internet Transport	$505,346	9/1/04 – 8/31/09
Anselmo Lastra	National Science Foundation	ITR-Collaborative Research: Image-Based Rendering In Forensic Science, Education, and Historical Preservation	$655,872	10/1/02 – 9/30/07
Anselmo Lastra	National Science Foundation	Fifth Generation Graphics Hardware	$362,000	8/15/03 – 7/31/08
Anselmo Lastra, Montek Singh	National Science Foundation	Power Aware Graphics Hardware	$350,000	6/1/07 – 5/31/10
Ming Lin	Office of Naval Research	Real-Time Interaction With Virtual Environments	$450,343	10/20/00 – 9/30/07
Ming Lin, Dinesh Manocha	National Science Foundation	High Fidelity Virtual Touch: Algorithms, Applications and Evaluation	$127,903	9/15/01 – 8/31/06
Ming Lin	US Army Research Office	Conference Support for ACM Workshop On "General Purpose Computing On Graphics Processors"	$15,000	6/13/04 – 12/12/04

Ming Lin	US Army Research Office	Physically-Based Interaction with Massive Datasets	$100,000	8/15/03 – 8/14/05
Ming Lin	National Science Foundation	Physically-Inspired Modeling For Haptic Rendering	$200,000	8/15/04 – 7/31/09
Ming Lin, Richard Superfine	National Science Foundation	Modeling & Simulation of Fibrin Fibers	$100,000	7/15/04 – 6/30/06
Ming Lin	Drexel University	CI-TEAM- (Subcontract to Drexel University)	$58,000	9/15/05 – 12/31/06
Ming Lin, Dinesh Manocha	US Army Research Office	Multiresolution Algorithms for Processing Giga-Models: Real-time visualization	$333,572	7/28/06 – 7/27/09
Ming Lin	National Science Foundation	CI-TEAm Implementation; Collaborative Research: Cyber-Infrastructure for Engineers	$225,000	1/1/07 – 12/31/08
Ming Lin, Dinesh Manocha, Jim Anderson	US Army Research Office	DURIP: High-Performance Many-Core Clusters for Modeling and Simulation	$149,050	9/19/08 – 9/18/09
Dinesh Manocha	Office of Naval Research	Video Based Acquisition, Representations and Rendering of Large Real and Synthetic Environments	$5,000	10/1/00 – 9/30/03
Dinesh Manocha, Ming Lin	US Army Research Office	Handling Massive Models: Representation, Real-time Display & Interaction	$342,446	9/1/02 – 8/31/07
Dinesh Manocha	US Army Research Office	Instrumentation for Portable Walkthrough and Computer-Generated Force Computation	$86,952	5/1/04 – 4/30/06
Dinesh Manocha, Naga Govindaraju	Naval Air Warfare Center	Interactive Onesaf Computations Using COTS Graphics Hardware	$3,196,034	3/18/04 – 9/30/08
Dinesh Manocha	National Science Foundation	Multiresolution Algorithms for Virtual Prototyping of Massive CAD Models	$382,823	7/1/04 – 6/30/08
Dinesh Manocha	US Army Research Office	High Performance Clusters for Modeling and Simulation	$81,722	5/1/06 – 4/30/08
Dinesh Manocha, Ming Lin	National Science Foundation	Conference Support for Edge Computing Workshop	$10,000	4/1/06 – 9/30/06
Dinesh Manocha, Naga Govindaraju	Combustion Research and Flow Technology, Inc.	STTR: Utilizing GPUs as an Efficient Chemical Kinetics Co-processor	$45,000	10/1/05 – 3/19/06

Dinesh Manocha	Univ. of California, Lawrence Livermore National Laboratory	Efficient and Scalable Data Structures for Topological Geometric Models	$30,012	9/12/05 – 9/30/05
Dinesh Manocha, Ming Lin	US Army Research Office	Experiential Technologies for Urban Warfare and Disaster Response	$724,000	9/8/08 – 9/30/11
Ketan Mayer-Patel	National Science Foundation	Protocol Coordination for Multistream Applications	$245,444	10/1/02 – 9/30/07
Ketan Mayer-Patel	National Science Foundation	CAREER: Enabling Futuristic Distributed Application With Integrative Multistream Networking	$404,387	8/15/03 – 7/31/09
Leonard McMillan, Wei Wang	US Air Force Office of Scientific Research	Enhanced Night-Vision Via a Combination of Poisson Interpolation and Machine Learning	$240,648	9/15/04 – 1/14/06
Leonard McMillan	US Army Research Office	Proposal For 3-Year Extension Of The Triangle Computer Science Distinguished Lecture Series	$94,820	9/1/04 – 8/31/07
Leonard McMillan, Ketan Mayer-Patel	National Science Foundation	Tera-Pixels - Next Generation Display Architectures	$299,969	4/15/06 – 3/31/09
Leonard McMillan, Wei Wang	National Science Foundation	Collaborative Systems: Visualizing and Exploring High-Dimensional Data	$309,419	9/1/06 – 8/31/09
Leonard McMillan	Booz Allen and Hamilton, Inc.	caBIG Integrative Cancer Research Workspace	$97,770	3/7/08 – 2/14/09
Fabian Monrose	National Science Foundation	CAREER: Towards Effective Identification of Application Behaviors in Encrypted Traffic	$81,182	8/19/08 – 8/31/09
Steve Pizer, Ed Chaney, Eric Wallen, Lester Kwock	National Cancer Institute	Deformable mapping of MRI and MRSI data to TRUS images to guide prostate	$186,146	9/24/08 – 8/31/10
Steve Pizer, Ed Chaney, Guido Gerig, Julian Rosenman, Keith Muller	National Institute of Biomedical Imaging and Bioengineering	Medical Image Presentation	$5,934,946	7/3/88 – 2/28/08
Marc Pollefeys	National Science Foundation	CAREER: Visual 3D Acquisition Modeling and Rendering of the Real World	$410,696	2/15/03 – 1/31/09

Marc Pollefeys, Henry Fuchs, Leonard McMillan	US Dept of the Interior	Heterogeneous networks of cameras for improving situational awareness	$119,802	7/1/03 – 6/30/04
Marc Pollefeys	National Science Foundation	Converting 2D Video to 3D with Applications to 3D-TV, Video Analysis and Compression	$285,969	8/15/03 – 7/31/07
Marc Pollefeys	Science Applications International Corporation	UrbanScape Project	$1,082,807	3/8/05 – 6/30/07
Marc Pollefeys	Siemens Medical Systems, Inc.	Calibration & 3D modeling from pan-tilt-zoom camera networks	$30,669	8/1/04 – 7/31/05
Marc Pollefeys	Packard (David and Lucile) Foundation	Packard Fellowship Grant #2005-29100	$625,000	10/14/05 – 10/15/10
Marc Pollefeys, Greg Welch	US Dept of the Interior	VACE: 3D Content Extraction from Video Streams	$657,079	9/30/06 – 9/29/09
Marc Pollefeys, Jan-Michael Frahm	US Dept of Energy	3D worlds for Change Detection, Compression, Stabilization and Tracking in Aerial	$588,160	8/30/08 – 8/29/11
Jan Prins	University of Maryland at College Park	Unbalanced Tree Search Benchmark	$164,256	5/5/04 – 12/31/06
Daniel Reed, Jan Prins, Wei Wang	NIH	Carolina Center for Experimental Genetic Analysis	$1,795,000	10/1/04 – 9/30/07
Mike Reiter	Carnegie-Mellon University	Accountability for Information Flow via Explicit Formal Proof	$30,100	6/1/07 – 11/30/08
Mike Reiter	University of California at Berkeley	TRUST SA	$41,582	6/1/07 – 10/31/08
Mike Reiter	Vanderbilt University Medical Center	POLLUX: Enhancing the Quality of Service of the Global Information Grid	$207,585	7/1/07 – 8/23/08
Mike Reiter	National Science Foundation	CyberTrust Center: Security Through Interaction Modeling (STIM)	$4,000,609	7/1/07 – 9/30/09
Mike Reiter	National Science Foundation	Collaborative Research: Using Generative Models to Evaluate and Strengthen Biometric	$90,081	7/1/07 – 11/30/08

Mike Reiter	Johns Hopkins University	New Frameworks for Detecting and Minimizing Information Leakage in Anonymized Ne	$105,256	3/25/08 – 3/24/09
Mike Reiter, Fabian Monrose	National Science Foundation	Collaborative Research: CT-L: CLEANSE: Cross-Layer Large-Scale Efficient Analysis	$106,899	10/1/08 – 9/30/12
Montek Singh	The Boeing Company	High-Speed Asynchronous Pipeline Technology for the DARPA CLASS Project	$274,500	3/14/05 – 3/30/07
Jack Snoeyink	Duke University	ITR/ACS+IM Computational Geometry for Structural Biology and Bioinformatics	$745,307	9/15/00 – 2/28/07
Jack Snoeyink	Univ. of California, Lawrence Livermore National Labs	Pentatope Meshes for Compression and Progressive Transmission of 4D Data Sets	$50,000	10/18/01 – 9/30/03
Jack Snoeyink	Duke University	Seeding Project for Enzyme Design	$72,241	5/15/03 – 5/14/04
Jack Snoeyink	Univ. of California, Lawrence Livermore National Labs	Streaming Meshes for Storing, Transmitting and Accessing Compressed Geometric Models	$50,000	10/1/03 – 8/30/04
Jack Snoeyink	Univ. of California, Lawrence Livermore National Labs	Dynamic Contour Trees	$9,280	8/15/03 – 9/30/03
Jack Snoeyink	Duke University	Inverse Kinematics, Sterics & Data - To Fit RNA Backbone	$221,351	6/1/05 – 5/31/09
Jack Snoeyink	US Dept of Defense	Meshless wavelets and their application to terrain modeling	$1,292,569	3/24/05 – 12/31/08
Jack Snoeyink	Univ. of California, Lawrence Livermore National Labs	Dynamic Reeb Graphs	$9,435	8/30/04 – 9/30/04
Jack Snoeyink	National Science Foundation	Collaborative Research: Fundamentals and Algorithms for Streaming Meshes	$279,605	9/1/04 – 8/31/08
Jack Snoeyink	Duke University Medical Center	MolProbity Service and Related 3D-Analysis Resources	$78,586	7/1/06 – 6/30/09

Martin Styner	Kitware, Inc.	STTR: High Throughput Web-based Image Analysis of Mouse Brain MR Imaging Studies	$199,606	6/15/07 – 5/30/09
Russell Taylor	National Center for Research Resources	Supercomputer Instrumentation for Biomedical Image Analysis and Simulation	$1,988,494	6/15/07 – 6/14/09
Wei Wang	National Science Foundation	CAREER: Mining Salient Localized Patterns in Complex Data	$421,000	3/15/05 – 2/28/10
Wei Wang	Microsoft New Faculty Fellowship	MotifSpace: An Integrated Paradigm for Analyzing the Relationships between Protein Structure and Function,	$200,000	6/1/05 – 5/31/07
Wei Wang, Jan Prins	National Science Foundation	Identifying Spatial Motifs for Classification of Protein Structure and Function	$300,000	7/15/05 – 6/30/09
Wei Wang, Jan Prins, Leonard McMillan	National Science Foundation	III-Core: Discovering and Exploring Patterns in Subspaces	$159,762	9/1/08 – 8/31/11
Greg Welch, Henry Fuchs	National Library of Medicine	Three-Dimensional Tele-Presence for Medical Consultation: extending medical expertise throughout, between, and beyond hospitals	$2,640,637	9/30/03 – 3/31/08
Greg Welch, Henry Fuchs	Office of Naval Research	Transportable Computing Clusters for Real World Acquisition, Display, and Immersive Training	$132,600	4/10/06 – 6/11/07
Greg Welch, Henry Fuchs, Herman Towles	Renaissance Science Corporation	SBIR Deployable Intelligent Projection Systems for Training	$49,870	6/19/07 – 9/30/08
Greg Welch, Henry Fuchs	National Science Foundation	Integrated Projector-Camera Modules for the Capture and Creation of Wide	$930,000	4/1/08 – 3/31/11
Greg Welch, Henry Fuchs, Anselmo Lastra, Herman Towles, Marc Pollefeys	Office of Naval Research	Behavior Analysis and Synthesis for Intelligent Training – BASE-IT	$1,503,000	2/21/08 – 2/20/11
Mary Whitton, Fred Brooks, Leonard McMillan, Wei Wang	Office of Naval Research	VE Technologies for Effective Training	$920,000	11/15/03 – 12/31/08

Guido Gerig	Eli Lilly and Co.	Applic of Shape Anal of Subcortical & Cortical Struct to Demo Drug-Eff on Morphology	$129,542	1/18/05 – 12/31/07
Guido Gerig	Brigham and Women's Hospital	National Alliance For Medical Image Computing (NAMIC) Core 1 (UNC portion of proposal): Structural Analysis of Anatomical Shapes And Of White Matter	$774,274	9/17/04 – 7/31/09

9.8 Appendix H: Course descriptions

Undergraduate-Only Courses

Courses with numbers below 500 may not be taken for graduate credit. These courses are introductory and service courses often taken by non-computer science majors.

COMP 050 Computers Make It Possible (3).
How computers have affected society and how those uses have changed computers. Introduces the student to realistic capabilities of computers and how to distinguish popular press hyperbole from reality.

COMP 056 The World Wide Web: What, How & Why (3).
Explore, use, and ponder World Wide Web. Include strong skills development components: critical thinking, frequent writing and presentation of information in multiple on-line forms; and if sufficient background, Web programming.

COMP 060 Robotics with LEGO® (3).
Explore process of design, and nature of computers, by designing, building and programming LEGO robots. Previous programming experience is not required.

COMP 061 3D Animation with Computers-- Your Cinematic Debut (3). Hands-on exploration of computer-based three-dimensional modeling and animation. Each student will plan an animated story, model necessary objects and scenery, animate models, and at the end present an animated short.

COMP 065 Folding, From Paper to Proteins (3).
Explore the art of origami, the science of protein, and mathematics of robotics through lectures and discussions, and projects involving artistic folding, mathematical puzzles, scientific exploration, and research.

COMP 066 Random Thoughts (3).
Explores in depth notions of 'randomness' and its antithesis, 'structure.' We will collectively conduct several classic experiments to explore the nature of randomness. Computer programming skills helpful, but not required.

COMP 070 Computability, Unsolvability, and Consciousness (3).
Turing machines, their programming and universality. Unsolvability of the halting problem. Incompleteness of logical systems and its implication for human consciousness. Consequences of the laws of physics for consciousness.

COMP 101 Computers: Power Tools for the Mind (3)
The nature of computers, their capabilities, and limitations. How computers work; popular applications; problem-solving skills; algorithms and programming; potential use and abuse in society. Lectures, weekly readings, and laboratory assignments.

COMP 110 Introduction to Programming (3)
Introduction to computer use. Approaches to problem-solving; algorithms and their design;
fundamental programming skills.

COMP 116 Introduction to Scientific Programming (3)
Prerequisite, MATH 231. An introduction to programming for computationally oriented
scientists. Fundamental programming skills, using MATLAB and another imperative
programming language (such as C). Problem analysis and algorithm design, with examples drawn
from simple numerical and discrete problems.

COMP 121 Introduction to Functional Programming (3)
An introduction to programming in the functional programming style, e.g., using a dialect of
LISP. A brief introduction to an imperative language such as Pascal. A first course for
prospective majors or students with some programming background.

COMP 371 Language and Computers (LING 301) (3)
Prerequisite, LING 101. Uses simple linguistic problems to introduce students to the use of
programming languages especially suited to analyze and process natural language on the
computer. No prior programming knowledge is presupposed.

COMP 380 Computers and Society (3)
Cultural, social, philosophical, technological, and economic effects of information technology on
individuals, groups, and society. Risks and controversies. Ethics of technology and computer use.

COMP 392 Practicum (1-3)
Prerequisites, Computer Science Major Permission of Instructor. Work experience in non-
elementary computer science. Pass or fail grade depends on a substantial written report by student
and evaluation by employer. May be repeated for up to six credits.

COMP 396 Independent Study in Computer Science (1 - 3)
For advanced majors in Computer Science or Computer Science track of Math Sciences or
Computer Engineering track of Applied Sciences who wish to conduct an independent study or
research project with a faculty supervisor. May be taken repeatedly for up to a total of 6 credit
hours.

Upper-Level Undergraduate Courses
(graduate credit may be allowed)

COMP 401 Foundation of Programming (4).
Prerequisite, a course in COMP 110-129. Advanced programming. Program specifications,
preconditions, postconditions, loop invariants. Linear data structures, searching, and sorting.
Algorithm paradigms and analysis.

COMP 410 Data Structures (4).
Prerequisite, COMP 401. The analysis of data structures and their associated algorithms. Abstract
data types, lists, stacks, queues, trees, and graphs. Sorting, searching, hashing.

COMP 411 Computer Organization (3).
Prerequisite, COMP 401. Digital logic, circuit components. Data representation, computer
architecture and implementation, assembly language programming.

COMP 416 Introduction to WWW Programming (3).
Prerequisite, COMP 401 or equivalent experience. Client-side programming in Java for the WWW. Introduction to TCP/IP, HTTP, and WWW architecture. Emphasis on applet programming and component programming using threads, simple client-server applications, and XML.

COMP 426 Advanced WWW Programming (3).
Prerequisite, COMP 416. Server-side programming in Java for the WWW. Emphasis on servlet programming and distributed component programming using APIs for object serialization, remote method invocation, database connectivity, and XML generation.

COMP 431 Internet Services and Protocols (3).
Prerequisites, COMP 410, 411. Application-level protocols HTTP, SMTP, FTP, transport protocols TCP and UDP, and the network-level protocol IP. Internet architecture, naming, addressing, routing, and DNS. Sockets programming. Physical-layer technologies, Ethernet, ATM, and wireless.

COMP 455 Models of Languages and Computation (3).
Prerequisites, MATH 381 or other evidence of mathematical maturity, and COMP 110 or equivalent experience. Introduction to the theory of computation. Finite automata, regular languages, pushdown automata, context-free languages, and Turing machines. Undecidable problems.

COMP 485 Natural Language Processing (INLS 510) (3).
Prerequisite, COMP 110, 116 or 121. See course listings for School of Information and Library Science.

COMP 486 Applications of Natural Language Processing (INLS 512) (3).
Prerequisite, COMP 110, 116, or 121, or graduate standing in Information and Library Science. See course listings for School of Information and Library Science.

COMP 487 Information Retrieval (INLS 509) (3).
Prerequisite, INLS 261, COMP 110, or COMP 121. See course listings for School of Information and Library Science.

COMP 520 Compilers (3).
Prerequisites, COMP 410, 411. Design and construction of compilers. Theory and pragmatics of lexical, syntactic, and semantic analysis. Interpretation. Code generation for a modern architecture. Runtime environments. Includes a large compiler implementation project.

COMP 521 Files and Databases (3)
Prerequisites, COMP 410, 411, MATH 381. Placement of data on secondary storage. File organization. Database history, practice, major models, system structure, and design.

COMP 523 Software Engineering Laboratory (3)
Prerequisites, COMP 410, 411. Organization and scheduling of software engineering projects, structured programming, and design. Each team designs, codes, and debugs program components and synthesizes them into a tested, documented program product.

COMP 524 Programming Language Concepts (3)
Prerequisite, COMP 410. Concepts of high-level programming and their realization in specific

languages. Data types, scope, control structures, procedural abstraction, classes, concurrency. Run-time implementation.

COMP 530 Operating Systems (3)
Prerequisites, COMP 410, 411. Types of operating systems. Concurrent programming. Management of storage, processes, devices. Scheduling, protection. Case study. Students implement significant components of a small operating system.

COMP 541 Digital Logic and Computer Design (4)
Prerequisite, COMP 411. This course is an introduction to digital logic as well as the structure and electronic design of modern processors. Students will implement a working computer during the laboratory sessions.

COMP 550 Algorithms and Analysis (3)
Prerequisites, MATH 381 and COMP 410. Formal specification and verification of programs. Techniques of algorithm analysis. Problem-solving paradigms. Survey of selected algorithms.

COMP 575 Introduction to Computer Graphics (3)
Prerequisites, COMP 410, MATH 547. Hardware, software, and algorithms for computer graphics. Scan conversion, 2D and 3D transformations, object hierarchies. Hidden surface removal, clipping, shading, and antialiasing. Not for graduate credit.

COMP 590 Topics in Computer Science (1-3)
Prerequisite, permission of the instructor. This course has variable content and may be taken multiple times for credit.

Graduate Courses

COMP 631 Computer Networks (3)
Prerequisites, COMP 431, COMP 530, knowledge of probability and statistics (alternatively, STOR 435), or permission of the instructor. Traditional topics in computer networks, including link layer protocols, switching, IP, TCP, and congestion control. Additional topics may include peer-to-peer infrastructures, network security, and multimedia applications.

COMP 633 Parallel and Distributed Computing (3)
Prerequisites, COMP 530, 550. Principles and practices of parallel and distributed computing. Models of computation. Concurrent programming languages and systems. Architectures. Algorithms and applications. Practicum.

COMP 651 Computational Geometry (3)
Prerequisite, undergraduate analysis of algorithms course (e.g., COMP 550) or permission of instructor. Design and analysis of algorithms and data structures for geometric problems. Applications in graphics, CAD/CAM, robotics, GIS, and molecular biology.

COMP 662 Scientific Computation (MATH 662) (ENVR 662) (3)
Direct methods for linear systems. Least squares problems. Iterative methods for linear systems. Direct and iterative methods for eigenvalue problems. The singular value decomposition. Methods for (stiff) systems of ODEs.

COMP 665 Images, Graphics and Vision (3)
Prerequisites, COMP 410, MATH 383. Display devices and procedures. Scan conversion. Matrix algebra supporting viewing transformations in computer graphics. Basic differential geometry.

Coordinate systems, Fourier analysis, FDFT algorithm. Human visual system, psychophysics, scale in vision.

COMP 715 Visualization in the Sciences (MTSC 715) (PHYS 715) (3)
Computational visualization applied in the natural sciences. For both computer science and natural science students. Available techniques and their characteristics, based on human perception, using software visualization toolkits. Project course. Spring. Taylor.

COMP 720 Compilers (3)
Prerequisites, COMP 455, 520, 524,. Tools and techniques of compiler construction. Lexical, syntactic, and semantic analysis. Emphasis on code generation and optimization.

COMP 721 Database Management Systems (3)
Prerequisites, COMP 521, 550. Database management systems, implementation, and theory. Query languages, query optimization, security, advanced physical storage methods and their analysis.

COMP 723 Software Design and Implementation (3)
Prerequisites, COMP 524, 550. Principles and practices of software engineering. Object-oriented and functional approaches. Formal specification, implementation, verification, and testing. Software design patterns. Practicum.

COMP 724 Programming Languages (3)
Prerequisites, COMP 455, 520, 524. Selected topics in the design and implementation of modern programming languages. Formal semantics. Type theory. Inheritance. Design of virtual machines. Garbage collection. Principles of restructuring compilers.

COMP 730 Operating Systems (3)
Prerequisite, COMP 530. Theory, structuring, and design of operating systems. Sequential and cooperating processes. Single processor, multiprocessor, and distributed operating systems.

COMP 734 Distributed Systems (3)
Prerequisite, COMP 431 or permission of instructor. Design and implementation of distributed computing systems and services. Inter-process communication and protocols; naming and name resolution; security and authentication; scalability; high availability; replication; transactions; group communications; distributed storage systems.

COMP 735 Distributed and Concurrent Algorithms (3)
Prerequisites, COMP 633, 723. Verification of concurrent systems. Synchronization; mutual exclusion and related problems, barriers, rendezvous, nonblocking algorithms. Fault tolerance: consensus, Byzantine agreement, self-stabilization. Broadcast algorithms. Termination and deadlock detection. Clock synchronization.

COMP 737 Real-time Systems (3)
Prerequisite, COMP 530. Taxonomy and evolution of real-time systems. Timing constraints. Design, implementation, and analysis of real-time systems. Theory of deterministic scheduling and resource allocation. Case studies and project.

COMP 740 Computer Architecture and Implementation (3)
Prerequisites, COMP 411, PHYS 352. Architecture and implementation of modern single-

processor computer systems. Performance measurement. Instruction set design. Pipelining. Instruction-level parallelism. Memory hierarchy. I/O system. Floating-point arithmetic. Case studies. Practicum.

COMP 741 Elements of Hardware Systems (3)
Prerequisite, COMP 411. Issues and practice of information processing hardware systems for computer scientists with little or no previous hardware background. System thinking, evaluating technology alternatives, basics of electronics, signals, sensors, noise and measurements.

COMP 744 VLSI Systems Design (3)
Prerequisites, COMP 740, knowledge of digital logic techniques. Introduction to the design, implementation and realization of very large-scale integrated systems. Each student designs a complete digital circuit that will be fabricated and returned for testing and use.

COMP 750 Algorithm Analysis (3)
Prerequisites, COMP 455, 550. Algorithm complexity. Lower bounds. The classes P, NP, PSPACE, and co-NP; hard and complete problems. Pseudo-polynomial time algorithms. Advanced data structures. Graph-theoretic, number-theoretic, probabilistic, and approximation algorithms.

COMP 752 Mechanized Mathematical Inference (3)
Prerequisite, COMP 825. Propositional calculus. Semantic tableaux. Davis-Putnam algorithm. Natural deduction. First-order logic. Completeness. Resolution. Problem representation. Abstraction. Equational systems and term rewriting. Specialized decision procedures. Nonresolution methods.

COMP 758 Information Theory (STOR 252] (3)
COMP 759 Error Correcting Codes (STOR 253) (3)

COMP 761 Introductory Computer Graphics (1)

COMP 762 Discrete Event Simulation (STOR 762) (3)

COMP 763 Semantics and Program Correctness (3)
Prerequisite, COMP 724. Formal characterization of programs. Denotational semantics and fixed-point theories. Proof of program correctness and termination. Algebraic theories of abstract data types. Selected topics in the formalization of concurrent computation.

COMP 764 Monte Carlo Method (3)
Prerequisites, MATH 233, 416, 418, STOR 435, COMP 110, or consent of the instructor. Relevant probability and statistics. General history. Variance reduction for sums and integrals. Solving linear and nonlinear equations. Random, pseudorandom generators; random trees. Sequential methods. Applications.

COMP 766 Visual Solid Shape (3)
Prerequisites, MATH 233, 416. 3D differential geometry; local and global shape properties; visual aspects of surface shape. Taught largely through models and figures. Applicable to graphics, computer vision, human vision, and biology.

COMP 767 Geometric and Solid Modeling (3)
Prerequisites, COMP 575 or 770, and MATH 661. Curve and surface representations. Solid

models. Constructive solid geometry and boundary representations. Robust and error-free geometric computations. Modeling with algebraic constraints. Applications to graphics, vision, and robotics.

COMP 768 Physically Based Modeling and Simulation (3)
Prerequisites, COMP 665, or permission of the instructor. Geometric algorithms, computational methods, simulation techniques for modeling based on mechanics and its applications.

COMP 770 Computer Graphics (3)
Prerequisites, COMP 665, 761. Study of graphics hardware, software, and applications. Data structures, graphics, languages, curve surface and solid representations, mapping, ray tracing and radiosity.

COMP 775 Image Processing and Analysis (BMME 775) (3)
Prerequisites, COMP 665, MATH 547, and STOR 435. Approaches to analysis of digital images. Scale geometry, statistical pattern recognition, optimization. Segmentation, registration, shape analysis. Applications, software tools.

COMP 776 Computer Vision in our 3D World (3)
Prerequisites, MATH 416, 566, COMP 550, 665, 775, or permission of the instructor. Fundamental problems of computer vision. Projective geometry. Camera models, camera calibration. Shape from stereo, epipolar geometry. Photometric stereo. Optical flow, tracking, motion. Range finders, structured light. Object recognition.

COMP 787 Visual Perception (3)
Prerequisites, COMP 665 (vision segment), PSYC 730, or equivalent. Surveys form, motion, depth, scale, color, brightness, texture, and shape perception. Includes computational modeling of vision, experimental methods in visual psychophysics and neurobiology, recent research, and open questions.

COMP 788 Expert Systems (3)
Prerequisite, COMP 750. Languages for knowledge engineering. Rules, semantic nets, and frames. Knowledge acquisition. Default logics. Uncertainties. Neural networks.

COMP 790 Topics in Computer Science (1-3)
Prerequisite, permission of the instructor. This course has variable content and may be taken multiple times for credit.

COMP 822 Topics in Discrete Optimization (STOR 822) (3).

COMP 824 Functional Programming (3)
Prerequisite, COMP 524. Programming with functional or applicative languages. Lambda calculus; combinators; higher-order functions; infinite objects. Least fixed points, semantics, evaluation orders. Sequential and parallel execution models.

COMP 825 Logic Programming (3)
Prerequisite, COMP 524. Propositional calculus, Horn clauses, first-order logic, resolution. Prolog: operational semantics, relationship to resolution, denotational semantics, and non-logical features. Programming and applications. Selected advanced topics.

COMP 831 Internet Architecture and Performance (3)
Prerequisite, COMP 431 or permission of instructor. Internet structure and architecture; traffic characterization and analysis; errors and error recovery; congestion and congestion control; services and their implementations; unicast and multicast routing.

COMP 832 Multimedia Networking (3)
Prerequisites, COMP 431 and 530. Audio/video coding and compression techniques and standards. Media streaming and adaptation. Multicast routing, congestion and error control. Internet protocols RSVP, RTP/RTCP. Integrated and differentiated services architecture for the Internet.

COMP 841 Advanced Computer Architecture (3)
Prerequisite, COMP 740. Concepts and evolution of computer architecture, machine language syntax and semantics; data representation; naming and addressing; arithmetic; control structures; concurrency; input-output systems and devices. Milestone architectures.

COMP 842 Advanced Computer Implementation (3)
Prerequisites, COMP 740, knowledge of digital logic techniques. The application of digital logic to the design of computer hardware. Storage and switching technologies. Mechanisms for addressing, arithmetic, logic, input/output, and storage. Microprogrammed and hard-wired control.

COMP 844 Advanced Design of VLSI Systems (3)
Prerequisite, COMP 744. Advanced topics in the design of digital MOS systems. Students design, implement, and test a large custom integrated circuit. Projects emphasize the use of advanced computer-aided design tools.

COMP 850 Advanced Analysis of Algorithms (3)
Prerequisite, COMP 750. Design and analysis of computer algorithms. Time and space complexity; absolute and asymptotic optimality. Algorithms for searching, sorting, sets, graphs, and pattern-matching. NP-complete problems and provably intractable problems.

COMP 870 Advanced Image Synthesis (3)
Prerequisite, COMP 770. Advanced topics in rendering, including global illumination, surface models, shadings, graphics hardware, image-based rendering, and antialiasing techniques. Topics from the current research literature.

COMP 872 Exploring Virtual Worlds (3)
Prerequisite, COMP 870. Project course, lecture, and seminar on real-time interactive 3D graphics systems in which the user is "immersed" in and interacts with a simulated 3D environment. Hardware, modeling, applications, multi-user systems.

COMP 875 Recent Advances in Image Analysis (3)
Prerequisite, COMP 775. Lecture and seminar on recent advances in image segmentation, registration, pattern recognition, display, restoration, and enhancement.

COMP 892 Practicum (0.5)
Prerequisite, permission of instructor. Work experience in an area of computer science relevant to the student's research interests and pre-approved by the instructor. The grade, pass or fail only, will depend on a written report by the student and on a written evaluation by the employer

COMP 911 Professional Writing in Computer Science (3)
Prerequisite, graduate major in computer science. Analysis of good and bad writing. Exercises in organization and composition. Each student also writes a thesis-quality short technical report on a previously approved project.

COMP 915 Technical Communication in Computer Science (1)
Prerequisite, graduate major in computer science or permission of instructor. Seminar on teaching, short oral presentations, and writing in computer science.

COMP 916 Seminar in Professional Practice (1)
Prerequisite, satisfaction of MS Computer Science program product requirement. The role and responsibilities of the computer scientist in a corporate environment, as an entrepreneur, and as a consultant. Professional ethics.

COMP 917 Seminar in Research (1)
Prerequisite, graduate major in computer science. The purposes, strategies, and techniques for conducting research in computer science and related disciplines.

COMP 918 Research Administration for Scientists (1)
Prerequisite, graduate status. Introduction to grantsmanship, research grants and contracts, intellectual property, technology transfer, conflict of interest policies. Course project: grant application in NSF FastLane.

COMP 980 Computers and Society (1)
Prerequisite, graduate major in computer science. Seminar on social and economic effects of computers on such matters as privacy, employment, power shifts, rigidity, dehumanization, dependence, quality of life.

COMP 990 Research Seminar in Computer Science (0.5-3)
Prerequisite, permission of the instructor. Seminars in various topics offered by members of the faculty.

COMP 991 Reading and Research (1-3)
Prerequisite, permission of the instructor. Directed reading and research in selected advanced topics.

COMP 993 Master's Thesis (Var.)
Prerequisite, permission of staff.

COMP 994 Doctoral Dissertation (Var.)
Prerequisite, permission of staff.

9.9 Appendix I: Graduate program evaluation by alumni

Graduate Alumni Evaluations
  I.   **Degree Program**
      a. Courses I wanted to take were offered.
          5: Strongly agree   22
          4: Agree   23
          3: Neither agree nor disagree   1
          2: Disagree   1
          1: Strongly disagree   0

          Comments:
          ➢ "What I didn't realize while I was at UNC is that I wanted to take more cross-disciplinary courses with other departments. I stuck close to the CS department, which arguably wasn't playing to all my strengths. But I did thoroughly enjoy classes like Jeffay's Multimedia class and Gary Bishop's seminar on interactive audio."
          ➢ "Some courses were really helpful for my career but I also found some of the courses were never used at all."
          ➢ "Fantastic choice of courses, and option to take courses at Duke, NC State filled in any gaps."
          ➢ "I would have been very interested in courses dealing with real systems (a hardcore operating systems course for example). All system courses that were offered at UNC were dummy courses (advanced operating systems, networking, etc.) that do not teach much. Distributed systems was close to being a real systems course, but it didn't go all the way. There's nothing in Databases, machine learning, neural networks, the knowledge of which is pretty useful in the industry (and as a computer scientist)..."
          ➢ "Some courses that are offered now, I would have liked to have taken. But I can't see anything I would want that's not offered right now."
          ➢ "I thought the classes were good, but there weren't any classes on game development, so some students in my year organized one."
          ➢ "I went to UNC for the strong computer graphics program and definitely had a great list of classes to choose from."
          ➢ "I would have liked a course on machine learning."

      b. The MS course requirements were reasonable.
          5: Strongly agree   17
          4: Agree   21
          3: Neither agree nor disagree   4
          2: Disagree   1
          1: Strongly disagree   0

          Comment:
          ➢ "Needed more consideration given to prior MS-level courses taken. In my case I received MS from UNC Greensboro. Would have preferred an easier process to move straight into PhD track."
          ➢ "Though when I was enrolled, the Master's thesis was an option but many professor's weren't real keen on taking me up on it."

> ➢ "There was some confusion about the writing requirement. Talking to current students in the program, there seems to still be some confusion about the writing requirement. The core classes in 94-95 were of mixed quality, but that doesn't necessarily say anything about how things are today."
> ➢ "The MS program has a good balance of courses in your discipline with courses outside of your discipline. I liked trying to apply graphics to courses that were not quite related."
> ➢ "The course load was challenging, but I feel like I learned a lot because of it."
> ➢ "In retrospect, the breadth of my knowledge in CS was highly influenced by these courses. I was an EE major, so I had a different background than the average."
> ➢ "The choice of what areas to deem "core" will always be subjective and I did not necessarily agree with where that line was drawn."
> ➢ "My MS curriculum adequately prepared me for my career over the past decade. Everything from parallel programming, compilers, scientific computing, architecture, and of course graphics courses created a base that has allowed me to survive and even excel through 3+ economic downturns in the semiconductor industry. I regularly utilize the core knowledge UNC provided in my rather haphazard wandering through the fields of computer science and architecture. Someday I will figure out what I want to do with my life, but for now I savor the adaptability and flexibility in my own destiny the core curriculum and electives I chose has allowed me to retain."
> ➢ "There was a lot of debate about this while I was there. After I finished my MS, the core curriculum was revamped and the CCE exam was dropped in favor of an integrative paper. I agreed with some changes to the core, but lamented others, sometimes after the fact. For example, one of the core courses I did worst in (because it was difficult and because I valued it less than other courses such as computer graphics) was Parallel and Distributed computing. The parallel part of this course is now central to my everyday work, and it becoming crucial to all computer scientists. I believe parallel computing should be part of the core."

c. The Ph.D. course requirements were reasonable.
    5: Strongly agree   12
    4: Agree   16
    3: Neither agree nor disagree   3
    2: Disagree   2
    1: Strongly disagree   0

Comments:
> ➢ "I wonder if more courses in the area of the dissertation should be required. although this may be best considered on a case-by-case basis."
> ➢ "Although I did not stay for a PhD I believe UNC's requirements were definitely reasonable."
> ➢ "The oral qual was a difficult format for me. I think this has been dropped since I left."
> ➢ "I always felt like the course requirements for MS and PhD were about the same. I went to UNC with the idea of getting a PhD, and it was nice to get the MS along the way, because it was always there as a fall-back option."

➤ "When going for both an MS and PhD, the number of examinations and requirements combined felt excessive. I was not bothered particularly by this, but think some of the requirements could be simplified, dropped, or made conditional without any significant loss in overall quality."

➤ "PhD students should have all their coursework completed during their MS and be able to focus on their research/dissertation during the PhD program."

➤ "There were actually so many CS classes out of my focus that I never took some of the classes *related* to my focus, and I now wish I had. The core, I feel, was reasonable."

➤ "It was fine. 'Requirements' is a little vague. The requirement of these PhDs is that your advisor thinks you're done, that part is not vague. Exactly what that means is different per person."

➤ "I went through at the transition away from the old core when the IP was introduced. I feel, and I know I am rare in this, that it is possible to get through with too narrow a background now. That would be a concern when hiring a UNC graduate for an academic position. (However it appears to be a problem everywhere, so perhaps it doesn't disadvantage graduates against the competition.)"

d. The MS program product requirement was useful.

5: Strongly agree	2
4: Agree	12
3: Neither agree nor disagree	11
2: Disagree	3
1: Strongly disagree	3

Comments:

➤ "I had prior experience at IBM which counted toward this requirement."

➤ "Software Engineering was one of the weakest CORE required courses in 94-95, and my group's program product reflected that."

➤ "The MS program product requirement is a joke. It should either be removed or made more significant in scope to more closely match the real world."

➤ "It got me involved in a project I got a paper out of, but I didn't find the experience of the 135 course itself very satisfactory."

➤ "I was in the first class that had to write the integrated paper. I found this to be a great exercise since it was very similar to writing and submitting a research paper. The only problem was coming up with topics from 3 different areas of CS, which was very difficult and the advisors did not provide too much help picking good topics."

➤ "I barely remember what the product requirement was, which to me says that it wasn't very relevant for me."

➤ "I was able to use a project from undergraduate, so it didn't really concern me, other than getting it approved."

➤ "As an EMPLOYER, I appreciate when new hires come in with product experience and cannot imagine an MS student without such a background. For a PhD student, this also provides good grounding in the 80% of product development that doesn't involve code. However I'd encourage retaining an 'easy out' option for students that can pass a review of previous product experience."

➤ "If a person got as far as UNC to an MS or a PhD, this should be taken for granted. People get past this anyway by citing an older internship."

> ➤ "Anybody with a clue finds a way to get out of this requirement so that they don't have to take the software engineering course which is viewed as a waste of time by most students and faculty that I interacted with."
> ➤ "I liked the concept, but it seemed that most people including myself 'got around' it by using undergrad projects or various other things that seemed to not live up to the original intention."

e. The MS writing requirement was useful.

5: Strongly agree	4
4: Agree	19
3: Neither agree nor disagree	7
2: Disagree	5
1: Strongly disagree	1

Comments:
> ➤ "I don't object to a writing requirement in principle, but the class I had to take was, in its current implementation, pretty useless."
> ➤ "I would have preferred to use a published paper to satisfy the writing requirement instead of the integrative paper."
> ➤ "I attempted the thesis route but my adviser was not good about reading it/offering feedback. However, it was one of the most useful requirements as I had never written a 60 page scientific paper before."
> ➤ "Writing was absolutely the weakest required course in 94-97. I learned nothing in it - it only covered elementary grammar, teaching was horrible, expectations were low."
> ➤ "It is useful in theory but not effective in practice. Every student should be assigned to help a professor who is working on a publication and be a co-author, regardless of overlap in research interest or experience. That would motivate the professor to help the student learn how to publish -- if their own publication was on the line!"
> ➤ "I really enjoyed writing a Masters thesis as a prelude to what the PhD program would be like. I ended up with a technical paper that could have probably turned into a PhD thesis had I gone on."
> ➤ "I waived this requirement. Writing papers with my advisor or other professors was much more instructive."
> ➤ "Not sure if it would have been useful if I had done a masters only. But given that I did a Ph.D., I believe that writing a dissertation and publishing articles, and the tutelage I received from Steve Pizer on those, were way more useful than the MS writing requirement."
> ➤ "Had I been continuing on to the PhD program, where I would need to write papers, yes. Otherwise, not particularly. Though I suppose it does help non-writer students (such as myself) realize what a large chunk of the PhD program would entail, and I guess that's good."
> ➤ "Technical writing is certainly an important skill and should be demonstrated I think. However, I also think there is more than one style of technical writing. For instance, research papers, funding proposals, internal white papers, design documents, user documentation, etc., should not be written in the same style or with the same considerations in mind. This requirement felt like a mismatch for the MS degree because my own submission was really demonstrating research-related skills, making it more closely related to a PhD track."

> ➤ "We write enough for other classes, this was redundant and seemed rather bureaucratic."
> ➤ "It improved my writing style a bit, but not by much."
> ➤ "I think writing is an invaluable skill and I really appreciated the writing requirement; I am proud of my Master's Paper (the longest paper I ever wrote!) and I derived a lot of value from researching my topic, interacting with the professors that reviewed the paper, and finally submitting it."
> ➤ "I qualified out of this via paper publication, but I feel writing skills are very important. However I believe the writing course offered to MS students was pretty poor. Better off writing a paper (IP requirement)."
> ➤ "The IP was a great learning tool for me. I can't recall if the writing class was part of the MS or PhD requirements but it was NOT useful."

f. It was useful to write a thesis/dissertation.

5: Strongly agree	26
4: Agree	5
3: Neither agree nor disagree	2
2: Disagree	2
1: Strongly disagree	0

Comments:
> ➤ "I think the ability to write clearly and to articulate your ideas is one of the critical skills necessary to attaining your PhD."
> ➤ "I enjoyed it, I just wish I had more feedback while writing it, and that since it was 'only' a Master's thesis I got a bit more help from the faculty."
> ➤ "I expect that this will be more germane later in the survey: although I learned from doing the Ph.D., the experience was awful, poorly managed, and did not leave me prepared for a career in academia."
> ➤ "I didn't write one here, but is it really reasonable to consider eliminating the dissertation?"
> ➤ "Getting the PhD (and fulfilling the tasks involved) has been the best educational experience in my life!"
> ➤ "I gained immensely in terms of both research and writing skills."
> ➤ "The ability to integrate pieces into a coherent whole is a key skill for any developer or researcher. As with large software designs, this exercise forces students to learn how to logically organize and present a non-trivial collection of concepts and results. The experience should also help to demonstrate the strong parallels between developing documentation and developing software."
> ➤ "I liked the UNC approach to this – for MS candidates, you can write one or do a product + writing requirement. I still believe a thesis is overkill if you're going into industry."
> ➤ "It is useful to write something, e.g. submit an academic paper. It is not essential that it be a thesis."
> ➤ "More guidance from your advisor would be good. When you are writing such a large document for the first time, much guidance is needed. But many times, there is little help and direction in how to do this well."
> ➤ "Before writing it I wasn't sure how educationally valuable it would be, but by the time I was done I appreciated the value."

> "Even though I just finished it, man it feels so good to have put it all together like that. While I'm not sure that what I contributed in seven years was only 140 pages, it's still great."
> "It taught me a LOT. In a perfect world I would structure PhD programs differently so that the focus wasn't so strongly on one item."

g. The Ph.D. qualifying exam was reasonable.

5: Strongly agree	12
4: Agree	15
3: Neither agree nor disagree	6
2: Disagree	5
1: Strongly disagree	0

Comments:
> "I did take and pass it, although I didn't end up entering the program."
> "I understand its purpose, but in my experience, I saw very capable individuals fail the exam. A lot of times, it depended on which professors you got for your exam."
> "It is arbitrary and not a good predictor of success in the PhD program. Many who pass do not complete PhDs. Many who do not pass would probably go on to do well. There are many paths to a PhD and not all successful candidates have the same intellect, which is a good thing. Plus, if the student is smarter than those testing him/her, then tests often are no longer a valid measure at this level."
> "So far the new system seems better to me."
> "The oral qual was difficult and a bit random chance depending on which professors you got. Some were notoriously tougher than others."
> "I think it's good to have some way of evaluating whether a student is ready for the kind of thinking involved in the PhD. Is the qual the best way? I honestly don't know..."
> "I took the qual when it was an oral exam given by several faculty members. I felt it was useful and reasonable, and I look back on it as a very positive experience. I understand the department has changed it since then."
> "Subject matter not covered in the course shouldn't be part of the exam. Courses should be required to cover the material that might be part of the exam or the exam should be adjusted."
> "The one negative aspect in my eyes, which I'm not sure can be eliminated, is that there was a 'fear factor' that played into the exam in addition to just testing for knowledge and critical thinking skills. But maybe that was done on purpose to test thinking under pressure, I'm not sure."
> "If I recall correctly, this was just a variant of a comprehensive exam when I took it. Although expecting students to have internalized some understanding of basic techniques makes sense, it seems more appropriate for such an exam to focus on skills and process than on details and results. The latter will vary significantly based on what area of research the student moves into. This test should focus on assessing the student's ability to adapt to unfamiliar situations and (ideally) see any parallels that exist to familiar situations that might provide good leads."

➢ "For me, I now see the wisdom in the quals: faculty correctly assessed I wasn't ready yet. Additionally, I felt the process highly subjective. I learned a very valuable lesson out of the process--I should have been more politically savvy, gotten to know more faculty, got them to know me. I think back on this failure as a significant growth experience and am thankful for the decision that was made. While subjective, that's how the real world works. You don't get funded in industry without understanding both the technical and political aspects of decisions, and strong communication and interpersonal skills are required for career growth. Programmers can be jerks, architects cannot. You are not preparing people to be programmers you are preparing them to be future leaders, and I feel the qual exam is very useful to allow a collective judgment on an individual.

➢ "Due to current policies, the exam is completely pointless. If a student passes the exam, it's no guarantee of admission to the PhD program since a champion is still required. It's just an extra hurdle that guarantees nothing."

➢ "I liked the ability to take the oral qualifying exam at the end of the first year. It was a big improvement over the previous system (DWE)."

➢ "Having failed it once and passed it once I can see how it can be both good and bad. It is difficult to make this objective, but I agree with the importance of having something like this."

➢ "I took it when everyone took the 3 sessions no matter what. That was one of the most useful things I went through in transitioning to being an academic 'adult'. I would urge a return to making everyone do it as a service to the students - it is more then just a filter, it really built character and taught me what it meant to talk in front of educated peers on hard issues that I had not perfectly prepared."

➢ "I took the DWE. I feel preparing for the DWE, with the requirement of knowledge in many key fields of computer science made me more confident and really helped to prepare me to my later professional life. I do not believe an oral exam in a few limited topics would have had the same profound benefit. I don't know if you've moved back to written DWE-like tests, but I think you should. There are great benefits to the student that simply cannot be obtained through studying for anything less daunting."

h. I was satisfied with the advice I received regarding the degree program.

5: Strongly agree	17
4: Agree	20
3: Neither agree nor disagree	4
2: Disagree	3
1: Strongly disagree	1

Comments:
➢ "The writing requirement was unclearly enough explained that two weeks before MS graduation I was told I wasn't going to get it. I chose research groups, advisors, and committee members poorly, and figure that whatever advice I got didn't help."

➢ "The departmental attitude is more 'sink or swim' regarding student advising. Works for students who are already independent types, but doesn't help others flourish and grow toward academic independence."

- ➤ "I felt that I knew everything I needed in order to graduate, there were no last minute surprise courses, requirements, etc."
- ➤ "I got some advice from students and a few professors, but I think there should be a formal review sometime in your second year to sit down with your advisor and discuss options."
- ➤ "Steve Pizer gave me excellent advice and guidance."
- ➤ "It varied. Some was unhelpful but some was very helpful."
- ➤ "The role of advising/chairing should be taken more seriously, and faculty should allot more time/effort to this task."
- ➤ "Drs. Jeffay and Don Smith were fantastic advisors, and they had a lot of patience with me as I was trying to figure out what I was actually good enough at to pursue a career in."

i. Overall I was happy with the degree program.
    5: Strongly agree   24
    4: Agree   17
    3: Neither agree nor disagree   3
    2: Disagree   3
    1: Strongly disagree   0

Comments:
- ➤ "There were clear signs of manifest failure on my advisor's part, both in his relationship with his students and his conduct of research, and yet he's still there 11 years after I became his student, still with as far as I can tell a record that doesn't suggest he should have tenure or be mentoring."
- ➤ "I loved my time at UNC, it was by far the hardest 2 years of my life, the workload was incredible. The best part was that people worked together as teams, everybody was friendly and willing to help each other out. I wouldn't trade that for any other university. I really felt like I was part of a big family at UNC. I would do anything possible for other members of the family. My advisors pushed me hard, but gave me support anytime I needed it."
- ➤ "I have nothing but good memories of the program and people, and the alumni connection really helped propel my career."
- ➤ "I'm extremely thankful I came to UNC."
- ➤ "Having a MS from UNC in computer graphics is a defining characteristic of who I am as an individual today. I don't think, sitting on the porch in 100 degree Midwestern heat in a small town in Indiana I ever imagined the life I have been given the chance to lead. UNC allowed me to turn my dreams into goals. It was also the hardest transition in my life--from a small Midwestern town to a leading research university, a huge cultural shift, very stressful, very exciting. I am beyond happy I chose UNC--I rarely face technical issues professionally that I didn't have in some form/fashion in school. I regularly reference material, textbooks, etc. that I used some 10 years ago in my curriculum at UNC."
- ➤ "I'm happy with the education I received, but there were a lot of unnecessary hurdles to leap and paperwork to fill out along the way."
- ➤ "It was an MS/CS from a great school, which has opened lots of doors for me professionally. It wasn't until a few years after leaving the program that I found my niche in web/interaction design, and the skills I use daily are largely ones I have learned since leaving UNC. So, in some ways, my experience at UNC wasn't very relevant to my eventual career, but that has

more to do with me than UNC. Drs. Jeffay and Smith were fantastic advisors, I made some great friends at UNC, and I have enormous respect for the department."

➢ "Could have used more emphasis on publications."
➢ "I think I may have hit the sweet spot as the program evolved: Taking the core courses; IP instead of written exam; taking the quals."

II. Quality of Teaching in Computer Science

a. The faculty was well-prepared.

5: Strongly agree	17
4: Agree	23
3: Neither agree nor disagree	5
2: Disagree	1
1: Strongly disagree	0

Comments:
➢ "I would actually 'strongly agree' for many, with a few exceptions."
➢ "Some were prepared, others were not."
➢ "Carolina always had strong faculty."
➢ "Some strong professors in the classroom, some very weak."
➢ "Sometimes it was obvious that the faculty was preoccupied with research and was not fully prepared to give lectures."
➢ "Faculty was amazing and the lessons were very well prepared. Additionally the research groups were well run."
➢ "Overall, yes, but there were problems at times. I'm not sure if it was a problem with preparation or with the teaching approaches."
➢ "For class or for their field? For class, it was honestly about 70/30. Core curriculum seemed to be taken fairly seriously. Sometimes it was obvious a professor would rather be doing something else that instruction. on balance, I think faculty was more prepared than less prepared and actually exceeded expectations set by the common wisdom of 'research university professors don't care about teaching'. I think that was the exception and not the rule."
➢ "Most of the questions on this page are only relevant if the subject matter being taught is of interest to the student. I must say that the algorithms course was poorly taught. No motivation was provided for the algorithms, and students lacked an appreciation for the things being presented. The beauty of some of the proofs was lost in the monotony. I got an 'H' in the course, so I'm not saying this to blame the professor for my poor performance."
➢ "Can only think of one class whose professor was lax in preparation."
➢ "It really depends. One course I took (204) was often cancelled for no apparent reason. With a full load, cancelling my least favorite class was welcome, but doing it multiple times in a semester is a problem. Other professors relied heavily on student presentations and lectures to reduce their own workload, but this is not uncommon and I understand why it happens. But on the whole, I would say the majority of my teachers were well-prepared for class."
➢ "I truly appreciate the depth of knowledge of some professors."
➢ "There was only one course I had that had severe problems for a graduate level course; and that was only for half the class."

b. The faculty was motivated and enthusiastic.

5: Strongly agree   15
4: Agree   26
3: Neither agree nor disagree   4
2: Disagree   0
1: Strongly disagree   1

Comments:
- ➢ "The faculty was motivated and enthusiastic about the research, I don't know that that always carried over into the classroom."
- ➢ "Some very motivated, some not so."
- ➢ "Most definitely were; a few weren't."
- ➢ "This varied a lot from faculty member to faculty member."
- ➢ "Yes, and their enthusiasm increased my own."
- ➢ "Again, 70% of the time yes, 30% of the time no."
- ➢ "Having learned about other departments since graduation, I cannot emphasis enough how wonderful the faculty at Chapel Hill was. I always felt supported and that people wanted me to succeed, even if they were putting up hurdles in front of me."

c. Evaluation of my work was fair and impartial.
    5: Strongly agree   22
    4: Agree   22
    3: Neither agree nor disagree   2
    2: Disagree   1
    1: Strongly disagree   0

Comments:
- ➢ "Generally true, though I think at times luck had something to do with it."
- ➢ "I don't think this is possible with project-based classes. It is too hard to be objective, or rather, too time-consuming."
- ➢ "I always felt that I received the proper grade on my assignments."
- ➢ "All but in one course."
- ➢ "For the most part, yes, though there was one incident I was less than pleased about. My professor suggested a project idea they knew I had no experience in, because I had no experience in it, and then graded it as if I'd done a lot of work with it before the project. That irked me."
- ➢ "Yes, but there were lots of times when helpful guidance/feedback could have been given but wasn't."

d. Overall, the faculty was effective in teaching.
    5: Strongly agree   13
    4: Agree   25
    3: Neither agree nor disagree   4
    2: Disagree   3
    1: Strongly disagree   1

Comments:
- ➢ "Some were very effective, some were not as effective."
- ➢ "Brooks, Anderson, Jeffay, and a few others helped compensate for the weakest."

- ➤ "I once heard that a good teacher is one who the A students think of as a good teacher 5+ years after taking the class. Pizer's Solid Shape class was one. Mago's Architecture class another. None of the others come to mind."
- ➤ "I think that the faculty teaching style required some getting used to. In undergrad the faculty generally gives you a bit more details, whereas graduate faculty give some basics and let the students figure out all of the details on their own."
- ➤ "I had a variety of faculty, ranging from ones who did a great job at teaching to some who obviously felt that teaching was beneath them. Overall, I felt the teaching was effective, but there was very wide variation."
- ➤ "Some of the faculty really knew their field, but they weren't necessarily great teachers. Overall I felt that teaching wasn't much of a priority among several of the professors."
- ➤ "I gained much from my degree and stay at UNC, however I would not rank the program high in its ability to instruct students in class or in research groups."
- ➤ "Some faculty members care a lot about teaching while others don't. It's impossible to accurate characterize the entire department one way or the other."
- ➤ "Teaching didn't appear to be the focus, both in the classroom and in the lab. Some professors were very very good at it (e.g. Steve Pizer), but many weren't strong in that area."
- ➤ "From discussion with students of other programs, I feel that the department's teaching was much better then the norm. There were a couple courses however that were low effort on part of the professor: where we were read the book and told to do the hard problems without guidance or assistance. I do not feel that teaching had a meaningful impact either way on tenure and promotion. Still, I think the department is way above the norm for a research institution."
- ➤ "Almost all were extremely good, but a few weren't."

III.   Quality of Research Experience

a.   I was able to work on a research project that excited me.

5: Strongly agree	23
4: Agree	17
3: Neither agree nor disagree	1
2: Disagree	5
1: Strongly disagree	1

Comments:
- ➤ "In retrospect, it would have been possible to find projects that interested me *more* than what I did, but I hadn't figured that out yet."
- ➤ "Incoming class in 2002 was so large, many students including myself were not placed into desirable research positions early. This means to me that the program as a whole was not prepared for this."
- ➤ "I worked for David Beard my first year, then for Henry Fuchs my second through fifth years. That was invaluable experience and most directly led to my success in the two job searches I have done."
- ➤ "The project started off exciting, but ..."
- ➤ "I strongly approve of this department's lack of a wall between MS and Ph.D. students. The idea that all students come in on an equal footing, even if they

have expressed an intention to leave with an MS, creates a good atmosphere in the department."
➤ "I worked with Dinesh and Ming and they were very supportive of my work. They pushed very hard but also rewarded me when things went well."
➤ "I got my first choice of research project, and partnered with a PhD student that was working on something exciting, so I think I got lucky."
➤ "I personally enjoyed a lot my research and the research team. I don't think this was the case for everybody in the department though."
➤ "I did one independent study that I was excited about, other than that I TA'd because I wasn't wanted in the research group that had the research I really loved."
➤ "Ming Lin offered a wide variety of research options."
➤ "Worked on a GPGP related project with Dinesh."

b. I was satisfied with my interaction with faculty on my research projects.
5: Strongly agree	19
4: Agree	19
3: Neither agree nor disagree	3
2: Disagree	4
1: Strongly disagree	0

Comments:
➤ "The faculty was motivated about projects and always around to brainstorm."
➤ "First year interaction didn't quite seem to click for either of us. Working for Manocha & Brooks was great - although I didn't get as much from Brooks as I'd have liked to, the fault may have been mine for not asking."
➤ "I think it would have been nice to have a weekly meeting set up, but my advisor was Dr. Brooks who is understandably very busy. I did have frequent interaction with Mary Whitton though, so having her available was a big help."
➤ "I had great interactions with my advisor. I wish I had more interactions with other faculty members."
➤ "I had an issue with a faculty member outside of computer science, but I feel that those I worked with in computer science shielded me from that as well as they possibly could."
➤ "We lost a few really good people in my field, and replaced them with great but young people. I guess that's just timing."

c. I was satisfied with my interaction with students on my research projects.
5: Strongly agree	19
4: Agree	15
3: Neither agree nor disagree	7
2: Disagree	0
1: Strongly disagree	0

Comments:
➤ "There were some students I encountered who didn't seem to agree with being part of a team and were thus not very good collaborators. I think that some students expected every single task to yield a publishable result. I think

the value of system-building and (to be blunt) downright menial software tasks or hardware assembly tasks are not understood as extremely important in a research program. I agreed with it then, but having now run my own research program for a few years, I really emphasize the importance of "silly" aspects of the work as serving the project in critical ways."

➢ "I never clicked socially with most of the students in the department, but that's my personality at work. (And those I did get along well with all left with their MS)

➢ "I worked very closely with other students on our research, this was invaluable to me since that is how most people work in the real world."

➢ "The Graphics Lab was a great place to work as you'd get a lot of help just by being near a lot of other smart students. People often did impromptu demos of their work, which would inevitably spark ideas or identify issues."

➢ "My particular project was specialized enough that I didn't get the chance to interact with other students as much as many of the other graphics students (on more "mainstream" projects) did. I would have liked to have done more of that. I had great interactions with the 2-3 other students working in my area, though."

➢ "All my graduate student peers were bright, motivated, and a pleasure to work with."

➢ "I very rarely was able to work with other students, at least not in the way that the more organized groups were. The times I was able to were great."

d. Overall I was satisfied with my research experience.
   5: Strongly agree   24
   4: Agree   14
   3: Neither agree nor disagree   2
   2: Disagree   5
   1: Strongly disagree   2

Comments:
   ➢ "For the preceding four questions: my research experience didn't work out that great, but I don't think it was entirely the program's fault. Only did it one year; TA'd the other year."

   ➢ "I'm not giving up the Ph.D. now that I have it, but having left academia after 6 years of teaching I'm not sure that it'll ever do me much good (given opportunity costs)."

   ➢ "I enjoyed the projects I worked on, but still was not happy with the experience. When collaborating with professors outside CS the research was more satisfying, because it appeared more "valid". That is the benefit of Computer Science as ToolSmith. The problem with CS as ToolSmith is that it is difficult to get support for a research project that is pure CS. By support I mean validation from faculty advisors and funding. The culture of the department doesn't allow for thinking along those directions. I would say the department culture is more practical than creative. Which is disappointing for someone who is both strongly analytical and very intuitive. I would have liked to do pure research in CS versus being a ToolSmith. That is the only way I can articulate my dissatisfaction."

   ➢ "The research experience was more important than the classwork in my opinion."

- ➢ "When I was a student, very few faculty had available funding. This dramatically limited what areas students could work in and who they could work with. I felt my advisor overeagerly pushed me into an area of research because funding was available not because it aligned with my interests. When I discovered this area wasn't where I wanted to do work, I had no choice but to leave the department because nobody else could afford to take on students."
- ➢ "I felt that I spent too much time working on research projects that did not help me progress towards a dissertation."
- ➢ "Research experience was a dream come true."
- ➢ "UNC CS was an awesome place to do research!"
- ➢ "Focus more on publications."

IV.   Quality of Support/Infrastructure
a.   The administration staff was of high quality.

5: Strongly agree	28
4: Agree	17
3: Neither agree nor disagree	2
2: Disagree	0
1: Strongly disagree	0

Comments:
- ➢ "I guess? I have no idea how to rate administration beyond 'didn't screw anything up for me.'"
- ➢ "There were a few problems, but I think they were fixed."
- ➢ "Superb."
- ➢ "I never had any problems with administration; they were always very helpful when I needed something. In addition they were extremely helpful during my application process."
- ➢ "Amazing."
- ➢ "My appreciation of the UNC staff has grown after I graduated, moved to a faculty job at another school, and got a better feel for how much they were dealing with. Everything went very smoothly while I was there, which I realize now took a great deal of work and didn't just happen".
- ➢ "Yes, from before I arrived until after I left."
- ➢ "Had no issues in my 2 year stay. Everyone was helpful and problems got resolved pretty quickly, be it IT related or paycheck related."
- ➢ "The admin staff helped students navigate the university bureaucracy so we could concentrate on our research and studies. They were great."
- ➢ "Efficient and friendly"

b.   The facilities staff was of high quality.

5: Strongly agree	28
4: Agree	16
3: Neither agree nor disagree	2
2: Disagree	1
1: Strongly disagree	0

Comments:
- ➢ "Help@cs.unc.edu is usually fairly prompt if that's what we're talking about."
- ➢ "Some were quite happy to help, others seemed to be disconnected."

> ➤ "Again, superb. You really notice the difference when you work somewhere else."
> ➤ "I always got great support when having problems with the systems."
> ➤ "John Sopko is still one of the best system admins I have ever worked with!"
> ➤ "I could always count on facilities to help solve my technical issues."
> ➤ "The facilities group was amazing."
> ➤ "I know I was difficult at times, and I'm thankful for the generosity, tolerance, and support the facilities staff showed me. Thanks!"

c. The facilities/resources available to me were of high quality.
   5: Strongly agree   34
   4: Agree   13
   3: Neither agree nor disagree   0
   2: Disagree   0
   1: Strongly disagree   0

Comments:
> ➤ "I still miss AFS."
> ➤ "The CS department was way above other school's facilities. Sitterson hall was truly a great place to be."
> ➤ "This was great - I felt like I had anything I needed or wanted available."
> ➤ "I have to say, that as single projects with large specific resource needs (eve, telepresence) replaced shared resources in the labs, the facilities/resources available to me more and more became the desktop in my office. This had more of an impact on the quality/quantity of interactions with others (students and faculty) than on the quality of resources. It's also a pretty common side-effect of today's computing power. But it wasn't an entirely positive thing. Avoid the day when student's personal laptop/desktops are more powerful than the department supplied machine in their office. Department as ghost town is dreadful."
> ➤ "Without a doubt, UNC had amazing facilities for us. I am particularly appreciative of the philosophy that prevented resources from being locked up by research group/lab. I hope that remains true in the new building."

V.   General

a. Overall the UNC Computer Science Dept provided me a hospitable and nurturing environment in which to learn.
   5: Strongly agree   28
   4: Agree   14
   3: Neither agree nor disagree   2
   2: Disagree   1
   1: Strongly disagree   1

Comments:
> ➤ "The best part was the camaraderie of the students. When I was having trouble with a bug, it seemed there was always someone (not always a student, actually) who was willing to sit and listen to me explain what I was trying to do and help me figure it out. Sometimes just trying to explain my code or work to someone else helped me realize the flaw, and sometimes the other person actually solved my problem, but it was always nice to feel like I

wasn't completely on my own. I tried to return the favor to newer students in my last year or two as well."
- ➢ "I loved being there. Everybody was part of a big family that fostered creativity instead of fostering competition. It was in our best interest to help everybody out."
- ➢ "This has and I imagine will always be one of my most memorable and cherished experiences."
- ➢ "Learned a lot outside of UNC, on my own, and in my internship at VMware."
- ➢ "This was the best thing about the experience. UNC CS, unlike other departments I've known, really cared about its students and treated them with dignity and respect. It's hard to overstate how important and how unique this is."
- ➢ "I had to stay past my 10 semesters, but my RA was available until my last semester and summer. Overall, really good, but if I couldn't have relied on some family loans for those last 8 months I might feel quite a bit differently."
- ➢ "I am pretty sure the environment at UNC CS was better then that of any graduate program I have heard of yet from my colleagues or at conferences."

b. Overall my experiences in the UNC Computer Science Dept have prepared me well for the next stage in my career.
5: Strongly agree	23
4: Agree	17
3: Neither agree nor disagree	4
2: Disagree	1
1: Strongly disagree	0

Comments:
- ➢ "For research, strongly agree. - For teaching, (extra) strongly agree. The teaching class and PhD teaching requirement are unusual among schools, and immensely helpful. I wish I could convince my own faculty to adopt something similar! - For funding, perhaps many young faculty get this experience as a postdoc (which I did not do), but I have talked to other young faculty who had grant-writing experience as students, and really wish that I had as well."
- ➢ "Reputation alone has helped a lot, but also the research experience has meant quite a bit. The coursework has been surprisingly less relevant, but once in a while it does come into play. But also, the ability to work with someone like Henry Fuchs has been invaluable in learning professional practice (and Dr. Brooks' seminar of that name was helpful too)."
- ➢ "My research after leaving UNC-CH was fundamentally unproductive and unsatisfying; although the fault there is mainly mine, I wasn't well prepared. Brooks did great work in the PhD seminar *telling* us about how to plan our careers, but my advisor did not involve me in actually doing so. I've taught graduate students, now, but I'm not even satisfied that I did that well, and have no confidence in my ability to advise a Ph.D. Similarly, Brooks did great work in the teaching seminar telling us how to teach, but my student teaching during summer school was of very little value, completely unsupervised, openly viewed by the faculty as a necessary waste of time. Teaching undergraduates for six years I was competent but uninspired; I have

to presume much of this was temperament, but again, UNC-CH could have done a lot more to set me up for this."

➢ "The most helpful is being a UNC CS-alum. The fellow alums are great, and can help you get a foot in the door."

➢ "I couldn't have gotten the jobs that I did without my research experiences at UNC."

➢ "I feel very prepared for everything I've faced since leaving UNC."

➢ "I think you can tell from my previous responses I am very happy with my experience at UNC and continue my involvement and relationships to this day."

➢ "I feel this is particularly true for MS students, but less so for PhD track students."

➢ "I received good real-world knowledge in computer graphics, which was sufficient for the next stage in my career, but I decided to go work for an OS company, which I always wanted to do."

➢ "It prepared me well for the post-doc, but I don't have a next job yet. It's not the dept's job to push students to achieve at a level that will get them the job they want. But the dept probably *should* suggest where the student is lacking in the basic expectations for that career. Especially when that career is academia, the faculty would be in the position to know."

➢ "Sometimes I feel like I glided through a little too easily. The changing Ph.D. qualifiers during my stay let me pick and choose a easier course of study than, in retrospect, I would like to see my own students take. I learned an enormous amount about graphics but could have used a more thorough grounding in other core aspects of computer science and math. I also probably could have used a bit more pressure to publish, in retrospect, and a bit less attitude toward 'SIGGRAPH or bust' (but that was the whole field back then). Then again, I graduated in five years instead of eight, and still went on to a successful career, so maybe all that was for the best."

➢ "In that my career goal is liberal arts college professor, I am disappointed there was not more opportunity to teach courses. While I laud the policy of tech comm, writing, and teaching a course, the teaching track should be better funded. At the same time I can imagine how difficult it might be to get a faculty member interested in your research if you're not "full-time" with them."

➢ "I was a non-CS-major switching fields and UNC's emphasis on non-majors was perfect for me -- especially the ability to get the equivalent training associated with an undergraduate CS degree in only a few years (through the use of 1/2 semester courses)."

Other Comments:
➢ "I didn't know how lucky I was to have chosen UNC back when I was graduating college, but I can't imagine my career without that experience and 'brand' on my resume."

➢ "My Ph.D.-level skills broadly applicable in industry mostly seem to be technical writing (thanks to a committee member, not my advisor, and definitely not the writing course or MS writing project) and presenting."

➢ "The network I ended up with after UNC was very helpful in my career. Also, collaborations with other schools through the STC (Utah, Brown, Cornell, Cal Tech) was great. I wish there was a little more collaboration with companies."

➢ "I just wanted to mention that the collaborative environment at UNC was fantastic and important to what I looked in jobs."

- ➢ "I believe that the specific results and knowledge that students seek during their time in the university is far less important than the experience they gain. Specifically, I seldom use the results or knowledge from my research in my professional work. However, I use the problem-solving and communication (including writing) skills that I developed while pursuing my degrees on a daily basis. Consequently, I think skill development is of chief importance. For specific results and background information, I've found that there is little benefit to memorizing details. However, students should be aware of the existence of results, the underlying concept behind the results, and where to obtain the details when they are needed."
- ➢ "Cohesion rather than competition within and between the faculty and student bodies, and easy inter-dept, inter-univ (Duke) and interdisciplinary collaboration are unique UNC strengths. Please improve the curricular program and facilities while keeping the dept's strengths and doing all possible to attract and retain the best faculty."
- ➢ "Many of the questions were difficult to answer because depending on what course/faculty the satisfaction varied greatly."
- ➢ "Although there are some choices I would make differently if I was doing it again, I am happy with my choice of attending UNC for graduate school. I hope that the growth in faculty size does not change the environment or nature of the program."
- ➢ "Many positives from the program, however two things that hampered me are the lack of professional development for academics and the lack of focus on publications (so, my CV was not competitive until after I was a postdoc and published a lot)."

9.10 Appendix J: Graduate program evaluation by current students

Graduate Alumni Evaluations

VI.   Degree Program

a. Courses I wanted to take were offered.

5: Strongly agree	22
4: Agree	23
3: Neither agree nor disagree	1
2: Disagree	1
1: Strongly disagree	0

Comments:

➢ "What I didn't realize while I was at UNC is that I wanted to take more cross-disciplinary courses with other departments. I stuck close to the CS department, which arguably wasn't playing to all my strengths. But I did thoroughly enjoy classes like Jeffay's Multimedia class and Gary Bishop's seminar on interactive audio."

➢ "Some courses were really helpful for my career but I also found some of the courses were never used at all."

➢ "Fantastic choice of courses, and option to take courses at Duke, NC State filled in any gaps."

➢ "I would have been very interested in courses dealing with real systems (a hardcore operating systems course for example). All system courses that were offered at UNC were dummy courses (advanced operating systems, networking, etc.) that do not teach much. Distributed systems was close to being a real systems course, but it didn't go all the way. There's nothing in Databases, machine learning, neural networks, the knowledge of which is pretty useful in the industry (and as a computer scientist)..."

➢ "Some courses that are offered now, I would have liked to have taken. But I can't see anything I would want that's not offered right now."

➢ "I thought the classes were good, but there weren't any classes on game development, so some students in my year organized one."

➢ "I went to UNC for the strong computer graphics program and definitely had a great list of classes to choose from."

➢ "I would have liked a course on machine learning."

b. The MS course requirements were reasonable.

5: Strongly agree	17
4: Agree	21
3: Neither agree nor disagree	4
2: Disagree	1
1: Strongly disagree	0

Comment:

➢ "Needed more consideration given to prior MS-level courses taken. In my case I received MS from UNC Greensboro. Would have preferred an easier process to move straight into PhD track."

- ➢ "Though when I was enrolled, the Master's thesis was an option but many professor's weren't real keen on taking me up on it."
- ➢ "There was some confusion about the writing requirement. Talking to current students in the program, there seems to still be some confusion about the writing requirement. The core classes in 94-95 were of mixed quality, but that doesn't necessarily say anything about how things are today."
- ➢ "The MS program has a good balance of courses in your discipline with courses outside of your discipline. I liked trying to apply graphics to courses that were not quite related."
- ➢ "The course load was challenging, but I feel like I learned a lot because of it."
- ➢ "In retrospect, the breadth of my knowledge in CS was highly influenced by these courses. I was an EE major, so I had a different background than the average."
- ➢ "The choice of what areas to deem "core" will always be subjective and I did not necessarily agree with where that line was drawn."
- ➢ "My MS curriculum adequately prepared me for my career over the past decade. Everything from parallel programming, compilers, scientific computing, architecture, and of course graphics courses created a base that has allowed me to survive and even excel through 3+ economic downturns in the semiconductor industry. I regularly utilize the core knowledge UNC provided in my rather haphazard wandering through the fields of computer science and architecture. Someday I will figure out what I want to do with my life, but for now I savor the adaptability and flexibility in my own destiny the core curriculum and electives I chose has allowed me to retain."
- ➢ "There was a lot of debate about this while I was there. After I finished my MS, the core curriculum was revamped and the CCE exam was dropped in favor of an integrative paper. I agreed with some changes to the core, but lamented others, sometimes after the fact. For example, one of the core courses I did worst in (because it was difficult and because I valued it less than other courses such as computer graphics) was Parallel and Distributed computing. The parallel part of this course is now central to my everyday work, and it becoming crucial to all computer scientists. I believe parallel computing should be part of the core."

c. The Ph.D. course requirements were reasonable.

5: Strongly agree	12
4: Agree	16
3: Neither agree nor disagree	3
2: Disagree	2
1: Strongly disagree	0

Comments:
- ➢ "I wonder if more courses in the area of the dissertation should be required. although this may be best considered on a case-by-case basis."
- ➢ "Although I did not stay for a PhD I believe UNC's requirements were definitely reasonable."
- ➢ "The oral qual was a difficult format for me. I think this has been dropped since I left."

➢ "I always felt like the course requirements for MS and PhD were about the same. I went to UNC with the idea of getting a PhD, and it was nice to get the MS along the way, because it was always there as a fall-back option."

➢ "When going for both an MS and PhD, the number of examinations and requirements combined felt excessive. I was not bothered particularly by this, but think some of the requirements could be simplified, dropped, or made conditional without any significant loss in overall quality."

➢ "PhD students should have all their coursework completed during their MS and be able to focus on their research/dissertation during the PhD program."

➢ "There were actually so many CS classes out of my focus that I never took some of the classes *related* to my focus, and I now wish I had. The core, I feel, was reasonable."

➢ "It was fine. 'Requirements' is a little vague. The requirement of these PhDs is that your advisor thinks you're done, that part is not vague. Exactly what that means is different per person."

➢ "I went through at the transition away from the old core when the IP was introduced. I feel, and I know I am rare in this, that it is possible to get through with too narrow a background now. That would be a concern when hiring a UNC graduate for an academic position. (However it appears to be a problem everywhere, so perhaps it doesn't disadvantage graduates against the competition.)"

d. The MS program product requirement was useful.
    5: Strongly agree   2
    4: Agree   12
    3: Neither agree nor disagree   11
    2: Disagree   3
    1: Strongly disagree   3

Comments:
    ➢ "I had prior experience at IBM which counted toward this requirement."
    ➢ "Software Engineering was one of the weakest CORE required courses in 94-95, and my group's program product reflected that."
    ➢ "The MS program product requirement is a joke. It should either be removed or made more significant in scope to more closely match the real world."
    ➢ "It got me involved in a project I got a paper out of, but I didn't find the experience of the 135 course itself very satisfactory."
    ➢ "I was in the first class that had to write the integrated paper. I found this to be a great exercise since it was very similar to writing and submitting a research paper. The only problem was coming up with topics from 3 different areas of CS, which was very difficult and the advisors did not provide too much help picking good topics."
    ➢ "I barely remember what the product requirement was, which to me says that it wasn't very relevant for me."
    ➢ "I was able to use a project from undergraduate, so it didn't really concern me, other than getting it approved."
    ➢ "As an EMPLOYER, I appreciate when new hires come in with product experience and cannot imagine an MS student without such a background. For a PhD student, this also provides good grounding in the 80% of product development that doesn't involve code. However I'd encourage retaining an

'easy out' option for students that can pass a review of previous product experience."
- ➢ "If a person got as far as UNC to an MS or a PhD, this should be taken for granted. People get past this anyway by citing an older internship."
- ➢ "Anybody with a clue finds a way to get out of this requirement so that they don't have to take the software engineering course which is viewed as a waste of time by most students and faculty that I interacted with."
- ➢ "I liked the concept, but it seemed that most people including myself 'got around' it by using undergrad projects or various other things that seemed to not live up to the original intention."

e. The MS writing requirement was useful.

5: Strongly agree	4
4: Agree	19
3: Neither agree nor disagree	7
2: Disagree	5
1: Strongly disagree	1

Comments:
- ➢ "I don't object to a writing requirement in principle, but the class I had to take was, in its current implementation, pretty useless."
- ➢ "I would have preferred to use a published paper to satisfy the writing requirement instead of the integrative paper."
- ➢ "I attempted the thesis route but my adviser was not good about reading it/offering feedback. However, it was one of the most useful requirements as I had never written a 60 page scientific paper before."
- ➢ "Writing was absolutely the weakest required course in 94-97. I learned nothing in it - it only covered elementary grammar, teaching was horrible, expectations were low."
- ➢ "It is useful in theory but not effective in practice. Every student should be assigned to help a professor who is working on a publication and be a co-author, regardless of overlap in research interest or experience. That would motivate the professor to help the student learn how to publish -- if their own publication was on the line!"
- ➢ "I really enjoyed writing a Masters thesis as a prelude to what the PhD program would be like. I ended up with a technical paper that could have probably turned into a PhD thesis had I gone on."
- ➢ "I waived this requirement. Writing papers with my advisor or other professors was much more instructive."
- ➢ "Not sure if it would have been useful if I had done a masters only. But given that I did a Ph.D., I believe that writing a dissertation and publishing articles, and the tutelage I received from Steve Pizer on those, were way more useful than the MS writing requirement."
- ➢ "Had I been continuing on to the PhD program, where I would need to write papers, yes. Otherwise, not particularly. Though I suppose it does help non-writer students (such as myself) realize what a large chunk of the PhD program would entail, and I guess that's good."
- ➢ "Technical writing is certainly an important skill and should be demonstrated I think. However, I also think there is more than one style of technical writing. For instance, research papers, funding proposals, internal white papers, design documents, user documentation, etc., should not be written in

the same style or with the same considerations in mind. This requirement felt like a mismatch for the MS degree because my own submission was really demonstrating research-related skills, making it more closely related to a PhD track."

➢ "We write enough for other classes, this was redundant and seemed rather bureaucratic."

➢ "It improved my writing style a bit, but not by much."

➢ "I think writing is an invaluable skill and I really appreciated the writing requirement; I am proud of my Master's Paper (the longest paper I ever wrote!) and I derived a lot of value from researching my topic, interacting with the professors that reviewed the paper, and finally submitting it."

➢ "I qualified out of this via paper publication, but I feel writing skills are very important. However I believe the writing course offered to MS students was pretty poor. Better off writing a paper (IP requirement)."

➢ "The IP was a great learning tool for me. I can't recall if the writing class was part of the MS or PhD requirements but it was NOT useful."

f. It was useful to write a thesis/dissertation.
    5: Strongly agree   26
    4: Agree   5
    3: Neither agree nor disagree   2
    2: Disagree   2
    1: Strongly disagree   0

Comments:
    ➢ "I think the ability to write clearly and to articulate your ideas is one of the critical skills necessary to attaining your PhD."

    ➢ "I enjoyed it, I just wish I had more feedback while writing it, and that since it was 'only' a Master's thesis I got a bit more help from the faculty."

    ➢ "I expect that this will be more germane later in the survey: although I learned from doing the Ph.D., the experience was awful, poorly managed, and did not leave me prepared for a career in academia."

    ➢ "I didn't write one here, but is it really reasonable to consider eliminating the dissertation?"

    ➢ "Getting the PhD (and fulfilling the tasks involved) has been the best educational experience in my life!"

    ➢ "I gained immensely in terms of both research and writing skills."

    ➢ "The ability to integrate pieces into a coherent whole is a key skill for any developer or researcher. As with large software designs, this exercise forces students to learn how to logically organize and present a non-trivial collection of concepts and results. The experience should also help to demonstrate the strong parallels between developing documentation and developing software."

    ➢ "I liked the UNC approach to this – for MS candidates, you can write one or do a product + writing requirement. I still believe a thesis is overkill if you're going into industry."

    ➢ "It is useful to write something, e.g. submit an academic paper. It is not essential that it be a thesis."

> ➢ "More guidance from your advisor would be good. When you are writing such a large document for the first time, much guidance is needed. But many times, there is little help and direction in how to do this well."
> ➢ "Before writing it I wasn't sure how educationally valuable it would be, but by the time I was done I appreciated the value."
> ➢ "Even though I just finished it, man it feels so good to have put it all together like that. While I'm not sure that what I contributed in seven years was only 140 pages, it's still great."
> ➢ "It taught me a LOT. In a perfect world I would structure PhD programs differently so that the focus wasn't so strongly on one item."

g. The Ph.D. qualifying exam was reasonable.
    5: Strongly agree   12
    4: Agree   15
    3: Neither agree nor disagree   6
    2: Disagree   5
    1: Strongly disagree   0

Comments:
> ➢ "I did take and pass it, although I didn't end up entering the program."
> ➢ "I understand its purpose, but in my experience, I saw very capable individuals fail the exam. A lot of times, it depended on which professors you got for your exam."
> ➢ "It is arbitrary and not a good predictor of success in the PhD program. Many who pass do not complete PhDs. Many who do not pass would probably go on to do well. There are many paths to a PhD and not all successful candidates have the same intellect, which is a good thing. Plus, if the student is smarter than those testing him/her, then tests often are no longer a valid measure at this level."
> ➢ "So far the new system seems better to me."
> ➢ "The oral qual was difficult and a bit random chance depending on which professors you got. Some were notoriously tougher than others."
> ➢ "I think it's good to have some way of evaluating whether a student is ready for the kind of thinking involved in the PhD. Is the qual the best way? I honestly don't know..."
> ➢ "I took the qual when it was an oral exam given by several faculty members. I felt it was useful and reasonable, and I look back on it as a very positive experience. I understand the department has changed it since then."
> ➢ "Subject matter not covered in the course shouldn't be part of the exam. Courses should be required to cover the material that might be part of the exam or the exam should be adjusted."
> ➢ "The one negative aspect in my eyes, which I'm not sure can be eliminated, is that there was a 'fear factor' that played into the exam in addition to just testing for knowledge and critical thinking skills. But maybe that was done on purpose to test thinking under pressure, I'm not sure."
> "If I recall correctly, this was just a variant of a comprehensive exam when I took it. Although expecting students to have internalized some understanding of basic techniques makes sense, it seems more appropriate for such an exam to focus on skills and process than on details and results. The latter will vary

significantly based on what area of research the student moves into. This test should focus on assessing the student's ability to adapt to unfamiliar situations and (ideally) see any parallels that exist to familiar situations that might provide good leads."

➢ "For me, I now see the wisdom in the quals: faculty correctly assessed I wasn't ready yet. Additionally, I felt the process highly subjective. I learned a very valuable lesson out of the process--I should have been more politically savvy, gotten to know more faculty, got them to know me. I think back on this failure as a significant growth experience and am thankful for the decision that was made. While subjective, that's how the real world works. You don't get funded in industry without understanding both the technical and political aspects of decisions, and strong communication and interpersonal skills are required for career growth. Programmers can be jerks, architects cannot. You are not preparing people to be programmers you are preparing them to be future leaders, and I feel the qual exam is very useful to allow a collective judgment on an individual."

➢ "Due to current policies, the exam is completely pointless. If a student passes the exam, it's no guarantee of admission to the PhD program since a champion is still required. It's just an extra hurdle that guarantees nothing."

➢ "I liked the ability to take the oral qualifying exam at the end of the first year. It was a big improvement over the previous system (DWE)."

➢ "Having failed it once and passed it once I can see how it can be both good and bad. It is difficult to make this objective, but I agree with the importance of having something like this."

➢ "I took it when everyone took the 3 sessions no matter what. That was one of the most useful things I went through in transitioning to being an academic 'adult'. I would urge a return to making everyone do it as a service to the students - it is more then just a filter, it really built character and taught me what it meant to talk in front of educated peers on hard issues that I had not perfectly prepared."

➢ "I took the DWE. I feel preparing for the DWE, with the requirement of knowledge in many key fields of computer science made me more confident and really helped to prepare me to my later professional life. I do not believe an oral exam in a few limited topics would have had the same profound benefit. I don't know if you've moved back to written DWE-like tests, but I think you should. There are great benefits to the student that simply cannot be obtained through studying for anything less daunting."

h. I was satisfied with the advice I received regarding the degree program.

5: Strongly agree	17
4: Agree	20
3: Neither agree nor disagree	4
2: Disagree	3
1: Strongly disagree	1

Comments:
➢ "The writing requirement was unclearly enough explained that two weeks before MS graduation I was told I wasn't going to get it. I chose research groups, advisors, and committee members poorly, and figure that whatever advice I got didn't help."

➢ "The departmental attitude is more 'sink or swim' regarding student advising. Works for students who are already independent types, but doesn't help others flourish and grow toward academic independence."
➢ "I felt that I knew everything I needed in order to graduate, there were no last minute surprise courses, requirements, etc."
➢ "I got some advice from students and a few professors, but I think there should be a formal review sometime in your second year to sit down with your advisor and discuss options."
➢ "Steve Pizer gave me excellent advice and guidance."
➢ "It varied. Some was unhelpful but some was very helpful."
➢ "The role of advising/chairing should be taken more seriously, and faculty should allot more time/effort to this task."
➢ "Drs. Jeffay and Don Smith were fantastic advisors, and they had a lot of patience with me as I was trying to figure out what I was actually good enough at to pursue a career in."

i. Overall I was happy with the degree program.
   5: Strongly agree   24
   4: Agree   17
   3: Neither agree nor disagree   3
   2: Disagree   3
   1: Strongly disagree   0

Comments:
➢ "There were clear signs of manifest failure on my advisor's part, both in his relationship with his students and his conduct of research, and yet he's still there 11 years after I became his student, still with as far as I can tell a record that doesn't suggest he should have tenure or be mentoring."
➢ "I loved my time at UNC, it was by far the hardest 2 years of my life, the workload was incredible. The best part was that people worked together as teams, everybody was friendly and willing to help each other out. I wouldn't trade that for any other university. I really felt like I was part of a big family at UNC. I would do anything possible for other members of the family. My advisors pushed me hard, but gave me support anytime I needed it."
➢ "I have nothing but good memories of the program and people, and the alumni connection really helped propel my career."
➢ "I'm extremely thankful I came to UNC."
➢ "Having a MS from UNC in computer graphics is a defining characteristic of who I am as an individual today. I don't think, sitting on the porch in 100 degree Midwestern heat in a small town in Indiana I ever imagined the life I have been given the chance to lead. UNC allowed me to turn my dreams into goals. It was also the hardest transition in my life--from a small Midwestern town to a leading research university, a huge cultural shift, very stressful, very exciting. I am beyond happy I chose UNC--I rarely face technical issues professionally that I didn't have in some form/fashion in school. I regularly reference material, textbooks, etc. that I used some 10 years ago in my curriculum at UNC."
➢ "I'm happy with the education I received, but there were a lot of unnecessary hurdles to leap and paperwork to fill out along the way."
➢ "It was an MS/CS from a great school, which has opened lots of doors for me professionally. It wasn't until a few years after leaving the program that I

found my niche in web/interaction design, and the skills I use daily are largely ones I have learned since leaving UNC. So, in some ways, my experience at UNC wasn't very relevant to my eventual career, but that has more to do with me than UNC. Drs. Jeffay and Smith were fantastic advisors, I made some great friends at UNC, and I have enormous respect for the department."

➢ "Could have used more emphasis on publications."

➢ "I think I may have hit the sweet spot as the program evolved: Taking the core courses; IP instead of written exam; taking the quals."

VII. Quality of Teaching in Computer Science

a. The faculty was well-prepared.

5: Strongly agree	17
4: Agree	23
3: Neither agree nor disagree	5
2: Disagree	1
1: Strongly disagree	0

Comments:

➢ "I would actually 'strongly agree' for many, with a few exceptions."

➢ "Some were prepared, others were not."

➢ "Carolina always had strong faculty."

➢ "Some strong professors in the classroom, some very weak."

➢ "Sometimes it was obvious that the faculty was preoccupied with research and was not fully prepared to give lectures."

➢ "Faculty was amazing and the lessons were very well prepared. Additionally the research groups were well run."

➢ "Overall, yes, but there were problems at times. I'm not sure if it was a problem with preparation or with the teaching approaches."

➢ "For class or for their field? For class, it was honestly about 70/30. Core curriculum seemed to be taken fairly seriously. Sometimes it was obvious a professor would rather be doing something else that instruction. on balance, I think faculty was more prepared than less prepared and actually exceeded expectations set by the common wisdom of 'research university professors don't care about teaching'. I think that was the exception and not the rule."

➢ "Most of the questions on this page are only relevant if the subject matter being taught is of interest to the student. I must say that the algorithms course was poorly taught. No motivation was provided for the algorithms, and students lacked an appreciation for the things being presented. The beauty of some of the proofs was lost in the monotony. I got an 'H' in the course, so I'm not saying this to blame the professor for my poor performance."

➢ "Can only think of one class whose professor was lax in preparation."

➢ "It really depends. One course I took (204) was often cancelled for no apparent reason. With a full load, cancelling my least favorite class was welcome, but doing it multiple times in a semester is a problem. Other professors relied heavily on student presentations and lectures to reduce their own workload, but this is not uncommon and I understand why it happens. But on the whole, I would say the majority of my teachers were well-prepared for class."

➢ "I truly appreciate the depth of knowledge of some professors."

> ➢ "There was only one course I had that had severe problems for a graduate level course; and that was only for half the class."

b. The faculty was motivated and enthusiastic.

5: Strongly agree	15
4: Agree	26
3: Neither agree nor disagree	4
2: Disagree	0
1: Strongly disagree	1

Comments:
> ➢ "The faculty was motivated and enthusiastic about the research, I don't know that that always carried over into the classroom."
> ➢ "Some very motivated, some not so."
> ➢ "Most definitely were; a few weren't."
> ➢ "This varied a lot from faculty member to faculty member."
> ➢ "Yes, and their enthusiasm increased my own."
> ➢ "Again, 70% of the time yes, 30% of the time no."
> ➢ "Having learned about other departments since graduation, I cannot emphasis enough how wonderful the faculty at Chapel Hill was. I always felt supported and that people wanted me to succeed, even if they were putting up hurdles in front of me."

c. Evaluation of my work was fair and impartial.

5: Strongly agree	22
4: Agree	22
3: Neither agree nor disagree	2
2: Disagree	1
1: Strongly disagree	0

Comments:
> ➢ "Generally true, though I think at times luck had something to do with it."
> ➢ "I don't think this is possible with project-based classes. It is too hard to be objective, or rather, too time-consuming."
> ➢ "I always felt that I received the proper grade on my assignments."
> ➢ "All but in one course."
> ➢ "For the most part, yes, though there was one incident I was less than pleased about. My professor suggested a project idea they knew I had no experience in, because I had no experience in it, and then graded it as if I'd done a lot of work with it before the project. That irked me."
> ➢ "Yes, but there were lots of times when helpful guidance/feedback could have been given but wasn't."

d. Overall, the faculty was effective in teaching.

5: Strongly agree	13
4: Agree	25
3: Neither agree nor disagree	4
2: Disagree	3
1: Strongly disagree	1

Comments:

- "Some were very effective, some were not as effective."
- "Brooks, Anderson, Jeffay, and a few others helped compensate for the weakest."
- "I once heard that a good teacher is one who the A students think of as a good teacher 5+ years after taking the class. Pizer's Solid Shape class was one. Mago's Architecture class another. None of the others come to mind."
- "I think that the faculty teaching style required some getting used to. In undergrad the faculty generally gives you a bit more details, whereas graduate faculty give some basics and let the students figure out all of the details on their own."
- "I had a variety of faculty, ranging from ones who did a great job at teaching to some who obviously felt that teaching was beneath them. Overall, I felt the teaching was effective, but there was very wide variation."
- "Some of the faculty really knew their field, but they weren't necessarily great teachers. Overall I felt that teaching wasn't much of a priority among several of the professors."
- "I gained much from my degree and stay at UNC, however I would not rank the program high in its ability to instruct students in class or in research groups."
- "Some faculty members care a lot about teaching while others don't. It's impossible to accurate characterize the entire department one way or the other."
- "Teaching didn't appear to be the focus, both in the classroom and in the lab. Some professors were very very good at it (e.g. Steve Pizer), but many weren't strong in that area."
- "From discussion with students of other programs, I feel that the department's teaching was much better then the norm. There were a couple courses however that were low effort on part of the professor: where we were read the book and told to do the hard problems without guidance or assistance. I do not feel that teaching had a meaningful impact either way on tenure and promotion. Still, I think the department is way above the norm for a research institution."
- "Almost all were extremely good, but a few weren't."

VIII. Quality of Research Experience

a. I was able to work on a research project that excited me.

5: Strongly agree	23
4: Agree	17
3: Neither agree nor disagree	1
2: Disagree	5
1: Strongly disagree	1

Comments:
- "In retrospect, it would have been possible to find projects that interested me *more* than what I did, but I hadn't figured that out yet."
- "Incoming class in 2002 was so large, many students including myself were not placed into desirable research positions early. This means to me that the program as a whole was not prepared for this."
- "I worked for David Beard my first year, then for Henry Fuchs my second through fifth years. That was invaluable experience and most directly led to my success in the two job searches I have done."

➢ "The project started off exciting, but ..."
➢ "I strongly approve of this department's lack of a wall between MS and Ph.D. students. The idea that all students come in on an equal footing, even if they have expressed an intention to leave with an MS, creates a good atmosphere in the department."
➢ "I worked with Dinesh and Ming and they were very supportive of my work. They pushed very hard but also rewarded me when things went well."
➢ "I got my first choice of research project, and partnered with a PhD student that was working on something exciting, so I think I got lucky."
➢ "I personally enjoyed a lot my research and the research team. I don't think this was the case for everybody in the department though."
➢ "I did one independent study that I was excited about, other than that I TA'd because I wasn't wanted in the research group that had the research I really loved."
➢ "Ming Lin offered a wide variety of research options."
➢ "Worked on a GPGP related project with Dinesh."

b. I was satisfied with my interaction with faculty on my research projects.
    5: Strongly agree   19
    4: Agree   19
    3: Neither agree nor disagree   3
    2: Disagree   4
    1: Strongly disagree   0

Comments:
➢ "The faculty was motivated about projects and always around to brainstorm."
➢ "First year interaction didn't quite seem to click for either of us. Working for Manocha & Brooks was great - although I didn't get as much from Brooks as I'd have liked to, the fault may have been mine for not asking."
➢ "I think it would have been nice to have a weekly meeting set up, but my advisor was Dr. Brooks who is understandably very busy. I did have frequent interaction with Mary Whitton though, so having her available was a big help."
➢ "I had great interactions with my advisor. I wish I had more interactions with other faculty members."
➢ "I had an issue with a faculty member outside of computer science, but I feel that those I worked with in computer science shielded me from that as well as they possibly could."
➢ "We lost a few really good people in my field, and replaced them with great but young people. I guess that's just timing."

c. I was satisfied with my interaction with students on my research projects.
    5: Strongly agree   19
    4: Agree   15
    3: Neither agree nor disagree   7
    2: Disagree   0
    1: Strongly disagree   0

Comments:

- ➢ "There were some students I encountered who didn't seem to agree with being part of a team and were thus not very good collaborators. I think that some students expected every single task to yield a publishable result. I think the value of system-building and (to be blunt) downright menial software tasks or hardware assembly tasks are not understood as extremely important in a research program. I agreed with it then, but having now run my own research program for a few years, I really emphasize the importance of "silly" aspects of the work as serving the project in critical ways."
- ➢ "I never clicked socially with most of the students in the department, but that's my personality at work. (And those I did get along well with all left with their MS)
- ➢ "I worked very closely with other students on our research, this was invaluable to me since that is how most people work in the real world."
- ➢ "The Graphics Lab was a great place to work as you'd get a lot of help just by being near a lot of other smart students. People often did impromptu demos of their work, which would inevitably spark ideas or identify issues."
- ➢ "My particular project was specialized enough that I didn't get the chance to interact with other students as much as many of the other graphics students (on more "mainstream" projects) did. I would have liked to have done more of that. I had great interactions with the 2-3 other students working in my area, though."
- ➢ "All my graduate student peers were bright, motivated, and a pleasure to work with."
- ➢ "I very rarely was able to work with other students, at least not in the way that the more organized groups were. The times I was able to were great."

d. Overall I was satisfied with my research experience.
5: Strongly agree	24
4: Agree	14
3: Neither agree nor disagree	2
2: Disagree	5
1: Strongly disagree	2

Comments:
- ➢ "For the preceding four questions: my research experience didn't work out that great, but I don't think it was entirely the program's fault. Only did it one year; TA'd the other year."
- ➢ "I'm not giving up the Ph.D. now that I have it, but having left academia after 6 years of teaching I'm not sure that it'll ever do me much good (given opportunity costs)."
- ➢ "I enjoyed the projects I worked on, but still was not happy with the experience. When collaborating with professors outside CS the research was more satisfying, because it appeared more "valid". That is the benefit of Computer Science as ToolSmith. The problem with CS as ToolSmith is that it is difficult to get support for a research project that is pure CS. By support I mean validation from faculty advisors and funding. The culture of the department doesn't allow for thinking along those directions. I would say the department culture is more practical than creative. Which is disappointing for someone who is both strongly analytical and very intuitive. I would have liked to do pure research in CS versus being a ToolSmith. That is the only way I can articulate my dissatisfaction."

> ➢ "The research experience was more important than the classwork in my opinion."
> ➢ "When I was a student, very few faculty had available funding. This dramatically limited what areas students could work in and who they could work with. I felt my advisor overeagerly pushed me into an area of research because funding was available not because it aligned with my interests. When I discovered this area wasn't where I wanted to do work, I had no choice but to leave the department because nobody else could afford to take on students."
> ➢ "I felt that I spent too much time working on research projects that did not help me progress towards a dissertation."
> ➢ "Research experience was a dream come true."
> ➢ "UNC CS was an awesome place to do research!"
> ➢ "Focus more on publications."

IX. Quality of Support/Infrastructure

a. The administration staff was of high quality.

5: Strongly agree	28
4: Agree	17
3: Neither agree nor disagree	2
2: Disagree	0
1: Strongly disagree	0

Comments:
> ➢ "I guess? I have no idea how to rate administration beyond 'didn't screw anything up for me.'"
> ➢ "There were a few problems, but I think they were fixed."
> ➢ "Superb."
> ➢ "I never had any problems with administration; they were always very helpful when I needed something. In addition they were extremely helpful during my application process."
> ➢ "Amazing."
> ➢ "My appreciation of the UNC staff has grown after I graduated, moved to a faculty job at another school, and got a better feel for how much they were dealing with. Everything went very smoothly while I was there, which I realize now took a great deal of work and didn't just happen".
> ➢ "Yes, from before I arrived until after I left."
> ➢ "Had no issues in my 2 year stay. Everyone was helpful and problems got resolved pretty quickly, be it IT related or paycheck related."
> ➢ "The admin staff helped students navigate the university bureaucracy so we could concentrate on our research and studies. They were great."
> ➢ "Efficient and friendly"

b. The facilities staff was of high quality.

5: Strongly agree	28
4: Agree	16
3: Neither agree nor disagree	2
2: Disagree	1
1: Strongly disagree	0

Comments:

➢ "Help@cs.unc.edu is usually fairly prompt if that's what we're talking about."
➢ "Some were quite happy to help, others seemed to be disconnected."
➢ "Again, superb. You really notice the difference when you work somewhere else."
➢ "I always got great support when having problems with the systems."
➢ "John Sopko is still one of the best system admins I have ever worked with!"
➢ "I could always count on facilities to help solve my technical issues."
➢ "The facilities group was amazing."
➢ "I know I was difficult at times, and I'm thankful for the generosity, tolerance, and support the facilities staff showed me. Thanks!"

c. The facilities/resources available to me were of high quality.

5: Strongly agree	34
4: Agree	13
3: Neither agree nor disagree	0
2: Disagree	0
1: Strongly disagree	0

Comments:
➢ "I still miss AFS."
➢ "The CS department was way above other school's facilities. Sitterson hall was truly a great place to be."
➢ "This was great - I felt like I had anything I needed or wanted available."
➢ "I have to say, that as single projects with large specific resource needs (eve, telepresence) replaced shared resources in the labs, the facilities/resources available to me more and more became the desktop in my office. This had more of an impact on the quality/quantity of interactions with others (students and faculty) than on the quality of resources. It's also a pretty common side-effect of today's computing power. But it wasn't an entirely positive thing. Avoid the day when student's personal laptop/desktops are more powerful than the department supplied machine in their office. Department as ghost town is dreadful."
➢ "Without a doubt, UNC had amazing facilities for us. I am particularly appreciative of the philosophy that prevented resources from being locked up by research group/lab. I hope that remains true in the new building."

X. General

a. Overall the UNC Computer Science Dept provided me a hospitable and nurturing environment in which to learn.

5: Strongly agree	28
4: Agree	14
3: Neither agree nor disagree	2
2: Disagree	1
1: Strongly disagree	1

Comments:
➢ "The best part was the camaraderie of the students. When I was having trouble with a bug, it seemed there was always someone (not always a student, actually) who was willing to sit and listen to me explain what I was trying to do and help me figure it out. Sometimes just trying to explain my code or work to someone else helped me realize the flaw, and sometimes the

other person actually solved my problem, but it was always nice to feel like I wasn't completely on my own. I tried to return the favor to newer students in my last year or two as well."

➢ "I loved being there. Everybody was part of a big family that fostered creativity instead of fostering competition. It was in our best interest to help everybody out."

➢ "This has and I imagine will always be one of my most memorable and cherished experiences."

➢ "Learned a lot outside of UNC, on my own, and in my internship at VMware."

➢ "This was the best thing about the experience. UNC CS, unlike other departments I've known, really cared about its students and treated them with dignity and respect. It's hard to overstate how important and how unique this is."

➢ "I had to stay past my 10 semesters, but my RA was available until my last semester and summer. Overall, really good, but if I couldn't have relied on some family loans for those last 8 months I might feel quite a bit differently."

➢ "I am pretty sure the environment at UNC CS was better then that of any graduate program I have heard of yet from my colleagues or at conferences."

b. Overall my experiences in the UNC Computer Science Dept have prepared me well for the next stage in my career.

5: Strongly agree	23
4: Agree	17
3: Neither agree nor disagree	4
2: Disagree	1
1: Strongly disagree	0

Comments:
➢ "For research, strongly agree. - For teaching, (extra) strongly agree. The teaching class and PhD teaching requirement are unusual among schools, and immensely helpful. I wish I could convince my own faculty to adopt something similar! - For funding, perhaps many young faculty get this experience as a postdoc (which I did not do), but I have talked to other young faculty who had grant-writing experience as students, and really wish that I had as well."

➢ "Reputation alone has helped a lot, but also the research experience has meant quite a bit. The coursework has been surprisingly less relevant, but once in a while it does come into play. But also, the ability to work with someone like Henry Fuchs has been invaluable in learning professional practice (and Dr. Brooks' seminar of that name was helpful too)."

➢ "My research after leaving UNC-CH was fundamentally unproductive and unsatisfying; although the fault there is mainly mine, I wasn't well prepared. Brooks did great work in the PhD seminar *telling* us about how to plan our careers, but my advisor did not involve me in actually doing so. I've taught graduate students, now, but I'm not even satisfied that I did that well, and have no confidence in my ability to advise a Ph.D. Similarly, Brooks did great work in the teaching seminar telling us how to teach, but my student teaching during summer school was of very little value, completely unsupervised, openly viewed by the faculty as a necessary waste of time. Teaching undergraduates for six years I was competent but uninspired; I have

to presume much of this was temperament, but again, UNC-CH could have done a lot more to set me up for this."

➢ "The most helpful is being a UNC CS-alum. The fellow alums are great, and can help you get a foot in the door."

➢ "I couldn't have gotten the jobs that I did without my research experiences at UNC."

➢ "I feel very prepared for everything I've faced since leaving UNC."

➢ "I think you can tell from my previous responses I am very happy with my experience at UNC and continue my involvement and relationships to this day."

➢ "I feel this is particularly true for MS students, but less so for PhD track students."

➢ "I received good real-world knowledge in computer graphics, which was sufficient for the next stage in my career, but I decided to go work for an OS company, which I always wanted to do."

➢ "It prepared me well for the post-doc, but I don't have a next job yet. It's not the dept's job to push students to achieve at a level that will get them the job they want. But the dept probably *should* suggest where the student is lacking in the basic expectations for that career. Especially when that career is academia, the faculty would be in the position to know."

➢ "Sometimes I feel like I glided through a little too easily. The changing Ph.D. qualifiers during my stay let me pick and choose a easier course of study than, in retrospect, I would like to see my own students take. I learned an enormous amount about graphics but could have used a more thorough grounding in other core aspects of computer science and math. I also probably could have used a bit more pressure to publish, in retrospect, and a bit less attitude toward 'SIGGRAPH or bust' (but that was the whole field back then). Then again, I graduated in five years instead of eight, and still went on to a successful career, so maybe all that was for the best."

➢ "In that my career goal is liberal arts college professor, I am disappointed there was not more opportunity to teach courses. While I laud the policy of tech comm, writing, and teaching a course, the teaching track should be better funded. At the same time I can imagine how difficult it might be to get a faculty member interested in your research if you're not "full-time" with them."

➢ "I was a non-CS-major switching fields and UNC's emphasis on non-majors was perfect for me -- especially the ability to get the equivalent training associated with an undergraduate CS degree in only a few years (through the use of 1/2 semester courses)."

Other Comments:

➢ "I didn't know how lucky I was to have chosen UNC back when I was graduating college, but I can't imagine my career without that experience and 'brand' on my resume."

➢ "My Ph.D.-level skills broadly applicable in industry mostly seem to be technical writing (thanks to a committee member, not my advisor, and definitely not the writing course or MS writing project) and presenting."

➢ "The network I ended up with after UNC was very helpful in my career. Also, collaborations with other schools through the STC (Utah, Brown, Cornell, Cal Tech) was great. I wish there was a little more collaboration with companies."

➢ "I just wanted to mention that the collaborative environment at UNC was fantastic and important to what I looked in jobs."

➢ "I believe that the specific results and knowledge that students seek during their time in the university is far less important than the experience they gain. Specifically, I seldom use the results or knowledge from my research in my professional work. However, I use the problem-solving and communication (including writing) skills that I developed while pursuing my degrees on a daily basis. Consequently, I think skill development is of chief importance. For specific results and background information, I've found that there is little benefit to memorizing details. However, students should be aware of the existence of results, the underlying concept behind the results, and where to obtain the details when they are needed."

➢ "Cohesion rather than competition within and between the faculty and student bodies, and easy inter-dept, inter-univ (Duke) and interdisciplinary collaboration are unique UNC strengths. Please improve the curricular program and facilities while keeping the dept's strengths and doing all possible to attract and retain the best faculty."

➢ "Many of the questions were difficult to answer because depending on what course/faculty the satisfaction varied greatly."

➢ "Although there are some choices I would make differently if I was doing it again, I am happy with my choice of attending UNC for graduate school. I hope that the growth in faculty size does not change the environment or nature of the program."

➢ "Many positives from the program, however two things that hampered me are the lack of professional development for academics and the lack of focus on publications (so, my CV was not competitive until after I was a postdoc and published a lot)."

9.11 Appendix K: Undergraduate program evaluation by alumni

Undergraduate Alumni Evaluations
   XI.   Degree Program
   a.   Courses I wanted to take were offered.
       5: Strongly agree   8
       4: Agree   21
       3: Neither agree nor disagree   4
       2: Disagree   1
       1: Strongly disagree   0

   Comments:
   ➤ "It was tough when many upper level courses were only offered once per year, so it seemed that everyone was always vying for seats in the same classes."
   ➤ "I didn't like that some were offered in alternate years (like Operating Systems). I can understand being offered only in the spring or fall, but once every two years was not frequent enough."
   ➤ "The one thing I would have like to seen different in course offerings is the ability to have taken additional programming language courses of choice."
   ➤ "Nice mix of Database courses, C++ intro, Data Structures, Algorithm Analysis, Project Management."
   ➤ "Most undergraduate courses were a little 'light.' Operating Systems (Jeffay), Graphics (McAllister), etc were exceptions and were excellent."
   ➤ "During my time, certain courses such as compilers and operating systems were offered every other year. Since I couldn't take compilers, I had to take it the undergraduate course during grad school."
   ➤ "More computer graphics courses would have been useful."
   ➤ "I really appreciated the experimental courses (which were labeled Comp 190). Those allowed me to take classes that weren't normally offered, and I appreciated that."
   ➤ "Classes were very theoretical, only a couple of applicable classes."
   ➤ "I feel more hands-on courses would have been valuable."

   b.   The computer science course requirements were reasonable.
       5: Strongly agree   10
       4: Agree   18
       3: Neither agree nor disagree   3
       2: Disagree   2
       1: Strongly disagree   1

   Comments:
   ➤ "A few less of the Math/Physics requirements that could have been substituted with core computer science courses would have been of more assistance to me in my career path."
   ➤ "Was difficult because I had to finish in 2 years all of the requirements but a good solid base."
   ➤ "Some of the courses at the math/physics requirements at the time were irrelevant (Electromagnetism and Optics as an example) to an undergraduate

education in computer science. Even the basic kinematics with physics was questionable, as the time could have been better spent on more advanced math/CS items better related to the major. My younger brother is in the physics program now and his course of study is much more reasonable and focused."

➢ "The requirements were difficult, but they should be."

➢ "Some classes were "out of scope" and didn't really teach me how to apply my skills."

➢ "SDLC should have been a requirement, not an elective. (Common software development tools like source control, use cases, test cases, client interaction, etc.) A slight curriculum shift toward practical programming would have been a big boost for me after graduation."

c. The honors requirements were reasonable.
    5: Strongly agree   3
    4: Agree   11
    3: Neither agree nor disagree   5
    2: Disagree   1
    1: Strongly disagree   0

Comments:
    ➢ "I thought that some sort of research project would be fitting. I see that is now the case."
    ➢ "I don't remember the honors requirements being openly discussed by professors in class. Maybe the advisors mentioned it once a year, or maybe my grades weren't high enough. Honors graduation projects were not disclosed as part of the honors program (which I was in at the time). Unless you are from an academia home life, it's not understood by most students why they would want to graduate with honors. Is it worth the extra effort? Or would it be better to be well rounded and participate in sports and extra curricular activities and build team spirit that will last a lifetime."

d. I was satisfied with the advice I received regarding the degree program.
    5: Strongly agree   9
    4: Agree   9
    3: Neither agree nor disagree   8
    2: Disagree   4
    1: Strongly disagree   3

Comments:
    ➢ "Not much advice was given."
    ➢ "It was easy to understand the requirements by using the major sheets offered by the Academic Advisement department."
    ➢ "I got great advice when I sought it (which probably was not often enough)."
    ➢ "I received good advice while I was participating in the program however, computer science as a major wasn't a very good match for me. I thought it was what I wanted because I had always done very well in math and had an interest in technology. But, no one ever pulled me aside before I got too far into it and asked me if I really enjoyed it or painted a clear picture as to what

the major was really like. Areas I particularly thrived in had more of a business/real world application (database classes/Internet) etc. However, in my senior year, Kevin Jeffay was my advisor and told me something that I will never forget and that was also the most valuable piece of advice I ever received -- that even though at the end of 4 years I find myself struggling with the some of the programming and classwork (not for a lack of trying), I will find that this degree will be invaluable and will help me in ways I don't yet see. And he was absolutely right. I wound up doing Internet Marketing, but having the background of a programmer made the technology side very easy to understand. It also allowed me to understand and be able to communicate with programmers, database analysts in ways that most marketers can't reach them or talk to them."

e. Overall I was happy with the degree program.
    5: Strongly agree   9
    4: Agree   20
    3: Neither agree nor disagree   2
    2: Disagree   3
    1: Strongly disagree   0

Comments:
  ➢ "I was fully prepared to start a career in computer software services after I graduated."
  ➢ "UNC CS was a fairly rigorous program, and was more robust than the CS degrees I have heard about during numerous job interviews with potential candidates at my employer. The program kept us up late a night studying and programming that's for sure, but the lessons learned were mostly real world lessons that we would remember later. The relatively high bar at UNC is known in the business world and carries prestige internationally. UNC lacked the internship requirements that NC State department facilitated. I wish internships were more readily available, even within the other UNC departments who do computer systems work, but I know that its more up to the companies sponsoring internships than the CS department. UNC has a good career services department that was far better than other schools I have heard of- helping students to be placed into good paying real world jobs. I really appreciated the 50 or so interviews I was able to attend my senior year with various technology and consulting companies, and had several good job offers by my last senior semester there before departing Chapel Hill. Overall I was happy with the degree results and the UNC reputation in the end, but it was a roller coaster ride getting to the degree and I won't forget those difficulties encountered along the way."
  ➢ "I wish we had done more with real-time systems and more modern topics like cloud computing and software as a service."
  ➢ "I was told by one of my professors that I actually got the first ever Computer Science degree (every one before me was Math Sciences). I had a great time."
  ➢ "I was for the most part happy with the program. I would have preferred more computer classes than obscure mathematics classes. I also found some of the professors hard to understand (one in particular whose name escapes me, but studied at Oxford or Cambridge)."

➤ "I'm happy that I did it, and proud that I didn't give up, but the CS program and its advisers felt consistently unapproachable. I generally felt like I was "doing this on my own". In comparison, the Math department seemed to bend over backwards to make sure each student's questions were fully answered. Math was far from my strong point, but the approachability of its professors made the classroom environment much more comfortable."

➤ "I learned how to learn, which has served me well in my career as a technology and management consultant."

➤ "I felt advising was somewhat lacking in terms of help to ensure proper degree completion."

XII. Quality of Teaching in Computer Science

a. The faculty was well-prepared.

5: Strongly agree	12
4: Agree	20
3: Neither agree nor disagree	2
2: Disagree	4
1: Strongly disagree	0

Comments:

➤ "Allowing too many classes to be taught by teaching assistants with a lot on their plates with doctoral or master's research is detrimental to undergraduate learning. I would guard against this in the future, although I did not think that was an issue during my years at UNC."

➤ "They knew their stuff."

➤ "Some faculty members were amazing but the general rule seemed to be faculty more focused on research than on teaching."

➤ "There was a broad range of quality in professors during my time. Some were exceptional (e.g. Gary Bishop). Others seemed to treat undergraduate education as chore they had to perform."

➤ "I think there was only a short time during one course when there was a switch of instructors for a month during the semester where I thought an instructor wasn't well prepared to teach."

➤ "Even the graduate students were, for the most part, excellent teachers."

➤ "Most of the faculty was well-prepared and good at their jobs. There were some that I did not feel were fantastic."

b. The faculty was motivated and enthusiastic.

5: Strongly agree	9
4: Agree	18
3: Neither agree nor disagree	5
2: Disagree	3
1: Strongly disagree	0

Comments:

➤ "Most professors and instructors were motivated and enthusiastic. There were one or two exceptions."

➤ "Some were, some were not. It was hit or miss."

➤ "I never had a faculty member who was anything less than 100% willing to work with me to help solve a problem."

➤ "A majority were not. There were definitely some professors who stood out as great teachers, but some who just came to get the job done."

c.   Evaluation of my work was fair and impartial.
   5: Strongly agree   8
   4: Agree   24
   3: Neither agree nor disagree   2
   2: Disagree   1
   1: Strongly disagree   0

Comments:
➤ "I think the TA's generally grading the programming assignments were very fair. Tests were generally fair and not too outlandish in subject matter. I wish there were more face-to-face interview quizzes to talk to students and interview them for the subjects at hand (more like the real world meetings we have with customers, managers, subject matter experts) than the written examinations and programming assignments. I really got the concepts, but the tests didn't always test the memorable concepts by testing the small details, so my grades may not have been all A's when I really thought I got the concepts."
➤ "COMP114 I had a horrible TA but other than that I think it was pretty good."
➤ "If it weren't for Professor Coggins (now gone from the department), this would be strongly agree."
➤ "The program was tough, but fair. The one exception that stands out in the extreme was COMP 120 under Halton (I think). Failing half the class? Ridiculous."
➤ "I did have some noted examples of students cheating on programming assignments. Comparing work for some one who did not cheat with those that did can skew the results of assignments."

d.   Overall, the faculty was effective in teaching.
   5: Strongly agree   11
   4: Agree   19
   3: Neither agree nor disagree   2
   2: Disagree   3
   1: Strongly disagree   0

Comments:
➤ "Some were better than others."
➤ "The CS material taught was memorable, except for algorithm analysis class where the material was too deep for the degree. I think that speaks to the faculty being effective. I still remember and use many of the lessons taught."
➤ "Dr Bishop is the best professor I have ever had. Dr Mayer-Patel is also a notable standout."
➤ "There were a couple of teachers (I can think of one off the top of my head) that I did not think were fantastic. But, generally, the teachers were effective. I particularly appreciated Profs. Jeffay and Mayer-Patel."
➤ "Despite a general irreverence for "average" students and the coddling of superstars, professors were always well-qualified to teach their respective courses."

> ➢ "The general consensus among most of my colleagues was that the learning experience was greatest away from the classroom. The teacher was basically there to give us materials and assign work/homework from the syllabus, though very little of what was taught *in* class actually helped in broadening our knowledge of the material. Eliminating the boredom factor and offering an engaging presence in the classroom would have helped. I also remember times when seeking outside assistance from more than one professor only to find that their attitude was "you did poorly on the exam, I don't need to waste my time with you", which was highly insensitive considering the purpose of my approaching the professor in his office was to learn and understand how to improve. I received no type of help whatsoever in that regard as a result. The reaction from some others more absorbed in their own egos and research efforts were literally stating "You're supposed to know this stuff already, I don't have time to teach it to you" -- but not everyone has the same coursework in every prerequisite class, and not everyone is taught the same material. This was especially so in the math department. In the end, even though I graduated with a 3.0 and was a very well-respected student in the department, I found myself vastly under-prepared for the real world."

XIII. Quality of Research Experience
  a. I was able to work on a research project that excited me.
    5: Strongly agree   5
    4: Agree   4
    3: Neither agree nor disagree   7
    2: Disagree   3
    1: Strongly disagree   0

   Comments:
   > ➢ "I would like to have done this. Maybe advertise these opportunities more and make more available."
   > ➢ "Don't remember any offering of a research project. Professor Welch's class on Project Management was the closest thing to a project we worked on in the CS degree.
   > ➢ "In the only computer graphics class I took, I was able to do a combined project with my astrophysics class."
   > ➢ "Thank you Dr. Brooks & Mary Whitton."

  b. I was satisfied with my interaction with faculty on my research projects.
    5: Strongly agree   4
    4: Agree   9
    3: Neither agree nor disagree   4
    2: Disagree   1
    1: Strongly disagree   0

   Comments:
   > ➢ "This is based solely on the strength of Dr Bishop as my advisor."
   > ➢ "Faculty should have done more to communicate the deliverables expected as a result of a few large projects."

  c. I was satisfied with my interaction with students on my research projects.
    5: Strongly agree   6

4: Agree   7
3: Neither agree nor disagree   3
2: Disagree   1
1: Strongly disagree   0

Comments:
  ➢ "I wish I had done more research projects, which is partially the fault of the curriculum but mostly my fault for having other motivations at the time."
  ➢ "My team was motivated and very helpful."

d. Overall I was satisfied with my research experience.
   5: Strongly agree   3
   4: Agree   11
   3: Neither agree nor disagree   3
   2: Disagree   1
   1: Strongly disagree   0

Comments:
  ➢ "I did not undertake any research projects while a student in Mathematical Sciences at UNC."
  ➢ "It got me my first job at Microsoft, which has enabled me to now work in varied jobs including Mozilla Foundation and Government Consulting."

XIV. Quality of Support/Infrastructure
   a. The administration staff was of high quality.
      5: Strongly agree   6
      4: Agree   17
      3: Neither agree nor disagree   8
      2: Disagree   0
      1: Strongly disagree   0

Comments:
  ➢ "I actually found those employed at Sitterson that were not part of the faculty not as helpful as one would like, as they routinely were to accept assignment turn-ins, help schedule use of labs, and provide other non-curriculum services. There seemed to be a good deal of turnover in this area as well."
  ➢ "There were a couple of secretaries I remembers, one was very harsh to the undergrads and favored grad students and faculty. The other was quite nice."
  ➢ "Didn't have much interaction with the administrative staff aside from obtaining and returning my key card."

   b. The facilities staff was of high quality.
      5: Strongly agree   5
      4: Agree   17
      3: Neither agree nor disagree   7
      2: Disagree   1
      1: Strongly disagree   0
Comments:
  ➢ "I don't remember any problems."

c. The facilities/resources available to me were of high quality.
    5: Strongly agree   11
    4: Agree   18
    3: Neither agree nor disagree   4
    2: Disagree   1
    1: Strongly disagree   0

Comments:
  ➢ "Sitterson is a great building."
  ➢ "I can't recall a moment being around Sitterson where I was disgusted with the facilities - bathroom, classroom or otherwise."
  ➢ "The lab machines in 2000 and 2001 running Windows NT were just ok. We really didn't understand how the Unix servers were set up, and we just limped along when we couldn't figure things out. There wasn't an open help desk that I remember. I'm sure times have changed and everyone has a laptop now. We had to have class in other buildings outside Sitterson, and those classrooms were pretty awful in old decrepit buildings."
  ➢ "Computer labs handled all of my needs."
  ➢ "The labs had a lot of room for improvement."

XV. **General**
  a. Overall the UNC Computer Science Dept provided me a hospitable and nurturing environment in which to learn.
      5: Strongly agree   13
      4: Agree   14
      3: Neither agree nor disagree   4
      2: Disagree   3
      1: Strongly disagree   0

Comments:
  ➢ "UNC CS professors were known to be quirky academics and generally too busy with their own prestigious research to genuinely care about their undergrad students. I tried to be open-minded and care about the people, but I couldn't connect. Funny thing is that I am a great connector outside academia, and I have many colleagues and mentors with great working relationships currently, so I can't figure out why I didn't have those same nurturing and open experiences with anyone beyond the students in the CS department. I can remember the professors, and a couple who were quite friendly, but I genuinely felt like a number, and I don't believe anyone remembers me. Undergrads were treated as second class citizens in the CS building from the few encounters I remember with the faculty outside the classroom. I would consider that when putting my children through their university experience. A large research school isn't the friendliest place for students to learn and explore. Throughout my UNC CS experience never had a personal relationship with any CS professor, and I regret that, but I didn't find them too open or interested, and as a naive teenage kid, there wasn't much structure to make that happen in a fun and rewarding manner. My honors professors in other departments were much more open and inviting with students, inviting them to dinners, guest lecturer series, homework help sessions, trips off campus, which helped inspire us and nurture us. In CS

there were never structured brainstorming round tables, don't remember any guest lecturer series to hear about happenings in the major developments from the RTP area, or any open discussions on current events between professors and students outside the classroom lectures. It all seemed a bit stuffy and cold. I remember grad students teaching classes were much more approachable and connected much better with students. I would prioritize openness and friendly discussions amongst students and faculty if I were in charge of the department because its not a very inviting place, and plus computer geeks in general aren't known to be the best with social graces. College is an emotional time, and I think the CS department could use a few psychologists/advisors on staff to coach the students and faculty on their personal development goals beyond their technical prowess. I seriously think the lack of daily time management goals and structure hurts students in their college experience, and instead we could offer much more nurturing environment with a few 'parental figures' within the CS department who really care and watched over the students on a personal level. I remember I was assigned a mentor grad student and that helped me see the behind the scenes of the Sitterson building and understand what happens in the graphics labs upstairs. Having a mentor dinner party or mixers would be a good idea. Having guest lecturer from the business world would be great."

- "The plusses and minuses of my experience put me in the middle."
- "Hospitable and nurturing are not the first words that come to mind... although I think I got a great education."
- "At the time I felt as though the resources were a bit limited out side of the TA and professors office hours. They were always willing to make time and meet, but a lot of peer help was discouraged because of the nature of our assignments. I also felt as though it was a bit isolating as a female student. It was intimidating to ask questions in class and there's definitely a difference between how men and women learn and absorb information."

b. Overall my experiences in the UNC Computer Science Dept have prepared me well for the next stage in my career.

5: Strongly agree	11
4: Agree	17
3: Neither agree nor disagree	4
2: Disagree	2
1: Strongly disagree	0

Comments:
- "I felt well-rounded and grounded in the theory and application of computer sciences."
- "I learned a lot, but there were certain things that I didn't learn until starting work and going to graduate school. I think improvement of the software engineering course would help people going into industry. I strongly suggest making Operating Systems a required course for all undergraduate students. What you learn is fundamental for being an effective computer scientist. I also don't think it's a bad idea for everyone to have to take Compilers."
- "Any failure was my own fault - I didn't go to class and/or study near enough."

> ➢ "I can't get a job in anything Computer Science related, and since the industry changes so fast, what I did learn has become quickly outdated. The closest thing to a job that I can be considered for is something IT related (software/hardware installation, virus removal, web design), which had nothing to do with CS at all... I think, perhaps, were I to be involved in the graduate program, I might be saying something else, considering the programs are highly specialized. The undergraduate program, however, inadequately prepared me for any type of career in CS where learning on the job is often not an option these days."

Other comments:
> ➢ "Glad that an undergrad degree was added; hopefully the languages taught are more current."
> ➢ "As a follow up to my first comments, I find that students graduating now are smarter and harder workers than those in my years just after graduation. However, with the movement towards higher level programming languages, they are less prepared to take on the challenges of real world software engineering in a corporate environment. I would recommend the department look at requiring an internship or co-op experience for students graduating with a B.S. in Computer Science from UNC as the hands-on experience in their field of choice in the computer science industry would put them ahead of their peers, many of whom also had to do this during their undergraduate time." "Thanks for the newsletters and staying connected with the alums!"
> ➢ "Mostly, I felt the undergraduate department didn't attempt to excel. While the graduate department had interesting, leading edge research, the undergraduate classes were less demanding than they could have been (with the earlier exceptions). I'd like to see the department work to seed the appetite for the next language, architecture or algorithm experts by providing more "deep" classes in addition to the "broad" ones that currently exist. That said, there was available part time work with the research groups (I worked with CADDLab) which helped more than anything prepare me for the workplace."
> ➢ "I think the major has changed a lot since I was in school, but I didn't like being required to take the upper-level math and/or physics classes in addition to the computer science classes. I think I should have had more flexibility with which courses I took to satisfy the degree requirements. In fact, I was unable to take some classes that I wanted to because either a) they did not count as a core comp sci course or b) I didn't have time because I had to take a math or physics course."
> ➢ "Prof. Weiss was one of my favorite professors ever. I am sorry I was a year too late to actually get a Computer Science degree."
> ➢ "I feel like I worked very hard for mediocre grades, which would have been acceptable if I thought I had learned a great deal from the experience. I did not. Having now had a vastly different graduate school experience, I think that either the faculty or career services office (or both) should be involved in helping us explore possible careers in academia or industry from a much earlier point in the program."
> ➢ "As I mentioned earlier I felt some more courses devoted to actual practical programming concepts like design patterns, mvc frameworks and the like would be been valuable to me. I learned a lot of theoretical things, but I felt I was not prepared on some practical concerns like using CVS etc."

9.12 Appendix L: Undergraduate program evaluation by current students

Current Undergraduate Student Evaluations

XVI. **Degree Program**

    a. Courses I want to take have been offered.

5: Strongly agree	6
4: Agree	30
3: Neither agree nor disagree	3
2: Disagree	2
1: Strongly disagree	0

Comments:

➢ "Would be nice to have a course on functional programming. Also, I'd like to see courses offered to beginners (which are probably not CS majors) in interesting languages, rather than just boring ones."

➢ "Would love to see a games course (in addition to serious games). Classes like Compilers and Operating Systems should be separated. There needs to be a balance of hard and easy classes. Right now I feel like one semester contains a lot of hard classes while the other contains easy ones. Without separation, it is almost impossible to take them all."

➢ "Would like more courses using co-operate development environments. Also, more courses not taught with Java."

➢ "I think the course offerings are generally well-thought out. I personally wish COMP 121 was still offered, I think it'd be a good intro course for students coming in from high school who already have CS experience (like me)."

➢ "A lot of the courses that undergraduates are interested in are offered in the same semester. For example, starting this year, Software Engineering Lab, Operating Systems, Intro. to Computer Graphics, and Compilers are all offered only in the fall. Even if you're ahead in the major and capable of taking all of these in your junior year, it forces you to take two at a time, or to make sure you're not studying abroad fall semester, as well as squishing a lot of the "core" major courses into one semester, all of which is unreasonable. I realize that the faculty who teach each course are often unavailable in the Spring, but I wish that either more faculty taught those courses, to make them more broadly available, or some other things were changed."

➢ "Though there are a wide variety of different computer courses, some areas such as security have not been explored in classes. Computer security such as, faults in a system, bugs, hacking attempts, viruses, spyware... etc. would make a great course to study and would help improve the safety of all computer users who took this course who could in turn benefit society in a professional job that focuses on this topic."

➢ "Game development?"

➢ "I want to learn program languages such as C++, as i want to one day enter the computer gaming field."

➢ "I've been able to take a few classes learning to create games, but haven't been able to really learn the intricacies of making them. I know NC State offers several courses, why don't we?"

> ➤ "I wish courses were offered more often. Additionally, I wish I had been able to take courses in machine learning and data mining."
> ➤ "For the most part. Most courses are, however, offered only once per year - usually not an issue, but there are a few classes I've been unable to take because of this. A prime example is that Operating Systems & Compilers are both typically considered Senior-level courses, but are only offered during the fall semesters."

b. The computer science course requirements are reasonable.

5: Strongly agree	3
4: Agree	33
3: Neither agree nor disagree	2
2: Disagree	2
1: Strongly disagree	1

Comments:
> ➤ "The physics requirement is unnecessary."
> ➤ "A few of the classes that are required seem to contain only about 20% useful CS material, but that material is not offered in other classes so there is no choice. The recent changes to the curriculum are a good step forward."
> ➤ "Four semesters of a foreign language is excessive."
> ➤ "The PHYS117 requirement should be replaced with any two-course natural science sequence."
> ➤ "So far, I think CS course requirements are reasonable, especially more so that PHYS 117 is not required. A clear distinction on the website between hard (truly required) and soft (recommended) prerequisites would be nice."
> ➤ "They offer students a good selection, but it would be best if the students were given sessions to try to figure out what they would like to focus on in computer science rather than getting a general overall view of the major."
> ➤ "The prerequisites are getting better with the drop of physics 117 but the amount of math classes is a little ridiculous, we practically have a math minor."
> ➤ "Physics 117 was a dumb one, so I'm glad they got rid of that. Overall the computer classes are great, but the math and science required sometimes seem a little pointless. It also doesn't help that math and science at UNC are often pretty bad."
> ➤ "They seem fine, but since this is only my first semester I don't really know."
> ➤ "I think the second lab science requirement should include sciences besides physics, biology, and chemistry, such as geology or astronomy."

c. The honors requirements are reasonable.

5: Strongly agree	2
4: Agree	15
3: Neither agree nor disagree	6
2: Disagree	3
1: Strongly disagree	0

Comments:
> ➤ "There are no computer science honors courses and a distinct paucity of math/physics courses that are of any use to me in fulfilling my honors requirements."

➤ "I think you're just referring to graduating with honors, but as a student in the honors program, I find it tough to balance CS courses and honors courses, since no CS honors courses/options exist (having honors options of normal CS courses, with more elaborate assignments but meeting with the normal blocks would be great news for us honors students). The Honors Contract may be useful, but I don't have experience with it and I don't think CS teachers do either."

➤ "I don't have that much experience with the honors requirements but they seem generally reasonable."

d. I am satisfied with the advice I have received regarding the degree program.
   5: Strongly agree   7
   4: Agree   18
   3: Neither agree nor disagree   11
   2: Disagree   3
   1: Strongly disagree   0

Comments:
   ➤ "Good to have a mix of professors with academic and industry backgrounds."
   ➤ "Jeffay's advice is always spot-on and helpful. He's very accessible, responds quickly to email, I have no complaints."
   ➤ "Not a single person, my advisor now or when I hadn't declared yet told me in what order to take the classes. While there is the clear order of prerequisites and then major requirements, there should be a direct order in which to take the classes especially the math classes, so that they build upon each other."
   ➤ "The advising I've received from the department is top-notch, orders of magnitude better than general college advising or honors program advising. It's nice to be able to talk to someone who actually is familiar with more than just a worksheet."
   ➤ "At least with the advice I have received from within the department. Academic Advising tends to be rather lacking in their knowledge of the CS program."

e. Overall I am happy with the degree program.
   5: Strongly agree   6
   4: Agree   25
   3: Neither agree nor disagree   7
   2: Disagree   1
   1: Strongly disagree   0

Comments:
   ➤ "There needs to be more emphasis on two things in my opinion – first on low level coding. There are not enough classes that force students to consider memory management at an early stage. Another is that of data structures. The class labeled data structures was more about design patterns, which although EXTREMELY useful are not data structures. And the algorithms class assumes you already know something about general data structures."

➢ "I love CS at UNC (even though I'm just a sophomore). In fact, one of the reasons I'm hesitant to study abroad is because I like the department here so much and don't want to take CS classes elsewhere. :) However, the CS academic website needs to be kept *up to date*! The posted syllabi are just ludicrous (ten years out of date?). My COMP 410 and COMP 416 (and to a lesser extent COMP 401) courses are completely different from what's stated online, and I have to a) look at course websites and b) talk to other students to find out what courses really are."

XVII. **Quality of Teaching in Computer Science**
   a. The faculty is well-prepared.
5: Strongly agree	7
4: Agree	26
3: Neither agree nor disagree	5
2: Disagree	1
1: Strongly disagree	0

   Comments:
   ➢ "70% of my computer science professors have been well prepared and have taught the classes well. And well, the other 30% were to my disappointment underwhelming, and I didn't learn as much as I originally intended."
   ➢ "I think the faculty here is very well-prepared for what they teach--they present material well, have useful websites, and are accessible for questions."
   ➢ "Some are some aren't. It just depends on the person."
   ➢ "They have a great wealth of knowledge that is wonderful to draw from."
   ➢ "I have had excellent professors and then I have had professors that seem like they don't have an answer to my questions ever. They are like presidential candidates that avoid questions."
   ➢ "It's hit or miss here. For the most part, I love the teachers in computer science. However, some of the courses taught by TAs often seem jumbled."
   ➢ "I personally did not like the way in which the intro CS classes were taught (Foundations of Programming, Data Structures); specifically, how the professor changed the curriculum to his own liking."

   b. The faculty is motivated and enthusiastic.
5: Strongly agree	12
4: Agree	18
3: Neither agree nor disagree	6
2: Disagree	2
1: Strongly disagree	0

   Comments:
   ➢ "This one probably sides on 60% enthusiastic and 40% unenthusiastic. Ketan Mayer-Patel is one of the most enthusiastic professors I have had and I truly enjoyed every minute of his class. Some teachers appear to really dislike teaching the subjects which they are assigned."
   ➢ "Part of the reasons I love my CS courses are the enthusiastic faculty!"
   ➢ "Again, some are some aren't. It just depends on the person."
   ➢ "Computer science isn't a topic to be too motivated about, but my teachers seem to enjoy what they do here."

> ➢ "My favorite professors have always been from the CS department."
> ➢ "I love the other faculty members I have met."
> ➢ "This holds true for many members of the faculty, but there are also a number of professors in the department who, though brilliant in their field, show no enthusiasm for teaching - at least at the undergraduate level."

c. Evaluation of my work is fair and impartial.
    5: Strongly agree   7
    4: Agree   29
    3: Neither agree nor disagree   0
    2: Disagree   0
    1: Strongly disagree   1

Comments:
> ➢ "I don't feel like the TAs are that motivated to do a good job, sometimes."
> ➢ "While a few of the TA's have been unreasonably harsh, for the most part grading has been fair."
> ➢ "I've had no reason to assume evaluation of my work is partial or unfair."
> ➢ "Never had any major issues with this."
> ➢ "Every single class has seemed to grade to an agenda. They want the perfect distribution of grades so they don't give out many B's or A's. I feel like sometimes after you turn in your first assignment, then you are locked into a certain region of the grading scale and then you cannot escape it."
> ➢ "A couple times I've received final grades far lower than I was expecting based on the grades of my assignments. But there is no indication of bias."

d. Overall, the faculty is effective in teaching.
    5: Strongly agree   8
    4: Agree   24
    3: Neither agree nor disagree   3
    2: Disagree   3
    1: Strongly disagree   0

Comments:
> ➢ "I love the faculty."
> ➢ "One thing I can't figure out, however, is with such a prestigious graphics department why is undergraduate graphics taught by a grad student! Seems like a slap in the face to us undergrads. Give us one of these famous graphics professors if they aren't too busy."
> ➢ "Yes--all the CS teachers I've had are great! TAs, on the other hand, are another story."
> ➢ "Most of the professors have been VERY good, however there have been a few that were not very good. Individual class reviews are a much better indicator of this."
> ➢ "I feel like the professors tell my hypothetically what stuff should be like, but then they never provide a precise picture."

XVIII. Quality of Research Experience
a. I have been able to work on a research project that excited me.

5: Strongly agree	5
4: Agree	10
3: Neither agree nor disagree	4
2: Disagree	6
1: Strongly disagree	0

Comments:

> "It took some trying, but I found a project to work on. I always felt like I needed more preparation before I had anything to offer to a research group, but since then I've realized that most of the learning I've needed to do for my research group I've done outside of classes."
> "The opportunities were available although I have done other extra curricular activities around the department."
> "Currently I have not participated in any research here, partially because I am still a freshman, but I am looking forward to researching topics of interest to me."
> "The exciting research projects are sought after by every single person so of course there aren't enough to go around."

b. I am satisfied with my interaction with faculty on my research projects.

5: Strongly agree	7
4: Agree	10
3: Neither agree nor disagree	5
2: Disagree	1
1: Strongly disagree	0

Comments:

> "My professor has been quite helpful, motivational, and realistic."
> "I'm working with a fantastic graduate student, but I feel a bit distant from the faculty in the research group."

c. I am satisfied with my interaction with students on my research projects.

5: Strongly agree	3
4: Agree	7
3: Neither agree nor disagree	7
2: Disagree	2
1: Strongly disagree	0

Comments:

(none)

d. Overall I am satisfied with my research experience.

5: Strongly agree	6
4: Agree	10
3: Neither agree nor disagree	5
2: Disagree	3
1: Strongly disagree	0

Comments:

> "I haven't done that much research, but I have gotten involved to some degree, and I really feel like the sky is the limit."

XIX. Quality of Support/Infrastructure

a. The administration staff is of high quality.

5: Strongly agree	9
4: Agree	20
3: Neither agree nor disagree	6
2: Disagree	1
1: Strongly disagree	0

Comments:
- "They've always been helpful."
- "Every single one is extremely nice and gets things done quickly."
- "The administration I've been in contact with are: a) Jeffay--who is always helpful and great as described earlier b) Prins--I talked to him at the study abroad fair and he was extremely helpful and nice!"
- "My advisor won't respond to my emails. I even left a note his door and he hasn't even taken the time to email me."
- "Our admins are great; I really have had a fantastic experience working with them."

b. The facilities staff is of high quality.

5: Strongly agree	11
4: Agree	21
3: Neither agree nor disagree	2
2: Disagree	0
1: Strongly disagree	0

Comments:
- "I have no complaints with the facilities staff."
- "They are very kind."
- "As far as I can tell they are; when are we getting reliable WiFi in the Brooks building?!"

c. The facilities/resources available to me are of high quality.

5: Strongly agree	13
4: Agree	18
3: Neither agree nor disagree	5
2: Disagree	0
1: Strongly disagree	0

Comments:
- "Some of the undergraduate computer labs could use a face lift."
- "Wireless access is spotty, especially in Brooks, but even in the main portion of Sitterson. The UNC-1 network is not 'hidden' on the rest of campus anymore, and having it remain hidden here just makes it harder to connect. I wish there was a public access terminal that non CS-students could use (that just used ONYEN login), for the times before I received a CS login. I don't know about many of the resources/facilities available to me because they're scattered throughout the building and my classes haven't used them. Overall though, what I do know of and can access works well, it's just I don't know of a lot and can't access some."

> ➤ "I really don't like that so much of the building is being taken up by unused furniture. Surely we can use that space better than as a place to store broken shelves?"

XX. General

a. Overall the UNC Computer Science Dept provides a hospitable and nurturing environment in which to learn.

5: Strongly agree	16
4: Agree	18
3: Neither agree nor disagree	3
2: Disagree	0
1: Strongly disagree	0

Comments:
> ➤ "Probably the best department/thing to major in on campus."
> ➤ "I LOVE the Sitterson lobby!!! No other major at Carolina enjoys the same great environment that we CS students enjoy, and I wouldn't have it any other way."
> ➤ "I love UNC CS. Nothing more to say then that."
> ➤ "So far it is good. I haven't had many computer courses per-say here quite yet, but I am very excited that I will be able to take so many."
> ➤ "I feel very comfortable in the department and a distinct sense of community."
> ➤ "I love the building and can't wait until I get to have more than one class in Sitterson."

b. Overall my experiences in the UNC Computer Science Dept should prepare me well for the next stage in my career.

5: Strongly agree	12
4: Agree	19
3: Neither agree nor disagree	6
2: Disagree	0
1: Strongly disagree	0

Comments:
> ➤ "Already accepted a job offer 9 months from graduation, and had companies calling/begging for me to join them. Encourage lots of internships, however. As great as Carolina's CS classes are I have learned more in the 3 months of internship than several of my CS classes combined."
> ➤ "I feel like my courses give me a rigorous grounding in abstract CS topics but also help give me practical, applicable experience. COMP 410 (Object Oriented Analysis and Design, not Data Structures) was especially helpful in this regard, I think, from what I've taken."
> ➤ "I suppose I'll find out in a few years. I think it's been good preparation but I'm afraid that I won't have the breadth of experience that others who have gone to larger CS programs will have."

Other Comments:
> ➤ "I've really been super satisfied with the CS department. The faculty are enthusiastic, the courses are challenging (but you do well if you put in enough effort), and there's plenty to learn."

➢ "The only bad experience I have had was the lack of honors courses useful to my major."

➢ "Computer Science TAs are extremely variable--the ones I had for 401 were flat-out horrible, others I've had are decent. Perhaps there needs to be more administration / oversight of TAs instead of leaving it up to the teachers? I must reiterate though: Keep the academic information on the website CURRENT--I'm using programming languages in my COMP 416 course that probably didn't exist (or weren't used) when the syllabus was written."

➢ "The only major fault that I am able to find with the computer science major at UNC is the amount of general ed. course a student must take for coming here. If a student would like to study mainly computers, they wouldn't necessarily need an education about the world or history of foreign countries, etc. I would prefer less general ed. and more focus on computers because I have a passion for them and feel a lack of daily computer learning and use. It also was a turn off when making my college decision choice, but I wound up here. I hope I get a great education in Computer Science while I'm here."

➢ "Can we have an undergraduate research fair so undergrads can meet professors and graduate students working on interesting projects? A big part of the reason it was so hard to find a research project to work on was because I didn't know who to talk to. I get the feeling something like this is done for graduate students every year. Also, I'm glad CS club is back; that's a really good thing."

9.13 Appendix M: Faculty 5-year CVs

To access faculty CVs by name, use the PDF bookmarks.

Ron Alterovitz

Assistant Professor (starting January 2009)
Department of Computer Science
University of North Carolina at Chapel Hill
Chapel Hill, NC 27599-3175

E-mail: ron@cs.unc.edu
Web: http://www.cs.unc.edu/~ron

EDUCATION

University of California, Berkeley
Ph.D., Industrial Engineering and Operations Research, 2006
Minors: Computer Science and Bioengineering
Thesis: *Planning and Optimization Algorithms for Image-Guided Medical Procedures*
Committee: Ken Goldberg (Chair), James F. O'Brien, Alper Atamtürk, and Jean Pouliot

University of California, Berkeley
M.S., Industrial Engineering and Operations Research, 2003

AWARDS &
HONORS

- National Institutes of Health (NIH) Ruth L. Kirschstein National Research Service Award, 2007
- Department of Defense (DOD) Prostate Cancer Research Fellowship, 2006
- Best Paper Award Finalist, IEEE/RSJ International Conference on Intelligent Robots and Systems (one of 7 finalists/1,000+ submissions), 2003
- National Science Foundation (NSF) Graduate Research Fellowship, 2003-2006
- National Defense Science and Engineering Graduate (NDSEG) Fellowship, 2001-2003

POSITIONS
HELD

University of North Carolina at Chapel Hill
Department of Computer Science
Assistant Professor   *Starting Spring 2009*

University of California, Berkeley
Department of Electrical Engineering and Computer Sciences
NIH Postdoctoral Research Fellow   *Fall 2007–Fall 2008*

University of California, San Francisco
UCSF Comprehensive Cancer Center
NIH Postdoctoral Research Fellow   *Fall 2007–Fall 2008*

LAAS-CNRS (National Center for Scientific Research), Toulouse, France
Robotics and Artificial Intelligence Group
Postdoctoral Research Fellow   *Fall 2006–Summer 2007*

University of California, Berkeley
Berkeley Automation Sciences Laboratory
Graduate Student Researcher (Ken Goldberg, Advisor)   *Fall 2001–Summer 2006*

TEACHING

- *Graduate Student Instructor*, University of California, Berkeley
  EECS/BioE 125: Introduction to Robotics, Fall 2005
  Taught planning algorithms, robot control, and programming, led lab sessions implementing key concepts on an Adept robotic manipulator, and discussed medical and biological applications including robotic surgical assistants and biologically inspired robots.

- *Guest Lecturer*, University of California, Berkeley
  BioE 24: Aspects of Bioengineering, Fall 2007
  IEOR 131: Computer Simulation, Spring 2003

- *Graduate Study Committee Member*, Advisor to the Dean of the College of Engineering on graduate programs and course changes, University of California, Berkeley, 2005-2006.

PROFESSIONAL ACTIVITIES

- *Co-organizer*, Workshop, Medical Needle Steering: Recent Results and Future Opportunities, selected for inclusion in the 11th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), New York, NY, Sept. 2008

- *Selected Participant*, NSF / CCC / CRA Roadmapping for Robotics Workshop: A Research Roadmap for Medical and Healthcare Robotics, Arlington, VA, June 2008.

- *Program Committee*, Robotics: Science and Systems Conference, Zurich, Switzerland, 2008

- *Associate Editor*, Medical Physics, the scientific journal of the American Association of Physicists in Medicine, 2005-2006

- *Reviewer*, Invited to peer-review papers for journal publications and conference proceedings:
  IEEE Transactions on Robotics, 2005-2008
  IEEE Transactions on Information Technology in Biomedicine, 2007
  Medical Image Analysis Journal, 2005-2006
  Medical Physics, 2008
  Computer Aided Surgery, 2008
  Robotics: Science and Systems Conference, 2006, 2008
  Second International Symposium on Medical Simulation, 2004
  IEEE International Conference on Robotics and Automation, 2002-2007
  IEEE/RSJ International Conference on Intelligent Robots and Systems, 2002-2007
  MICCAI, 2007-2008

INVITED TALKS

- *Carnegie Mellon University*, Robotics Institute, Pittsburgh, PA, June 17, 2008.

- *Arizona State University*, Biomedical Informatics Department, Phoenix, AZ, May 22, 2008.

- *Vanderbilt University*, Mechanical Engineering Department, Nashville, TN, Apr. 21, 2008.

- *University of North Carolina, Chapel Hill*, Computer Science Department, Chapel Hill, NC, Mar. 17, 2008.

- *Johns Hopkins University*, Center for Computer Integrated Surgical Systems and Technology Engineering Research (CISST ERC), Baltimore, MD, Mar. 5, 2008.

- *University of California, Davis*, Center for Information Technology Research in the Interest of Society, Sacramento, CA, Jan. 18, 2008.

- *Workshop on Algorithmic Motion Planning*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), San Diego, CA, Oct. 29, 2007.

- *University of California, Berkeley*, Electrical Engineering and Computer Sciences Department, Berkeley, CA, Oct. 11, 2007.

- *LAAS-CNRS* (National Center for Scientific Research), Toulouse, France, Oct. 26, 2006.

- *University of California, Irvine*, Computer Science Department, Irvine, CA, Apr. 25, 2006.

- *University of California, Berkeley*, Industrial Engineering and Operations Research Department, Berkeley, CA, Oct. 28, 2005.

- *Case Western Reserve University*, Electrical Engineering and Computer Science Department, Cleveland, OH, Aug. 18, 2005.

- *Workshop on Medical Robotics and Welfare*, IEEE International Conference on Robotics and Automation (ICRA), Barcelona, Spain, Apr. 18, 2005.

- *George Washington University*, Colloquium of the Institute for Biomedical Engineering, Washington, DC, Mar. 25, 2005.

- *Johns Hopkins University*, Center for Computer Integrated Surgical Systems and Technology Engineering Research (CISST ERC), Baltimore, MD, Mar. 23, 2005.

- *Workshop on Reality-Based Modeling of Tissues for Simulation and Robot-Assisted Surgery*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Las Vegas, NV, Oct. 31, 2003.

- *Workshop on Recent Advances in Medical Robotics*, IEEE International Conference on Robotics and Automation (ICRA), Taipei, Taiwan, Sept. 15, 2003.

REFEREED
ARTICLES

- Vincent Duindam, **Ron Alterovitz**, Shankar Sastry, and Ken Goldberg, "Screw-Based Motion Planning for Bevel-Tip Flexible Needles in 3D Environments with Obstacles," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, May 2008, pp. 2483-2488.

- **Ron Alterovitz**, Thierry Siméon, and Ken Goldberg, "The Stochastic Motion Roadmap: A Sampling Framework for Planning with Markov Motion Uncertainty," in *Proc. Robotics: Science and Systems*, Jun. 2007, pp. 1-8.

- **Ron Alterovitz**, Etienne Lessard, Jean Pouliot, I-Chow Joe Hsu, James F. O'Brien, and Ken Goldberg, "Optimization of HDR Brachytherapy Dose distributions Using Linear Programming with Penalty Costs," *Medical Physics*, vol. 33, no. 11, pp. 4012-4019, Nov. 2006.

- **Ron Alterovitz**, Michael Branicky, and Ken Goldberg, "Constant-Curvature Motion Planning Under Uncertainty with Applications in Image-Guided Medical Needle Steering," in *Proc. Workshop on the Algorithmic Foundations of Robotics*, Jul. 2006, pp. 1-16.

- **Ron Alterovitz**, Ken Goldberg, Jean Pouliot, I-Chow Joe Hsu, Yongbok Kim, Susan Moyher Noworolski, and John Kurhanewicz, "Registration of MR Prostate Images with Biomechanical Modeling and Nonlinear Parameter Estimation," *Medical Physics*, vol. 33, no. 2, pp. 446-454, Feb. 2006.

- **Ron Alterovitz**, Andrew Lim, Ken Goldberg, Gregory S. Chirikjian, and Allison M. Okamura, "Steering Flexible Needles Under Markov Motion Uncertainty," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Aug. 2005, pp. 120-125.

- **Ron Alterovitz**, Ken Goldberg, and Allison M. Okamura, "Planning for Steerable Bevel-tip Needle Insertion Through 2D Soft Tissue with Obstacles," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, Apr. 2005, pp. 1652-1657.

- **Ron Alterovitz**, Ken Goldberg, John Kurhanewicz, Jean Pouliot, I-Chow Joe Hsu, "Image Registration for Prostate MR Spectroscopy Using Biomechanical Modeling and Optimization of Force and Stiffness Parameters," in *Proc. 26th Annual Int. Conf. of the IEEE Engineering in Medicine and Biology Society (EMBS)*, Sept. 2004, pp. 1722-1725.

- **Ron Alterovitz**, Jean Pouliot, Richard Taschereau, I-Chow Joe Hsu, and Ken Goldberg, "Sensorless Planning for Medical Needle Insertion Procedures," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2003, pp. 3337-3343.
  (**Best Paper Award Finalist**)

- **Ron Alterovitz**, Jean Pouliot, Richard Taschereau, I-Chow Joe Hsu, and Ken Goldberg, "Needle Insertion and Radioactive Seed Implantation in Human Tissues: Simulation and Sensitivity Analysis," in *Proc. IEEE International Conference on Robotics and Automation (ICRA)*, Sept. 2003, pp. 1793-1799.

GRANTS

- NIH Ruth L. Kirschstein National Research Service Award (F32), 2007-2010
  "Deformable registration for image-guided radiotherapy"
  Principal Investigator (PI)
  Received a priority score of 147 "Outstanding" by NIH
  Awarded $141,318 over 3 years

- DOD Congressionally Directed Medical Research Programs Grant, 2007-2009
  "Deformable registration for prostate cancer image-guided radiation therapy"
  Principal Investigator (PI)
  Awarded $112,444 over 2 years, I declined funding

Ron Alterovitz

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

VITA

James Hampton Anderson

September 2008

Education

Ph.D., Computer Science, The University of Texas at Austin, August 1990.

M.S., Computer Science, Purdue University, August 1983.

B.S. with high honor, Computer Science, Michigan State University, June 1982.

Employment Experience

Professor, Department of Computer Science, University of North Carolina at Chapel Hill, January 2002 - present.

Associate Professor, Department of Computer Science, University of North Carolina at Chapel Hill, January 1997 - December 2001.

Assistant Professor, Department of Computer Science, University of North Carolina at Chapel Hill, August 1993 - December 1996.

Assistant Professor, Department of Computer Science, University of Maryland at College Park, August 1990 - August 1993.

Member of the Technical Staff, AT&T Bell Laboratories, Naperville, Illinois, June 1982 - August 1985.

Refereed Journal Papers

A. Block, J. Anderson, and G. Bishop, "Fine-Grained Task Reweighting on Multiprocessors," *Journal of Embedded Computing*, special issue on multiprocessor real-time scheduling, 18 pages, to appear.

A. Block, J. Anderson, and U. Devi, "Task Reweighting under Global Scheduling on Multiprocessors," *Real-Time Systems*, special issue on selected papers from the 18th Euromicro Conference on Real-Time Systems, Volume 39, Number 1-3, pages 123–167, August 2008.

U. Devi and J. Anderson, "A Schedulable Utilization Bound for the Multiprocessor EPDF Pfair Algorithm," *Real-Time Systems*, Volume 38, Number 3, pages 237–288, April 2008.

J. Anderson, V. Bud, and U. Devi, "An EDF-based Restricted-Migration Scheduling Algorithm for Multiprocessor Soft Real-Time Systems," *Real-Time Systems*, Volume 38, Number 2, pages 85–131, February 2008.

U. Devi and J. Anderson, "Tardiness Bounds under Global EDF Scheduling on a Multiprocessor," *Real-Time Systems*, Volume 38, Number 2, pages 133–189, February 2008.

J. Anderson and S. Baruah, "Energy-Efficient Synthesis of EDF-Scheduled Multiprocessor Real-Time Systems," *International Journal of Embedded Systems*, Volume 4, Number 1, 2008.

J. Anderson and Y.-J. Kim, "A Generic Local-Spin Fetch-and-ϕ-based Mutual Exclusion Algorithm," *Journal of Parallel and Distributed Computing*, Volume 67, Issue 5, pages 551–580, May 2007.

Y.-J. Kim and J. Anderson, "Adaptive Mutual Exclusion with Local Spinning," *Distributed Computing*, Volume 19, Number 3, pages 197–236, January 2007.

Y.-J. Kim and J. Anderson, "Nonatomic Mutual Exclusion with Local Spinning," *Distributed Computing*, part of a "best of PODC 2002" special issue, Volume 19, Number 1, pages 19–61, September 2006.

A. Srinivasan and J. Anderson, "Optimal Rate-based Scheduling on Multiprocessors," *Journal of Computer and System Sciences*, Volume 72, Issue 6, pages 1094–1117, September 2006.

P. Holman and J. Anderson, "Locking under Pfair Scheduling," *ACM Transactions on Computer Systems*, Volume 24, Number 2, pages 140–174, May 2006.

P. Holman and J. Anderson, "Group-based Pfair Scheduling," *Real-Time Systems*, Volume 32, Numbers 1-2, pages 125–168, February 2006.

P. Holman and J. Anderson, "Supporting Lock-Free Synchronization in Pfair-scheduled Systems," *Journal of Parallel and Distributed Computing*, Volume 66, Issue 1, pages 47–67, January 2006.

P. Holman and J. Anderson, "Adapting Pfair Scheduling for Symmetric Multiprocessors," *Journal of Embedded Computing*, Volume 1, Number 4, pages 543–564, 2005.

A. Srinivasan and J. Anderson, "Efficient Scheduling of Soft Real-Time Applications on Multiprocessors," *Journal of Embedded Computing*, special issue of best papers from the 15th Euromicro Conference on Real-Time Systems, Volume 1, Number 2, pages 285–302, 2005.

A. Srinivasan and J. Anderson, "Fair Scheduling of Dynamic Task Systems on Multiprocessors," *Journal of Systems and Software*, special issue of best papers from the 11th International Workshop on Parallel and Distributed Real-Time Systems, Volume 77, Number 1, pages 67–80, April 2005.

J. Anderson and A. Srinivasan, "Mixed Pfair/ERfair Scheduling of Asynchronous Periodic Tasks," *Journal of Computer and System Sciences*, Volume 68, Issue 1, pages 157–204, February 2004.

Refereed Conference and Workshop Papers

B. Brandenburg and J. Anderson, "A Comparison of the M-PCP, D-PCP, and FMLP on LITMUS$^{\text{RT}}$," *Proceedings of the 12th International Conference on Principles of Distributed Systems*, Luxor, Egypt, 12 pages, December 2008. Acceptance rate: 29% (regular papers).

H. Leontyev and J. Anderson, "A Unified Hard/Soft Real-Time Schedulability Test for Global EDF Multiprocessor Scheduling," *Proceedings of the 29th IEEE Real-Time Systems Symposium*, Barcelona, Spain, IEEE Computer Society Press, 10 pages, December 2008. Acceptance rate: 23% (main track).

B. Brandenburg, J. Calandrino, and J. Anderson, "On the Scalability of Real-Time Scheduling Algorithms on Multicore Platforms: A Case Study," *Proceedings of the 29th IEEE Real-Time Systems Symposium*, Barcelona, Spain, IEEE Computer Society Press, 10 pages, December 2008. Acceptance rate: 23% (main track).

B. Brandenburg and J. Anderson, "An Implementation of the PCP, SRP, D-PCP, M-PCP, and FMLP Real-Time Synchronization Protocols in LITMUS$^{\text{RT}}$," *Proceedings of the 14th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications*, Kaohsiung, Taiwan, IEEE Computer Society Press, pages 185–194, August 2008. Acceptance rate: 26%.

J. Calandrino and J. Anderson, "Cache-Aware Real-Time Scheduling on Multicore Platforms: Heuristics and a Case Study," *Proceedings of the 20th Euromicro Conference on Real-Time Systems*, Prague, Czech Republic, IEEE Computer Society Press, pages 209–308, July 2008. Acceptance rate: 30%.

A. Block, B. Brandenburg, J. Anderson, and S. Quint, "An Adaptive Framework for Multi-processor Real-Time Systems," *Proceedings of the 20th Euromicro Conference on Real-Time Systems*, Prague, Czech Republic, IEEE Computer Society Press, pages 23–33, July 2008. Acceptance rate: 30%.

H. Leontyev and J. Anderson, "A Hierarchical Multiprocessor Bandwidth Reservation Scheme with Timing Guarantees," *Proceedings of the 20th Euromicro Conference on Real-Time Systems*, Prague, Czech Republic, IEEE Computer Society Press, pages 191–200, July 2008. Acceptance rate: 30%.

B. Brandenburg, J. Calandrino, A. Block, H. Leontyev, and J. Anderson, "Real-Time Synchronization on Multiprocessors: To Block or Not to Block, to Suspend or Spin?," *Proceedings of the 14th IEEE Real-Time and Embedded Technology and Applications Symposium*, St. Louis, Missouri, IEEE Computer Society Press, pages 342–353, April 2008. Acceptance rate: 25%.

H. Leontyev and J. Anderson, "Generalized Tardiness Bounds for Global Multiprocessor Scheduling," *Proceedings of the 28th IEEE Real-Time Systems Symposium*, Tucson, Arizona, IEEE Computer Society Press, pages 413–422, December 2007. Acceptance rate: 26%.

B. Brandenburg, A. Block, J. Calandrino, U. Devi, H. Leontyev, and J. Anderson, "LITMUS$^{\text{RT}}$: A Status Report," *Proceedings of the 9th Real-Time Workshop*, Linz, Austria, Real-Time Linux Foundation, pages 107–123, November 2007.

B. Brandenburg and J. Anderson, "Feather-Trace: A Light-Weight Event Tracing Toolkit," *Proceedings of the Third International Workshop on Operating Systems Platforms for Embedded Real-Time Applications*, Pisa, Italy, pages 20–27, July 2007.

H. Leontyev and J. Anderson, "Tardiness Bounds for EDF Scheduling on Multi-Speed Multicore Platforms," *Proceedings of the 13th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications*, Daegu, Korea, IEEE Computer Society Press, pages 103–111, August 2007. Acceptance rate: 30%.

A. Block, H. Leontyev, B. Brandenburg, and J. Anderson, "A Flexible Real-Time Locking Protocol for Multiprocessors," *Proceedings of the 13th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications*, Daegu, Korea, IEEE Computer Society Press, pages 47–57, August 2007. Acceptance rate: 30%.

H. Leontyev and J. Anderson, "Tardiness Bounds for FIFO Scheduling on Multiprocessors," *Proceedings of the 19th Euromicro Conference on Real-Time Systems*, Pisa, Italy, IEEE Computer Society Press, pages 71–80, July 2007. Acceptance rate: 30%.

B. Brandenburg and J. Anderson, "Integrating Hard/Soft Real-Time Tasks and Best-Effort Jobs on Multiprocessors," *Proceedings of the 19th Euromicro Conference on Real-Time Systems*, Pisa, Italy, IEEE Computer Society Press, pages 61–70, July 2007. Acceptance rate: 30%.

J. Calandrino, J. Anderson, and D. Baumberger, "A Hybrid Real-Time Scheduling Approach for Large-Scale Multicore Platforms," *Proceedings of the 19th Euromicro Conference on Real-Time Systems*, Pisa, Italy, IEEE Computer Society Press, pages 247–256, July 2007. Acceptance rate: 30%.

J. Calandrino, D. Baumberger, T. Li, S. Hahn, and J. Anderson, "Soft Real-Time Scheduling on Performance Asymmetric Multicore Platforms," *Proceedings of the 13th IEEE Real-Time and Embedded Technology and Applications Symposium*, Bellevue, Washington, IEEE Computer Society Press, pages 101–110, April 2007. Acceptance rate: 28%.

J. Anderson and J. Calandrino, "Parallel Real-Time Task Scheduling on Multicore Platforms," *Proceedings of the 27th IEEE Real-Time Systems Symposium*, Rio de Janeiro, Brazil, IEEE Computer Society Press, 10 pages, pages 89–100, December 2006. Acceptance rate: 24%.

J. Calandrino, H. Leontyev, A. Block, U. Devi, and J. Anderson, "LITMUS[RT]: A Testbed for Empirically Comparing Real-Time Multiprocessor Schedulers," *Proceedings of the 27th IEEE Real-Time Systems Symposium*, Rio de Janeiro, Brazil, IEEE Computer Society Press, pages 111–123, December 2006. Acceptance rate: 24%.

J. Calandrino and J. Anderson, "Quantum Support for Multiprocessor Pfair Scheduling in Linux," *Proceedings of the Second International Workshop on Operating Systems Platforms for Embedded Real-Time Applications*, Dresden, Germany, pages 36–41, July 2006.

A. Block and J. Anderson, "Accuracy versus Migration Overhead in Multiprocessor Reweighting Algorithms," *Proceedings of the 12th International Conference on Parallel and Distributed Systems*, Minneapolis, Minnesota, IEEE Computer Society Press, pages 355–364, July 2006. Acceptance rate: 35%.

U. Devi, H. Leontyev, and J. Anderson, "Efficient Synchronization under Global EDF Scheduling on Multiprocessors," *Proceedings of the 18th Euromicro Conference on Real-Time Systems*, Dresden, Germany, IEEE Computer Society Press, pages 75–84, July 2006. Acceptance rate: 25%.

A. Block, J. Anderson, and U. Devi, "Task Reweighting under Global Scheduling on Multiprocessors," *Proceedings of the 18th Euromicro Conference on Real-Time Systems*, Dresden, Germany, IEEE Computer Society Press, pages 128–138, July 2006. Acceptance rate: 25%.

J. Anderson, J. Calandrino, and U. Devi, "Real-Time Scheduling on Multicore Platforms," *Proceedings of the 12th IEEE Real-Time and Embedded Technology and Applications Symposium*, San Jose, California, IEEE Computer Society Press, pages 179–190, April 2006. Acceptance rate: 30%.

U. Devi and J. Anderson, "Flexible Tardiness Bounds for Sporadic Real-Time Task Systems on Multiprocessors," *Proceedings of the 20th IEEE International Parallel and Distributed Processing Symposium*, Rhodes Island, Greece, IEEE Computer Society Press, April 2006 (on CD ROM). Acceptance rate: 25%.

U. Devi and J. Anderson, "Tardiness Bounds for Global EDF Scheduling on a Multiprocessor," *Proceedings of the 26th IEEE Real-Time Systems Symposium*, Miami, Florida, IEEE Computer Society Press, pages 330–341, December 2005. Winner, best paper award. Acceptance rate: 21%.

N. Fisher, J. Anderson, and S. Baruah, "Task Partitioning upon Memory-Constrained Multiprocessors," *Proceedings of the 11th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications*, Hong Kong, China, IEEE Computer Society Press, pages 416–421, August 2005. Acceptance rate: 33%.

A. Block, J. Anderson, and G. Bishop, "Fine-Grained Task Reweighting on Multiprocessors," *Proceedings of the 11th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications*, Hong Kong, China, IEEE Computer Society Press, pages 429–435, August 2005. Acceptance rate: 33%.

J. Anderson, V. Bud, and, U. Devi, "An EDF-based Scheduling Algorithm for Multiprocessor Soft Real-Time Systems," *Proceedings of the 17th Euromicro Conference on Real-Time Systems*, Palma de Mallorca, Spain, IEEE Computer Society Press, pages 199–208, July 2005. Acceptance rate: 18%.

U. Devi and J. Anderson, "Desynchronized Pfair Scheduling on Multiprocessors," *Proceedings of the 19th IEEE International Parallel and Distributed Processing Symposium*, Denver, Colorado, IEEE Computer Society Press, April 2005, on CD ROM. Acceptance rate: 34%.

A. Block and J. Anderson, "Task Reweighting on Multiprocessors: Efficiency versus Accuracy," *Proceedings of 13th International Workshop on Parallel and Distributed Real-Time Systems*, Denver, Colorado, April 2005, on CD ROM. Acceptance rate: 35%.

U. Devi and J. Anderson, "Schedulable Utilization Bounds for EPDF Fair Multiprocessor Scheduling," *Proceedings of the 10th International Conference on Real-Time and Embedded*

Computing Systems and Applications, Gothenburg, Sweden, Springer-Verlag Lecture Notes in Computer Science, pages 261–280, August 2004. Acceptance rate: 33%.

P. Holman and J. Anderson, "Implementing Pfairness on a Symmetric Multiprocessor," *Proceedings of the 10th IEEE Real-Time and Embedded Technology and Applications Symposium*, Toronto, Canada, IEEE Computer Society Press, pages 544–553, May 2004. Acceptance rate: 27% (for regular track papers).

U. Devi and J. Anderson, "Fair Integrated Scheduling of Soft Real-Time Tardiness Classes on Multiprocessor Platforms," *Proceedings of the 10th IEEE Real-Time and Embedded Technology and Applications Symposium*, Toronto, Canada, IEEE Computer Society Press, pages 554–561, May 2004. Acceptance rate: 27% (for regular track papers).

U. Devi and J. Anderson, "Improved Conditions for Bounded Tardiness under EPDF Fair Multiprocessor Scheduling," *Proceedings of 12th International Workshop on Parallel and Distributed Real-Time Systems*, Santa Fe, New Mexico, 8 pages, April 2004. (On CD ROM.)

S. Baruah and J. Anderson, "Energy-efficient Synthesis of Periodic Task Systems upon Identical Multiprocessor Platforms," *Proceedings of the 24th IEEE International Conference on Distributed Computing Systems*, Tokyo, Japan, IEEE Computer Society Press, pages 428–435, March 2004. Acceptance rate: 18%.

J. Anderson, A. Block, and A. Srinivasan, "Quick-release Fair Scheduling," *Proceedings of the 24th IEEE Real-Time Systems Symposium*, Cancun, Mexico, IEEE Computer Society Press, pages 130–141, December 2003. Acceptance rate: 17% (for full papers).

Y.-J. Kim and J. Anderson, "Timing-based Mutual Exclusion with Local Spinning," *Proceedings of the 17th International Symposium on Distributed Computing*, Sorrento, Italy, Lecture Notes in Computer Science 2848, Springer Verlag, pages 30–44, October 2003. Acceptance rate: 27%.

S. Baruah and J. Anderson, "Energy-aware Implementation of Hard-real-time Systems upon Multiprocessor Platforms," *Proceedings of the ISCA 16th International Conference on Parallel and Distributed Computing Systems*, Reno, Nevada, pages 430–435, August 2003.

A. Srinivasan and J. Anderson, "Efficient Scheduling of Soft Real-Time Applications on Multiprocessors," *Proceedings of the 15th Euromicro Conference on Real-Time Systems*, Porto, Portugal, IEEE Computer Society Press, pages 51–59, July 2003. Acceptance rate: 31%.

P. Holman and J. Anderson, "Using Hierarchal Scheduling to Improve Resource Utilization in Multiprocessor Real-Time Systems," *Proceedings of the 15th Euromicro Conference on*

Real-Time Systems, Porto, Portugal, IEEE Computer Society Press, pages 41–50, July 2003. Acceptance rate: 31%.

J. Anderson and Y.-J. Kim, "Local-spin Mutual Exclusion Using Fetch-and-ϕ Primitives," *Proceedings of the 23rd IEEE International Conference on Distributed Computing Systems*, Providence, Rhode Island, IEEE Computer Society Press, pages 538–547, May 2003. Acceptance rate: 18%.

A. Srinivasan and J. Anderson, "Fair Scheduling of Dynamic Task Systems on Multiprocessors," *Proceedings of the 11th International Workshop on Parallel and Distributed Real-Time Systems*, Nice, France, 10 pages, April 2003. (On CD ROM.) Acceptance rate: 50%.

A. Srinivasan, P. Holman, J. Anderson, and S. Baruah, "The Case for Fair Multiprocessor Scheduling," *Proceedings of the 11th International Workshop on Parallel and Distributed Real-Time Systems*, Nice, France, 10 pages, April 2003. (On CD ROM.) Acceptance rate: 50%.

A. Srinivasan, P. Holman, J. Anderson, S. Baruah, and J. Kaur, "Multiprocessor Scheduling in Processor-based Router Platforms: Issues and Ideas," *Proceedings of the Second Workshop on Network Processors*, pages 48–62, February 2003. Held in conjunction with the Ninth International Symposium on High-performance Computer Architecture, Anaheim, CA, February 2003. Acceptance rate: 57%.

Invited Papers

J. Anderson, Y.-J. Kim, and T. Herman, "Shared-memory Mutual Exclusion: Major Research rends Since 1986," *Distributed Computing*, Volume 16, Number 2-3, pages 75–110, 2003. Special issue celebrating the twentieth anniversary of PODC.

Refereed Short Papers

H. Leontyev and J. Anderson, "Tardiness Bounds for EDF Scheduling on Dual-Speed Multicore Platforms," *Proceedings of the 27th IEEE Real-Time Systems Symposium Work-in-Progress Session*, Rio de Janeiro, Brazil, pages 105–108, December 2006.

J. Anderson and J. Calandrino, "Parallel Task Scheduling on Multicore Platforms," *ACM SIGBED Review*, 7 pages, January 2006.

J. Anderson and J. Calandrino, "Parallel Task Scheduling on Multicore Platforms," *Proceedings of the 26th IEEE Real-Time Systems Symposium Work-in-Progress Session*, Miami, Florida, 4 pages, December 2005.

P. Holman and J. Anderson, "The Staggered Model: Improving the Practicality of Pfair Scheduling," *Proceedings of the 24th IEEE Real-Time Systems Symposium Work-in-Progress Session*, Cancun, Mexico, pages 125–128, December 2003.

Book Chapters

A. Srinivasan, P. Holman, J. Anderson, S. Baruah, and J. Kaur, "Multiprocessor Scheduling in Processor-based Router Platforms: Issues and Ideas," in *Network Processor Design: Issues and Practices Volume II*, P. Crowley and H. Hadimioglu (eds.), Morgan Kaufmann Publishers, San Francisco, CA, pages 75–99, 2004.

J. Carpenter, S. Funk, P. Holman, A. Srinivasan, J. Anderson, and S. Baruah, "A Categorization of Real-Time Multiprocessor Scheduling Problems and Algorithms," in *Handbook of Scheduling: Algorithms, Models, and Performance Analysis*, Joseph Y. Leung (ed.), Chapman and Hall/CRC, Boca Raton, Florida, pages 30.1–30.19, 2004.

J. Anderson, P. Holman, and A. Srinivasan, "Fair Multiprocessor Scheduling," in *Handbook of Scheduling: Algorithms, Models, and Performance Analysis*, Joseph Y.-T. Leung (ed.), Chapman and Hall/CRC, Boca Raton, Florida, pages 31.1–31.21, 2004.

Funded Proposals

Ongoing Projects

DURIP: High-Performance Many-Core Clusters for Modeling and Simulation, $149,050, M. Lin, PI, J. Anderson and D. Manocha, co-PIs, October 2008 - October 2009.

EHCS (EHS), TM: Real-Time Synchronization on Multicore Platforms, $350,000, J. Anderson, PI, S. Baruah, Co-PI, National Science Foundation, September 2008 - September 2011.

CSR-EHCS (EHS), SM: Formal Foundations of Real-Time Systems Analysis: Principles and Potential Pitfalls, $270,000, S. Baruah, PI, J. Anderson, Co-PI, National Science Foundation, September 2008 - September 2011.

A Real-Time Linux for Multiprocessor Platforms, $18,000, J. Anderson, PI, IBM, January 2008 - December 2009.

CSR-EHS: Real-Time Computing on Multicore Platforms, $200,000, J. Anderson, PI, S. Baruah, Co-PI, National Science Foundation, October 2006 - September 2009.

Real-Time Computing on Multicore Platforms, $313,755, J. Anderson, PI, S. Baruah, Co-PI, U.S. Army Research Office, October 2006 - September 2009.

Real-Time Computing on Multicore Systems, $165,000, J. Anderson, PI, S. Baruah, Co-PI, Intel, May 2006 - May 2009.

DCS: Multiprocessor Real-Time Computing: Formal Foundations, $400,000, S. Baruah, PI, J. Anderson, Co-PI, National Science Foundation, January 2006 - December 2008.

Completed Projects

Real-Time Fine-grained Adaptivity on Multiprocessors: Acoustic Tracking as a Test Case, $358,300 plus $14,500 departmental cost sharing, J. Anderson, PI, S. Baruah and G. Bishop, co-PIs, National Science Foundation, August 2004 - August 2007.

Energy-aware Synthesis of Embedded Systems on Multiprocessor Platforms, $270,000, S. Baruah, PI, J. Anderson, co-PI, National Science Foundation, August 2003 - August 2006.

Time Complexity Limits for Shared-memory Synchronization, $107,497, J. Anderson, PI, National Science Foundation, September 2002 - August 2005.

Flexible Fair Scheduling on Multiprocessors, $267,002, J. Anderson, PI, S. Baruah, co-PI, National Science Foundation, September 2002 - August 2005.

Support for RTSS 2004, $15,000, J. Anderson, PI, National Science Foundation, September 2004 - March 2005.

Rate-based Scheduling Technology for Latency-sensitive Graphics Applications, $350,000 plus $33,600 in UNC cost sharing, J. Anderson, PI, S. Baruah, K. Jeffay, and R. Taylor, co-PIs, National Science Foundation Information Technology Research (ITR), August 2000 - August 2004.

Real-Time Scheduling on Heterogeneous Multiprocessors, $239,999, S. Baruah, PI, J. Anderson, co-PI, National Science Foundation, August 2000 - August 2004.

Pfair-scheduled Real-Time Systems: Extending Theory to Practice, $150,000, J. Anderson, PI, National Science Foundation, July 1999 - July 2003.

Invited Talks

Real-Time on Multicore: An Overview of Real-Time Computing Research at UNC
Honeywell, Golden Valley, Minnesota, July 2008.

Tardiness Bounds for Global Multiprocessor Scheduling Algorithms
Dagstuhl Seminar on Scheduling, Dagstuhl, Germany, February 2008.

An Introduction to Rate-Monotonic Scheduling and Analysis
    IEEE Eastern North Carolina Section Embedded Systems Special Interest Group, RTP, January 2008.

Real-Time Computing on Multicore Platforms
    University of Kaiserslauten, Germany, June 2007.

Real-Time Synchronization on Multiprocessors: To Block or Not to Block, to Suspend or Spin?
    University of Kaiserslauten, Germany, June 2007.

Real-Time Computing Research at UNC
    IBM, RTP, North Carolina, June 2007.

Real-Time Computing on Multicore Platforms II
    Intel, Hillsboro, Oregon, April 2007.

Real-Time Computing on Multicore Platforms
    Intel, Hillsboro, Oregon, April 2006.

Real-Time Computing on Multicore Platforms
    IBM, RTP, North Carolina, October 2005.

Real-Time Scheduling on Multicore Platforms
    Scuola Superiore Sant'Anna, Pisa, Italy, July 2005.

A Categorization of Real-Time Multiprocessor Scheduling Problems and Algorithms
    Scuola Superiore Sant'Anna, Pisa, Italy, July 2005.

Real-Time Scheduling on Multicore Platforms
    Vienna University of Technology, Vienna, Austria, July 2005.

The Case for Multiprocessor Fair Scheduling
    2004 US-Korean Conference, RTP, North Carolina, August 2004.

Real-Time Fine-grained Adaptivity on Multiprocessors
    IBM, RTP, North Carolina, November 2003.

Overview of "Nonblocking Synchronization: Algorithms and Performance Evaluation" by Yi Zhang
    University of Chalmers, Gothenburg, Sweden, June 2003.

Quick-release Fair Scheduling

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University of Chalmers, Gothenburg, Sweden, June 2003.

Quick-release Fair Scheduling
University of York, England, June 2003.

Quick-release Fair Scheduling
University of Brussels, Belgium, June 2003.

Fellowships, Awards, and Honors

Computer Science Student Association Teaching Award, University of North Carolina, 1995, 2002, and 2005.

Professional Service

Guest Editor

"Best of RTSS 2004" special issue of *Real-Time Systems: The International Journal of Time-Critical Computing Systems*, 2005.

Book Editor

Principles of Distributed Systems, 9th International Conference, OPODIS 2005, Lecture Notes in Computer Science, 3974, Springer, 2006.

Conference and Workshop Program Chair

Fourth International Workshop on Operating Systems Platforms for Embedded Real-Time Applications, Prague, Czech Republic, July 2008.

9th International Conference on Principles of Distributed Systems, Pisa, Italy, December 2005 (co-chair).

25th IEEE Real-Time Systems Symposium, Lisbon, Portugal, December 2004 (co-chair).

Conference General Chair

26th IEEE Real-Time Systems Symposium, Miami, Florida, December 2005.

Conference Program Committee Member (Selected)

Euromicro Conference on Real-Time Systems, 2002, 2006, 2007, 2008, 2009.

First Workshop on Compositional Theory and Technology for Real-Time Embedded Systems, 2008.

International Conference on Distributed Computing Systems, 2003, 2007, 2009.

IEEE Real-Time and Embedded Technology and Applications Symposium, 2004, 2008, 2009.

ACM Symposium on Applied Computing, 2009.

International Conference on Principles of Distributed Systems, 2005, 2006, 2007, 2008.

IEEE Real-Time Systems Symposium, 1998, 2001, 2002, 2004, 2006, 2007, 2008.

International Symposium on Distributed Computing, 2004, 2008.

IEEE International Conference on Embedded and Real-Time Computing Systems and Applications, 2007, 2008.

International Workshop on Operating Systems Platforms for Embedded Real-Time Applications, 2008.

IEEE International Symposium on Network Computing and Applications, 2006.

International Workshop on Distributed Computing, 2005.

ACM Symposium on Principles of Distributed Computing, 1994, 1998, 2000, 2005.

Other Service

National Science Foundation, 14 Panels, 1993–2008.

Panelist, "Where Do We Go from Here: Next Steps in Real-Time and Embedded Operating Systems," Second International Workshop on Operating Systems Platforms for Embedded Real-Time Applications, Dresden, Germany, July 2006.

Ph.D. Students Supervised

Jae-Heon Yang, Ph.D. received August 1994 (at Maryland). Dissertation title: *Scalable Synchronization in Shared Memory Multiprocessing Systems*.

Mark Moir, Ph.D. received August 1996. Dissertation title: *Efficient Object Sharing in Shared-memory Multiprocessors*.

Srikanth Ramamurthy, Ph.D. received December 1997. Dissertation title: *A Lock-free Approach to Object Sharing in Real-Time Systems*.

Yong-Jik Kim, Ph.D. received December 2003. Dissertation title: *Hardware Support for Scalable Synchronization on Shared-memory Multiprocessors*.

Anand Srinivasan, Ph.D. received December 2003. Dissertation title: *Efficient and Flexible Fair Scheduling of Real-Time Tasks on Multiprocessors*.

Phil Holman, Ph.D. received August 2004. Dissertation title: *On the Implementation of Pfair-scheduled Multiprocessor Systems*.

Umamaheswari Devi, Ph.D. received December 2006. Dissertation title: *Soft Real-Time Scheduling on Multiprocessors*.

Aaron Block, Ph.D. received August 2008. Dissertation title: *Multiprocessor Adaptive Real-Time Systems*.

Jim Anderson

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

The Real-Time Systems group has produced a Linux extension called LITMUS^{RT} (http://www.cs.unc.edu/~anderson/litmus-rt/), which provides support for real-time scheduling and synchronization policies designed for multi-core platforms. LITMUS^{RT} has been downloaded and used by a number of research groups in the U.S., Europe, and Asia to use in their research efforts.

Sanjoy K Baruah

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Electronic mail: baruah@cs.unc.edu
URL: http://www.cs.unc.edu/~baruah

EDUCATION & EXPERIENCE

- **Professor**. Department of Computer Science, The University of North Carolina, Chapel Hill, North Carolina. July 2005 - present.
- **Associate Professor**. Department of Computer Science, The University of North Carolina, Chapel Hill, North Carolina. July 1999 - June 2005.
- **Assistant Professor**. Department of Computer Science, The University of Vermont, Burlington, Vermont. September 1993 - August 1999.
- **Assistant Professor.** Department of Computer & Information Science, New Jersey Institute of Technology, Newark, NJ. September 1995 - August 1996 (on leave from the University of Vermont).
- **Faculty Research Associate.** Department of Computer Science, The University of Maryland, College Park, Maryland. March-September 1993.
- **Ph.D. in Computer Sciences.** The University of Texas, Austin, Texas. May 1993.
  Dissertation title: The Uniprocessor Scheduling of Sporadic Real-Time Tasks
  Thesis advisors: A. K. Mok and C. G. Plaxton
- **M.S. in Computer Sciences with a minor in Mathematics.** The University of Texas at Austin, Austin, Texas. August 1989.
- **B.Tech. in Computer Science and Engineering.** The Indian Institute of Technology, New Delhi, India. May 1987.
  Thesis: An AI draftsman for schematics.

RESEARCH

EXTERNAL RESEARCH GRANTS

Real-Time Synchronization on Multicore Platforms (2007-2010).
(**co-Principal Investigator**; PI Jim Anderson)
Sponsor: National Science Foundation.

Formal foundations of real-time systems analysis: Principles and potential pitfalls (2007-2010).
(**Principal Investigator**; co-PI Jim Anderson)
Sponsor: National Science Foundation.

Real-Time Computing on Multicore Platforms (2006-2009).
(**co-Principal Investigator**; PI Jim Anderson)
Sponsor: Army Research Office

Real-Time Computing on Multicore Platforms (2006-2008), $200,000.
(**co-Principal Investigator**; PI Jim Anderson)
Sponsor: National Science Foundation.

Multiprocessor Real-Time Computing: Formal Foundations (2006-2009), $400,000.
(**Principal Investigator**; co-PI Jim Anderson)
Sponsor: National Science Foundation.

Real-time Fine-grained Adaptivity on Multiprocessors: Acoustic Tracking as a Test Case (2004-2007), $43,300.
(**co-Principal Investigator**; PI Jim Anderson; additional co-Pi Gary Bishop)
Sponsor: National Science Foundation.

Energy-Aware Synthesis of Embedded Systems on Multiprocessor Platforms (2003-2006), $270,000.
(**Principal Investigator**; co-PI Jim Anderson)
Sponsor: National Science Foundation.

Flexible fair scheduling on multiprocessors (2002-2005), $267,002.
(**co-Principal Investigator**; PI Jim Anderson)
Sponsor: National Science Foundation.

PUBLICATIONS

Surveys, Opinions, etc.

1. Nathan Fisher and Sanjoy Baruah. Rate-monotonic scheduling . In **Encyclopedia of Algorithms**, Ming-Yang Kao (ed). Springer.
2. Theodore Baker and Sanjoy Baruah. Schedulability Analysis of Multiprocessor Sporadic Task Systems . In **Handbook of Real-Time and Embedded Systems**, Sang H. Son, Insup Lee, and Joseph Y-T Leung (eds). Chapman Hall/ CRC Press.
3. John Carpenter, Shelby Funk, Phil Holman, Anand Srinivasan, Jim Anderson, and Sanjoy Baruah. A Categorization of Real-time Multiprocessor Scheduling Problems and Algorithms . In **Handbook of Scheduling: Algorithms, Models, and Performance Analysis**, Joseph Y-T Leung (ed). Chapman Hall/ CRC Press. 2004.
4. Sanjoy Baruah and Joel Goossens. Scheduling Real-time Tasks: Algorithms and Complexity . In **Handbook of Scheduling: Algorithms, Models, and Performance Analysis**, Joseph Y-T Leung (ed). Chapman Hall/ CRC Press. 2004.

Recent Technical Reports

Theodore Baker, Nathan Fisher, and Sanjoy Baruah. Algorithms for Determining the Load of a Sporadic Task System **FSU-CS TR-051201.** December 2005.

Journals

5. Marko Bertogna, Nathan Fisher and Sanjoy Baruah Resource holding times: Computation and Optimization. **Real-Time Systems**. 2008.
6. Enrico Bini, Thi Huyen Chau Nguyen, Pascal Richard, and Sanjoy Baruah. A Response Time Bound in Fixed-Priority Scheduling with Arbitrary Deadlines. **IEEE Transactions on Computers**, Accepted for publication.
7. Nathan Fisher and Sanjoy Baruah. The Feasibility of General Task Systems with Precedence Constraints on Multiprocessor Platforms. **Real-Time Systems**. 2008.
8. Sanjoy Baruah and Ted Baker. Schedulability analysis of global EDF. **Real-Time Systems** 38(3), pp 223-235. 2008.
9. Alan Burns and Sanjoy Baruah Sustainability in real-time scheduling. **Journal of Computing Science and Engineering** 2 (1), pp 74-97. 2008.
10. James Anderson and Sanjoy Baruah. Energy-efficient synthesis of EDF-scheduled multiprocessor real-time systems. **International Journal of Embedded Systems** 4 (1). 2008.
11. Sanjoy Baruah and Nathan Fisher. The Partitioned Dynamic-priority Scheduling of Sporadic Task Systems. **Real-Time Systems** 36 (3), pp 199-226. 2007.
12. Sanjoy Baruah and Nathan Fisher. Non-Migratory Feasibility and Migratory Schedulability Analysis of Multiprocessor Real-Time Systems. **Real-Time Systems** 39(1-3), pp 97-122. 2008
13. Sanjoy Baruah and Nathan Fisher. The Partitioned Multiprocessor Scheduling of Deadline-constrained Sporadic Task Systems. **IEEE Transactions on Computers** 55 (7), pp 918-923. 2006
14. Nathan Fisher and Sanjoy Baruah. An Approximation Scheme for Feasibility Analysis in Static-Priority Systems with Bounded Relative Deadlines. **Journal of Embedded Computing**. Accepted for publication
15. Sanjoy Baruah. The non-preemptive scheduling of periodic tasks upon multiprocessors. **Real-time Systems** 32 (1-2), pp 9-20. 2006.
16. Shelby Funk and Sanjoy Baruah. Restricted EDF migration on uniform multiprocessors. **Technique Et Science Informatiques** 24 (8), pp 917-938. 2005 Hermes-Lavoisier.
17. Sanjoy Baruah and John Carpenter. Multiprocessor fixed-priority scheduling with restricted interprocessor migrations. **Journal of Embedded Computing** 1 (2). 2004
18. Sanjoy Baruah. Optimal utilization bounds for the fixed-priority scheduling of periodic task systems on identical multiprocessors **IEEE Transactions on Computers** 53 (6), pp. 781-784. 2004.
19. Sanjoy Baruah, Shelby Funk, and Joel Goossens. Robustness results concerning EDF scheduling upon uniform multiprocessors. **IEEE Transactions on Computers** 52 (9), pp. 1185-1195. 2003.

20. Carlos Amaro, Sanjoy Baruah, Alexander Stoyen, and Wolfgang Halang. Non-preemptive scheduling to maximize the minimum global inter-completion time. **Automatica** 39 (6), pp. 957-967. 2003.

21. Joel Goossens, Shelby Funk, and Sanjoy Baruah. Priority-driven scheduling of periodic task systems on multiprocessors. **Real-time Systems** 25 (2-3), pp. 187-205. 2003.

22. Sanjoy Baruah and Joel Goossens. Rate-monotonic scheduling on uniform multiprocessors. **IEEE Transactions on Computers** 52 (7), pp. 966-970. 2003.

Proceedings: Refereed Conferences and Workshops

23. Sanjoy Baruah and Joel Goossens Deadline Monotonic Scheduling on Uniform Multiprocessors **Proceedings of the 12th International Conference on Principles of Distributed Systems**, Luxor, Egypt. December 2008. Springer-Verlag.

24. Sanjoy Baruah and Joel Goossens. The EDF scheduling of sporadic task systems on uniform multiprocessors. **Proceedings of the Real-Time Systems Symposium**, Barcelona, Spain. December 2008. IEEE Computer Society Press.

25. Bjorn Andersson, Konstantinos Bletsas and Sanjoy Baruah . Scheduling Arbitrary-Deadline Sporadic Task Systems on Multiprocessors. **Proceedings of the Real-Time Systems Symposium**, Barcelona, Spain. December 2008. IEEE Computer Society Press.

26. Sanjoy Baruah and Enrico Bini. Partitioned scheduling of sporadic task systems: an ILP-based approach. **Proceedings of the International Conference on Design and Architectures for Signal and Image Processing (DASIP 2008)**, Brussels, Belgium. November 2008.

27. Luigi Palopoli, Luca Abeni, Tommaso Cucinotta, Giuseppe Lipari, and Sanjoy Baruah. Weighted Feedback Reclaiming for Multimedia Applications. **Proceedings of the 6th IEEE Workshop on Embedded Systems for Real-Time Multimedia** , Atlanta, GA. October 2008.

28. Sanjoy Baruah and Alan Burns. Quantifying the sub-optimality of uniprocessor fixed-priority scheduling. **Proceedings of the 16th International Conference on Real-Time and Network Systems**, Rennes, France. October, 2008.

29. Suriayati Chuprat, Shaharuddin Salleh, and Sanjoy Baruah Evaluation of a linear programming approach towards scheduling divisible real-time loads **Proceedings of the International Symposium on Information Technology (co-sponsored by the IEEE)**, Kuala Lumpur, Malaysia. August 2008.

30. Suriayati Chuprat and Sanjoy Baruah Scheduling Divisible Real-Time Loads on Clusters with Varying Processor Start Times **Proceedings of the IEEE International Conference on Embedded and Real-Time Computing Systems and Applications**, Kaohsiung, Taiwan. August 2008. IEEE Computer Society Press.

31. Sanjoy Baruah and Ted Baker. Global EDF schedulability analysis of arbitrary sporadic task systems **Proceedings of the EuroMicro Conference on Real-Time Systems**, Prague, Czech Republic. July 2008. IEEE Computer Society Press.

32. Sanjoy Baruah and Steve Vestal. Schedulability analysis of sporadic tasks with multiple criticality specifications **Proceedings of the EuroMicro Conference on**

Real-Time Systems, Prague, Czech Republic. July 2008. IEEE Computer Society Press.

33. Sanjoy Baruah and Nathan Fisher Hybrid-priority Scheduling of Resource-sharing Sporadic Task Systems. **Proceedings of the Real-Time Technology and Applications Symposium**, St. Louis, MO. April, 2008. IEEE Computer Society Press.

34. Sanjoy Baruah and Nathan Fisher Hybrid-Priority Real-Time Scheduling. **Proceedings of the 16th International Workshop on Parallel and Distributed Real-Time Systems**, Miami, FL. April, 2008.

35. Sanjoy Baruah and Nathan Fisher Global fixed-priority scheduling of arbitrary-deadline sporadic task systems. **The 9th International Conference on Distributed Computing and Networking**, pp 215-226, Kolkata, India. January, 2008. Springer-Verlag.

36. Sanjoy Baruah and Nathan Fisher. Global Deadline-Monotonic scheduling of arbitrary-deadline sporadic task systems. **Proceedings of the 11th International Conference on Principles of Distributed Systems**, Guadeloupe, French West Indies. December 2007. Springer-Verlag.

37. Nathan Fisher, Marko Bertogna and Sanjoy Baruah. The Design of an EDF-scheduled Resource-sharing Open Environment. **Proceedings of the Real-Time Systems Symposium**, Tucson, AZ. December 2007. IEEE Computer Society Press.

38. Sanjoy Baruah. Techniques for Multiprocessor Global Schedulability Analysis. **Proceedings of the Real-Time Systems Symposium**, Tucson, AZ. December 2007. IEEE Computer Society Press.

39. Suriayati Chuprat and Sanjoy Baruah Deadline-based Scheduling of Divisible Real-Time Loads. **Proceedings of the ICSA International Conference on Parallel and Distributed Computing Systems**, Las Vegas, Nevada. September 2007.

40. Nathan Fisher and Sanjoy Baruah. The Global Feasibility and Schedulability of General Task Models on Multiprocessor Platforms **Proceedings of the EuroMicro Conference on Real-Time Systems**, Pisa, Italy. July 2007. IEEE Computer Society Press.

41. Nathan Fisher, Marko Bertogna and Sanjoy Baruah. Resource-locking durations in EDF-scheduled systems. **Proceedings of the Real-Time Technology and Applications Symposium**, Bellevue, WA. April 2007. IEEE Computer Society Press.

42. Enrico Bini and Sanjoy Baruah. Efficient computation of response time bounds under fixed-priority scheduling. **Proceedings of the 15th International Conference on Real-Time and Network Systems**, pp 95-104, Nancy, France. March, 2007.

43. Marko Bertogna, Nathan Fisher, and Sanjoy Baruah. Static-Priority Scheduling and Resource Hold Times. **Proceedings of the 15th International Workshop on Parallel and Distributed Real-Time Systems**, Long Beach, CA. March 2007.

44. Sanjoy Baruah and Alan Burns. Sustainable Schedulability Analysis. **Proceedings of the Real-Time Systems Symposium**, pp 159-168, Rio de Janerio, Brazil. December 2006. IEEE Computer Society Press.

45. Sanjoy Baruah. Resource sharing in EDF-scheduled systems: A closer look. **Proceedings of the Real-Time Systems Symposium**, pp 379-387, Rio de Janerio, Brazil. December 2006. IEEE Computer Society Press.
46. Nathan Fisher and Sanjoy Baruah. Global Static-Priority Scheduling of Sporadic Task Systems on Multiprocessor Platforms . **Proceedings of the IASTED International Conference on Parallel and Distributed Computing and Systems** , Dallas, TX. November 2006.
47. Nathan Fisher, Theodore Baker, and Sanjoy Baruah. Algorithms for Determining the Demand-Based Load of a Sporadic Task System **Proceedings of the IEEE International Conference on Embedded and Real-Time Computing Systems and Applications**, pp 135-144, Sydney, Australia. August 2006. IEEE Computer Society Press.
48. Sanjoy Baruah and Nathan Fisher. The Feasibility Analysis of Multiprocessor Real-Time Systems. **Proceedings of the EuroMicro Conference on Real-Time Systems**, pp 85-94, Dresden, Germany. July 2006. IEEE Computer Society Press.
49. Nathan Fisher, Sanjoy Baruah, and Theodore Baker. The Partitioned Scheduling of Sporadic Tasks according to Static Priorities. **Proceedings of the EuroMicro Conference on Real-Time Systems**, pp 118-127, Dresden, Germany. July 2006. IEEE Computer Society Press.
50. Nathan Fisher and Sanjoy Baruah. The Partitioned Multiprocessor Scheduling of Non-preemptive Sporadic Task Systems. **Proceedings of the 14th International Conference on Real-Time and Network Systems**, pp 99-108, Poitiers, France. May, 2006.
51. Sanjoy Baruah and Samarjit Chakraborty. Schedulability Analysis of Non-Preemptive Recurring Real-Time Tasks. **Proceedings of the 14th International Workshop on Parallel and Distributed Real-Time Systems**, Rhodes, Greece. April 2006.
52. Nathan Fisher and Sanjoy Baruah. The Partitioned, Static-Priority Scheduling of Sporadic Real-Time Tasks with Constrained Deadlines on Multiprocessor Platforms. **Proceedings of the 9th International Conference on Principles of Distributed Systems**, pp 291-305, Pisa, Italy. December 2005. Springer-Verlag.
53. Sanjoy Baruah and Nathan Fisher. The Partitioned Multiprocessor Scheduling of Sporadic Task Systems. **Proceedings of the Real-Time Systems Symposium**, pp 321-329, Miami, Florida. December 2005. IEEE Computer Society Press.
54. Nathan Fisher, Jim Anderson, and Sanjoy Baruah. Task partitioning upon memory-constrained multiprocessors **Proceedings of the IEEE International Conference on Embedded and Real-Time Computing Systems and Applications**, Hong Kong. August 2005. IEEE Computer Society Press.
55. Sanjoy Baruah and Nathan Fisher. Real-time scheduling of sporadic task systems when the number of distinct task types is small **Proceedings of the IEEE International Conference on Embedded and Real-Time Computing Systems and Applications**, Hong Kong. August 2005. IEEE Computer Society Press.
56. Nathan Fisher and Sanjoy Baruah. A polynomial-time approximation scheme for feasibility analysis in static-priority systems with arbitrary relative deadlines **Proceedings of the EuroMicro Conference on Real-Time Systems**, pp 117-126, Palma de Mallorca, Spain. July 2005. IEEE Computer Society Press.

57. Sanjoy Baruah. The limited-preemption uniprocessor scheduling of sporadic task systems **Proceedings of the EuroMicro Conference on Real-Time Systems**, pp 137-144, Palma de Mallorca, Spain. July 2005. IEEE Computer Society Press.

58. Shelby Funk and Sanjoy Baruah. Task Assignment on Uniform Heterogeneous Multiprocessors **Proceedings of the EuroMicro Conference on Real-Time Systems**, pp 219-226, Palma de Mallorca, Spain. July 2005. IEEE Computer Society Press.

59. Sanjoy Baruah and Nathan Fisher. The Partitioned Scheduling of Sporadic Real-Time Tasks on Multiprocessor Platforms **Proceedings of the Workshop on Compile/Runtime Techniques for Parallel Computing**, Oslo, Norway. June, 2005.

60. Nathan Fisher and Sanjoy Baruah. A Polynomial-Time Approximation Scheme for Feasibility Analysis in Static-Priority Systems with Bounded Relative Deadlines. **Proceedings of the 13th International Conference on Real-Time Systems**, pp 233-249, Paris, France. April, 2005.

61. Sanjoy Baruah and Nathan Fisher. Code-size Minimization in Multiprocessor Real-Time Systems. **Proceedings of the 13th International Workshop on Parallel and Distributed Real-Time Systems**, Denver, Colorado. April 2005.

62. Sanjoy Baruah. Feasibility analysis of preemptive real-time systems upon heterogeneous multiprocessor platforms. **Proceedings of the IEEE International Real-Time Systems Symposium**, Lisbon, Portugal. December 2004. IEEE Computer Society Press.

63. Thomas Marlowe and Sanjoy Baruah. Fairness-preserving degradation in overloaded multimedia conference systems. **Proceedings of the ICSA 16th International Conference on Parallel and Distributed Computing Systems**, San Francisco, California. September 2004.

64. Sanjoy Baruah and Nathan Fisher. A dynamic-programming approach to task partitioning among memory-constrained multiprocessors. **Proceedings of the International Conference on Real-Time Computing Systems and Applications**, Gothenburg, Sweden. August, 2004. Springer-Verlag.

65. Sanjoy Baruah. Partitioning real-time tasks among heterogeneous multiprocessors. **Proceedings of the 33rd International Conference on Parallel Processing**, pp 467-474, Montreal, Canada. August, 2004. IEEE Computer Society Press.

66. Sanjoy Baruah and Giuseppe Lipari. Executing aperiodic jobs in a multiprocessor constant-bandwidth server implementation. **Proceedings of the EuroMicro Conference on Real-Time Systems**, pp 109-116, Catania, Sicily. July 2004. IEEE Computer Society Press.

67. Sanjoy Baruah. Task partitioning upon heterogeneous multiprocessor platforms. **Proceedings of the 10th International IEEE Real-Time and Embedded Technology and Applications Symposium** , pp 536-543, Toronto, Canada. May, 2004. IEEE Computer Society Press.

68. Sanjoy Baruah and Giuseppe Lipari. A multiprocessor implementation of the Total Bandwidth Server. **Proceedings of the 18th International Parallel and Distributed Processing Symposium** , Santa Fe, New Mexico. April, 2004. IEEE Computer Society Press.

69. Sanjoy Baruah. Cost-efficient synthesis of real-time systems upon heterogeneous multiprocessor platforms . **Proceedings of the 12th International Workshop on Parallel and Distributed Real-Time Systems**, Santa Fe, New Mexico. April 2004.
70. Shelby Funk and Sanjoy Baruah. Restricted EDF migration on uniform multiprocessors. **Proceedings of the 12th International Conference on Real-Time Systems**, Nancy, France. March, 2004.
71. Sanjoy Baruah and Jim Anderson. Energy-efficient synthesis of periodic task systems upon identical multiprocessor platforms. **Proceedings of the Twenty-Fourth International Conference on Distributed Computing Systems**, pp 428-435, Tokyo, Japan. March 2004. IEEE Computer Society Press.
72. Sanjoy Baruah and Joel Goossens. The static-priority scheduling of periodic task systems upon identical multiprocessor platforms **Proceedings of the IASTED International Conference on Parallel and Distributed Computing and Systems (PDCS 2003)**, pp 427-432, Marina Del Rey, California. November 2003.
73. Jim Anderson and Sanjoy Baruah. Energy-aware Implementation of Hard-real-time Systems upon Multiprocessor Platforms **Proceedings of the ICSA 16th International Conference on Parallel and Distributed Computing Systems**, pp 430-435, Reno, Nevada. August 2003.

INVITED LECTURES AT CONFERENCES, WORKSHOPS, ETC.

- June 2009: At MAPSP 2009: The 9th Workshop on Models and Algorithms for Planning and Scheduling Problems (Abbey Rolduc, The Netherlands).
- Sept 2008: At the ARTIST summer school (Autrans, France). "Multiprocessor Real-Time Computing: Formal Foundations"
- April 2006: At RTNS'06: The 14th International Conference on Real-Time and Networked Systems (Poitiers, France). "Multiprocessor Real-time Scheduling Theory: questions (many) and answers (a few)"

Visiting students and postdocs

- *Joel Goossens*. Postdoc visitor from Universite Libre de Bruxelles (Brussels, Belgium). April 2008, April 1st 2002-May 1st 2002, April 1st 2001-June 1st 2001, April 22nd 2000-June 22nd 2000. (Currently faculty member at ULB, Brussels)
- *Suriayati Chuprat*. Visiting PhD student from University of Technology Malaysia (Kuala Lumpur, Malaysia). March - April 2007. March - May 2008.
- *Marco Bertogna*. Visiting PhD student from Scuola Superiore S. Anna (Pisa, Italy). September 2006 - January 2007.
- *Damir Isovic*. Visiting PhD student from Malardalen University (Vesteras, Sweden). April - May 2004.
- *Enrico Bini*. Visiting PhD student from Scuola Superiore S. Anna (Pisa, Italy). March - December 2003. (Currently faculty member at Scuola Superiore S. Anna, Pisa)

Former graduate students

- Nathan Fisher Ph.D., The University of North Carolina. Summer 2007. Thesis title: *The Multiprocessor Real-Time Scheduling of General Task Systems*. (First job: Wayne State University)
- Shelby Funk Ph.D., The University of North Carolina. Fall 2004. Thesis title: *EDF Scheduling on Heterogeneous Multiprocessors*. (First job: The University of Georgia)
- Mithun Arora M.S., The University of North Carolina. Spring 2004. (First job: Microsoft)

Served (or serving) on the PhD dissertation committees of

- *Rodolfo Pellizzoni*, The University of Illinois at Urbana-Champaign.
- *John Calandrino*, The University of North Carolina.
- *Aaron Block*, The University of North Carolina.
- *Adrian Ilie*, The University of North Carolina.
- *Arvind Easwaran*, The University of Pennsylvania. PhD: 2008.
- *Marko Bertogna*, Scuola Superiore S. Anna (Italy). PhD: 2008.
- *Abhishek Singh*, The University of North Carolina. Ph.D: 2007.
- *Claudio Scordino*, Scuola Superiore S. Anna (Italy). Ph.D: 2007.
- *Yu Sun*, The University of Texas at Austin. Ph.D: 2007.
- *UmaMaheshwari Devi*, The University of North Carolina. Ph.D: 2006.
- *Swaha Das*, The University of North Carolina. Ph.D: 2005.
- *George Greene*, The University of North Carolina.
- *Damir Isovic*, Malardalen University (Sweden). Ph.D: 2004.
- *Phil Holman*, The University of North Carolina. Ph.D: 2004.
- *Yong-Jik Kim*, The University of North Carolina. PhD: 2003.
- *Anand Srinivasan*, The University of North Carolina. PhD: 2003.
- *Michele Clark Weigle*, The University of North Carolina. PhD: 2003.
- *Sergey Gorinsky*, The University of Texas at Austin. PhD: 2003.

PROFESSIONAL ACTIVITIES

Conference-organization responsibilities

- Co-organizer of **Dagstuhl Seminar on Scheduling.** (2010)
- Program Committee co-Chair (for core real-time systems), **Real-Time Computing Systems and Applications Symposium (RTCSA).** (2007)
- Track Co-Chair, Real-time systems. **Design, Automation and Test in Europe (DATE).** (2007; 2006; 2005)
- General Chair, **Real-Time Systems Symposium (RTSS).** (2003)
- Program Committee Chair, **Real-Time Systems Symposium (RTSS).** (2002)
- Executive committee member, **The IEEE Real-Time Technical Committee.** (2005-present)

- Executive committee member, **The EuroMicro Technical Committee on Real-Time Systems.** (2002-present)

Editorial responsibilities

- Member of the editorial board, **<u>Journal of Computing Science and Engineering</u>.** (2007-present)
- Member of the editorial board, **<u>The International Journal of Embedded Systems</u>.** (2004-present)
- Associate editor, **<u>Real-Time Systems: The International Journal of Time-Critical Computing Systems</u>.** (2003-present)
- Associate editor, **<u>IEEE Transactions on Computers</u>.** (2001-2005)

Served on the Program Committees of:

- **RTSS:** The Annual IEEE International Real-Time Systems Symposium. (1997-2001; 2004-2007)
- **ECRTS:** Euromicro Conference on Real-Time Systems. (2002-2009)
- **RTAS:** The Annual IEEE International Real-Time Technology & Applications Symposium. (1997-1998; 2001; 2004; 2007)
- **RTCSA:** The IEEE International Conference on Real-Time Computing Systems and Applications. (2004-2006, 2008)
- **RTNS:** The International Conference on Real-Time and Networked Systems. (2006-2008)
- **ICDCS:** The International Conference on Distributed Computing Systems. (2001; 2003-2004)
- **SUTC:** The IEEE International Conference on Sensor Networks, Ubiquitous and Trustworthy Computing. (2008)
- **ACM-SAC:** ACM Symposium on Applied Computing (Real-time track). (2008)
- **ICESS:** The International Conference on Embedded Software and Systems. (2009; 2008)
- **EUC:** The IFIP International Conference on Embedded And Ubiquitous Computing. (2006)
- **ETFA:** The IEEE International Conference on Emerging Technologies and Factory Automation. (2006)
- **WPDRTS:** IEEE International Workshop on Parallel and Distributed Real-Time Systems. (2003-2008)
- Brazilian Workshop on Real-time and Embedded Systems. (2008)
- **AC:** IADIS International Conference Applied Computing. (2004)
- **CEC04EAST:** IEEE International Conference on e-Commerce Technology for Dynamic E-Business. (2004)

Sanjoy Baruah

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Joel Goossens, Suriayati Chuprat, Marco Bertogna, Damir Isovic, Enrico Bini, Giuseppe Lipari

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

T. GARY BISHOP

Profession Preparation

Ph.D., University of North Carolina at Chapel Hill, Computer Science, 1984; advisor, Henry Fuchs.

BEET, Southern Technical Institute, Marietta, GA., Electrical Engineering Technology with highest honor, 1976

Appointments

University of North Carolina at Chapel Hill
Professor, January 2005-Present
Associate Professor, January 1997-December 2004
Research Associate Professor, May 1991-December 1996
Adjunct Associate Professor, January 1989-April 1991

Sun Microsystems
Senior Staff Engineer, January 1988-May 1991.

AT&T Bell Laboratories
Member of Technical Staff, June 1984-January 1988.

University of North Carolina at Chapel Hill
Executive Officer, Department of Computer Science, August 1979-August 1981.

Savannah Electric and Power Company
Senior System Analyst, January 1977-December 1978.

Awards

Kauffman Entrepreneurship Fellowship, 2007

Engaged Faculty Scholar, 2007-2009

Class of 1996 Excellence in Advising Award, 2005.

Tanner Faculty Award for Excellence in Undergraduate Teaching 2003
Computer Science Students Association Teaching Award 2003-2004, 1999-2000, 1995-96.

Teaching

Lego Robotics, Computer Organization, Enabling Technology, Enabling Technology First Year Seminar, Images/Graphics/Vision, Computer Graphics, Elements of Hardware Systems, Kalman Filters, Immersive Computing Environments, Interactive Audio

Dissertations Advised

Manuel Oliveira, "Relief Texture Mapping", Ph.D. May 2000.
Chun-Fa Chang, "LDI Tree: A Sampling Rate Preserving and Hierarchical Data Representation for Image-Based Rendering", Ph.D. August 2001.
Nicholas Vallidis, "Whisper: A Spread-Spectrum Approach to Occlusion in Acoustic Tracking", Ph.D. August 2002.
Paul Rademacher, "Measuring the Perceived Visual Realism of Images", Ph.D. May 2003.

Selected Publications
Patents

Gary Bishop and Manuel de Oliveira Neto. 'Methods and Systems for Producing Three-Dimensional Images Using Relief Textures', patent number 6,424,351. 2002.

Refereed Articles

Aaron Block, James Anderson, and Gary Bishop (2005), "Fine-Grained Task Reweighting on Multiprocessors", Proceedings of the 11th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications, Hong Kong, China, IEEE Computer Society Press, pp. 429–435, August 2005.

Jay Fischer, Jeremy Cummings, Kalpit Desai, Leandra Vicci, Ben Wilde, Chris Weigle, Gary Bishop, Russell Taylor II, C.W. Davis, R.C. Boucher, Timothy O'Brien, and Richard Superfine (2005), Three-dimensional force microscope: A nanometric optical tracking and magnetic manipulation system for the biomedical sciences, Review of Scientific Instruments, 76, 053711, 11 pages.

Peter Parente and Gary Bishop, "BATS: The Blind Audio Tactile Mapping System," Proceedings of ACM Southeast Regional Conference, March 2003, pp. 132-138.

Richard Superfine, Gary Bishop, Jeremy Cummings, Jay Fisher, G. Matthews, D. Sill, Russell Taylor II, Leandra Vicci, Chris Weigle, Greg Welch, and Ben Wilde (2002), Touching in Biological Systems: A 3D Force Microscope, Proceedings of Microscopy and Microanalysis (Quebec City, Canada).

Ruigang Yang, Greg Welch, Gary Bishop: Real-Time Consensus-Based Scene Reconstruction Using Commodity Graphics Hardware. Pacific Conference on Computer Graphics and Applications 2002: pp. 225-235

Dorian Miller and Gary Bishop. 'Latency meter: a device for easily monitoring VE delay,' Proceedings of the SPIE Engineering Reality of Virtual Reality, San Jose, CA, January 2002.

Greg Welch, Gary Bishop, Leandra Vicci, Stephen Brumback, Kurtis Keller, and D'nardo Colucci. 'High-Performance Wide-Area Optical Tracking – The HiBall Tracking System.' Presence: Teleoperators and Virtual Environments. 10(1). 2001.

Manuel Oliveira, Gary Bishop and David McAllister. 'Relief Texture Mapping', Proceedings of SIGGRAPH'00 (New Orleans, LA, July 23-27, 2000). In *Computer Graphics* Proceedings, Annual Conference Series, 2000, ACM SIGGRAPH, pp. 259-268.

Gary Bishop and Greg Welch. "Working the Office of 'Real Soon Now'," IEEE Computer Graphics and Applications, July-August 2000, pp. 76-78.

Other Articles

Simon Julier and Gary Bishop. "Guest Editors' Introduction: Tracking: How Hard Can It Be?" IEEE Computer Graphics and Applications 22(6) pp. 22-23 2002.

Greg Welch and Gary Bishop (2001), An Introduction to the Kalman Filter, SIGGRAPH 2001 course 8. In Computer Graphics, Annual Conference on Computer Graphics & Interactive Techniques. ACM Press, Addison-Wesley, Los Angeles, CA, USA (August 12–17), SIGGRAPH 2001 course pack edition.

Bonnie Danette Allen, Gary Bishop, and Greg Welch (2001), Tracking: Beyond 15 Minutes of Thought, SIGGRAPH 2001 course 11. In Computer Graphics, Annual Conference on Computer Graphics & Interactive Techniques. ACM Press, Addison-Wesley, Los Angeles, CA, USA (August 12–17), SIGGRAPH 2001 course pack edition.

Gary Bishop

Information concerning teaching activities over the academic years 2003-04 through 2007-08:

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

I work 4 hours per week in the general college advising office to help students with course and major selection.

I served on the University Teaching Awards selection committee for 3 years.

c. Course development work undertaken (2-3 sentences per item)

I developed a new course "Enabling Technology" for CS undergrads and graduate students, which I have taught 3 times so far. In this course students learn about the applications of computers to mitigating the effects of disabilities. This is an approved APPLES service learning course.

I developed a new First Year Seminar, "Enabling Technology." We survey issues in technology and disability and develop content ideas for new software using Wizard of Oz simulation techniques (since they aren't programmers). This is an approved APPLES service learning course.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

Our educational software for blind students is in use world wide. I have letters in Braille from a blind teacher in India who uses it in her classroom. As of April 2007 (I'll update these numbers) our software was in use in 70 countries and 46 US States. We believe more than 3000 copies are in use.

We have held our Maze Day event for blind school children each year since 2005. They come to Sitterson Hall from all over the state (renting buses to come from Charlotte!) to try out software systems developed by UNC students. About 212 children have visited along with 230 teachers and parents have participated. We demonstrated 42 different projects during that time.

Tar Heel Reader is a web-based collection of easy-to-read books for beginning readers and a tool for easily creating new books. Each book is switch-accessible for kids with motor impairments and speech enabled so that kids can hear the book read to them. In the 20 weeks (so far) it has been operating since May 2008 it has grown to 1044 books in 5 languages. Over 66400 books have been read in 46 countries.

Tar Heel Typer and the Hawking Toolbar are tools to enable people with motor impairments to write and access the web. Our new writing tool with math completion in addition to word completion is going to rock the world!

SerialKeysX enables Mac OSX users with motor impairments to control their computers.

Frederick Phillips Brooks, Jr.

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Born 19 April 1931 Durham, NC
Married, three children:
  Kenneth P. Brooks, 8/14/58
  Roger G. Brooks, 12/25/61
  Barbara B. LaDine, 2/24/65

EDUCATION

Ph.D., Harvard University, Applied Mathematics (Computer Science), 1956; Howard H. Aiken, advisor; dissertation: *The Analytic Design of Automatic Data Processing Systems*
S.M., Harvard University, Applied Mathematics (Computer Science), 1955
A.B. *summa cum laude,* Duke University, Physics, 1953. First in class of 1953.

TEACHING EXPERIENCE

University of North Carolina at Chapel Hill, Department of Computer Science
Kenan Professor of Computer Science, 1975-
Professor of Computer Science, 1964-75
Chairman, 1964-1984; founder

Twente Technical University, Enschede, The Netherlands: Visiting Professor, 1970
Columbia University: Adjunct Assistant Professor, 1960-61
Vassar College: Visiting Instructor, 1958
IBM Systems Research Institute, Voluntary Education Program, and Summer Student Program Teacher, 1957-59

DEVELOPMENT EXPERIENCE

IBM Corporation
Poughkeepsie, New York
Corporate Processor Manager for Development of System/360 Computer Systems, 1961-1965
Manager of Operating System/360, 1964-65
Manager, System/360 Hardware Development, Data Systems Division, 1961-64
Systems Planning Manager, Data Systems Division (8000 series *et al.*), 1960-61
Yorktown Heights, New York: Advisory Engineer, Thomas J. Watson Research Center, 1959-60
Poughkeepsie, New York
Project STRETCH: Advisory Engineer, 1958-59; Staff Engineer, 1956-58; Associate Engineer, 1956
Professional summer jobs at IBM Endicott, Bell Labs, North American Aviation, Marathon Oil Co., 1952-56

COMPUTER DESIGNS

IBM System/360: Manager of whole project, 1961-64
IBM 8000 Series (never produced): Manager of Architecture, 1960-61
IBM 7950 (Harvest): Instruction set-up, adjustments, 1957-58
IBM 7030 (Stretch): Instruction sequencing, interruption, variable-field-length arithmetic, editing, programmable console, 1956-59
A specialized computer for payroll, Ph.D. Dissertation, 1955-56

PATENTS
U.S. 2,981,020: "Alphabetical Read-Out Device"

U.S. 3,048,332: "Program Interruption System" with D.W. Sweeney; also French, German, British patents on same. Broad coverage of mask-controlled interruption, vectored interruption, etc.

HONORS
Centennial Medal, Harvard University Graduate School of Arts and Sciences, 2007

Eckert-Mauchly Award, Association for Computing Machinery and The Institute of Electrical and Electronics Engineers–Computer Society, 2004

SERVICE
UNC Chancellor's Advisory Committee, 2000-2003; Chair, 2001-2003

Trinity School of Durham and Chapel Hill: Advisory Committee, Chair, 1995-2003; Board of Trustees, 2003- present (Chair, 2003-present)

CURRENT SUPPORT
2006-2009: Preparation of two books on the Science of Design, NSF, PI, $488,604
2005-2009: "Computer Integrated Systems for Microscopy & Manipulation," NIH, Co-PI,
    $4,575,005

PAST SUPPORT
2003-2007: "VE Technologies for Effective Training," Office of Naval Research, Co-PI, $560,000

BIBLIOGRAPHY

BOOKS AND CHAPTERS
Whitton, M.C. and Brooks, F.P. (*in press). *"Evaluating VE Component Technologies," in *VE Components and Training Technologies,* Nicholson, D., D. Schmorrow and J. Cohn, (Eds.). Westport, CN: Praeger Security International.

Brooks, F. P. , "Introduction to Chapter 7: Software and Systems Management", in R. Selby, ed., *Software Engineering: Barry W. Boehm's Lifetime Contributions to Software Development, Management, and Research.* Hoboken NJ, Wiley-IEEE CS Press, 2007, 573-578.

Taylor II, R. M., D. Borland, F. P. Brooks, Jr., M. Falvo, M. Guthold, T. Hudson, K. Jeffay, G. Jones, D. Marshburn, S. J. Papadakis, L. C. Qin, A. Seeger, F. D. Smith, D. H. Sonnenwald, R. Superfine, S. Washburn, C. Weigle, M. C. Whitton, P. Williams, L. Vicci and W. Robinett, "Visualization and Natural Control Systems for Microscopy," in *Visualization Handbook*, Edited by C. Johnson and C. Hansen, Harcourt Academic Press, 2004, 875-900.

Brooks, Jr., F. P. "Foreword" in D. Luebke, M. Reddy, J. D. Cohen, A. Varshney, B. Watson, and R. Huebner, *Level of Detail for 3D Graphics*. San Francisco, CA: Morgan Kaufmann Publishers, 2003, ix.

TECHNICAL PAPERS (Major papers marked*)

*Brooks, F. P., "STRETCHING is Great Exercise; It Gets You in Shape to Win," *Annals of the History of Computation,* accepted, to appear 2009.

Burns, Eric, Sharif Razzaque, Mary C. Whitton, Frederick P. Brooks, Jr. 2007: "MACBETH: Management of Avatar Conflict by Employment of a Technique Hybrid," *International Journal of Virtual Reality, 2007.*

Jerald, J, A, Fuller, A. Lastra, M. Whitton, L. Kohli, F. Brooks 2007: "Latency Compensation by Horizontal Scanline Selection for Head-Mounted Displays," *Proceedings of SPIE, Vol. 6490, Stereoscopic Displays and Virtual Reality Systems XIV* (San Jose, CA, January 28-February 1, 2007).

Burns, E., F. P. Brooks, Jr. 2006: "Perceptual sensitivity to visual/kinesthetic discrepancy in hand speed, and why we might care," *Proceedings of the ACM Symposium on Virtual Reality Software and Technology* (Limassol, Cyprus, November 01-03, 2006), 3-8, VRST '06, ACM Press, New York, NY.

Brooks, Jr., Frederick P. "Software and Systems Management—Chapter 7 Summary," *Software Engineering: The Legacy of Barry W. Boehm*, R. Selby, ed., New York: John Wiley & Sons Inc., To appear (May 2007).

Burns, E., S. Razzaque, A.T. Panter, M. C. Whitton, M. R. McCallus, F. P. Brooks, Jr. 2006: "The Hand Is More Easily Fooled than the Eye: Users Are More Sensitive to Visual Interpenetration than to Visual-Proprioceptive Discrepancy," *Journal on Presence: Teleoperators and Virtual Environments,* **15**, 1: 1-15, February 2006.

Meehan, Michael, S. Razzaque, B. Insko, M. Whitton, F. P. Brooks 2005: "Review of Four Studies on the Use of Physiological Reaction as a Measure of Presence in Stressful Virtual Environments," *Applied Psychophysiology and Biofeedback*, **30**, 3: 239-258, September 2005.

*Brooks, Fred, J. Cannon-Bowers, H. Fuchs, L. McMillan, M. Whitton 2005: "A New VE Challenge: Immersive Experiences for Team Training," *Proceedings of HCI International 2005*, v. 9, (Las Vegas, Nevada, July 2005), CD-ROM. (Invited)

Whitton, Mary, B. Lok, B. Insko, F. Brooks 2005: "Integrating Real and Virtual Objects in Virtual Environments," *Proceedings of HCI International 2005*, (Las Vegas, Nevada, July 2005), v. 9, (Las Vegas, Nevada, July 2005), CD-ROM. (Invited)

Whitton, M., Cohn, J., Feasel, J., Zimmons, P., Razzaque, S., Poulton, S., McLeod, B., Brooks, F. 2005: "Comparing VE Locomotion Interfaces," *Proceedings of IEEE Virtual Reality 2005*, (Bonn, Germany March, 2005), 123-130, IEEE Computer Society.

Burns, E., Razzaque, S., Panter, A. T., Whitton, M. C., McCallus, M. R., & Brooks, F. P. 2005: "The Hand is Slower than the Eye: A quantitative exploration of visual dominance over proprioception," *Proceedings of IEEE Virtual Reality 2005,* (Bonn, Germany March 2005), 3-10, IEEE Computer Society.

Lok, Benjamin, Samir Naik, Mary Whitton, and Frederick Brooks 2004: "Experiences in Extemporaneous Incorporation of Real Objects in Immersive Virtual Environments," *Beyond Glove and Wand Based Interaction Workshop Manual*, 107-110, IEEE Virtual Reality 2004, Chicago, IL.

*Lok, Benjamin, Samir Naik, Mary Whitton, and Frederick P. Brooks, Jr. 2004: "Effects of Handling Real Objects and Avatar Fidelity on Cognitive Task Performance and Sense of Presence

in Virtual Environments," *Journal on Presence: Teleoperators and Virtual Environments*, **12**, 6: 615-628.

*Lok, B., S. Naik, M.C. Whitton, F.P. Brooks, Jr. 2003: "Incorporating Dynamic Real Objects into Immersive Virtual Environments," *Proceedings of ACM SIGGRAPH 2003 Symposium on Interactive 3D Graphics* (Monterey, CA, April 28-30, 2003), 31-40, ACM, New York. Five best papers were selected for presentation at SIGGRAPH 2003. The abstract is in those proceedings, *ACM Transactions on Graphics* **22**,3: 701.

*Lok, B., F.P. Brooks, Jr., S. Naik, M.C. Whitton 2003: "Effects of Handling Real Objects and Self-Avatar Fidelity on Cognitive Task Performance in Virtual Environments," *Proceedings of IEEE Virtual Reality 2003* (Los Angeles, CA, March 22-26, 2003), 125-132, IEEE Computer Society.

*Meehan, M., S. Razzaque, M.C. Whitton, F.P. Brooks, Jr. 2003: "Effect of Latency on Presence in Stressful Environments," *Proceedings of IEEE Virtual Reality 2003* (Los Angeles, CA, March 22-26, 2003), 141-148,
IEEE Computer Society.

Brooks, Jr., F.P. 2003: "Three Great Challenges for Half-Century-Old Computer Science." *Journal of the ACM*, **50**, 1: 25-26.

OTHER
Brooks, Jr., F. P., J. Cannon-Bowers, H. Fuchs, L. McMillan, M. Whitton, "Virtual Environment Training for *Dismounted* Teams—Technical Challenges," Paper presented at Human Factors & Medicine Panel Workshop on Virtual Media for Military Applications, U.S. Military Academy, West Point, NY, June 13-15, 2006.

Brooks, Jr., F. P., "Making and Measuring Effective Virtual Environments," Keynote speech at IEEE Virtual Reality 2005, Bonn, Germany, March 12-16, 2005.

Brooks, Jr., F. P., "Collaboration and Telecollaboration in Design," Turing Lecture at The British Computer Society/Institution of Electrical Engineers Meeting, London, England, January 20, 2005.

Brooks, Jr., F. P., "Human Motion in Virtual Environments for Team Training," Keynote speech at NATO Intelligent Motion and Interaction Within Virtual Environments Conference, London, UK, September 15-17, 2003.

Brooks, Jr., F.P., "Truth vs. Beauty," Panel Presentation during Special Session "Truth Before Beauty: Guiding Principles for Scientific and Medical Visualization," ACM SIGGRAPH'03, San Diego, CA, July 30, 2003.

Brooks, Jr., F.P., "Project Lessons Learned the Hard Way," Keynote speech at ASYNC 2003, Vancouver, Canada,
May 12-16, 2003.

LECTURES

2008
"How Do We Know **What** to Design?", sd&m Design Conference, Berlin

"How Do We Know **What** to Design?", Manchester (U.K.) Chapter of SIGGRAPH

"Collaboration and Telecollaboration in Design", Oxford Computer Laboratory

"'Science of Design' is a Misguided and Misleading Goal", Dagstühl Workshop on Design, Wangen, Germany

2007
"Collaboration and Telecollaboration in Design," Invited Lecture, Clemson University, Clemson, SC, February 19, 2007.

"How Do We Know **What** to Design?", Cambridge University Computer Laboratory

Oral video interview for Computer History Museum

"Collaboration and Telecollaboration in Design" OOPSLA Keynote, Montreal

"'No Silver Bullet—Essence and Accident in Software Engineering' Revisited After 20 Years," OOPSLA panel, Montreal.

2006
"Collaboration in Design," IBM University Day, Research Triangle Park, NC, October 27, 2006.

Brooks, Jr., F. P., J. Cannon-Bowers, H. Fuchs, L. McMillan, M. Whitton, "Virtual Environment Training for *Dismounted* Teams—Technical Challenges," Paper presented at Human Factors & Medicine Panel Workshop on Virtual Media for Military Applications, U.S. Military Academy, West Point, NY, June 13-15, 2006.

"Further Thoughts on the Future of Visualization," Panel at Symposium on the Future of Visualization, University of North Carolina at Charlotte, Charlotte, NC, May 1-2, 2006.

2005
"IBM Research and Development - 1945-1959," IBM Research & Development 60th Anniversary, Yorktown, NY, October 11, 2005.

"Making and Measuring Effective Virtual Environments," Keynote speech at IEEE Virtual Reality 2005, Bonn, Germany, March 15, 2005.

"Collaboration and Telecollaboration in Design," Turing Lecture at the Seventh British Computer Society/ Institution of Electrical Engineers Meeting, London, England, January 20, 2005.

"Collaboration and Telecollaboration in Design," The University of Manchester, Manchester, England, January 18, 2005.

2004
"Measuring the Effectiveness of Virtual Environments," Barr Systems Distinguished Lecture, University of Florida, Gainesville, FL, December 7, 2004.

"Celebration and Tribute to Ken Iverson, 1920-2004," Celebration of Remembrance for Dr. Kenneth E. Iverson, Computer History Museum, Mountain View, CA, November 30, 2004.

"What Makes a Virtual Environment Effective? Researches as Chapel Hill," Media, Minds and Magic Workshop, Technische Universiteit, Eindhoven, Netherlands, October 21, 2004.

NIH mentioned.

"On the Power of Streaming Table-Lookup," ACM Workshop on General Purpose Computing on Graphics Processors, Los Angeles, CA, August 7, 2004.

Conferences and National and International Society Meetings (2007-2008 only)
Design Thinking Research Society, Workshop 7, London
OOPSLA Conference, Montreal
SD&M Design Conference, Berlin
RAVE Virtual Environments Conference, Barcelona
Carnegie-Mellon SCS Advisory Committee, Pittsburgh
MIT-Cambridge Computer Science Curriculum Conference, Cambridge (U.K)
Design Research Society Annual Conference, Sheffield
National Academy of Sciences (U.S.) regional meeting, Cambridge (U.K.)
Royal Academy Of Engineering, "Global Warming," London
Royal Academy Of Engineering, "Engineering the Future Underground—World-Class Tube For A World-Class City," London
British Computer Society Elite, "Future Of IT", London
Royal Academy Of Engineering, "Checking And Engineering", London
British Computer Society, "The Impact of Software Eng Research on Software Eng Practice", London
Computer Journal lecture meeting, "The Future of Computer Technology," London
Royal Academy Of Engineering laboratory visit, Royal Appleton Laboratory, Didcot
Royal Academy Of Engineering laboratory visit, O'Riordan Flight Simulator Laboratory

Fred Brooks

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

PRASUN DEWAN
2004-Present

GENERAL INFORMATION

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Address   Department of Computer Science, University of North Carolina, Chapel Hill,
               NC 27599-3175

EDUCATION

1980   B. Tech. in Electrical Engineering, Indian Institute of Technology (IIT), New Delhi
1986   Ph.D. in Computer Science, University of Wisconsin-Madison

PROFESSIONAL EXPERIENCE

Summer 1979 Summer Intern, Computer Maintenance Corporation (previously IBM India)
1980-81   Teaching Assistant, University of Wisconsin at Madison
1981-86   Research Assistant, University of Wisconsin at Madison
1984   Summer Intern, INTEL Corporation
1986-93   Assistant Professor, Purdue University
1993-98   Associate Professor, University of North Carolina at Chapel Hill
1998-   Professor, University of North Carolina at Chapel Hill
2002-2003   Visiting Researcher, Microsoft Corporation
Summer 2005 Visiting Researcher, Microsoft Corporation
Summer 2008 Visiting Researcher, Tata Consultancy Services

RESEARCH INTERESTS

System Support for Distributed Collaboration
System Support for User Interfaces
Distributed Object-Oriented Database Management Systems
Collaborative Software Engineering Tools

I. RESEARCH

Ph.D. Dissertation

"Automatic Generation of User Interfaces," University of Wisconsin-Madison, 1986.
Advisor: Marvin Solomon

Refereed Journal Publications

1. Omojokun, O., Pierce, J., Isbell, C., Dewan, P. "Comparing End-user and Intelligent
   Remote Control Interface Generation." The Journal of Personal and Ubiquitous

Computing, Volume 10, Issue 2-3. pp. 136-143. 2006. Also in Proc. Third
International Conference on   Appliance Design.

Refereed Conference Publications
(Acceptance ratios for papers are given when available.   The vast majority of papers are in
conferences with acceptance rates of 0.14-0.3.)

1. Chung, G. and P. Dewan. "Towards Dynamic Collaboration Architectures.
    "Proceedings of CSCW. 2004. Acceptance ratio: 0.29
2. Dewan, P. "Teaching Inter-Object Design Patterns to Freshmen." Proceedings of
    SIGCSE. 2005. (Acceptance ratio: 0.32)
3. Junuzovic, S., G. Chung, and P. Dewan. "Formally Analyzing Two-User Centralized
    and Replicated Architectures." in ECSCW. 2005. Paris. (Acceptance ratio: 0.19)
4. Roussev, V. and P. Dewan. "Supporting High Coupling and User-Interface
    Flexibility." in ECSCW. 2005. Paris. (Acceptance Ratio: 0.19)
5. Junuzovic, S., P. Dewan. "Response Times in N-user Replicated, Centralized and
    Proximity-Based Hybrid Collaboration Architectures." CSCW. 2006. Paris.
    (Acceptance ratio: 0.21)
6. Omojokun, O, P. Dewan. "Automatic Generation of Device User-Interfaces?," IEEE
    Percom '07 (Acceptance ratio: 0.09).
7. Dewan, P. "Towards a Universal Model for Toolkit Data Structures", IFIP EHCI '07.
8. Dewan, P., S. Junuzovic, G. Sampathkumar. "The Symbiotic Relationship between
    Virtual Computing Lab and Collaboration Technology," International Conference of
    the Virtual Computing Initiative, May 2007.
9. Prasun Dewan and Rajesh Hegde, Semi-synchronous conflict detection and resolution
    in asynchronous software development, Proc. ECSCW Conference, September 2007.
    Springer London, pp. 159-178 (Acceptance ratio: 0.19)
10. Prasun Dewan and Henry McEuen, Active Notifications, Proc. ICST/IEEE
    CollaborateCom Conference, Nov 2007. (Short Paper)
11. Sasa Junuzovic and Prasun Dewan, Multicasting in Groupware?, Proc. ICST/IEEE
    CollaborateCom Conference, Nov 2007
12. Sasa Junuzovic, Prasun Dewan, and Yong Rui, Read, Write, and Navigation
    Awareness in Realistic Multi-View Collaborations, Proc. ICST/IEEE
    CollaborateCom Conference, Nov 2007.
13. Olufisayo Omojokun and Prasun Dewan, Efficient Retargeting of Generated Device
    User-Interfaces, IEEE Percom Conference, Mar 2008 (Acceptance ratio: 0.11)
14. Rajesh Hegde and Prasun Dewan, Connecting Programming Environments to Support
    Ad-Hoc Collaboration, Proc. 23rd ACM/IEEE Conference on Automated Software
    Engineering, Sep 2008. (Acceptance ration: 0.12)
15. Sasa Junuzovic and Prasun Dewan, Serial vs. Concurrent Scheduling of Transmission
    and Processing Tasks in Collaborative Systems, ICST/ACM CollaborateCom
    Conference, Nov 2008.
16. Olufisayo Omojokun, Charles L. Isbell, and Prasun Dewan, Towards Automatic
    Personalization of Device Controls, 2009 IEEE International Conference on
    Consumer Electronics, to be held in Las Vegas, USA from January 10-14, 2009.

Book Chapters

1. Omojokun, O. and Dewan, P. "Ubiquitous Computing" In Berkshire Encyclopedia of Human Computer Interaction, William Bainbridge, editor, Berkshire Publishing, 2004.
2. Dewan, Prasun. "Multi-User Interfaces" in Berkshire Encyclopedia of Human Computer Interaction, William Bainbridge, editor, Berkshire Publishing, 2004.
3. Dewan, Prasun. "Collaborative Applications" In Practical Handbook of Internet Computing, Munindar P. Singh, editor, CRC Press (2004)
4. Dewan, Prasun. "Taxonomy of Collaborative Software Development Tools", In "Collaborative Software Engineering", Ivan Mistrik, editor, Springer-Verlag (invited and conditionally accepted chapter for book to appear in October 2009)

Refereed Workshop Publications
1. Prasun Dewan, Eric Horvitz, and Jonathan Grudin, A "Thought Experiment" to Illustrate and Motivate Mixed-Initiative Access Control, IEEE TustCol Workshop, November 2007, Co-located with CollaborateCom 2007.
2. Prasun Dewan, Dimensions of Tools for Detecting Software Conflicts, ACM International Workshop on Recommendation Systems for Software Engineering (RSSE 2008), November 10, 2008. Co-located with ACM FSE 2008

Software Systems
Design and implementation of following experimental software systems led to published work.

1. ObjectEditor: A Java-based System for Automating the Implementation of User-Interfaces. Used in teaching of CS1 and 2 courses. Also used to implement research applications. Implements concepts in conference papers 6,7, 13.
2. OneNote Extension: An extension to OneNote that provides read, write and navigation awareness. Implements concepts in conference paper 12.
3. VisualStudio Extension: An extension to VisualStudio supporting collaborative software development. Implements concepts in conference papers 9 and 14.
4. Log-based Collaboration Infrastructure: A log-based system supporting dynamic centralization, replication, and migration of components of collaboration infrastructures. Implements concepts in conference papers 1, 3, 5, 11 and 15.

Research Funding
1. 2002-2005, Log-based Middleware for Pervasive Application Sharing, $360,000, *National Science Foundation.*
2. 2002-2003, Supporting Reuse, Composition, and Automation in a Collaboration Infrastructure, $33,783, *National Science Foundation.*
3. 2003-2005, User-Interface Generation for Mobile and Desktop Computing, $280,921,*National Science Foundation.*
4. August 2003, Self-configuring Ad-hoc Networks Supporting Multiple Mobile Devices, $25,000, *Microsoft Corporation*.
5. August 2004, Generating Speech User Interfaces, $ 17,000, IBM.

6. August 2005, Generating Speech User Interfaces, $ 30,000, IBM.
7. Sep 2007-2010, Evaluating the Performance of Distributed Synchronous Collaboration Architectures, $437,000, *National Science Foundation.*
8. Sep 2008-2011, Collaborative Mixed-Initiative Access Control, $410,162, *National Science Foundation*

Fellowships to Ph.D. Students
1. 2006, Interacting with Network Appliances, UNC Alumni Fellowship (Student: Olufisayo Omojokun)
2. 2008-2010, Towards Self Optimizing Collaborative Systems, Microsoft Fellowship (Student: Sasa Junuzovic)
3. 2008-2010, Towards Self Optimizing Collaborative Systems, National Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Scholarship (PGS D).(Student: Sasa Junuzovic)

II. PROFESSIONAL ACTIVITIES

Editorial Activities
1. Associate Editor, ACM Transactions on Computer Human Interaction, 1999 - present.
2. Associate Editor, Journal of Computer Supported Cooperative Work, Kluwer Academic Publishers, 2001-present
3. Foundation Editor (responsible for Group and Organization Interfaces), Journal for Universal Computer Science, Internet-based Electronic Journal, Springer Verlag, 1995 - present.
4. Editor of special issue on Consistency Management in Synchronous Collaboration of Journal of Computer Supported Cooperative Work, 2008.

Tutorials
1. "Hands-On Introduction to Synchronous Groupware", CSCW 2006

Organization of Conference Activities
1. Conference chair - ACM Conference on Computer Supported Cooperative Work, 2011.

Conference Panels
1. Collaborate Computing and Service Oriented Computing, IEEE CollaboratCom Conference, Nov 2007
2.Collaborative Computing: From Network Management to Enterprise Systems and Web 2.0, IEEE CollaboratCom , Nov 2007

Colloquia
2005: Texas A&M University, Distinguished Talk: "Architectures of distributed collaborative applications."

III. TEACHING

Courses Developed

Comp 110 (Comp 14), Comp 401 (Comp 114), Comp 911 (Comp 291), Comp 790 (Ubiquitous Computing), Comp 790 (Collaborative Computing)

Ph.D. Advisees

Vassil Roussev: Flexible Sharing of Distributed Objects based on Programming Patterns (Graduated in August 2003).

Olufisayo Omojokun: Interacting with Networking Appliances (Graduated in May 2006).

Jason Carter: (Collaborative Software Engineering)

Kelli Bacon: (Access Control)

PostDocs

Chung, Gopeel

Prasun Dewan

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Gopeel Chung

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Jan-Michael Frahm   Curriculum Vitae

Jan-Michael Frahm
Research Assistant Professor
Computer Science Department
University of North Carolina at Chapel Hill
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Education

- July 2005: Dr.-Ing. (doctor in engineering) in Computer-Science, Christian-Albrechts-University of Kiel, Department Multi-Media Information Systems, Thesis: Camera Self-Calibration with known Camera Orientation, Advisor: Prof. Dr.-Ing. Reinhard Koch, grade: summa cum laude

- December 1999: Diploma in Computer Science (minor subject: medical imaging and medical information processing) at the University of Lübeck, Thesis: "Filtering and analysis of fluoroscopic images", grade equivalent to summa cum laude

Professional Experience and Projects

- Research Assistant Professor at the University of North Carolina at Chapel Hillin the Computer Vision group.
- Postdoctoral researcher at the University of North Carolina at Chapel Hill in the UrbanScape project, in the Computer Vision group of Professor Marc Pollefeys.
- Research and teaching assistant in the Department of Computer Science and Applied Mathematics of the Christian-Albrechts-University of Kiel, Multimedia Information Processing group of Professor Reinhard Koch. The main objectives of the research were structure from motion and camera self-calibration employing inertial sensors. (January 2000 - July 2005)
- Technical work package leader for \O_ine 3D-Scene Reconstruction" in EU-project MATRIS (Markerless real-time Tracking for Augmented Reality Image Synthesis www.ist-matris.org). (September 2004 - July 2005)
- Intern at Microsoft Research Redmond in the Interactive Visual Media Group on automatic detection and tracking of planes in image sequences for camera pose estimation (Mentor Dr. Rick Szeliski). (May 2004 - August 2004)
- Development and design of 3D-reconstruction software for uncalibrated structure from motion at the Christian-Albrechts-University of Kiel in the Multimedia Information Processing group. The software is now used as basic 3D-reconstruction module of the MARTIS and ARTESAS projects. (January 2003 - January 2004)
- Developer of the LGPL library BIAS for image processing and multi-view geometry. (January 2002 - present)
- Organization of the CeBIT 2003 presentation of the Multimedia Information Processing group. (January 2003 - March 2003)

Professional Activities

Chairing/organizing
- Co-chair ISPRS working group WG III/4 - Complex scene Analysis and 3D reconstruction
- Demo chair CVPR 2009
- Organizer of workshop on \Computer vision on GPU's" held in conjunction with CVPR 2008 together with Marc Pollefeys (ETH Zurich/UNC) and Mubarak Shah (UCF).
- Organizer of workshop for ICCV 2007 about \Virtual Representations and Modeling of Large -scale environments (VRML)" together with Marc Pollefeys (ETH Zurich), Frank Dallaert (Georgia Tech), and Jana Kosecka (GMU).

Program Committees (selected)
- CVPR 2007-2009 (IEEE Conference on Computer Vision and Pattern Recognition)
- ICCV 2007 (IEEE International Conference on Computer Vision)
- ECCV 2008 (European Conference on Computer Vision)
- ACCV 2007/2008 (Asian Conference on Computer Vision)
- ProCams Workshop 2007/2008
- Workshop on Dynamic Vision 2007 Heidelberg, Germany
- Third International Symposium on 3D Data Processing, Visualization and Transmission 2006/2008
- European Conference on Visual Media Production (CVMP 2006-2008)

Journal Reviewer (selected)
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- International Journal on Computer Vision
- Transactions on Image Processing
- IEEE Transactions on Visualization and Computer Graphics
- IEEE Transactions on Robotics
- IEEE Transactions on Systems, Man and Cybernetics
- IEEE Transactions on Circuits and Systems for Video Technology
- Journal of the Optical Society of America
- Journal for \Photogrammetrie-Fernerkundung-Geoinformation-PFG"

Conference Reviewer (selected)
- DAGM (German Pattern Recognition Conference)
- 3DPVT (3D Data Processing, Visualization and Transmission)
- CVPR (Computer Vision and Pattern Recognition)
- ICPR (International Conference Pattern Recognition)
- PCV (Photogrammetric Computer Vision)
- Siggraph
- Siggraph Asia

Panels
- NSF panel for computer vision (2007)

Teaching

Tutorials
- "Realtime Computer Vision for Augmented Reality", in conjunction with International Symposium Mixed and Augmented Realities, October 2006, St. Barbara, CA, USA, organized by myself and held together with Raphael Grasset from HITLabNZ
- "Building Blocks for 3D Scene Reconstruction with Interactive Frame Rates", in conjunction with DAGM, September 2006, Berlin, Germany, organized by myself and held together with Reinhard Koch as well as Jan-Friso Evers-Senne from the Christian-Albrechts-University of Kiel.
- "Visual-Geometric 3D-Scene Reconstruction from Uncalibrated Image Sequences", in conjunction with DAGM, September 2006, Munich, Germany, organized by Reinhard Koch and held together with me.

Courses
- Introduction to Robotics, guest lecture for introduction into Computer Vision (2006)
- 3D Urban Modeling, substitute instructor throughout the term (2006)
- Computer Vision, Guest lecture about tracking (2006)
- 3D Scene Reconstruction from Video, substitute instructor throughout the term and instructor for exercises and assignments (2005)
- Multimedia Communications, substitute instructor throughout the term and instructor for exercises, practical exercises and assignments (3 courses, 2002-2005)
- Multimedia Information Processing, substitute instructor throughout the term and instructor for exercises and assignments (4 courses, 2000-2004)

Students (Co-)Advised
- David Gallup, "Plane-sweeping Stereo with Multiple Directions"
- Brian Clipp, "Camera Pose Estimation using GPS and Inertia Sensors"
- Rahul Raguram, "Robust estimation in computer vision"
- Ram Krishan Kumar, "Camera network calibration"
- Megha Pandey, "Dynamic scene reconstruction"
- Timothy Johnson, "Large scale scene reconstruction"
- Nirup-Kumar Pothireddy, "Camera network calibration"

Collaborating/former students
- Li Guan, "Dynamic structure from motion"
- Sudipta Sinha, "GPU based video feature tracking and matching"
- Wilson Gaviao, "Visual Reconstruction of Endoscopy Data for Diagnose Support"
- Greg Coombe, "Surface Light Fields of Real Objects Under Virtual Illumination"
- Xiaowei Li, "Robust Camera Pose Estimation"
- Paul Merrel, "Real-time 3D Scene Reconstruction"
- Hua Yang, "Camera Tracking through Linearizing the Local Appearance Manifold"

Postdocs
- Christopher Zach, "Fast structure from motion"
- Enrique Dunn, "View planning for optimal scene reconstruction"
- Seon Joo Kim, "Gain Adaptive Real-Time Stereo Streaming"

Publications

Accepted Papers
2008

- Rahul Raguram, Jan-Michael Frahm, Marc Pollefeys, "A Comparative Analysis of RANSAC Techniques Leading to Adaptive Real-Time Random Sample Consensus", ECCV 2008
- Xiaowei Li, ChangchangWu, Christopher Zach, Svetlana Lazebnik, Jan-Michael Frahm, "Modeling and Recognition of Landmark Image Collections Using Iconic Scene Graphs", ECCV 2008
- Changchang Wu, Brian Clipp, Xiaowei Li, Jan-Michael Frahm, Marc Pollefeys, "3D Model Matching with Viewpoint Invariant Patches (VIPs)", CVPR 2008 (oral acceptance rate 4%).
- Ram Krishan Kumar, Adrian Ilie, Jan-Michael Frahm, Marc Pollefeys, "Simple calibration of non-overlapping cameras with a mirror", CVPR 2008 (oral acceptance rate 4%).
- David Gallup, Jan-Michael Frahm, Philippos Mordohai, Marc Pollefeys, "Variable Baseline/Resolution Stereo", CVPR 2008 (oral acceptance rate 4%).
- Seon Joo Kim, Jan-Michael Frahm, Marc Pollefeys, "Radiometric Calibration with Illumination Change for Outdoor Scene Analysis", CVPR 2008.
- M. Pollefeys, D. Nister, J.-M. Frahm, A. Akbarzadeh, P. Mordohai, B. Clipp, C. Engels, D. Gallup, S.-J. Kim, P. Merrell, C. Salmi, S. Sinha, B. Talton, L. Wang, Q. Yang, H. Stewenius, R. Yang, G. Welch, H. Towles, "Detailed Real-Time Urban 3D Reconstruction from Video, IJCV special issue on Modeling Large-Scale 3D Scenes".
- Brian Clipp, Jan-Michael Frahm, Marc Pollefeys, Jae-Hak Kim, Richard Hartley, "Robust 6DOF Motion Estimation for Non-Overlapping Multi-Camera Systems", WACV'08.
- Changchang Wu, Jan-Michael Frahm, Friedrich Frauendorfer, and Marc Pollefeys, "Image Localization in Satellite Imagery with Feature-based Indexing", ISPRS'08, (winner of the best poster award).
- Friedrich Frauendorfer, Changchang Wu, Jan-Michael Frahm and Marc Pollefeys, "Visual Word-based Location Recognition in 3D models using Distance Augmented Weighting", 3DPVT 2008.
- Greg Coombe, Jan-Michael Frahm and Anselmo Lastra, "Capturing a Surface Light Field Under Virtual Illumination", 3DPVT 2008.
- Christopher Zach, David Gallup and Jan-Michael Frahm, "Fast Gain-Adaptive KLT Tracking on the GPU", CV GPU' 08 workshop in conjunction with CVPR'08.
- Changchang Wu, Friedrich Fraundorfer, Jan-Michael Frahm and Marc Pollefeys, "3D Model Search and Pose Estimation from Single Images using VIP Features", S3D workshop in conjunction with CVPR'08.
- Christopher Zach, David Gallup, Jan-Michael Frahm, Marc Niethammer, "Fast Global Labeling for Real-Time Stereo Using Multiple Plane Sweeps", Vision Modeling and Visualization, 2008, Konstanz, Germany

2007

- Paul Merrell, Amir Akbarzadeh, LiangWang, PhilipposMordohai, Jan-Michael Frahm, Ruigang Yang, David Nister, and Marc Pollefeys, "Real-Time Visibility-Based Fusion of Depth Maps", ICCV 2007.
- Seon Joo Kim, Jan-Michael Frahm, and Marc Pollefeys, "Joint Feature Tracking and Radiometric Calibration from Auto-Exposure Video", ICCV 2007.

- D. Gallup, J.-M. Frahm, P. Mordohai, Q. Yang, M. Pollefeys, "Real-Time Plane-sweeping Stereo with Multiple Sweeping Directions", IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR' 07), 2007.
- Hua Yang, Marc Pollefeys, Greg Welch, Jan-Michael Frahm, and Adrian Ilie, "Differential camera tracking through linearizing the local appearance manifold", IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR' 07).
- S. Sinha, J.-M. Frahm, M. Pollefeys, Y. Genc, "Feature Tracking and Matching in Video Using Programmable Graphics Hardware", Journal of Machine Vision and Application.
- Brian Clipp, Greg Welch, Jan-Michael Frahm, and Marc Pollefeys, "Structure from Motion via a Two-Stage Pipeline of Extended Kalman Filters", BMVC 2007.
- Jae-Hak Kim, Richard Hartley, Jan-Michael Frahm, and Marc Pollefeys, "Visual Odometry for Non-Overlapping Views Using Second-Order Cone Programming", ACCV 2007.
- Paul Merrell, Philippos Mordohai, Jan-Michael Frahm and Marc Pollefeys, "Evaluation of Large-Scale Scene Reconstruction", VRML in conjunction with ICCV 2007.
- S. J. Kim, D. Gallup, J.-M. Frahm, A. Akbarzadeh, Q. Yang, R. Yang, D. Nister, M. Pollefeys, "Gain Adaptive Real-Time Stereo Streaming", Int. Conf. on Computer Vision Systems, 2007
- Philippos Mordohai, Jan-Michael Frahm, Amir Akbarzadeh, Brian Clipp, Chris Engels, David Gallup, Paul Merrell, Christina Salmi, Sudipta Sinha, Brad Talton, Liang Wang, Qing-Xiong Yang Yang, Henrik Stewenius, Herman Towles, Greg Welch, Ruigang Yang, Marc Pollefeys, and David Nister, "Real-time video-based reconstruction of urban environments", ISPRS Working Group V/4 Workshop 3D-ARCH 2007: 3D Virtual Reconstruction and Visualization of Complex Architectures, (ETH Zurich, Switzerland).

2006
- Jan-Michael Frahm and Marc Pollefeys "RANSAC for (Quasi-)Degenerate data (QDEGSAC)", CVPR 2006, (oral acceptance rate 4%)
- Sudipta Sinha, Jan-Michael Frahm, Marc Pollefeys and Yakup Genc, "GPU based video feature tracking and matching", EDGE 2006
- Jan-Michael Frahm, Greg Coombe and Anselmo Lastra, "Capturing Surface Light Fields of Real Objects with a Projector Camera System", ProCams 2006

2005
- Jan-Michael Frahm, Kevin Köser, Daniel Grest and Reinhard Koch, "Markerless Augmented Reality with Light Source Estimation for Direct Illumination", Conference on Visual Media Production 2005, Dec., London, UK
- Reinhard Koch, Jan-Friso Evers-Senne, Jan-Michael Frahm, Kevin Köser, "3D Reconstruction and Rendering from Image Sequences", WIAMIS 2005, Switzerland, April 2005
- Jan-Michael Frahm, "Camera Self-Calibration with known Camera Orientation", Ph.D. Thesis, Shaker Verlag, ISBN 3-8322-4153-1

2004
- Jan-Michael Frahm and Reinhard Koch, "Pose estimation for a Multi-Camera System", DAGM 2004, Sept. 2004, Tübingen, Germany

2003
- Jan-Michael Frahm and Reinhard Koch, "Camera Calibration and 3D Scene Reconstruction from image sequence and rotation sensor data", 8th International Workshop on Vision, Modeling, and Visualization 2003, Nov. 19-21, 2003 Munich, Germany

- Daniel Grest, Jan-Michael Frahm, and Reinhard Koch, "A Color Similarity Measure for Robust Shadow Removal in Real Time", 8th International Workshop on Vision, Modeling, and Visualization 2003, Nov. 19 - 21, 2003 Munich, Germany
- Jan-Michael Frahm and Reinhard Koch, "Camera Calibration with known Rotation", International Conference Computer Vision 2003, Oct. 2003, Nice, France
- Jan-Michael Frahm and Reinhard Koch, "Robust Camera Calibration from Images and Rotation Data", DAGM 2003, Sept. 2003, Magdeburg, Germany

Invited Papers

- Brian Clipp, Rahul Raguram, Jan-Michael Frahm, Greg Welch, and Marc Pollefeys, "A Mobile 3D City Reconstruction System", IEEE VR workshop on Cityscapes.
- Akbarzadeh, J.-M. Frahm, et al., "Towards Urban 3D Reconstruction From Video", 3D PVT 2006
- Jan-Michael Frahm, J.-F. Evers-Senne, and R. Koch, "Distributed Interaction Processing and Visualization of 3D Scenes in Real-time", 3rd, Int. Symposium on Image and Signal Processing and Analysis, Sept. 2003, Rome, Italy

Invited Talks

- "The status and future of (semi-)automatic image based reconstruction", keynote at 3D-Arch 2009, Italy
- "Real-Time Large Scale Scene Reconstruction", ETH Zurich, Switzerland, 2008
- "Real-Time Large Scale Scene Reconstruction" Christian-Albrechts University of Kiel, 2008
- "An Introduction to CUDA for Automotive Applications", NVISION'08, San Jose, USA
- "Fast 3D Modeling and Applications", Max-Plank Institute, September 2006, Saarbrücken, Germany
- "Fast 3D Urban Reconstruction and Applications", Microsoft Research, September 2006, Redmond, WA, USA

Patents

- Patent No: DE 103 400 23.0 "Verfahren zur Kamerakalibrierung mittels Rotationssensor" (camera calibration with known rotation) 2004 Germany
- Patent "Framework for Augmented Reality Applications", Germany, US-patent in processing

Jan-Michael Frahm

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Christopher Zach, Enrique Dunn, Seon Joo Kim

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

CURRICULUM VITAE

HENRY FUCHS, Ph.D.

Federico Gil Professor of Computer Science
Adjunct Professor – Department of Biomedical Engineering

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Home phone: 919.933.0634

Born: 20 January 1948
Place: Tokaj, Hungary
U.S. Citizen since 1963
Married to Melanie Mintzer, M.D.
Children: Samuel and Miriam

EDUCATION

Ph.D.   University of Utah, Computer Science, 1975

B.A.   University of California at Santa Cruz, Information and Computer Science, 1970

ACADEMIC EXPERIENCE

1978-   UNC Chapel Hill
          Adjunct Professor of Biomedical Engineering (2000-)
          Federico Gil Professor of Computer Science (1988-)
          Adjunct Professor of Radiation Oncology (1988-2008)
          Professor of Computer Science (1983-)
          Associate Professor of Computer Science (1978-83).

1975-82   University of Texas at Dallas
          Adjunct Associate Professor of Medical Computer Science (Southwestern Medical School,
          The University of Texas Health Science Center) (1979-82)
          Adjunct Associate Professor of Programs in Mathematical Sciences (1978-82)
          Computer Science Coordinator of Programs in Mathematical Sciences (1977-78)
          Assistant Professor of Programs in Mathematical Sciences (1975-78).

1970-74   University of Utah
          Research Assistant and Teaching Fellow, Computer Science Department

ACTIVE RESEARCH GRANTS

1. Cisco Systems: "Multi-View Displays for Telepresence with Proper Perspectives" (Co-PI with Greg Welch)

2. Office of Naval Research: "Behavioral Analysis and Synthesis for Intelligent Training" (Co-PI with Greg Welch)

3. Renaissance Science Corporation: "Deployable Intelligent Projections Systems for Training"

PREVIOUS GRANTS

--National Science Foundation, National Institutes of Health, National Cancer Institute, U.S. Dept. of Energy
--Defense Advanced Research Projects Agency, U.S. Air Force, Office of Naval Research
--General Electric, Cisco Systems, Microelectronics Center of N.C., Atari, Schlumberger-Doll, Digital Equipment Corp., University of California Lawrence Livermore National Laboratory

PROFESSIONAL ACTIVITIES (selected)

Member, External Advisory Board, Harvard's Neuroimage Analysis Center, 2004-present.

Member, Dept. of Energy Blue Ribbon Panel for Evaluation of ASCI Program, 1998-1999.

UNC Delegate, New Vistas in Transatlantic Science and Tech Cooperation, Washington D.C., 1998.

Member, Information Science and Technology Study Group, Advanced Research Projects Agency,1994.

Member, Computer Science and Telecommunications Board, National Research Council,1993-97.

Co-Director (with Gary Bishop), NSF Invitational Workshop on Research Directions in Virtual Environments, Chapel Hill, NC, March 1992.

Member, Special Study Sections, National Institutes of Health; Review Panels and Site Visit Committees, National Science Foundation: 1978-

MEMBER, Program Committees (selected):

- ACM-SIGGRAPH (1979, 1980, 1981, 1985-1992, 1998-2001, 2005) Annual Conferences on Computer Graphics and Interactive Techniques
- Symposium on Interactive 3D Graphics, 2001 in Chapel Hill, N.C.
- Symposium on Interactive 3D Graphics, 1990 at Snowbird, Utah
- Workshop on Volume Visualization, 1989 at UNC-Chapel Hill
- Conference on Advanced Research in VLSI (1986 at MIT, 1987 at Stanford, 1988 at MIT, 1989 at Caltech)
- EUROGRAPHICS, 1997
- International Electronic Image Week (CESTA, SIGGRAPH) FRANCE (1986 and 1987)
- Computer Graphics International (1987 in Japan; 1988 in Switzerland)

INVITED TALKS (selected):

-Graphics Hardware 2008, Keynote, June 20, Sarajevo, Bosnia and Herzegovina
-PROCAMS 2008, Keynote, August 9, Los Angeles
- Eurographics 2004, Keynote (1 of 2), September 2004, Grenoble, France.
- J. Barkley Rosser Distinguished Lecture, University of Wisconsin, Madison, WI, 3/2001.
- Distinguished Lecture, National Science Foundation (NSF), 2/2001.
- Address, Sesquicentennial Anniversary, University of Rochester, October 2000
- Distinguished Lecture, Stanford University Department of Computer Science, June 2000

PATENTS

1. Fuchs, H., D. Cotting, M. Naef and M. Gross, "Methods, systems and computer program products for imperceptibly embedding structured light patterns in projected color images for display on planar and non planar surfaces," US Patent #7,182,465, February 7, 2007.

2. Keller, K., J. Ackerman, M. Rosenthal, H. Fuchs and A. State, "Methods and systems for real-time structured light depth extraction, and endoscope using real—time structured light depth extraction," US Patent 6,503,195, January 7, 2003.

CURRENT SELECTED PUBLICATIONS

Sonnenwald, D., H. Soderholm, J. Manning MD, B. Cairns MD, H. Fuchs and G. Welch (2008) "Exploring the potential of video technologies for collaboration in emergency medical care." Part I: Information sharing. Journal of the American Society for Information Science and Technology, accepted for Dec. 2008.

Sonnenwald, D., H. Soderholm, J. Manning MD, B. Cairns MD, H. Fuchs and G. Welch (2008) "Exploring the potential of video technologies for collaboration in emergency medical care. Part II: Task performance." Journal of the American Society for Information Science and Technology, accepted for Dec. 2008.

Peck, T., M. Whitton, and H. Fuchs (2008). "Evaluation of reorientation techniques for walking in large virtual environments," in Proceedings of IEEE 2008, IEEE Computer Society Press.

Fuchs, H., A. State, H. Yang, T. Peck, S.W. Lee, M. Rosenthal (MD/PhD), A. Bulysheva, C. Burke (MD) (2008). Optimizing a Head-Tracked Stereo Display System to Guide Hepatic Tumor Ablation. Proceedings of Medicine Meets Virtual Reality (MMVR) 2008. Studies in Health Technology Informatics 2008, vol. 132, pp. 126-131.

Johnson, T., F. Gyarfas, R. Skarbez, H. Towles, and H. Fuchs (2007). "A Personal Surround Environment: Projective Display with Correction for Display Surface Geometry and Extreme Lens Distortion," in Proceedings of IEEE Virtual Reality Conference, VR'07, pp. 147–154.

Johnson, T., and H. Fuchs (2007). Real-Time Projector Tracking on Complex Geometry Using Ordinary Imagery, Proceedings of CVPR'07, IEEE Conference on Computer Vision and Pattern Recognition (June 2007), pp. 1-8.

Johnson, T., and H. Fuchs (2007). A Unified Multi-Surface, Multi-Resolution Workspace with Camera-Based Scanning and Projector-Based Illumination, Eurographics Symposium on Virtual Environments/Immersive Projections Technology Workshop 2007, Wiemar, Germany, July 2007.

Brooks Jr, F., J. Cannon-Bowers, H. Fuchs, L. McMillan, and M. Whitton (2006). Virtual Environment Training for Dismounted Teams—Technical Challenges. Human Factors & Medicine Panel Workshop on Virtual Media for Military Applications, U.S. Military Academy, West Point, NY, June 2006, pp. 13–15.

Quirk, P., T. Johnson, R. Skarbez, H. Towles, F. Gyarfas, and H. Fuchs (2006). RANSAC-Assisted Display Model Reconstruction for Projective Display, Proceedings of Virtual Reality Conference (March 25-29, 2006), Emerging Display Technologies, p. 318.

State, A., K. Keller, and H. Fuchs (2005). Simulation-Based Design and Rapid Prototyping of a Parallax-Free, Orthoscopic Video See-Through Head-Mounted Display, Proceedings of IEEE Computer Society Washington, DC (October 2005), pp. 28–31.

Brooks, F., J. Cannon-Bowers, H. Fuchs, L. McMillan, and M. Whitton (2005). "A New VE Challenge: Immersive Experiences for Team Training," Proceedings of HCI International 2005, vol. 9, 2005.

Cotting, D., M. Naef, M. Gross, and H. Fuchs (2005). Imperceptible Patterns for Reliable Acquisition of Mixed Reality Environments. Proceedings of Intl. Workshop on Image Analysis for Multimedia Interactive Services 2005, (WIAMIS05, Montreux, Switzerland, April 13-15, 2005).

Welch, G., State, A., Ilie, A., Low, K., Lastra, A., Cairns, B., Towles, H., Fuchs, H., Yang, R., Becker, S., Russo, D., Funaro, J., and Dam, A. v. "Immersive Electronic Books for Surgical Training," IEEE Multimedia Jul 2005, 12(3), 22-35.

Cotting, D., R. Ziegler, M. Gross, and H. Fuchs (2005). Adaptive Instant Displays: Continuously Calibrated Projections Using Per-Pixel Light Control, Proceedings of Eurographics 2005 (Dublin, Ireland, Aug. 29-Sep. 2, 2005), vol. 24, no. 3, pp. 705-714.

State, A., Keller, K. P., and Fuchs, H. (2005). Simulation-Based Design and Rapid Prototyping of a Parallax-Free, Orthoscopic Video See-Through Head-Mounted Display. Proceedings of the Fourth IEEE and ACM International Symposium on Mixed and Augmented Reality (October 5-8, 2005). IEEE Computer Society, Washington, DC, pp. 28-31.

Ilie, Adrian, Kok-Lim Low, Greg Welch, Anselmo Lastra, Henry Fuchs, and Bruce Cairns (MD) (2004). Combining Head-Mounted and Projector-Based Displays for Surgical Training, Presence: Teleoperators and Virtual Environments April 2004, vol. 13, no. 2, pp. 128-145.

Welch, G., H. Fuchs, B. Cairns, K. Mayer-Patel, D. Sonnenwald, R. Yang, A. State, H. Towles, A. Ilie, M. Ampalam, S. Krishnan, H. Maurin, V. Noel, and M. Noland, Remote 3D Medical Consultation. Chapter in BROADMED: 1st IEEE/CreateNet International Conference on Telemedicine over Broadband and Wireless Networks. (Boston: Omnipress 2005), pp. 103-110.

Cotting, D., M. Naef, M. Gross, and H. Fuchs (2004). Embedding Imperceptible Patterns into Projected Images for Simultaneous Acquisition and Display, Proceedings of the IEEE/ACM International Symposium on Mixed and Augmented Reality 2004 (Washington DC, Nov 2-5, 2004), IEEE Computer Society Press, pp. 100-109.

State, A., K. Keller, M. Rosenthal, H.Yang, J. Ackerman and H. Fuchs (2003). Stereo Imagery from the UNC Augmented Reality System for Breast Biopsy Guidance. Medicine Meets Virtual Reality (Newport Beach, CA, Jan 22-25, 2003).

Raij, A., G. Gill, A. Majumder, H. Towles and H. Fuchs (2003). PixelFlex2: A Comprehensive, Automatic, Casually-Aligned Multi-Projector Display. IEEE International Workshop on Projector-Camera Systems (PROCAMS-2003), Nice, France.

Kum, S.-U., K. Mayer-Patel and H. Fuchs (2003). Real-Time Compression for Dynamic 3D Environments. Proceedings of the 11th ACM International Conference on Multimedia (Berkeley, CA). ACM Multimedia 2003, pp. 185-194.

Kelshikar, N., X. Zabulis, J. Mulligan, K. Daniilidis, V. Sawant, S. Sinha, T. Sparks, S. Larsen, H. Towles, K. Mayer-Patel, H. Fuchs, J. Urbanic, K. Benninger, R. Reddy, and G. Huntoon (2003). Real-time Terascale Implementation of Tele-immersion. International Conference on Computation Science (Melbourne, Australia). Lecture Notes in Computer Science 2003, vol. 2660, p. 718.

Chen, W.-C., Lars Nyland, Anselmo Lastra, Henry Fuchs (2003). Video techniques: Acquisition of large-scale surface light fields. SIGGRAPH International Conference on Computer Graphics (San Diego, 2003), p. 1.

Henry Fuchs

Information concerning teaching activities over the academic years 2003-04 through
2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software,
research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

John H. Halton
Professor of Computer Science

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CB #3175, Sitterson Hall, Room 147
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Home:
108 Carolina Forest
Chapel Hill, NC 27516
(919) 942-4856

Education:
- B.A. 1953 (Cambridge)
- M.A. 1957 (Cambridge)
- D.Phil. 1960 (Oxford)

Honors:
- Fellow, Cambridge Philosophical Society (F.C.P.S.), 1954.
- Fellow, Institute of Mathematics and Its Applications (F.I.M.A.), 1964.
- Fellow, British Computer Society (F.B.C.S.), 1980.
- Senior Member, Institute of Electrical and Electronic Engineers (S.M.I.E.E.E.), 1984.
- Chartered Engineer (C.Eng.), British Engineering Council, 1990.
- Chartered Mathematician (C.Math.), Institute of Mathematics Council, 1992.
- Chartered Scientist (C.Sci.), British Science Council, 2006.

Research Interests:
Applications of combinatorial and probabilistic methods, and scientific and mathematical analysis, to computational, scientific, and engineering problems.

Monte Carlo method. All aspects of the method are studied---including the design and analysis of quasi-random sequences and sets; pseudo-random and quasi-random trees for parallel and branching computations; sampling in multi-dimensional spaces, with generalized probabilities; efficient variance-reduction techniques; generalized antithetic transformations; solution of large linear and nonlinear systems; sequential sampling techniques; parallel- and multi-processing; smooth approximation; optimization; and all kinds of applications.

Combinatorial, probabilistic, geometric, and parallel algorithms. These are designed and analyzed for a variety of problems, such as the Traveling Salesman Problem, application of tree structure to computation, bin-packing, triangulation, and the Shoelace Problem.

Mathematics and numerical analysis. Various problems relating to combinatorics, graphs, algebra, analysis, asymptotics, and geometry are investigated.

Absolute and probabilistic bounds on performance of complex systems. These include multi-computer algorithms, questions of scale, networking and communication paradigms, control schemes, debugging strategies, fault-tolerance and error-correction, distributed operating systems, and parallel languages.

PC boards and VLSI chips. The design of efficient layouts, and the efficient process of design of such circuits, are studied and analyzed.

Selected Publications:

An outline of quasi-probability. *Monte Carlo Methods & Applications*, 10 (2004) pp. 183–196.

Reusing paths in radiosity and global illumination. *Monte Carlo Methods & Applications* 10 (2004) pp. 575–585 (with M. SBERT and P. BEKAERT).

A general estimator for Fredholm integral equations of the second kind. Universitat de Girona, Research Report (2004) 5 pp. (with M. SBERT and P. BEKAERT).

"Sequential Monte Carlo techniques for solving non-linear systems." Invited presentation at *Fifth IMACS Seminar on Monte Carlo Methods—MCM2005*, Florida State University, Tallahassee, FL, May 2005. 26 pp.

Quasi-probability—why quasi-Monte-Carlo methods are statistically valid and how their errors can be estimated statistically. *Monte Carlo Methods & Applications*, 11 (2005) pp. 203–350.

Sequential Monte Carlo techniques for solving non-linear systems. *Monte Carlo Methods & Applications*, 12 (2006) pp. 113–141.

Fast GPU-based reuse of paths in radiosity. *Monte Carlo Methods & Applications*, 13 (2007) pp. 253–274 (with F. CASTRO, G. PATOW, and M. SBERT).

Efficient reuse of paths for random walk radiosity. *Computers & Graphics*, 32 (2008) pp. 65–81 (with F. CASTRO and M. SBERT).

Sequential Monte Carlo for linear systems—a practical summary. *Monte Carlo Methods & Applications*, 14 (2008) pp. 1–27.

Sigma-algebra theorems. *Monte Carlo Methods & Applications*, 14 (2008) pp. 171–189.

John Halton

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Kye S. Hedlund

Associate Professor
Department of Computer Science
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Chapel Hill, North Carolina 27599-3175
Office phone: (919) 962-1756
Email: hedlund@cs.unc.edu

Personal Data

Date of Birth: December 2, 1953
Marital status: married

Research Interests

Applications of Computers to the Biological Sciences
Ant Systematics

Education

Ph.D. Purdue University, Computer Science, 1982
M.S. Purdue University, Computer Science, 1979
B.A. Boston University, cum laude with distinction in Mathematics, 1975

Awards

Outstanding Paper Award, International Conference on Computer Design, IEEE Computer Society, 1984 (with L. Snyder; awarded for the paper "Systolic Architectures - A Wafer Scale Approach").

MCNC Teleclass Teaching Merit Award 1987.

UNC Junior Faculty Development Award, 1985.

IBM Faculty Development Award, 1983-1984. Awarded to fifty Assistant Professors throughout the country for excellence of research in science and engineering.

Raymond F. Boyce Teaching Award, Purdue University, 1978. Awarded annually for teaching excellence to one teaching assistant in the Department of Computer Science.

Grants

"Course Development Award," John T. Lupton Opportunities Func, UNC. $5000.

"Synthesis of High Speed CMOS Circuits," Microelectronics Center of North Carolina (1987, Principal Investigator). $20,000 (plus $27,000 matching funds from ONR Grant N00014-86-0680).

"Silicon Compilation," Microelectronics Center of North Carolina (1987, Principal Investigator). $20,000 (plus $20,000 matching funds from ONR Grant N00014-86-0680).

"Automated Translation of Netlists to Symbolic Layout," Microelectronics Center of North Carolina (1986, Principal Investigator). $20,000 (plus $27,349 matching funds from NSF Grant MCS-8219306).

"Wafer Scale Integration of Parallel Processors," Semiconductor Research Corporation (1985, Principal Investigator). $130,000.

"Automated Performance Optimization of MOS Integrated Circuits," Microelectronics Center of North Carolina (1985, Principal Investigator). $22,500 (plus $22,500 matching funds from NSF Grant MCS-8219306)

UNC Junior Faculty Development Award (1984), $3,000.

IBM Faculty Development Award (1983-5). $60,000.

"Transfer of Software Engineering Methodology to VLSI Design," Semiconductor Research Cooperative (1983). Grant 82-11-003 (Investigator) $80,475.

"Wafer Scale Integration of Parallel Processors," National Science Foundation (1982-5); Grant MCS-8302641 (Principal Investigator). $120,075.

Refereed Publications

Rajgopal, S., Hedlund, K., and Reaves, D. "Integrating Hardware Verification with CHDLs," *European Design Automation Conference*, 1991.

Rajgopal, S., Hedlund, K. and Reaves, D. "Integrating Hardware Verification with Design Automation," *International Workshop on Formal Methods in VLSI Design*, 1991.

Hedlund, K. "AESOP: A Tool for Automated Transistor Sizing," *ACM IEEE 23rd Design Automation Conference*, 1987. pg. 114--120.

Hedlund, K. "The Design of a Prototype WASP Machine," in Wafer Scale Integration (ed. G. Saucier & J. Trilhe), *North Holland,* 1986, pg. 89-97.

Hedlund, K. "WASP - A Wafer-scale Systolic Processor," *IEEE International Conference on Computer Design*, 1985. pg. 665-671.

Hedlund, K. "Electrical Optimization of PLAs," *ACM IEEE 22nd Design Automation Conference*, 1985. pg. 681-687.

Hedlund, K. "Models and Algorithms for Transistor Sizing in MOS Circuits," *IEEE International Conference on Computer-Aided Design*, 1984. pg. 501-504.

Hedlund, K. and Snyder, L. "Systolic Architectures - A Wafer Scale Approach," *IEEE International Conference on Computer Design*, 1984. Recipient of Best Paper Award. pg. 504-510.

Hedlund, K. and Snyder, L.   "Wafer Scale Integration of Configurable, Highly Parallel Processors," *Proceedings of the 1982 International Conference on Parallel Processing (IEEE and ACM)*. pg. 262-264.

Web Publication

Online Catalog and Identification Guide to the Ants of North America (work in progress). This is a virtual monograph available on the World Wide Web. This project has two goals: 1) to put on the World Wide Web a catalog and guide to identification for the North American ants, and 2) to explore the nature and implementation of a virtual monograph. The Online Catalog has two versions. The conventional print version, http://www.cs.unc.edu/~hedlund/ants/catalog/, delivers to the reader a format similar to a conventional printed catalog. It differs from a printed catalog by having all the data contained in a database, and the information seen by the reader is automatically generated from the database. This database centered design means that the catalog can be easily searched. Also, it can be easily kept up to date because each piece of information is stored only once in the database. Thus when there is a change in nomenclature there is a single change to the database, and the catalog is automatically regenerated to reflect the change throughout. The second version of the catalog, http://www.cs.unc.edu/~hedlund/dev/ants/screen/, provides the same information but in a format that better exploits the capabilities of the computer. Information is presented by overlapping windows that make it easier for the reader to navigate the complex information structure inherent in the catalog. Furthermore, the underlying paradigm of its usage is changed from passive reading of pre-prepared text to an active navigation of databases that allow the reader control over the form and content of the information seen.

New Courses

COMP 006D "The World Wide Web – Do We Really Need It". First year seminar taught Fall 2001 and Spring 2000. Computing technology has launched us into an entirely new world, one that will permanently affect our lives and the lives of our children and grandchildren. Yet, there is little debate about its value or consideration of the consequences. In the present climate of technological worship, American society presents us with a number of unchallenged beliefs such as:
- Technology is progress
- Progress is good (and inevitable)
- Science is the only valid means of knowing the world
- The more I consume, the happier I am

Where do these assumptions come from? Are they true? Do other societies have different views of the world? What is the relationship between the technocratic mindset and the world environmental crisis? This course is a critical and questioning examination of science and technology in which students will be challenged to question everything. We will examine how the World Wide Web is changing our world and what some of its effects may be. How does computing technology affect the way we view ourselves, the problems we can pose, and how we judge solutions to be good or bad? More generally, how does technology impact us as individuals and our culture? We will examine the western scientific worldview, its role in the environmental crisis, and alternative worldviews: the Native American perspective, Zen Buddhism, shamanism and mysticism.

Kye Hedlund

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

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Education

Ph.D. Computer Science, University of Washington, September 1989.

Thesis:	*The Real-Time Producer/Consumer Paradigm: Toward Verifiable Real-Time Computations*.
Advisor:	Professor Alan C. Shaw.
Honors:	IBM Graduate Fellowship 1987-1988, 1988-1989.

M.Sc. Computer Science, University of Toronto, November 1984.

Thesis:	*Real-Time Computer Systems: A Perspective on Performance, Modeling and Design*.
Advisor:	Professor G.S. Graham.
Honors:	University of Toronto Open Fellowship 1982-1983.

B.S. Mathematics with Highest Distinction, University of Illinois at Urbana-Champaign, May 1982.

Honors:	Phi Beta Kappa, James Scholar 1978-1981.

Academic Experience

Gillian Cell Distinguished Professor of Computer Science, University of North Carolina at Chapel Hill, Department of Computer Science, Chapel Hill, NC, 2008–present.

S. S. Jones Distinguished Professor of Computer Science, University of North Carolina at Chapel Hill, Department of Computer Science, Chapel Hill, NC, 2001–2008.

S. S. Jones Distinguished Term Associate Professor of Computer Science, University of North Carolina at Chapel Hill, Department of Computer Science, Chapel Hill, NC, 2000.

Associate Professor, University of North Carolina at Chapel Hill, Department of Computer Science, Chapel Hill, NC, 1996–2000.

Visiting Professor, Carnegie Mellon University, School of Computer Science, Pittsburgh, PA, 1994.

Assistant Professor, University of North Carolina at Chapel Hill, Department of Computer Science, Chapel Hill, NC, 1989–1995.

Instructor, Project Upward Bound, University of Illinois, Department of Mathematics, Urbana, IL, 1979–1982.

Honors and Awards

Gillian Cell Distinguished Professor of Computer Science, University of North Carolina at Chapel Hill, College of Arts and Sciences, Chapel Hill, NC, June 2008.

Outstanding Teaching Award, Computer Science Student Association, University of North Carolina at Chapel Hill, Department of Computer Science, May 2008.

Favorite Faculty Award, an award given by the Computer Science majors of the 2004 graduating class, May 2004.

Edward Kidder Graham Outstanding Faculty Award, an award given by the Class of 2004 and the General Alumni Association, April 2004.

Edward Kidder Graham Advisor of the Year Award, an award given by the Class of 2004 and the General Alumni Association, April 2004.

Award Papers: ACM SIGCOMM 2000, 2003.

Professional Activities

Editor   Associate Editor, *Real-Time Systems*, Kluwer Academic Publishers, The Netherlands, 2003-present.

Executive Committees   ACM/SIGCOMM Internet Measurement Conference Steering Committee, 2005-present.

College of Reviewers, Canada Research Chairs Program, 2004-present.

Statistical and Applied Mathematical Sciences Institute (SAMSI) program on Network Modeling for the Internet, 2002-2004.

IEEE Technical Committee on Real-Time Systems, 2000-present.

Other Committees   *IEEE Distinguished Visitors Program*, 2004–2007.

Conference Program Chair   11th International Workshop on Quality-of-Service (Co-Chair), Monterey, CA, June 2003.

Conference General Chair   ACM SIGCOMM Internet Measurement Conference, San Diego, CA, October 2007.

Member of Conference Program Committee   ACM SIGMETRICS 2008, Annapolis, MA, June 2008.

9th Passive and Active Measurement Conference 2008, Cleveland, OH, April 2008.

IEEE INFOCOM 2008, Phoenix, AZ, April 2008.

6th ACM SIGCOMM Workshop on Hot Topics in Networks, Atlanta, GA, November 2007.

15th IEEE International Conference on Network Protocols, Beijing, China, October 2007.

5th IEEE Workshop on Embedded Systems for Real-Time Multimedia, Salzburg, Austria, October 2007.

Workshop on Experimental Computer Science, ACM FCRC, San Diego, CA, June 2007.

15th International Workshop on Quality-of-Service, Chicago, IL, June 2007.

17th International Workshop on Network and Operating System Support for Digital Audio and Video, Urbana-Champaign, IL, June 2007.

10th IEEE Global Internet Symposium 2007, Anchorage, AK, May 2007.

ACM SIGMETRICS 2007, San Diego, CA, June 2007.

14th IEEE International Conference on Network Protocols, Santa Barbara, CA, October 2006.

ACM Internet Measurement Conference 2006, Rio de Janeiro, Brazil, October 2006.

4th IEEE Workshop on Embedded Systems for Real-Time Multimedia, Seoul, Korea, October 2006.

Second ACM SIGCOMM Conference on Future Networking Technologies, Lisbon, Portugal, December 2006.

16th International Workshop on Network and Operating System Support for Digital Audio and Video, Newport, RI, June 2006.

IEEE Workshop on Research Directions for Security and Networking in Critical Real-Time and Embedded Systems, San Jose, CA, April 2006.

IEEE INFOCOM 2006, Barcelona, Spain, April 2006.

13th IEEE International Conference on Network Protocols, Boston, MA, November 2005.

15th International Workshop on Network and Operating System Support for Digital Audio and Video, Skamania, WA, June 2005.

IEEE INFOCOM 2005, Miami, FL, March 2005.

SPIE/ACM Multimedia Computing and Networking 2005, San Jose, CA, January 2005.

ACM Multimedia 2004, New York, NY, October 2004.

ACM Internet Measurement Conference 2004, Taormina, Italy, October 2004.

16th EUROMICRO Conference on Real-Time Systems, Catania, Italy, June-July 2004.

14th International Workshop on Network and Operating System Support for Digital Audio and Video, Cork, Ireland, June 2004.

12th International Workshop on Quality-of-Service, Montreal, Canada, June 2004.

10th IEEE Real-time and Embedded Technology and Applications Symposium, Toronto, Canada, May 2004.

IEEE INFOCOM 2004, Hong Kong, March 2004.

24th IEEE Real-Time Systems Symposium, Cancun, Mexico, December 2003.

19th ACM Symposium on Operating Systems Principles, Lake George, New York, October 2003.

15th EUROMICRO Conference on Real-Time Systems, Porto, Portugal, July 2003.

Ninth IEEE Real-Time and Embedded Technology and Applications Symposium, Toronto, CA, May 2003.

SPIE/ACM Multimedia Computing and Networking 2003, San Jose, CA, January 2003.

Conference Organizing Committees

Finance Chair, IEEE Real-Time Systems Symposium, Miami, FL, December 2005.

Finance Chair, IEEE Real-Time Systems Symposium, Lisbon, Portugal, December 2004.

Finance Chair, IEEE Real-Time Systems Symposium, Cancun, Mexico, December 2003.

Poster Session Chair, ACM Symposium on Operating System Principles, Bolton Landing, NY, October 2003.

Refereed Publications

Technical Papers

Correlations of Size, Rate, and Duration in TCP Connections: The Case Against, C. Park, F. Hernández-Campos, J.S. Marron, K. Jeffay, F.D. Smith, *in submission*.

adudump: Passive, Streaming Inference of TCP Connection Structure and Application Behavior, J. Terrell, K. Jeffay, F.D. Smith, Passive and Active Measurement Conference (PAM 2009), Seoul, South Korea, April 2009, *in submission*.

Exposing Server Performance to Network Managers Through Passive Network Measurements, J. Terrell, K. Jeffay, F.D. Smith, J. Gogan, J. Keller, IEEE Internet Network Management Workshop, Orlando, FL, October 2008, *to appear*.

Multi-Resolution Anomaly Detection for the Internet, L. Zhang, Z. Zhu, K. Jeffay, J.S. Marron, F.D. Smith, IEEE Workshop on Network Management, Phoenix, AZ, April 2008, 6 pages.

The Effects of Active Queue Management and Explicit Congestion Notification on Web Performance, L. Le, J. Aikat, K. Jeffay, F.D. Smith, IEEE/ACM Transactions on Networking, Volume 15, Number 6, December 2007, pages 1217-1230.

Co-Scheduling Variable Execution Time Requirement Real-time Tasks and Non Real-Time Tasks, A. Singh, K. Jeffay, Proceedings of the 19th Euromicro Conference on Real-Time Systems, Pisa, Italy, July 2007, pages 191-200.

Quantifying the Effects of Recent Protocol Improvements to Standards-Track TCP: Impact on Web Performance, M.C. Weigle, K. Jeffay, F.D. Smith, Computer Communications, Volume 29, Number 15, September 2006, pages 2853-2866.

Tmix: A Tool for Generating Realistic TCP Application Workloads in ns-2, M.C. Weigle, P. Adurthi, F.

Hernández-Campos, K. Jeffay, F.D. Smith, ACM Computer Communications Review, Volume 36, Number 3, July 2006, pages 67-76.

A Loss and Queuing-Delay Controller for Router Buffer Management, L. Le, K. Jeffay, F.D. Smith, Proceedings of the 26th IEEE International Conference on Distributed Computing Systems, Lisbon, Portugal, July 2006, 10 pages.

Understanding Patterns of TCP Connection Usage with Statistical Clustering, F. Hernández-Campos, A.B. Nobel, F.D. Smith, K. Jeffay, Proceedings of the 13th IEEE/ACM International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS), Atlanta, GA, September 2005, pages 35-44.

Delay-Based Early Congestion Detection and Adaptation: Impact on Web Performance, M.C. Weigle, K. Jeffay, F.D. Smith, Computer Communications, Volume 8, Number 8, May 2005, pages 837-850.

Extremal Dependence: Internet Traffic Applications, F. Hernández-Campos, K. Jeffay, C. Park, J.S. Marron, S.I. Resnick, Stochastic Models, Volume 21, Number 1, 2005, pages 1-35.

Generating Realistic TCP Workloads, F. Hernández-Campos, F.D. Smith, K. Jeffay, Proceedings of the Computer Measurement Group's 2004 International Conference, Las Vegas, NV, December 2004, pages 273-284.

Differential Congestion Notification: Taming the Elephants, L. Le, J. Aikat, K. Jeffay, F.D. Smith, Proceedings of the 12th IEEE International Conference on Network Protocols, Berlin, Germany, October 2004, pages 118-128.

Stochastic Models for Generating Synthetic HTTP Source Traffic, J. Cao, W.S. Cleveland, Y. Gao, K. Jeffay, F.D. Smith M.C. Weigle, Proceedings of IEEE INFOCOM 2004, Hong Kong, March 2004, Volume 3, pages 1546-1557.

Variability in TCP Roundtrip Times, J. Aikat, J. Kaur, D. Smith, K. Jeffay, Proceedings of the 2003 ACM SIGCOMM Internet Measurement Conference, Miami Beach, FL, October 2003, pages 279-284.

Tracking the Evolution of Web Traffic: 1995-2003, F. Hernández-Campos, K. Jeffay, F.D. Smith, Proceedings of the 11th IEEE/ACM International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS), Orlando, FL, October 2003, pages 16-25.

The Effects of Active Queue Management on Web Performance, L. Le, J. Aikat, K. Jeffay, F.D. Smith, Proceedings of ACM SIGCOMM 2003, Karlsruhe, Germany, August 2003, pages 265-276.

Book Chapters   *Rate-Based Resource Allocation Methods*, K. Jeffay, in, "Handbook of Real-Time and Embedded Systems," I. Lee, J. Y-T. Leung, S.H. Son, editors, Chapman & Hall/CRC Press, Boca Raton, FL, 2008, pages 4-1 – 4-15. .

Visualization and Natural Control Systems for Microscopy, R.M. Taylor II, D. Borland, F.P. Brooks Jr., M. Falvo, M. Guthold, T. Hudson, K. Jeffay, G. Jones, D. Marshburn, S.J. Papadakis, L.-C. Qin, A. Seeger, F.D. Smith, D.H. Sonnenwald, R. Superfine, S. Washburn, C. Weigle, M.C. Whitton, P. Williams, L. Vicci, W. Robinett, in "Visualization Handbook," C. Johnson, C. Hansen, editors, Harcourt Academic Press, 2005, pages 875-900.

An Empirical Study of Delay Jitter Management Policies, D.L. Stone, K. Jeffay, in "Readings in Multimedia Computing and Networking," K. Jeffay, H.J. Zhang, editors, Morgan Kaufmann, San Francisco, CA, 2002, pages 525-537.

The Performance of Two-Dimensional Media Scaling for Internet Videoconferencing, P. Nee, K. Jeffay, G. Danneels, in "Readings in Multimedia Computing and Networking," K. Jeffay, H.J. Zhang, editors, Morgan Kaufmann, San Francisco, CA, 2002, pages 581-592.

Abstracts & Short Papers   *Quantifying the Effects of Recent Protocol Improvements to Standards-Track TCP*, M.C. Weigle, K. Jeffay, and F.D. Smith, Proceedings of the 11th IEEE/ACM International Symposium on Modeling,

Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS), Orlando, FL, October 2003, pages 226-229.

Posters   *Multivariate SVD Analyses For Network Anomaly Detection*, J. Terrell, L. Zhang, K. Jeffay, A. Nobel, H. Shen, F.D. Smith, Z, Zhu, ACM SIGCOMM 2005 Poster Session, Philadelphia, PA, August 2005.

How Real Can Synthetic Traffic Be?, F. Hernández-Campos, K. Jeffay, F.D. Smith, ACM SIGCOMM 2004 Poster Session, Portland, OR, August 2004.

A Non-Parametric Approach to Generation and Validation of Synthetic Network Traffic, F. Hernández-Campos, A. Nobel, F.D. Smith, K. Jeffay, IMA Workshop on Measurement, Modeling, and Analysis of the Internet, Minneapolis, MN, January 2004.

Books and Proceedings   *Quality-of-Service — IWQoS 2003*, K. Jeffay, I. Stoica, K. Wehrle, editors, Lecture Notes in Computer Science, Springer-Verlag, Berlin, Heidelberg, Germany, Volume 2707, 2003, ISBN 3-540-40281-0, 517 pages.

Unrefereed Publications

Invited Papers   *Modeling and Generation of TCP Application Workloads*, F. Hernández-Campos, K. Jeffay, F.D. Smith, Proceedings of the 4th IEEE International Conference on Broadband Communications, Networks, and Systems, Raleigh, NC, September 2007, 10 pages.

Statistical Clustering of Internet Communication Patterns, F. Hernández-Campos, A.B. Nobel, F.D. Smith, K. Jeffay, Proceedings of the 35th Symposium on the Interface of Computing Science and Statistics, Salt Lake City, UT, July 2003, Computing Science and Statistics, Volume 35, 2004.

Software Distributions   *tmix* — A synthetic TCP workload generator, F. Hernández Campos, K. Jeffay, F.D. Smith, June 2005.

     Distributed to other academic and industry networking research groups via the Web.

UNC VNC — A version of the public domain workspace sharing system VNC to support secure sharing of workspace regions and windows of individual applications. J. Branscomb, L. Fowler, K. Jeffay, August 2004.

     Distributed to other research groups and the public via the Web and SourceForge.

thttp 2003 — An HTTP/v1.0 and v1.1 traffic generation program used to simulate the traffic generated by a collection of geographically distributed web browsers and servers. L. Le, A. Van Osdol, F.D. Smith, K. Jeffay, January 2004.

     Distributed to other academic and industry networking research groups via the Web.

Patents   *Method for Understanding the Use of TCP/IP Networks by Users, and Non-Parametric Generation of Synthetic Internet Traffic*, U.S. Patent pending, F. Hernández-Campos, K. Jeffay, F.D. Smith, A. Nobel, March 2004.

Grants and Awards

Active   *Synthetic Traffic Generation Tools and Resource: A Community Resource for Experimental Networking Research*, K, Jeffay, F.D. Smith, UNC, M. Weigle, Old Dominion University, A. Vahdat, University of California San Diego, P. Barford, University of Wisconsin, National Science Foundation, grant number CRI 07-09081, August 2007, 3 years, $799,745.

Completed   *Modeling and Testing of Application Workloads on Corporate Enterprise Networks*, K, Jeffay, F.D.

Smith, IBM Global Services Faculty Award, September 2006, 2 years, $70,000 (exempt from indirect costs).

Tera-pixels: Using High-resolution Pervasive Displays to Transform Collaboration and Teaching, K, Jeffay, A. Lastra, K. Mayer-Patel, L. McMillan, F.D. Smith, National Science Foundation (CISE RI Program), grant number EIA 03-03590, August 2003, 5 years, $962,902.

Extracting and Using Semantic Information in Network Workloads, K, Jeffay, F.D. Smith, IBM Global Services Faculty Award, September 2006, 1 year, $40,000 (exempt from indirect costs).

Generation and Validation of Synthetic Internet Traffic, K, Jeffay, F.D. Smith, A.B. Noble, National Science Foundation, grant number ANI 03-23648, September 2003, 3 years, $470,000.

Invited Presentations

Keynote Addresses   *Network Neutrality Considered Harmful, Revisiting the Quality-of-Service Morass*
> *ACM International Workshop on Network and Operating System Support for Digital Audio and Video*, Newport, RI, May 2006.

Rate-Based Resource Allocation Methods for Multimedia Computing
> *SPIE Multimedia Computing and Networking 2003*, Santa Clara, CA, January 2003.

Distinguished Lectures   *The Most Overlooked Problem in Networking*
> University of Minnesota, Minneapolis, MN, January 2008.

The Effect of Active Queue Management on Web Performance: The Good, the Bad, and the Ugly
> University of Nebraska, Lincoln, NE, November 2003.
> University of Pennsylvania, April 2004.

Colloquia   *The Evolution of Quality-of-Service on the Internet*
> IEEE Computer Society Seattle Chapter, Seattle, WA, September 2005.

Modeling and Generating TCP Application Workloads
> Georgia Institute of Technology, Atlanta, GA, September 2005.
> Microsoft Research, Redmond, WA, September 2005.
> Worcester Polytechnic Institute, Worcester, MA, July 2005.
> Cisco Systems, RTP, NC, May 2005 (presently jointly with F. Hernandez-Campos and F.D. Smith).

A Rate-Based Execution Abstraction For Embedded Real-Time Systems
> University of Pennsylvania, April 2004.

How "Real" Can Synthetic Network Traffic Be?
> University of Virginia, March 2004.

Non-Parametric Approach to Generation and Validation of Synthetic Network Traffic
> Columbia University, New York, NY, January 2004.

Is Explicit Congestion Notification (ECN) Worthwhile?
> Cisco Systems, San Jose, CA, October 2003.
> Intel Architecture Labs, Hillsboro, OR, October 2003.

Students Supervised

Ph.D.
Candidates

Jeffrey S. Terrell, expected graduation: May 2009.

Dissertation: *Consider the Source: Network measurement by inference of application intent.*

John M. Menges, expected graduation: May 2009.

Dissertation: *Concur: An Investigation of Lightweight Migration in Support of Centralized Synchronous Distributed Collaboration.*

Honors: IBM Graduate Fellowship, 1992-1995, Computer Science Department Alumni Fellowship, 1995.

Current Employer: Amazon.com, Seattle, WA.

Ph.D.
Graduates

Abhishek Singh, May 2008.

Dissertation: *Co-Scheduling Variable Execution Time Requirement Real-Time Tasks and Non Real-Time Tasks.*

Current Employer: Microsoft, Redmond, WA.

Félix Hernández-Campos, May 2006.

Dissertation: *Generation and Validation of Empirically-Derived TCP Application Workloads.*

Honors: CMG Graduate Fellowship, 2002-2003.

Current Employer: Google Inc., Mountainview, CA.

Nguyen Tuong Long Le, December 2005.

Dissertation: *Investigating the Effects of Active Queue Management on the Performance of TCP Applications.*

Honors: ACM SIGCOMM 2003 Best Paper Award.

Current Employer: NEC Research, Heidelberg, Germany.

Thomas C. Hudson, May 2004. (Jointly supervised with R.M. Taylor.)

Dissertation: *Adapting a Collaborative, Force-Feedback, Graphical User Interface to Best-Effort Networks.*

Honors: Board of Governors Fellowship, 1997-2000.

Current Employer: University of North Carolina at Wilmington, Wilmington, NC.

Michele Aylene Clark Weigle, May 2003.

Dissertation: *Investigating the Use of GPS Synchronized Clocks in TCP Congestion Control.*

Honors: National Science Foundation Graduate Fellowship, 1996-1999.
Department of Computer Science Alumni Fellowship, 2002-2003.

Current Employer: Old Dominion University, Norfolk, VA.

M.Sc.
Candidates

Jay Aikat, Honors: CMG Graduate Fellowship, 2004-2005.

M.Sc.
Graduates,
Non-Thesis
Option

Srinivas Krishnan 2007.	Angela Van Osdol, 2005
Ashish Aswathi, 2007.	Abhishek Singh, 2004.
Lu Ping, 2007.	Nguyen Tuong Long Le, 2003.
Jeffrey S. Terrell, 2006.	

Graduate Student Committee Service

Ph.D. Dissertation Committee Member	Hennadiy Leontyev, 2009	Nathan Fisher 2007.
	Ritesh Kumar 2009	Lingsong Zhang (Department of Statistics) 2007.
	Andy Jones, 2009	Uma Devi, 2006.
	Aaron Block, 2009.	David Ott, 2005.
	Gennette Gil, 2008.	Shelby Funk, 2004.
	John Calandrino, 2008.	Philip Holman, 2004.
	Alok Shiram, 2007.	Juhyun Park (Department of Statistics), 2004.
	Sushant Rewaskar, 2007.	Anand Srinivasan, 2003.

Undergraduate Honors Projects

Shaddi Hasan, *Real-Time Traffic Visualization*, 2008.

Boriana Ditcheva, Lisa Fowler, Elise London, *Real-Time Traffic Modeling and Analysis With a CloudShield Server*, 2005.

Courtney McCarthy, *Internet Traffic Data Analysis*, 2003.

Departmental Service

Chair, Curriculum and Planning Committee, 2007-2008.

Computer Science Club Faculty Advisor, 2002-present.

Chair, Faculty Search Recruiting Committee, 1998-1999, 2000-2002, 2005-2007.

Committee on Defining the Role and Titles of Research Faculty, Fall 2000.

Director of Undergraduate Studies, 1992-present.

"Coach," ACM International Undergraduate Programming Contest, 1994-present.

University Service

Academic Advising Implementation Committee, 2007-2008.

CIO Search Committee, 2007.

Communication Fee Metric Task Force, 2006.

Strategic Planning for Information Technology, Communications and Networking Committee, 2006.

Vice-Chair, Division of Natural Sciences, College of Arts and Sciences, 2001-present.
Acting Chair, January 2003-June 2003.

Information Technology Services Telecommunications Advisory Committee, 2005-present.

Administrative Board of the General College, 2005-2007.

SACS Accreditation Compliance Committee, Academic Programs, 2005.

Undergraduate Admissions Advisory Committee, 2001-2003.

Service to Undergraduate Admissions:

Academic Days, Organizer, 2008.

Science Saturday Participant, 2005.

Explore Carolina Faculty Participant, 2005.

Kevin Jeffay

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Michele Wiegle

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

- Currently chair of the departmental curriculum committee -- Responsible for leading the department's efforts to evolve and improve the undergraduate curriculum and degree requirements.
- Head of dept advising -- Oversee undergraduate advising for the department.
- Participated in the development of the new BA degree in computer science.
- Member, University committee on Academic Advising -- Helping to overhaul the advising structures between departments and the University.
- SACS Accreditation Compliance Committee -- Helped assess and improve compliance for college academic programs.
- Undergraduate Admissions Advisory Committee -- Advise admissions on issues of outreach for science students. Also participate in numerous events on an annual basis to recruit students interested in the sciences to Carolina.

c. Course development work undertaken (2-3 sentences per item)

- Created and taught a new undergraduate course in computer security.
- Created a new process for graduation with honors including the development of an annual undergraduate research symposium.
- Helped create a new cooperative education internship program that enables students to retain full-time student status while working full-time outside the university.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

Improving quality of undergrad experience in CS through activities such as advisor to undergrad CS students club, coach of undergrad ACM Programming Contest teams.

Research software for synthetic traffic generation made available for outside researchers. I am currently funded by NSF to "productize" this software.

Jasleen Kaur

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University of North Carolina at Chapel Hill   Fax: (919) 962 1799
Chapel Hill, NC 27599-3175   Email: jasleen@cs.unc.edu

Education

Ph.D., Computer Sciences   August 2002
University of Texas at Austin   Austin, Texas
Thesis Title: Scalable Network Architectures for Providing Per-flow Service Guarantees
Advisor: Prof. Harrick M. Vin

M.S., Computer Sciences   May 1999
University of Texas at Austin   Austin, Texas

B.Tech., Computer Science and Engineering   May 1997
Indian Institute of Technology, Kanpur   Kanpur, India

Work Experience

University of North Carolina at Chapel Hill	*Assistant Professor*	July 2002 – present
University of Texas at Austin, TX	*Research Assistant*	Aug 1999 – July 2002
IBM T.J. Watson Research Labs, NY	*Summer Intern*	May 1999– Aug 1999
AT&T Research Labs, NJ	*Summer Intern*	May 1998– Aug 1998
Aeronautical Development Est., India	*Summer Employee*	May 1996– Aug 1996

Honors & Awards

• *National Science Foundation CAREER Award, 2004.*
• *Junior Faculty Development Award, 2004,* University of North Carolina at Chapel Hill

Publications

Book Chapter
• A. Srinivasan, P. Holman, J. Anderson, S. Baruah, and J. Kaur, "Multiprocessor Scheduling in Processor-based Router Platforms: *Issues and Ideas*", in Network Processors Design: Issues and Practices, Volume 2, Morgan Kaufman, 2003.

Papers Under Review
• V. Konda and J. Kaur, "RAPID: Shrinking the Congestion Control Timescale", submitted to the 28th IEEE INFOCOM, April 2009.

• R. Kumar and J. Kaur, "Towards a Queue Sensitive Transport Protocol", submitted to the 27th IEEE International Performance Computing and Communications Conference (IPCCC), Dec 2008.

Journal Papers
• R. Kumar and J. Kaur, "Practical Beacon Placement for Link Monitoring Using Network Tomography", in the IEEE Journal on Selected Areas in Communication (JSAC), special issue on Sampling the Internet: Techniques and Applications, volume 24, number 12, pages 2196-2209, Dec 2006.

• S. Rewaskar, J. Kaur, and F.D. Smith, "A Passive State-machine Based Approach for Reliable Estimation of TCP Losses", in the ACM SIGCOMM Computer Communications Review (CCR), volume 36, issue 3, pages 51-64, July 2006.

Refereed Papers
(According to Google Scholar, these papers had a total of 361 citations in Sept 2008).

• S. Rewaskar, J. Kaur, and F.D. Smith, "A Performance Study of Loss Detection/Recovery in Realworld TCP Implementations", in Proceedings of IEEE International Conference on Network Protocols (ICNP), Beijing, China, 10 pages, Oct 2007. 14% acceptance ratio.

> *Empirical results from this paper are being used to inform the loss detection mechanisms in the recently-developed Linux DCCP CCID-2 protocol. Gerrit Renker (University of Aberdeen) is leading this effort.*

• A. Shriram and J. Kaur, "Empirical Evaluation of Techniques for Measuring Available Bandwidth", in Proceedings of the 26th IEEE INFOCOM, Anchorage, AK, 9 pages, May 2007. 18% acceptance ratio.

• A. Shriram and J. Kaur, "Empirical Study of the Impact of Sampling Timescales and Strategies on Measurement of Available Bandwidth", in Proceedings of the Seventh Passive and Active Measurement Conference (PAM), Adelaide, Australia, 10 pages, March 2006. 25% acceptance ratio.

• V. Sawant and J. Kaur, "A Peer-to-Peer Architecture to Enable Versatile Lookup System Design", in Proceedings of the 2nd IEEE International Workshop on Networking Meets Databases (NetDB), Atlanta, GA, April 2006.

• R. Kumar and J. Kaur, "Efficient Beacon Placement for Network Tomography", in Proceedings of the ACM SIGCOMM Internet Measurement Conference (IMC), Sicily, Italy, 6 pages, October 2004. 24% acceptance ratio.

• W. Jin, J. Chase, and J. Kaur, "Interposed Proportional Sharing for a Storage Service Utility", in Proceedings of the ACM Sigmetrics - Performance (SIGMETRICS), New York, 12 pages, June 2004. 12% acceptance ratio.

• S. Rewaskar and J. Kaur, "Testing the Scalability Limits of Overlay Routing Infrastructures", in Proceedings of the Fifth Passive and Active Measurements Workshop (PAM), Juan-les-Pins, France, published in the Springer Lecture Notes in Computer Science Series, 10 pages, April 2004. 17% acceptance ratio.

• J. Aikat, J. Kaur, F.D. Smith, and K. Jeffay, "Variability in TCP Round-trip Times", in Proceedings of the ACM SIGCOMM Internet Measurement Conference (IMC), Miami, FL, 6 pages, October 2003. 29% acceptance ratio.

Invited (Non-refereed) Paper
• V. Konda and J. Kaur, "Rethinking the Timescales at Which Congestion-control Operates", in Proceedings of the 16th IEEE Workshop on Local and Metropolitan Area Networks (LANMAN), Transylvania, Romania, 6 pages, September 2008.

Refereed Extended Abstracts
• S. Rewaskar, J. Kaur, and D. Smith, "Accuracy of Probing Techniques in Estimating TCP Loss Rates", in Proceedings of ACM SIGCOMM, Pisa, Italy, 2 pages, Sept 2006.

• S. Rewaskar, J. Kaur, and D. Smith, "A Passive State-Machine Based Approach for Reliable Estimation of TCP Losses", in Proceedings of the Seventh Passive and Active Measurement Conference (PAM), Adelaide, Australia, 2 pages, March 2006.

• V. Sawant and J. Kaur, "Supporting Arbitrary Queries in Peer-to-Peer Networks using Hybrid Routing" in Proceedings of the 20th ACM Symposium on Operating Systems Principles (SOSP), Brighton, UK, 2 pages, October 2005.

• A. Shriram and J. Kaur, "Identifying Bottleneck Links Using Distributed End-to-end Available Bandwidth Measurements", in the First ISMA Bandwidth Estimation Workshop (BEst), San Diego, CA, 2 pages, December 2003.

Research Grants

As Principal Investigator
• Empirical Evaluation of Router Queue Occupancy at Short-timescales with Internet-derived Traffic Mixes, NSF REU Supplemental Award.
Amount: $6, 000 over 3 months (05/2008 – 08/2008).

• Re-assessing the Foundations of Internet Transport Protocols, NSF CAREER Award.
Amount: $500, 000 over 5 years (09/2004 – 08/2009).

• Modeling TCP Round-trip Times, University Junior Faculty Development Award.
Amount: $5, 000 over 1 year (2004).

As Senior Personnel
• Tera-Pixels: Using High-resolution Pervasive Displays to Transform Collaboration and Teaching, NSF CISE Research Infrastructure Award.
PIs: K. Jeffay, A. Lastra, K. Mayer-Patel, L. McMillan, and F.D. Smith.
Amount: $1, 200, 000 over 5 years (09/2003 – 08/2008).

Prototype Development

• *TCPdebug: A TCP-aware Passive Network Monitoring Tool-set*
TCPdebug is a set of OS-sensitive passive network monitoring tools for analyzing real-world TCP traces. It can currently analyze traces of connections originating from the Windows XP, Linux, Solaris, MacOS, and FreeBSD stacks. The tool-set is available for download at: http://www.cs.unc.edu/_jasleen/research/tcp-analysis/.

• *The CSGS Routing Platform*
Prototypes of core and edge routers of a Core-stateless Guaranteed Services (CSGS) network architecture have been implemented using Intel's IXP1200-based router platform. The prototypes attain packet processing speeds within 10% of those attained in conventional IP routers.

• *QLinux: A Multimedia Operating System*
QLinux is a Linux kernel that can provide QoS guarantees to applications that run on it—it was the first publicly-available operating system that provided such guarantees and is being used by hundreds of researchers around the world. I was an integral part of the team that designed and implemented the original release of QLinux. QLinux is available for download at: http://lass.cs.umass.edu/software/qlinux/.

Curriculum Development

• *Computer Networks*, a new introductory graduate course on the design of computer networks, designed in Fall 2003.

• *Systems Performance Analysis*, a new advanced undergraduate/graduate course on the performance evaluation of computer systems, designed in Spring 2005.

• *Research Topics in Networking*, a research-focused graduate seminar course on current open issues in networking, designed in Spring 2003.

Student Advising

Current Ph.D. Advisees
Vishnu Konda
Research Topic: Adaptive Congestion Control at Fine Timescales

Ritesh Kumar (ABD)
Proposal Title: Analysis and Design of Queue-friendly Transport Protocols

Sushant Rewaskar (ABT)
Thesis Title: Empirical Evaluation of Techniques for Mitigating the Impact of Packet
Losses on TCP Performance

Alok Shriram (ABT)
Thesis Title: Design of a Scalable Bandwidth Information Infrastructure

PRP Research Advising
Sami Benzaid, 2008-2009
Vishnu Konda, 2007-2008

Undergraduate Research Advising
Eric Gavaletz, Summer 2008.

Doctoral Dissertation Committees
Andy Jones
Hennadiy Leontyev
Liqiang Liu, Operations Research (Ph.D. 2007)
Uma Devi (Ph.D. 2006)
Long Le (Ph.D. 2005)
Philip Holman (Ph.D. 2004)
Michele C. Weigle (Ph.D. 2003)

Invited Presentations

Talks
• Rethinking the Timescales at Which Congestion-control Operates, the 16th IEEE
Workshop on Local and Metropolitan Area Networks, Transylvania, Romania,
September 2008.

• Extracting Queuing Behavior from Passive End-to-end Measurements, SAMSI Closing
Workshop, Research Triangle Park, NC, June 2004. Host: Prof. Steve Marron.

Posters
• S. Rewaskar, J. Kaur, and D. Smith, "A TCP-aware Network Performance Monitoring
Tool", IBM University Day, October 2004.

• S. Rewaskar, J. Aikat, J. Kaur, D. Smith, D. Pozefsky and K. Jeffay, "Variability in
TCP Roundtrip Times", in the SAMSI Workshop on Congestion Control and Heavy
Traffic Modeling, November 2003.

• A. Shriram and J. Kaur, "Estimating Bottleneck Links Using Distributed End-to-end
Measurements", in the SAMSI Workshop on Internet Tomography, October 2003.

Department Committees
• Faculty Search Sub-Committee (Security), Spring 2008.
• Graduate Curriculum and Planning Committee, Aug 2005 – present.
• Curriculum and Planning Committee, Aug 2003 – May 2005.
• Ad-hoc Committee on Titles, Fall 2003.
• Curriculum and Planning Committee, Aug 2002 – May 2003.

Professional Service

• *Organizing Committees:*
– Technical Program Co-chair, the 17th IEEE Workshop on Local and Metropolitan Area Networks (LANMAN 2010), New Jersey, April 2010.

– Co-organizer, the DIMACS/DyDAn Workshop on Internet Tomography, Rutgers University, NJ, May 2008. Organized by J. Kaur, D. Towsley, and W. Willinger.

– Student Travel Grant Committee, ACM SIGCOMM 2005, Philadelphia, PA, Aug 2005.

– Posters Committee, ACM SIGCOMM 2004, Portland, OR, August 2004.

– Publicity Chair, the 24th IEEE Real-time Systems Symposium (RTSS 2003), Cancun, Mexico, December 2003.

• *Technical Program Committees:*
– Program Committee, the 18th International Conference on Computer Communications and Networks (ICCCN 2009), San Francisco, August 2009.

– Program Committee, the 16th IEEE Workshop on Local and Metropolitan Area Networks (LANMAN 2008), Cluj-Napoca, Romania, September 2008.

– Program Committee, the 17th International Conference on Computer Communications and Networks (ICCCN 2008), St. Thomas, Virgin Islands, August 2008.

– Program Committee, the International Conference on Computer Communications and Networks (ICCCN 2006), Arlington, Virginia, October 2006.

– Program Committee, the 26th IEEE International Conference on Distributed Computing Systems (ICDCS 2006), Lisboa, Portugal, July 2006.

– Program Committee, the 16th International Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV 2006), Newport, Rhode Island, May 2006.

– Program Committee, the ACM Internet Measurement Conference (IMC 2005), New Orleans, LA, Oct 2005.

– Program Committee, the 25th IEEE International Conference on Distributed Computing Systems (ICDCS 2005), Columbus, Ohio, June 2005.

– Program Committee, the 13th IEEE International Workshop on Quality of Service (IWQoS 2005), Passau, Germany, June 2005.

• *Reviewer:*
– ACM Computer Communication Review.
– ACM Internet Measurement Conference.
– ACM Multimedia.
– ACM SOSP.
– ACM SIGCOMM.
– ACM/IEEE IWQoS.
– Communications of the ACM.
– IEEE/ACM COMSWARE.
– IEEE/ACM Transactions on Networking.
– IEEE ICCCN.
– IEEE ICDCS.
– IEEE INFOCOM.
– IEEE LANMAN.
– IEEE NOSSDAV.
– IEEE Transactions on Computers.
– IEEE Transactions on Dependable and Secure Computing.
– IEEE Transactions on Multimedia.
– Journal of Systems and Software.
– SPIE Multimedia Computing and Networking.

Jasleen Kaur

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

An undergraduate student, Eric Gavaletz, did a summer research project with me in the summer of 2008. He worked on a detailed experimental investigation of the spatial and temporal aspects of router queuing induced by aggregated network traffic.

c. Course development work undertaken (2-3 sentences per item)

I designed two new courses:
1) A new introductory graduate course in networking titled "Computer Networks" in Fall, 2003. This course has been approved to satisfy the systems distribution requirement of the Computer Science graduate program at UNC. The course is designed to serve two purposes. First, it reviews traditional topics and introduces students to current research areas in the field of networking. Second, through projects and assignments, it builds in students several skills required for the empirical networking research pursued in this department. This course is now offered in every fall semester.

2) Designed a new advanced undergraduate/graduate course titled "Systems Performance Analysis" in Spring, 2005. This course is designed to serve two purposes. First, it introduces concepts in systematic performance analysis techniques, including modeling, simulations, measurements, and tracing. Second, through projects and assignments, it familiarizes students with several tools that can be used to study stand-alone as well as distributed applications. The course requires students to work on hand-on projects--- projects in the first offering included the analysis of a web server, a database server, a gaming server, a media-streaming server, and a kernel process-creation API.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

We have conducted a large-scale project that passively analyzed the performance of loss detection mechanisms in real-world TCP transfers. For this analysis, we developed a set of analysis tools that emulate the TCP implementations in 5 prominent operating system stacks. We used these tools to analyze the performance of loss detection mechanisms in nearly 3 million real-world TCP transfers and found that the recommended as well as widely-used configurations of these mechanisms can be fairly sub-optimal in lowering data transfer times. We propose configurations that can improve the transfer times of a majority of connections by up to 40%. Empirical results from this study are being used to inform loss detection mechanisms in the recently-developed Linux DCCP CCID-2 protocol.

CURRICULUM VITAE

Anselmo A. Lastra

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University of North Carolina
CB# 3175 Sitterson Hall
Chapel Hill, NC 27599-3175
(919) 962-1958
lastra@cs.unc.edu
http://www.cs.unc.edu/~lastra

EDUCATION:

1988	Duke University, Durham, NC - Ph.D. in Computer Science
1981	Duke University, Durham, NC - M.A. in Computer Science
1972	Georgia Institute of Technology, Atlanta, GA - BSEE

PROFESSIONAL EXPERIENCE:

2006-   Professor of Computer Science and Research Associate of the Research Laboratories of Archaeology. Engaged in research in the area of computer graphics, principally rendering, image-based modeling, and hardware.

2001-2006   Associate Professor of Computer Science

1997-2001   University of North Carolina. Research Associate Professor.

1991-1997   University of North Carolina. Research Assistant Professor of Computer Science. Software Manager for the Pixel-Planes team. Over this time we completed the Pixel-Planes 5 and (with colleagues at Hewlett Packard) PixelFlow parallel graphics computers.

1988-1991   Duke University. Research Assistant Professor of Computer Science. Research in the areas of parallel processing and performance, and computational science. Working on problems in non-linear excitable media, and the mathematical aspects of genetics. Interests in graphics, and pattern recognition.

1986-1988   Duke University. Graduate student in the Department of Computer Science. Dissertation research on parallel algorithms for the simulation of biological processes at the cellular level. Related research topics in the prediction of the performance of parallel algorithms, and debugging of parallel programs.

1986   AT & T Bell Laboratories. Consultant for one year on a project to develop a special purpose dataflow machine for signal processing. Responsible for technical supervision of several people as well as software design.

1979-1985 Duke University and Duke University Medical Center. Research Assistant in the Department of Medicine and graduate student in the Department of Computer Science. Research in pattern recognition, both statistical and structural. Developed two systems for automated recognition and classification of electrocardiograms. Work in graphics, UNIX kernel, and embedded systems.

1975-1979 Coulter Electronics, Inc., Hialeah, Florida. Project Engineer. Managed design and development team of six to ten persons involved in hardware and software design of laboratory instrumentation. Supervised one product, the Coulter Lytening, completely from initial design to production.

1972-1975 Scidata, Inc., Atlanta, Ga. Electronic Engineer.

PUBLICATIONS

REFEREED

Joshua Steinhurst, Greg Coombe and Anselmo Lastra, Reducing Photon Mapping Bandwidth by Query Reordering, IEEE Transactions on Visualization and Computer Graphics, **(14)** 1, 13-24, 2008.

Kok-Lim Low and Anselmo Lastra, Predetermination of ICP Registration Errors and Its Application to View Planning, 3-D Digital Imaging and Modeling (3DIM), Montreal, Canada, August 2007.

Massimo Brizzi, Sarah Court, Ascanio d'Andrea, Anselmo Lastra and Daniele Sepio, 3D Laser Scanning as a Tool for Conservation: The Experiences of the Herculaneum Conservation Project, Symposium on Virtual Reality, Archaeology and Cultural Heritage (VAST), Nicosia, Cyprus, 2006.

Kok-Lim Low and Anselmo Lastra, An Adaptive Hierarchical Next-Best-View Algorithm for 3D Reconstruction of Indoor Scenes, Proceedings of 14th Pacific Conference on Computer Graphics and Applications (Pacific Graphics 2006), Taipei, Taiwan, 2006.

Joshua Steinhurst and Anselmo Lastra, Global Importance Sampling of Glossy Surfaces using the Photon Map, IEEE Symposium on Interactive Ray Tracing, Salt Lake City, Utah, 2006.

Chad Hantak and Anselmo Lastra, Metrics and Optimization Techniques for Registration of Color to Laser Range Scans, Symposium on 3D Data Processing, Visualization and Transmission (3DPVT), Chapel Hill, NC, 2006.

Greg Coombe and Anselmo Lastra, An Incremental Weighted Least Squares Approach to Surface Lights Fields, GRAPP 2006, International Conference on Computer Graphics Theory and Applications, Setúbal, Portugal, 25 - 28 February, 84-91, 2006.

Greg Welch, Ruigang Yang, Sascha Becker, Adrian Ilie, Dan Russo, Jesse Funaro, Andrei State, Kok-Lim Low, Anselmo Lastra, Herman Towles, Bruce Cairns, M.D., Henry Fuchs, and Andy van Dam. Immersive Electronic Books for Surgical Training. *IEEE Multimedia*, 22-35, July-Sept 2005.

David K. McAllister, Anselmo Lastra, Measuring and Rendering Spatially-Varying Fabrics, *Research Journal of Textile and Apparel,* **(9)** 1, 1-12, 2005.

Justin Hensley, Thorsten Scheuermann, Montek Singh, Anselmo Lastra, Fast Summed-Area Table Generation and its Applications, Proceedings of Eurographics 2005 and Computer Graphics Forum **(24)** 3, 547-555, 2005.

Justin Hensley, Montek Singh, and Anselmo Lastra, A Fast, Energy-Efficient Z-Comparator, Proceedings of Graphics Hardware 2005, Los Angeles, 41-44, 2005.

Greg Coombe, Chad Hantak, Radek Grzeszczuk, Anselmo Lastra, Online Construction of Surface Light Fields, Eurographics Symposium on Rendering, 83-90, 2005.

Josh Steinhurst, Greg Coombe, Anselmo Lastra, Reordering for Cache Conscious Photon Mapping, Proceedings of Graphics Interface 2005, May 9-11, Victoria, British Columbia, Canada, 97-104, 2005.

Justin Hensley, Anselmo Lastra, Montek Singh, A Scalable Counterflow-Pipelined Asynchronous Radix-4 Booth Multiplier, Proceedings of the 11th IEEE International Symposium on Asynchronous Circuits and Systems, IEEE Computer Society, Washington, DC, USA, 128-137, 2005.

Justin Hensley, Anselmo Lastra, Montek Singh: An Area- and Energy-Efficient Asynchronous Booth Multiplier for Mobile Devices. ICCD 2004: 18-25, IEEE Press, 2004.

Nathaniel Williams, Kok-Lim Low, Chad Hantak, Mark Pollefeys, and Anselmo Lastra, Automatic Image Alignment for 3D Environment Modeling, Proceedings of SIBGRAPI 2004, Curibita, Brazil, October 17-20, 2004, 388-395.

Ilie, Adrian, Kok-Lim Low, Greg Welch and Anselmo Lastra, "Combining Head-Mounted and Projector-Based Displays for Surgical Training", *Presence: Teleoperators and Virtual Environments* **13**(2), 128-145, MIT Press, 2004.

Greg Coombe, Mark J. Harris, and Anselmo Lastra, Radiosity on Graphics Hardware, Proceedings of Graphics Interface 2004, May 17-19, London, Ontario, Canada, 2004, AK Peters, 161-168, 2004.

Nathaniel Williams, Chad Hantak, Kok-Lim Low, John Thomas, Kurtis Keller, Lars Nyland, David Luebke, and Anselmo Lastra, Monticello Through the Window, Proceedings of the 4th International Symposium on Virtual Reality, Archaeology and Intelligent Cultural Heritage (VAST2003), Brighton, UK (November 2003), 131-138.

Kok-Lim Low and Anselmo Lastra, Reliable and Rapidly-Converging ICP Algorithm Using Multiresolution Smoothing, 4th IEEE International Conference on 3-D Digital Imaging and Modeling (3DIM 2003), 171-178, October 2003.

Celso Setsuo Kurashima, Anselmo Lastra, Marcelo Knorich Zuffo, A Virtual Simulation Tool for Development of Image-based Rendering Algorithms, Proceedings of 6th SVR Symposium on Virtual Reality. SBC Brazilian Computer Society, October 15-18, 2003. pp.60-70.

Mark J. Harris, William Baxter, Thorsten Scheuermann, Anselmo Lastra, Simulation of Cloud Dynamics on Graphics Hardware, Graphics Hardware 2003, San Diego, California, July 26-27, 92-101, 2003.

EXHIBITION

Virtual Monticello exhibition at the New Orleans Museum of Art, April-August 2003. This was a facade, 17 meters long, of Thomas Jefferson's home, Monticello, with two rear-projected, tracked, virtual-environment displays. It was experienced by 110,000 visitors. Please see http://www.cs.unc.edu/~ibr/projects/NOMA/index.html for details.

PATENT

Popescu, Voicu Anselmo Lastra, John Eyles, "Methods and apparatus for rendering images using 3D warping techniques," US Patent number 6,756,993, issued June 29, 2004.

CONFERENCE (un-refereed)

Anselmo Lastra, Ascanio d'Andrea and Daniele Sepio, Swivel-Chair VR: A Portable HMD System (poster presentation), Virtual Systems and Multimedia (VSMM), Brisbane, Australia, September 2007.

Jerald, Jason Andrew Fuller, Anselmo Lastra, Mary Whitton, Luv Kohli, Fred Brooks, Latency Compensation by Horizontal Scanline Selection for Head-Mounted Displays, Proceedings of the SPIE conference on The Engineering Reality of Virtual Reality, January 2007.

Hensley, Justin, Thorsten Scheuermann, Montek Singh, Anselmo Lastra, Interactive Summed-Area Table Generation for Glossy Environmental Reflections, *ACM SIGGRAPH 2005 Sketches and Applications*, 2005.

Wei-Chao Chen, Lars Nyland, Anselmo Lastra, Henry Fuchs, Acquisition of Large-Scale Surface Light Fields, *ACM SIGGRAPH 2003 Sketches and Applications*, July 2003.

TEACHING (number of times taught)

    Undergraduate level
        Digital Computer Design at UNC (4) – designed and inaugurated new course
        Systematic Programming (2) at UNC
        First Year Seminar using LEGO Robots (1) at UNC
        Software Design (1), at Duke University
        Computer Graphics (2), at Duke University – designed and inaugurated new course
    Graduate level
        Programming Methodology (3), at Duke University
        Advanced Image Generation (4), at UNC – advanced research preparation course
        Graphics Hardware at UNC (2)

GRANTS

Principal Investigator, Fifth Generation Graphics Architectures, National Science Foundation, $350,000, 2003-2007.

Co-Principal Investigator, Tera-Pixels: Using High-resolution Pervasive Displays to Transform Collaboration and Teaching, National Science Foundation, $1,066,316, 2003-2008.

Principal Investigator, ITR: Collaborative Research: Image-Based Rendering in Forensic Science, Education, and Historical Preservation, National Science Foundation, collaborative research with the University of Virginia, $1,190,818 to UNC, $1,439,054 total, 2002-2006.

Senior Investigator (and proposal editor), Real-Time Long-Distance Terascale Computation for Full Bandwidth Tele-Immersion, National Science Foundation, $2,651,500, 2001-2004.

PROFESSIONAL ACTIVITIES

Associate Editor and Tutorials Editor, IEEE Computer Graphics and Applications

Associate Editor, IEEE Transactions on Visualization and Computer Graphics, 2003-2007

Treasurer, Graphics Hardware 2007. San Diego

Steering committee for Graphics Hardware conferences, 2005-

Program committee, SIAGC 2006

Program committee, 3DPVT 2006

Program committee, ACM SIGGRAPH Video Game Symposium 2006

Program committee, Symposium on Point-Based Graphics 2006

Program committee, SIBGRAPI 2006

Program committee, EVA 2006, Austria

Program committee, Graphics Hardware 2006

Program committee, Symposium on Interactive 3D Graphics 2006

Program committee, GRAPP 2006

Program committee, Symposium on Point-Based Graphics 2005

Program committee, Graphics Hardware 2005

Co-Chair, Symposium on Interactive 3D Graphics 2005, Washington, DC

Program committee, 3DIM 2005

Co-Chair, Graphics Hardware 2004, Grenoble, France

Co-Chair, Workshop on General Purpose Computation on Graphics Processors, 2004, Los Angeles, CA

Program committee, Symposium on Point-Based Graphics 2004

Chair, Technical Outreach, SIGGRAPH (2003-2005)

INVITED TALKS

Keynote, *Title Bringing the Real to Virtual Reality,* SIACG 2006.

PAST GRADUATE STUDENTS

Mark Harris, PhD, UNC 2003
Karl Hillesland, PhD, UNC, 2005
Kok-Lim Low, Ph.D. UNC, 2006.
David K. McAllister, Ph.D., UNC, 2002.
Carl Mueller, Ph.D., UNC, 2000.
Voicu Popescu, Ph.D., UNC, 2001.

UNIVERSITY SERVICE

Faculty Council
SACS Accreditation Committee, UNC Graduate School

DEPARTMENTAL SERVICE

Director of Graduate Studies
Graduate Curriculum and Planning
Conflicts of Interest Committee
Undergraduate Curriculum Committee
Department Facilities Committee
Graduate Admissions Committee (twice)

PUBLIC SERVICE

2003 – Exhibition at New Orleans Museum of Art to celebrate the 200th anniversary of the Lewis and Clark expedition. Please see item under exhibitions in the publications section.

2004 – Documented a pre-Roman Faliscan tomb in central Italy by creating a 3D geometric model. This work is in collaboration with Professor Nicola Terrenato of the Department of Classics.

2005-6 – Technical advisor on a team to document the Suburban Baths on the Herculaneum archaeological site by creating a 3D model. This work is in collaboration with the British School at Rome.

Anselmo Lastra

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Fu-Che Wu

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

COMP 541 - Developed a novel undergraduate course on computer design. Students design and implement (on a field-programmable gate array) a full computer, including input and output to a monitor. Typical final projects range from text editors to computer games.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Svetlana Lazebnik

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Department of Computer Science
University of North Carolina at Chapel Hill
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Fax: 1 (919) 962-1799
E-mail: `lazebnik@cs.unc.edu`
URL: `http://www.cs.unc.edu/~lazebnik`

Research Interests

Object recognition and scene interpretation; reconstruction of 3D objects from photographs and video; machine learning techniques for visual recognition problems; Internet photo collections.

Education

May 2006	**Ph.D.** in Computer Science University of Illinois at Urbana-Champaign Advisor: Dr. Jean Ponce Dissertation title: *Local, Semi-Local and Global Models for Texture, Object and Scene Recognition*
Dec 2002	**M.S.** in Computer Science University of Illinois at Urbana-Champaign
June 2000	**B.S.** in Computer Science with Mathematics Minor (Graduation with Highest Honors) DePaul University, Chicago, IL

Academic Employment

July 2007 - Present	**Assistant Professor** Dept. of Computer Science, University of North Carolina at Chapel Hill
May 2006 - July 2007	**Post-Doctoral Research Associate** Dept. of Computer Science, University of Illinois at Urbana-Champaign
June 2001 - May 2006	**Research Assistant** Dept. of Computer Science, University of Illinois at Urbana-Champaign

Teaching Experience: University of North Carolina at Chapel Hill

Fall 2008	COMP 790-096: Computational Photography
Spring 2008	COMP 776-001: Computer Vision
Fall 2007	COMP 790-096: Computer Vision and the Web

Selected Awards

2008	Teaching Award UNC Department of Computer Science Student Association
2008	Junior Faculty Development Award University of North Carolina at Chapel Hill
2007	Outstanding Reviewer Award IEEE Computer Society Conference on Computer Vision and Pattern Recognition
2000 - 2006	Support for Underrepresented Groups in Engineering (SURGE) Fellowship College of Engineering, University of Illinois

Publications

Journal Articles

- S. Lazebnik and M. Raginsky, "Supervised Learning of Quantizer Codebooks by Information Loss Minimization," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, accepted, 2008.

- S. Lazebnik, Y. Furukawa, and J. Ponce, "Projective Visual Hulls," *International Journal of Computer Vision*,

vol. 74, no. 2, August 2007, pp. 137-165.

- F. Rothganger, S. Lazebnik, C. Schmid, and J. Ponce, "Segmenting, Modeling, and Matching Video Clips Containing Multiple Moving Objects," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 29, no. 3, March 2007, pp. 477-491.

- J. Zhang, M. Marszalek, S. Lazebnik, and C. Schmid, "Local Features and Kernels for Classifcation of Texture and Object Categories: A Comprehensive Study," *International Journal of Computer Vision*, vol. 73, no. 2, June 2007, pp. 213-238.

- F. Rothganger, S. Lazebnik, C. Schmid, and J. Ponce, "3D Object Modeling and Recognition Using Local Affine-Invariant Image Descriptors and Multi-View Spatial Constraints," *International Journal of Computer Vision*, vol. 66, no. 3, March 2006, pp. 231-259.

- S. Lazebnik, C. Schmid, and J. Ponce, "A Sparse Texture Representation Using Local Affine Regions," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 27, no. 8, August 2005, pp. 1265-1278.

- S. Lazebnik and J. Ponce, "The Local Projective Shape of Smooth Surfaces and Their Outlines," *International Journal of Computer Vision*, vol. 63, no. 1, June 2005, pp. 65-83.

Invited Papers and Book Chapters

- S. Lazebnik, C. Schmid, and J. Ponce, "Spatial Pyramid Matching," *Object Categorization: Computer and Human Vision Perspectives*, S. Dickinson, A. Leondardis, B. Schiele, and M. Tarr (eds.), Cambridge University Press, 2009. Accepted.

- J. Ponce, T. L. Berg, M. Everingham, D. A. Forsyth, M. Hebert, S. Lazebnik, M. Marszalek, C. Schmid, B. C. Russell, A. Torralba, C. K. I. Williams, J. Zhang, and A. Zisserman, "Dataset Issues in Object Recognition," *Toward Category-Level Object Recognition*, Springer-Verlag Lecture Notes in Computer Science vol. 4170. J. Ponce, M. Hebert, C. Schmid, and A. Zisserman (eds.), 2006, pp. 29-48.

- S. Lazebnik, C. Schmid, and J. Ponce, "A Discriminative Framework for Texture and Object Recognition Using Local Image Features," *Toward Category-Level Object Recognition*, Springer-Verlag Lecture Notes in Computer Science vol. 4170. J. Ponce, M. Hebert, C. Schmid, and A. Zisserman (eds.), 2006, pp. 423-442.

- F. Rothganger, S. Lazebnik, C. Schmid, and J. Ponce, "3D Object Modeling and Recognition from Photographs and Image Sequences," *Toward Category-Level Object Recognition*, Springer-Verlag Lecture Notes in Computer Science vol. 4170. J. Ponce, M. Hebert, C. Schmid, and A. Zisserman (eds.), 2006, pp. 105-126.

- C. Schmid, G. Dorko, S. Lazebnik, K. Mikolajczyk, and J. Ponce, "Pattern Recognition with Local Invariant Features," *Handbook of Pattern Recognition and Computer Vision*, 3rd edition, C.H. Chen and P.S.P Wang (eds.), World Scientific Publishing Co., 2005, pp. 71-92.

Refereed Conference and Workshop Papers

- M. Raginsky, S. Lazebnik, R. Willett, and J. Silva, "Near-Minimax Recursive Density Estimation on the Binary Hypercube," Accepted to *Advances in Neural Information Processing Systems*, 2008.

- X. Li, C. Wu, C. Zach, S. Lazebnik, and J.-M. Frahm, "Modeling and Recognition of Landmark Image Collections Using Iconic Scene Graphs," *Proceedings of the European Conference on Computer Vision*, 2008.

- B. Davis and S. Lazebnik, "Analysis of Human Attractiveness Using Manifold Kernel Regression," *International Conference on Image Processing* (special session on aesthetics, mood, and emotion), 2008.

- R. Raguram and S. Lazebnik, "Computing Iconic Summaries of General Visual Concepts," *First IEEE Workshop on Internet Vision* (in conjunction with CVPR), 2008.

- S. Lazebnik and M. Raginsky, "Learning Nearest-Neighbor Quantizers from Labeled Data by Information Loss Minimization," *Proceedings of the International Conference on Artificial Intelligence and Statistics*, 2007.

- S. Lazebnik, C. Schmid, and J. Ponce, "Beyond Bags of Features: Spatial Pyramid Matching for Recognizing Natural Scene Categories," *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, New York, June 2006, vol. 2, pp. 2169-2178.

- J. Zhang, M. Marszalek, S. Lazebnik, and C. Schmid, "Local Features and Kernels for Classifcation of Texture and Object Categories: A Comprehensive Study," *Beyond Patches Workshop* (in conjunction with CVPR), 2006.

- M. Raginsky and S. Lazebnik, "Estimation of Intrinsic Dimensionality Using High-Rate Vector Quantization," *Advances in Neural Information Processing Systems* 18, MIT Press, 2006, pp. 1105-1112.

- S. Lazebnik, C. Schmid, and J. Ponce, "A Maximum Entropy Framework for Part-Based Texture and Object Recognition," *Proceedings of the IEEE International Conference on Computer Vision*, Beijing, China, October 2005, vol. 1, pp. 832-838.

Theses

- S. Lazebnik, *Local, Semi-Local and Global Models for Texture, Object and Scene Recognition*, Ph.D. Dissertation, University of Illinois at Urbana-Champaign, May 2006, 172 pages.

Research Grants

- S. Lazebnik (co-PI), CRI:IAD Integrated Projector-Camera Modules for the Capture and Creation of Wide-Area Immersive Experiences (PI: Henry Fuchs), National Science Foundation, $310,000, 4/1/2008-3/31/2011.

- S. Lazebnik (PI), Junior Faculty Development Award, University of North Carolina at Chapel Hill, $7,500, 1/1/08-12/31/08.

Presentations

Research Seminars

- *Representing Internet Photo Collections with Iconic Images*
  - Microsoft Research Redmond, June 30, 2008

- *Object and Scene Recognition with Bags of Features and Spatial Pyramids*
  - Carnegie Mellon University, May 2, 2007
  - Microsoft Research, Redmond, April 16, 2007
  - University of California at San Diego, April 9, 2007
  - AT&T Research, April 5, 2007
  - New York University, April 4, 2007
  - State University of New York at Stony Brook, March 14, 2007
  - Kodak Research, March 7, 2007
  - University of Rochester, March 5, 2007
  - Duke University, February 28, 2007
  - University of North Carolina at Chapel Hill, February 26, 2007

- *Fun with Nearest-Neighbor Quantizers*
  - Carnegie Mellon University, VASC seminar, October 30, 2006

- *Improving Bag-of-Features Image Classification*
  - ETH Zurich, BIWI group seminar, September 12, 2006

- *Local, Semi-Local and Global Models for Texture, Object and Scene Recognition*
  - University of Washington, April 13, 2006
  - University of Texas at Austin, March 28, 2006
  - Stanford University, March 6, 2006
  - University of Wisconsin at Madison, February 27, 2006

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- *Local Image Features for Recognizing Textures, Objects, and Scenes*
  - Toyota Technical Institute, Chicago, February 2, 2006
  - Microsoft Research, Redmond, December 12, 2005

- *From Textons to Parts: Learning Texture and Object Representations Based on Local Image Features*
  - MIT Computer Science and Artificial Intelligence Lab, August 16, 2005
  - Stanford University, March 22, 2005
  - Xerox Research Centre Europe, February 22, 2005

- *Semi-Local Parts and Their Relations for Object Recognition*
  - INRIA Rhône-Alpes, February 21, 2005

Invited Workshops

- *An Empirical Bayes Approach to Contextual Region Classification*
  - Fourth International Workshop on Object Recognition, Lake Como, Italy, May 16, 2008

- *Exploring Image Data with Quantization-Based Techniques*
  - IPAM Workshop on Numerical Tools and Fast Algorithms for Massive Data Mining, Search Engines and Applications, UCLA, October 25, 2007

- *The Beauty of Local Invariant Features*
  - Third Sicily Workshop on Object Recognition, September 21, 2006
  - Workshop on Visual Learning and Recognition, Institute for Mathematics and Its Applications, University of Minnesota, May 22, 2006

- *A Maximum Entropy Framework for Part-Based Texture and Object Recognition*
  - Snowbird Learning Workshop, April 6, 2005 (poster)
  - Workshop on Visual Recognition/Pattern Classification, Mathematical Sciences Research Institute, Berkeley, March 21, 2005

Professional Service and Memberships

- Panels: NSF CISE, 2008

- Conference area chair: CVPR 2009

- Program committees:
  - European Conference on Computer Vision, 2008
  - First International Workshop on Internet Vision, 2008
  - 3rd International Workshop on Semantic Learning Applications in Multimedia, 2008
  - ICCV Workshop on 3D Representation for Recognition, 2007
  - International Conference on Artificial Intelligence and Statistics, 2007

- Conference and workshop refereeing:
  - Neural Information Processing Systems, 2006 and 2007
  - IEEE Conference on Computer Vision and Pattern Recognition, 2006 and 2007

- Journal refereeing:
  - Journal of Machine Learning Research
  - International Journal of Computer Vision
  - IEEE Transactions on Pattern Analysis and Machine Intelligence
  - IEEE Transactions on Image Processing
  - IEEE Transactions on Systems, Man, and Cybernetics (Part B)
  - Image and Vision Computing

- Member of IEEE (Institute of Electrical and Electronics Engineers) since 1999

- Member of ACM (Association for Computing Machinery) since 1999

Svetlana Lazebnik

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

I have developed two graduate seminars, Computer Vision and the Web, and Computational Photography. These seminars deal with the forefront of computer vision research and digital imaging. In the future, I would like to make Computational Photography a regular course.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

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Research Interests

• Physically-based and Geometric Modeling, Robotics, Haptic Rendering, Computer Graphics, Virtual Environments, Applied Computational Geometry.

Education

University of California, Berkeley
PH.D. IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE, DECEMBER 1993
Thesis: Efficient Collision Detection for Animation and Robotics
Advisor: John F. Canny
Major: Graphics, Robotics, Controls & Systems
Minor: Mathematics and Digital Signal Processing

M.S. IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE, MAY 1991
Specialization in Robotics and Computational Geometry
University of California, Berkeley

B.S. IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE, MAY 1988
Graduated with highest honors

Professional Experiences

Employment History

University of North Carolina at Chapel Hill, Department of Computer Science
Beverly W. Long Distinguished Professor (July 2007 - Present)
Full Professor (July 2004 - June 2007)
Tenured Associated Professor (Jan. 2001 - June 2004)
Tenure-track Assistant Professor (Dec. 1997 - Dec. 2000)
Adjunct Assistant Professor (June 1995 - Nov. 1997)

U.S. Army Research Office, Mathematical and Computer Sciences Division
Program Manager of Computer Science & Discrete Mathematics (May 1995 - Nov 1997)

NC A&T State University, Computer Science Department
Assistant Professor (Aug. 1994 - May 1995)

Naval Postgraduate School, Computer Science Department
Assistant Professor (Sept. 1993 - April 1995)

Digital Equipment Corporation, System Research Center
Summer Research Assistant for a graphics project (Summer 1993)

University of California, Berkeley, Computer Science Division
Teaching Assistant for a symbolic programming course (Spring 1993)

University of California, Berkeley, Robotics Group
Research Assistant for Intelligent Systems & Robotics Laboratory (Jul 1989 - May 1993)

Bell Communication Research Center
Junior Software Engineer for a UI system project (Summer 1988)

University of California, Berkeley, Tau Beta Phi Tutoring Program
Tutor for electrical engineering and computer science courses (1987 - 1988)

University of California, Berkeley, Protocol Workroom
Research Assistant for the Protocol Workroom (Sept. 1987 - June 1989)

Technical Advising and Consultation
June 2008 - May 2009: Microsoft Corporation
Aug. 2003 - Sept. 2004: Immersion Corporation and Irell & Manella LLP

Honors and Awards

Awards for Scientific Publications
2007: Best Paper Award, ACM Symposium on Virtual Reality Software and Technology 2007
2007: Best Course Notes Award for a New Course, SIGGRAPH 2007
2005: Best Paper Award, IEEE Virtual Reality Conference 2005
2003: Best Paper Award, ACM Symposium on Solid Modeling and Applications 2003

Professional Honors & Recognitions
2007-2012: Beverly W. Long Distinguished Professorship
2008: Carolina Women's Center Faculty Scholar
2004: W.N. Reynolds Research and Study Leave
2003: Hettleman Prize for Scholarly and Artistic Achievements
1996, 1999, 2003, 2004, 2007: ACM Recognition of Service Award

Professional Service

Program Chair and Conference/Workshop Chair
1. Program Chair, Eurographics Workshop on Natural Phenomena 2009.
2. Program Chair, IEEE Virtual Reality Conference 2008.
3. Chair, IEEE Virtual Reality Workshop on Virtual Cityscapes 2008.
4. Program Chair, ACM Symposium on Virtual Reality Software and Technology 2007.
5. Program Chair, IEEE Virtual Reality Conference 2007.
6. Chair, Workshop on Edge Computing Using New Commodity Architectures 2006.
7. Program Chair, Eurographics Symposium on Virtual Environments 2006.
8. Program Chair, Computer Animation and Social Agents 2005.
9. Tutorial/Course Chair, Eurographics 2005.
10. Chair, ACM Workshop on General Purpose Computing on Graphics Processors 2004.
11. Chair, NSF Workshop on Cyberinfrastructure and Cyberengineering, April 2004.
12. Program Chair, ACM SIGGRAPH/Eurographics Symposium on Computer Animation 2003.
13. Chair and Organizer, 2003 IEEE/IRJ International Conference on Intelligent Robots and Systems Workshop on Robotics for Nanosciences and Nanotechnology.

Editorialship

    1. Associate Editor-in-Chief, IEEE Transactions on Visualization and Computer Graphics, Jan. 2007 – present.

    2. Associate Editor, International Journal of Computational Geometry and Applications, Jan. 2009 – present.

    3. Associate Editor, Editorial Board of World Haptics Conference 2009.

    4. Founding Editorial Board Member, IEEE Transactions on Haptics, 2008 - Present.

    5. Editorial Board Member, Computer & Graphics Journal, July 2007 - Present.

    6. Associate Editor, International Journal on Virtual Reality, 2006 - Present.

    7. Associate Editor, IEEE Robotics and Automation Society Conference Editorial Board, 2006 - present.

    8. Associate Editor, IEEE Transactions on Visualization and Computer Graphics, 2004 - 2006.

    9. Guest Editor, Special Section of IEEE Transactions on Visualization and Computer Graphics on Virtual Reality, 2009.

    10. Guest Editor, Special Section of Computers & Graphics on Virtual Reality, 2009.

    11. Guest Editor, Special Issue of IEEE Computer Graphics & Applications on Virtual Reality, 2008.

    12. Guest Editor, Special Issue of Presence on Virtual Reality, 2008.

    13. Guest Editor, Special Section of IEEE Transactions on Visualization and Computer Graphics on Virtual Reality, 2008.

    14. Guest Editor, Special Issues of Proceedings of IEEE on Cutting Edge Computing Using New Commodity Architectures, March 2008.

    15. Guest Editor, Special Issue of Computers & Graphics on Virtual Environments, January/February 2007.

    16. Guest Editor, Special Issue of IEEE Transactions on Visualization and Computer Graphics on Haptics, Virtual and Augmented Reality, November/December 2005.

    17. Guest Editor, Special Issue of Computer Animation and Virtual Worlds on Computer Animation and Social Agents, July/August 2005.

    18. Guest Editor, Special Issue of IEEE Computer Graphics and Applications on "TOUCH-ENABLED INTERFACES", November/December 2004.

    19. Guest Editor, Special Issue of IEEE Computer Graphics and Applications on "HAPTIC RENDERING: BEYOND VISUAL COMPUTING", March/April 2004.

Advisory Boards and Steering Committees

    1. Member, Advisory Board of Eurographics 2009.

    2. Founding Member, Steering Committee of IEEE Robotics and Automation Society Technical Committee on Algorithms for Planning and Control of Robot Motion, 2008 - Present.

    3. Member, Steering Committee of IEEE VR Conference, 2007 - Present.

    4. Member, Expert Panel on Irish Graduate Program in Visualization, Graphics and Vision, 2007 - Present.

    5. Senior Advisor, IEEE Robotics and Automation Society and Computer Society Technical Committee on Haptics, 2006 - Present.

    6. Member, Software Technical Advisory Board of AGEIA Inc, 2005 - Present.

    7. Member, Conference Board of IEEE Haptics Symposium, 2005 - 2008.

    8. Member, NSF Information Technology Research (ITR) Committee of Visitors (COV) 2005.

    9. Founding Member, Steering Committee of ACM SIGGRAPH/Eurographics Symposium on Computer Animation, 2001 - 2006.

International Program Committees

    1. ACM Symposium on 3D Interactive Graphics and Games 2009.

    2. Eurographics 2009.

    3. Pacific Graphics 2008.

    4. ACM Virtual Reality Software and Technology 2008.

    5. Computer Graphics International 2008.

    6. ACM SIGGRAPH/Eurographics Symposium on Computer Animation 2008.

7. Computer Animation and Social Agents 2008.
8. 3DPVT 2008.
9. Eurographics (Full Paper Program) 2008.
10. Eurographics (Short Paper Program) 2008.
11. Robotics: Science and Systems 2008.
12. Eurographics Symposium on Virtual Environments 2008.
13. ACM Symposium on 3D Interactive Graphics and Games 2008.
14. IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems 2008.
15. Pacific Graphics 2007.
16. Eurographics Workshop on Natural Phenomena 2007.
17. ACM SIGGRAPH/Eurographics Symposium on Computer Animation 2007.
18. Immersive Projection Technology and Eurographics Virtual Environments Symposium 2007.
19. Computer Animation and Social Agents 2007.
20. Robotics: Science and Systems 2007.
21. Cyberworld 2007.
22. HAPTEX 2007.
23. ACM Symposium on Interactive 3D Graphics and Games 2007.
24. IEEE World Haptics Conference 2007.
25. International Conference on Human-Computer Interaction 2007.
26. Pacific Graphics 2006.
27. ACM Symposium on Virtual Reality Software and Technology 2006.
28. ACM SIGGRAPH/Eurographics Symposium on Computer Animation 2006.
29. IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems 2006.
30. IEEE Visualization 2006.
31. Computer Animation and Social Agents 2006.
32. ACM SIGGRAPH 2006, Papers Committee.
33. Eurohaptics 2006, Program Committee.
34. International Symposium on 3D Data Processing, Visualization and Transmission 2006.
35. Robotics: Systems and Science 2006.
36. International Workshop on Algorithmic Foundations of Robotics 2006.
37. ACM Symposium on Interactive 3D Graphics and Games 2006.
38. International Symposium on Non-Photorealistic Animation and Rendering 2006.
39. IEEE Virtual Reality Conference 2006.
40. HAPTEX 2005.
41. IEEE Visualization 2005.
42. ACM SIGGRAPH/Eurographics Symposium on Applied Perception on Graphics and Visualization 2005.
43. ACM Symposium on Virtual Reality and Software Technology 2005.
44. Pacific Graphics 2005.
46. Computer Animation and Social Agents 2005.
47. Computer Graphics International Conference 2005.
48. Robotics: Science and Systems 2005.
49. IEEE World Haptics Conference 2005.
50. ACM Symposium on Interactive 3D Graphics and Games 2005.
51. International Conference on Human-Computer Interaction 2005.
52. IEEE Visualization 2004.
53. Pacific Graphics 2004.
54. ACM SIGGRAPH 2004, Sketch Program.
55. ACM SIGGRAPH/Eurographics Symposium on Computer Animation 2004.
56. ACM SIGGRAPH Symposium on Applied Perception in Graphics and Visualization 2004.
57. International Workshop on Algorithmic Foundations of Robotics 2004.
58. Eurographics Symposium on Virtual Environments 2004.
59. ACM Symposium on Virtual Reality Software and Technology 2004.
60. IEEE Computer Animation and Social Agents 2004.

61. IEEE Virtual Reality Conference 2004.
62. ACM Symposium on Virtual Reality Software and Technology 2003.
63. IEEE/IRJ International Conference on Intelligent Robots and Systems 2003.
64. IEEE Computer Animation and Social Agents 2003.
65. IEEE International Conference on Robotics and Automation 2003.
66. ACM SIGGRAPH/Eurographics Symposium on Computer Animation 2003.
67. ACM Symposium on Interactive 3D Graphics 2003.
68. IEEE Virtual Reality Conference 2003.

Scientific Lectures

Over 80 Invited Talks at International Venues, Academic Institutes, and Research Laboratories.

Keynote and Invited Conference Presentations

1. Keynote Speaker, ACM SIGGRAPH International Conference on Virtual Reality Continuum and Its Applications, Singapore, China, 2008.
2. Keynote Speaker, ACM Symposium on Virtual Reality Software and Technology, Bordeaux, France, October 2008.
3. Invited Speaker, Motion in Games, Utrecht, Netherlands, June 2008.
4. Invited Speaker, SIAM Conference on Discrete Mathematics Mini-Symposium on Computational Geometry and Topology and Their Applications, June 2008.
5. Invited Speaker, IPAM Workshop on Scientific Computing Applications in Surgical Simulation of Soft Tissues, Los Angeles, January 2008.
6. Keynote Speaker, XVII Spanish Computer Graphics Conference (CEIG), Zaragoza, September 2007.
7. Keynote Speaker, EDUTAINMENT, Hong Kong, June 2007.
8. Invited Speaker, Workshop on Swarming in Natural and Engineered Systems, Philadelphia, May 2007.
9. Invited Speaker, DARPA Workshop on the Future of Constructive Simulations, January 2007.
10. Invited Speaker, 2006 Workshop on Current Progress of Education & Research in Computer Science, Durham, December 2006.
11. Banquet Speaker, Virtual Prototyping Engineering Research Center Conference, Research Triangle Park, August 2006.
12. Invited Speaker, Mini-Symposium on Physically-based Modeling, Simulation and Animation, Zurich, July 2006.
13. Invited Speaker, Summer Seminar on Rendering and Modeling in Computer Graphics, Ayia Napa, June 2006.
14. Keynote Speaker, ACM SIGGRAPH International Conference on Virtual Reality Continuum and Its Applications, Hong Kong, June 2006.
15. Invited Speaker, ARO Workshop on Multiscale Phenomena: Experiment, Theory, and Modeling, Research Triangle Park, July 2005.
16. Invited Speaker, Workshop on Motion Planning in Virtual Environments, Toulouse, Jan. 2005.
17. Keynote Speaker, Pacific Conference on Computer Graphics and Applications, Seoul, October 2004.
18. Invited Speaker, Dagstuhl Workshop on Hierarchical Methods, Dagstuhl, June 2003.

Distinguished Lectures

1. Distinguished Lecture Speaker, University of Missouri, Columbia, 2008-2009.
2. Distinguished Lecture Speaker, State University of New York, Stony Brook, 2007-2008.
3. Distinguished Lecture Speaker, Arizona State University, Tempe, December 2004.

Invited Panel Participations

1. Invited Panelist, NSF Cyberinfrastructure - Training, Education, and Mentoring (CI-TEAM) Community Workshop, Washington DC, July 2007.

2. Invited Panelist, NSF Design, Service, and Manufacturing Research and Grantees Conference, St. Louis, July 2006.

3. Invited Panelist, NIH/NSF Workshop on Visualization Research Challenges, Bethesda, September 2004.

4. Invited Participant, NSF/ENG Workshop on Cyberinfrastructure, Arlington, January 2004.

5. Invited Participant, The National Academies Computer Science and Telecommunication Board Planning Meeting on Fundamental Research Challenges in Computer Graphics, Salt Lake City, December 2003.

6. Invited Speaker, ArmyWorkshop on Modeling and Simulation, Research Triangle Park, November 2003.

Invited Course and Tutorial Presentations

1. Invited Course Speaker, IEEE/RSJ International Conference on Intelligent Robots and Systems, Zurich, September 2008.

2. Invited Course Speaker, ACM SIGGRAPH, Los Angeles, August 2008.

3. Invited Course Speaker, ACM SIGGRAPH, San Diego, August 2007.

4. Invited Course Lecturer, Canadian National Research Council, Montreal, September 2006.

5. Invited Course Speaker, ACM SIGGRAPH, Boston, July 2006

6. Course Organizer, ACM SIGGRAPH, Los Angeles, July 2005.

7. Invited Tutorial Speaker, Computer Animation and Social Agents, Geneva, July 2004.

8. Invited Course Speaker, ACM SIGGRAPH, Los Angeles, August 2004.

9. Invited Course Speaker, ACM SIGGRAPH, San Diego, July 2003.

Other Invited Seminars and Colloquia

1. Intel Corporation, Portland, Oregon, August 2008.

2. Department of Computer Science and Robotics Institute, Carnegie Mellon University, May 2008.

3. Department of Computer Science and UMIACS, University of Maryland at College Park, February 2008.

4. School of Computing, National University of Singapore, February 2008.

5. NSF Engineering Research Center for Computer-Integrated Surgical Systems and Technology, Johns Hopkins University, April 2007.

6. Department of Mechanical Engineering, Johns Hopkins University, April 2007.

7. Departments of Computer Science and Mechanical Engineering, McGill University, Sept 2006.

8. National Research Council Canada, Montreal, September 2006

9. Joint HMS & GRASP Seminar Series, University of Pennsylvania, October 2005.

10. Intel Corporation, Santa Clara, August 2005.

11. Institute of Creative Technology, University of Southern California, September 2004.

Research Funding

Grants and Contracts Awarded Since 1998

A Total of Over $4M External Funds as PI & Over $6M as Co-PI

1. "High-Performance Many-Core Clusters for Modeling and Simulation", total of $149K for 2008-2009, PI: M. Lin, funded by the Army Research Office.

2. "Real-time Physically-based Simulation and Interaction Using Many-Core Architectures", total of $225K for 2007-2009, PI: M. Lin, funded by Intel Corporation.

3. "CI-TEAM Implementation Project: Collaborative Research: Cyber-Infrastructure for Engineering Informatics Education", total of $900K (with $225K to UNC for 2007-2008, PI: M. Lin), funded by National Science Foundation.

4. "Multiresolution Algorithms for Processing Giga-Models: Real-time Visualization, Reasoning, and Interaction", total of $410,000 for 2006-2008, PI: M. Lin, funded by Army Research Office.

5. "Research in Edge Computing", total of $200K for October 2006 - September 2007, PI: D. Manocha, Co-PI: M. C. Lin, funded by Disruptive Technology Office.

6. "Conference Support for Edge Computing using New Commodity Architectures", total of $10,000 for 2006, PI: D. Manocha, Co-PI: M. C. Lin, funded National Science Foundation.

7. "Conference Support for Edge Computing using New Commodity Architectures", total of $35,000 for 2006, PI: D. Manocha, Co-PI: M. Lin, funded by DTO/RDECOM and DARPA.

8. "Conference Support for Edge Computing using New Commodity Architectures", total of $20,000 for 2006, PI: D. Manocha, Co-PI: M. Lin, funded by NVIDIA and ATI.

9. "Creation and Use of Multi-Disciplinary Engineering Models", total of $250,000 for 2005-2006, PI:W. Regli, Co-PIs: S. Gupta, M. Lin, and V. Shapiro, funded by National Science Foundation.

10. "Computer Generated Force Scalability", total of $2.5M for 2005-2008, PI: D. Manocha, Co-PI: M. Lin, funded by U.S. Army RDECOM, Army Modeling & Simulation Office, and Dole's Office.

11. "Enabling Real-Time Interaction for Moving Avatars in Virtual Environments", total of $469,074 for 2004-2007, PI: M. C. Lin, funded by the Office of Naval Research.

12. "NER: Modeling and Simulation of Fibrin Fibers", total of $100,000 for 2004-2005, PI: M. C. Lin, funded by National Science Foundation.

13. "Physically-Inspired Modeling for Haptic Rendering", 2004-2007, total of $200,000 for 2004-2007, PI: M. C. Lin, funded by National Science Foundation.

14. "GOALI: Multiresolution Algorithms for Virtual Prototyping of Massive CAD Models", total of $381,597 for 2004-2007, PI: Dinesh Manocha, co-PI: M. C. Lin, funded by National Science Foundation.

15. "Interactive OneSAF Computations using COTS Graphics Hardware", total of $875,000 for 2004-2006, PI: D. Manocha, Co-PI: M. C. Lin, funded by DARPA.

16. "Conference Support for ACMWorkshop on General Purpose Computation using Graphics Processors", total of $30K for 2004, PI: M. C. Lin, Army Research office, PEOSTRI, and RDECOM.

17. "Real-time Interaction with Virtual Environments", total of $646,919 for 2000-2004, PI: M. C. Lin, funded by Office of Naval Research.

18. "DURIP: Physically-based Interaction with Massive Datasets", total of $100,000 for 2003-2005, PI: M. C. Lin, funded by Army Research Office.

19. "Handling Massive Models: Representation, Real-Time Display and Interaction", total of $340,000 for 2002-2005, PI: D. Manocha, Co-PI: M. C. Lin, funded by Army Research Office.

20. "Conference Support for Workshop on Intelligent Human Augmentation", total of $35,000 for 2002-2003, PI: M. C. Lin, funded by Army Research Office

21. "High-Fidelity Virtual Touch: Algorithms, Applications and Evaluation", total of $370,000 for 2001-2004, PI: M. C. Lin, funded by National Science Foundation.

22. "DURIP: Physically-based Haptic Interaction with Virtual Environments", total of $166,300 for 2001-2002, PI: M. C. Lin, funded by Office of Naval Research.

23. "Real-Time Physically-based Modeling and Interaction", total of $225,000 plus over $75,000 equipment donation for 2001-2004, PI: M. C. Lin, funded by Intel Corporation.

Pending Proposals

1. "PlanUNC Deformable Registration System", total of $275K (direct cost), 2009-2011, PI: M. Foskey, Co-PI: M. Lin and Julian Rosenman, submitted to National Institutes of Health.

2. "GOALI: Digital Layout and Assembly of Large CAD Structures", total of $400K, 2009-2011, PI: D. Manocha, Co-PI: D. Kasik and M. Lin submitted to National Science of Foundation.

Refereed Scientific Publications

More Than 180 Refereed Work in Leading Journals and Conference Proceedings in Computer Graphics, Robotics, Haptics, Virtual Reality, and Geometric Computing; With an h-Index of 45 and More Than 5,000 Citations According to Google Scholar

Books and Research Monographs

1. Ming C. Lin and Miguel Otaduy (2008), "Haptic Rendering: Foundations, Algorithms, and Applications", over 650 pages, published by A. K. Peters.
2. Miguel A. Otaduy and Ming C. Lin (2006), "High-Fidelity Haptic Rendering", published by Morgan & Claypool Publishers.

Refereed Handbook and Book Chapters

1. M. C. Lin, A. Sud, J. Van den Berg, R. Gayle, S. Curtis, H. Yeh, S. Guy, E. Andersen, S. Patil, J. Sewall, and D. Manocha (2008), "Real-Time Path Planning and Navigation for Multi-agent and Crowd Simulations", Lecture Notes in Computer Science 5277, edited by A. Egges, A. Kamphuis, and M. Overmars, published by Springer-Verlag, p.23-32, 2008.
2. M. C. Lin and D. Manocha (2004), "Collision Detection", in Handbook of Data Structures and Applications, p. 56-1 - p. 56-20, edited by S. Sahni and D. Mehta, published by CRC Press, 2004.
3. M. C. Lin and D. Manocha (2003), "Collision and Proximity Queries", 20 pages, in Handbook of Discrete and Computational Geometry, Second Edition, pp. 787-807, edited by J. O'Rourke and E. Goodman, published by CRC Press, 2003.

Refereed Journal and SIGGRAPH Publications

1. N. Raghuvanshi, R. Narain, and M. Lin, "Efficient and Accurate Sound Propagation Using Adaptive Rectangular Decomposition", to appear in IEEE Trans. on Visualization and Graphics 2009.
2. R. Gayle, A. Sud, E. Andersen, S. Guy, M. Lin, and D. Manocha, "Interactive Navigation of Heterogeneous Agents Using Adaptive Roadmaps", to appear in IEEE Trans. on Visualization and Computer Graphics, Mar/Apr 2009.
3. R. Narain, J. Sewall, M. Carlson, and M. Lin, "Fast Animation of Turbulent Flows Using Energy Transport and Procedural Synthesis", Proc. of ACM SIGGRAPH Asia, December 2008.
4. W. Moss, M. Lin, and D. Manocha, "Constraint-based Motion Synthesis for Deformable Models". Journal of Computer Animation and Virtual World, Special Issue (Best of Computer Animation and Social Agents 2008).
5. A. Sud, E. Andersen, S. Curtis, M. Lin, and D. Manocha, "Real-time Path Planning in Dynamic Virtual Environments Using Multi-agent Navigation Graphs", to appear in IEEE Trans. on Visualization and Computer Graphics, 2008
6. V. Kwatra, P. Mordohai, R. Narain, S. Kumar Penta, M. Carlson, M. Pollefeys, and Ming C. Lin "Fluid in Video: Augmenting Real Video with Simulated Fluids", to appear in the Computer Graphics Forum (Proc. of Eurographics), 10 pages, April 2008.
7. Nico Galoppo, M. Otaduy, S. Tekin, M. Gross, and M. Lin, "Fast Contact Dynamics for Deformable Articulated Characters". in the Computer Graphics Forum (Proc. of EuroGraphics), 10 pages, September 2007.
8. V. Kwatra, D. Adalsteinsson, T. Kim, N. Kwatra, M. Carlson, and M. Lin (2007), "Texturing Fluids". IEEE Trans. on Visualization and Computer Graphics, July/August 2007
9. N. Raghuvanshi, C. Lauterbach, A. Chandak, D. Manocha, and Ming C. Lin (2007), "Real-Time Sound Synthesis and Propagation for Games", Communications of the ACM, p. 66-73, July 2007.
10. T. Kim and M. Lin (2007), "Stable Advection-Reaction-Diffusion with Arbitrary Anisotropy", Journal of Computer Animation and Virtual World, Special Issue (Best of Computer Animation and Social Agents), Volume 18, Issue 4-5 (September - December), p. 329-338, 2007
11. T. Kim and M. Lin (2007), "Fast Animation of Lightning Using Adaptive Meshes", IEEE Trans on Visualization and Computer Graphics, Vol. 13, Issue 2, pp. 390-402, 2007.
12. T. Kim, J. Sewall, A. Sud, and M. Lin (2007), "Fast Simulation of Laplacian Growth", in IEEE Computer Graphics and Applications, Vol. 27, No. 2, pp. 68-76, March/April 2007.
13. K.Ward, N. Galoppo, and M. Lin (2007), "Interactive Virtual Hair Salon", in Presence: Teleoperators & Virtual Environments. Vol. 16, No. 3, p. 237-251, June 2007. (The Most Downloaded Article of the Journal as of January 2008)

14. K. Ward, F. Bertails, T.-Y. Kim, S. Marshner, M.-P. Cani, and M. Lin (2007), "A Survey on Hair Modeling: Styling, Simulation, and Rendering", to appear in IEEE Trans on Visualization and Computer Graphics, Vol. 13, Issue 2, p. 213-234, 2007.

15. Y. Kim, S. Redon, M. Lin, D. Manocha, and J. Templeman (2007), "Interactive Continuous Collision Detection using Swept Volume for Avatars", in Presence: Teleoperators & Virtual Environments, Volume 16, Number 2, p. 206-223, 2007. (On The List of Top 20 Most Downloaded Articles as of October 2007)

16. N. Raghuvanshi and M. Lin (2007), "Physically-based Sound Synthesis for Large-Scale Virtual Environments", invited submission, in IEEE Computer Graphics and Applications, Vol. 27, No. 1, pp. 14-18, Jan/Feb 2007.

17. N. Govindaraju, I. Kabul, M. C. Lin, and D. Manocha, "Fast Continuous Collision Detection among Deformable Models using Graphics Processors", invited submission, in Computers & Graphics, Volume 31, Issue 1, p. 5-14, Jan 2007.

18. J. Wendt, W. Baxter, I. Oguz, and M. Lin (2007), "Finite-Volume Flow Simulations in Arbitrary Domains", in Graphical Models, Volume 69, Number 1, pp. 19-32, 2007.

19. M. A. Otaduy and M. C. Lin, (2006) "A Haptic Rendering Pipeline for Stable and Responsive Six- Degree-of-Freedom Manipulation", in IEEE Trans. on Robotics, Volume 22, Number 4, pp. 751-762, August 2006.

20. S. Redon and M. Lin (2006), "An Efficient, Error-Bounded Approximation Algorithm for Simulating Quasi-Statics of Complex Linkages", invited submission, Computer Aided Design, Volume 38, Issue 4, pp. 300-314, April 2006.

21. N. Govindaraju, M. Lin, and D. Manocha (2006), "Efficient Collision Culling among Deformable Objects using Graphics Processors", invited submission, in Presence, Volume 15, Number 1, pp. 62-76, January 2006.

22. N. Govindaraju, M. Lin, and D. Manocha (2006), "Fast and Reliable Collision Culling using Graphics Hardware", invited submission, in IEEE Trans on Visualization and Computer Graphics, Volume 12, Number 2, pp. 143-154, March/April 2006.

23. S. Redon and M. Lin (2006), "A Fast Method for Local Penetration Depth Computation", Vol. 11, No. 2, pp. 37-50, Journal of Graphical Tools, 2006.

24. N. Jain, I. Kabal, N. Govindaraju, M. Lin, and D. Manocha (2005), "Multiresolution Collision Handling for Cloth-like Simulations", Journal of Computer Animation and VirtualWorlds, Special Issue (Best of Computer Animation and Social Agents), pp. 141-151, July 2005.

25. S. Redon, N. Galoppo, and M. Lin (2005), "Adaptive Dynamics of Articulated Bodies", in the ACM Trans. on Graphics (Proc. of ACM SIGGRAPH), pp. 936-945, July 2005.

26. N. Govindaraju, D. Knott, N. Jain, I. Kabal, R. Tamstorf, R. Gayle, M. Lin, and D. Manocha (2005), "Collision Detection between Deformable Models using Chromatic Decomposition", in the ACM Trans. on Graphics (Proc. of ACM SIGGRAPH), pp. 991-999 (also Back-Cover Image), July 2005.

27. M. C. Lin and M. A. Otaduy (2005), "Sensation Preserving Haptic Rendering", IEEE Computer Graphics and Applications, invited submission, pp. 8-11, July/August 2005.

28. S. Redon, M. Lin, D. Manocha, and Y. Kim (2005), "Fast Continuous Collision Detection for Articulated Models", invited submission, in the Journal of Computing and Information Science in Engineering, pp. 126-137, 2005.

29. W. Baxter, Y. Liu and M. Lin (2004), "A Viscous Paint Model for Interactive Applications", in the Journal of Computer Animation and Virtual Worlds, Special Issue (Best of Computer Animation and Social Agents), pp. 433-441, July 2004.

30. H. Schmidl and M. Lin (2004), "Geometry-Driven Physical Interaction Between Avatars and Virtual Environments", in the Journal of Computer Animation and Virtual Worlds, Special Issue (Best of Computer Animation and Social Agents), pp. 229-236, July 2004.

31. M. Lin, W. Baxter, V. Scheib, and J. Wendt (2004) , "Physically-Based Virtual Painting", invited submission, in the Communications of the ACM, pp. 40-47, August 2004.

32. Y. Kim, G. Varadhan, M. C. Lin and D. Manocha (2004), "Fast Swept Volume Approximation of Complex Polyhedral Models", invited submission, Special Issue of Computer Aided Design, Volume 36, Number 11, pp. 1013-1027, 2004.

33. H. Schmidl, N. Walker, and M. Lin (2004), "Fast Update of OBBTrees for Articulated-Body Collision Detection", in the Journal of Graphical Tools, Volume 9, Number 2, pp. 1-9, 2004.

34. M. Foskey, M. C. Lin and D. Manocha (2003), "Efficient Computation of A Simplified Medial Axis", invited submission, Special Issue of ASME Journal of Computing and Information Science in Engineering, Volume 3, pp. 274-284, December 2003.

35. M. Otaduy and M. Lin (2003), "Sensation Preserving Simplification for Haptic Rendering", in ACM Trans. on Graphics (Proc. of ACM SIGGRAPH), Vol. 22, pp. 543-553, 2003.

36. Y. J. Kim and M. C. Lin and D. Manocha (2003), "Incremental Penetration Depth Estimation Between Convex Polytopes Using Dual-space Expansion", in IEEE Trans. on Visualization and Computer Graphics, pp. 152-163, 2003.

37. Y. Kim, M. Otaduy, M. C. Lin and D. Manocha (2003), "Six-Degree-of-Freedom Haptic Rendering Using Incremental and Localized Computations", in Presence, Vol. 12, No. 3, pp. 277-295, Cover Image Article, June 2003.

Refereed Papers in Conference Proceedings

1. J. van den Berg, M. Stilman, J. Kuffner, M. C. Lin, and D. Manocha, "Path Planning among Movable Obstacles: a Probabilistically Complete Approach", Proc. of International Workshop on Algorithmics of Robotics 2008.

2. H. Yeh, S. Curtis, S. Patil, J. van den Berg, D. Manocha, and M. Lin, "Composite Agents". Proc. of ACM SIGGRAPH/Eurographics on Computer Animation 2008.

3. J. Sewall, G. , N. Galoppo, G. Tsankov, and M. C. Lin, "Visual Simulation of Shockwaves". Proc. of ACM SIGGRAPH/Eurographics on Computer Animation 2008.

4. H. Lee, M. Lin, and M. Foskey, "Physically-Based Validation of Deformable Medical Image Registration". Proc. of MICCAI 2008.

5. N. Raghuvanshi, N. Galoppo, and M. C. Lin, "AcceleratedWave-based Acoustic Simulation". Proc. of ACM Symposium on Solid and Physical Modeling 2008.

6. J. van den Berg, M. Lin, and D. Manocha, "Using Reciprocal Velocity Obstacles for Real-Time Multi-Robot Navigation in Dynamic Environments", Proc. of IEEE Int. Conference on Robotics and Automation 2008.

7. J. van den Berg, S. Patil, J. Sewall, D. Manocha, and M. Lin "Interactive Navigation of Multiple Agents in Crowded Environments", Proc. of ACM Symposium on Interactive 3D Graphics and Games 2008.

8. A. Sud, R. Gayle, E. Andersen, S. Guy, M. Lin, and D. Manocha, "Real-time Navigation of Independent Agents Using Adaptive Roadmaps", Proc. of ACM Symposium on Virtual Reality Software and Technology 2007.

9. R. Gayle, A. Sud, M. Lin, and D. Manocha, "Reactive Deformation Roadmaps: Motion Planning of Mutliple Robots in Dynamic Environments", Proc. of IEEE/RSJ International Conference on Intelligent Robots 2007.

10. J. Sewall, P. Mecklenburg, S. Mitran, and M. Lin, "Fast Flow Simulation Using Residual Distribution Schemes", Proc. of Eurographics Workshop on Natural Phenomena 2007.

11. R. Narain, V. Kwatra, T. Kim, H. Lee, M. Carlson, M. Lin, "Feature-Guided Dynamic Texture Synthesis on Continuous Flows", Proc. of Eurographics Symposium on Rendering 2007.

12. N. Galoppo, M. Otaduy, S. Tekin, M. Gross, and M. Lin, "Haptic Rendering Using Dynamic Deformation Textures", invited submission, Proc. of Human Computer Interface International Symposium on Virtual Reality, July 2007.

13. I. Kabul, R. Gayle, and M. Lin, "Cable Route Planning in Complex Environments Using Constrained Sampling". Proc. ACM Symposium on Solid and Physical Modeling and Applications, p. 395-402, June 2007.

14. R. Gayle, M. Lin, and D. Manocha, "Efficient Motion Planning of Highly Articulated Chains using Physics-based Sampling". Proc. of IEEE International Conference on Robotics and Automation, p. 3319-3326, April 2007.

15. A. Sud, E. Andersen, S. Curtis, M. Lin, and D. Manocha, "Real-time Path Planning for Virtual Agents in Dynamic Environments", in the Proc. of IEEE Virtual Reality, p. 91-98, March 2007.

16. T. Kim, D. Adalsteinsson and M. Lin, "Modeling Ice Dynamics As A Thin-Film Stefan Problem", Proc. of ACM SIGGRAPH/Eurographics Symposium on Computer Animation, pp. 167-176 & 366, Cover Image Article, September 2006.

17. N. Galoppo, M. A. Otaduy, P. Mecklenburg, M. Gross and M. C. Lin, "Fast Simulation of Deformable Models in Contact Using Dynamic Deformation Textures", Proc. of ACM SIGGRAPH/Eurographics Symposium on Computer Animation, pp. 73-82 & 363, Sept 2006.
18. R. Gayle, M. C. Lin, and D. Manocha, "Adaptive Dynamics with Efficient Contact Handling for Articulated Robots", in the Proc. of Robotics: Science and System 2006.
19. N. Govindaraju, I. Kabul, M. C. Lin, and D. Manocha, "Fast Continuous Collision Detection among Deformable Models using Graphics Processors", in the Proc. of Eurographics Symposium on Virtual Environments, pp. 19-26, May 2006.
20. N. Raghuvanshi and M. Lin "Interactive Sound Synthesis for Large Scale Environments", Proc. of ACM Symposium on Interactive 3D Graphics and Games pp. 101-108, March 2006.
21. K.Ward, N. Galoppo, and M. Lin, "A Simulation-based VR System for Interactive Hairstyling", Proc. of IEEE Virtual Reality, pp. 257-260, March 2006.
22. J. Schoner, M. Falvo, S. Lord, R. Taylor II, and M. Lin "Interactive Simulation of Fibrin Fibers in Virtual Environments" Proc. of IEEE Virtual Reality, pp. 27-34, March 2006.
23. R. Gayle, P. Segars, M. Lin, and D. Manocha, "Path Planning for Deformable Robots in Complex Environments", Proc. of Robotics: Sciences and Systems, pp. 1-8, June 2005.
24. S. Redon and M. Lin, "An Efficient, Error-Bounded Approximation Algorithm for Simulating Quasi-Statics of Complex Linkages", Proc. of ACM Symposium on Solid and Physical Modeling, pp. 175-186, June 2005.
25. M. Otaduy and M. C. Lin, "Stable and Responsive Six-Degree-of-Freedom Haptic Manipulation Using Implicit Integration", Proc. of IEEE World Haptics Conference, pp. 247-256, March 2005.
26. S. Redon and M. Lin, "Practical Local Planning in the Contact Space", Proc. of IEEE International Conference on Robotics and Automation, pp. 4200-4205, April 2005.
27. R. Gayle, M. Lin, and D. Manocha, "Constraint-Based Motion Planning of Deformable Robots", Proc. of IEEE International Conference on Robotics and Automation, pp. 1046-1053, April 2005.
28. N. Govindaraju, M. Henson, M. C. Lin, and D. Manocha, "Interactive Visibility Ordering of Geometric Primitives in Complex Environments", Proc. of ACM Symposium on Interactive 3D Graphics and Games, pp. 49-56, March 2005.
29. N. Govindaraju, M. Lin, and D. Manocha, "Quick-CULLIDE: Fast Inter- and Intra-Object Collision Culling Using Graphics Hardware", Proc. of IEEE VR, pp. 59-66, March 2005.
30. N. Govindaraju, M. Lin and D. Manocha, "Fast and Reliable Collision Culling using Graphics Hardware", Proc. of ACM VRST, pp. 2-9, November 2004.
31. T. Kim and M. Lin, "Physically Based Animation and Rendering of Lightning", Proc. of Pacific Graphics, pp. 267-275 (also Cover Image), October 2004.
32. W. Baxter and M. Lin, "A Versatile, Interactive 3D Brush Model". Proc. of Pacific Graphics, pp. 319-328 (also Cover Image), October 2004.
33. M. Otaduy, N. Jain, A. Sud, and M. Lin, "Haptic Rendering of Interaction between Textured Models", Proc. of IEEE Visualization 2004.
34. T. Kim, M. Henson, and M. Lin, "A Hybrid Algorithm for Modeling Ice Formation", Proc. of ACM SIGGRAPH/Eurographics Symposium on Computer Animation 2004, p. 305-314.
35. M. Otaduy and M. Lin, "A Perceptually-Inspired Force Model for Haptic Texture Rendering", Proc. of ACM Symposium on Applied Perception on Graphics and Visualization 2004.
36. K. Ward, N. Galoppo, and M. Lin, "Modeling Hair Influenced by Water and Styling Products", Proc. of Computer Animation and Social Agents 2004.
37. S. Yoon, B. Salomon, M. Lin, and D. Manocha, "Fast Collision Detection between Massive Models using Dynamic Simplification", pp. 136-146, Proc. of Eurographics Symposium on Geometry Processing 2004.
38. Brian Salomon, Naga K. Govindaraju, Avneesh Sud, Russel Gayle, Ming Lin, Dinesh Manocha, Brett Butler, Maria Bauer, Angel Rodriguez, and Michael Macedonia, "Accelerating Line-of-Sight Computations Using GPUs", Proc. of Army Science Conference 2004
39. W. Baxter and M. Lin, "Haptic Interaction with Fluid Media", Proc. of Graphics Interface 2004. (8 pages)

40. S. Redon, M. Lin, D. Manocha and Y. Kim, "Fast Continuous Collision Detection for Articulated Models". Proc. of ACM Symposium on Solid Modeling and Applications 2004. (12 pages)

41. N. Govindaraju, B. Lloyd, W.Wang, M. Lin and D. Manocha, "Fast Computation of Database Operations using Graphics Processors", Proc. of ACM SIGMOD International Conference on Management of Data 2004. (12 pages)

42. W. Baxter, J. Wendt and M. Lin, "IMPaSTo: A Realistic, Interactive Model for Paint", Proc. of ACM Symposium on Non-Photorealistic Animation and Rendering, pp. 45-56, 2004.

43. S. Redon, Y. Kim, M. Lin, D. Manocha, and J. Templeman, "Interactive Continuous Collision Detection for Avatars in Virtual Environments", Proc. of IEEE Virtual Reality 2004. (9 pages)

44. K. Ward and M. Lin, "Adaptive Grouping and Subdivision for Simulating Hair Dynamics", Proc. of Pacific Graphics, p.234-243, 2003.

45. N. Govindaraju, S. Redon, M. Lin and D. Manocha, "CULLIDE: Interactive Collision Detection Between Complex Models in Large Environments using Graphics Hardware", in Proc. of SIGGRAPH/Eurographics Graphics Hardware, p.25-32, 2003.

46. M. Otaduy and M. Lin, "CLODs: Dual Hierarchies for Multiresolution Collision Detection", in Proc. of Symposium on Geometry Processing, p. 94-101, 2003.

47. T. Kim and M. Lin, "Visual Simulation of Ice Crystal Growth", in Proc. of ACM SIGGRAPH/Eurographics Symposium on Computer Animation, p.86-97, 2003.

Refereed Video Publications and Short Papers

1. R. Narain, J. Sewall, M. Carlson, and M. Lin, "Coupling Numerical and Procedural Methods for Animating Turbulent Fluids", Poster Proc. of ACM SIGGRAPH/Eurographics Symposium on Computer Animation, 2 pages, 2008.

2. J. Sewall, P. Mecklenburg, S. Mitran, and M. Lin, "Fast Fluid Simulation Using Residual Distribution Schemes", Poster Proc. of ACM SIGGRAPH/Eurographics Symposium on Computer Animation, 2 pages, 2007.

3. N. Galoppo, M. A. Otaduy, S. Tekin, M. Gross and M. C. Lin, "Accelerated Proximity Queries for Haptic Rendering of Deformable Models", Proc. of World Haptics Conference, 2 pages, 2007.

4. N. Galoppo, M. A. Otaduy, P. Mecklenburg, M. Gross and M. C. Lin, "Fast Simulation of Detailed Layered Deformable Objects in Contact", ACM SIGGRAPH SKETCHES, 1 page, 2006.

5. V. Kwatra, D. Adalsteinsson, N. Kwatra, M. Carlson, and M. Lin "Texturing Fluids", ACM SIGGRAPH SKETCHES, 1 page, 2006.

6. J. Wendt, W. Baxter, I. Oguz, and M. Lin, "3D Flows in Arbitrary Domains", in the Poster Proc. of ACM SIGGRAPH/Eurographics Symposium on Computer Animation, 2 pages, 2005.

7. N. Govindaraju, M. Lin, and D. Manocha, "GPGP: General Purpose Computations using Graphics Processors", in the Proc. of High-Performance Embedded Computing Workshop, 2 pages, 2005.

8. T. Kim, J. Sewall, A. Sud, and M. Lin, "A Fast Fractal Growth Algorithm", ACM SIGGRAPH SKETCHES, 1 page, 2005.

9. J. Wendt, W. Baxter, I. Oguz, and M. Lin, "Animation of SIGGRAPH Logo using FVM-Based Smoke", in ACM SIGGRAPH Electronic Art & Animation Catalog, 1 page, 2005.

10. J. Sewall, T. Kim, and M. Lin, "Green's Fractal Terrains", in Electronic Theater, ACM SIGGRAPH Electronic Art & Animation Catalog, 1 page, 2005

11. N. Govindaraju, M. Lin, and D. Manocha, "Fast and Reliable Collision Detection using Graphics Processors", in Proc. of ACM Computational Geometry Conference, Video Publication, 2 pages, 2005.

12. M. Otaduy, N. Jain, A. Sud, and M. Lin, "Haptic Rendering of Interaction between Textured Models", Presented at ACM SIGGRAPH SKETCHES, 1 page, 2004.

13. N. Govindaraju, M. Lin and D. Manocha, "Fast and Reliable Collision Culling using Graphics Hardware", Presented at ACM SIGGRAPH SKETCHES, 1 page, 2004.

14. T. Kim, M. Henson, and M. Lin, "A Physically-based Model of Ice", Presented at ACM SIGGRAPH SKETCHES, 1 page, 2004.

15. K. Ward, N. Galoppo, and M. Lin, "A Viscous Paint Model for Interactive Application", Presented at ACM SIGGRAPH SKETCHES, 1 page, 2004.

16. W. Baxter, Y. Liu and M. Lin, "A Viscous Paint Model for Interactive Applications", Presented at ACM SIGGRAPH SKETCHES, 1 page, 2004.

17. Y. Kim, M. Otaduy, M. Lin and D. Manocha (2003), "Fast Penetration Depth Estimation Using Rasterization Hardware and Hierarchical Refinement", in Proc. of ACM Computational Geometry Conference, Video Publication, 2 pages, 2003.

Other Scientific Publications

Manuscripts under Review

1. R. Gayle, M. Lin, and D. Manocha, "Motion Planning of multiple high-DOF Robots using C-Space Particles".

2. J. van den Berg, J. Sewall, M. C. Lin, and Dinesh Manocha "Virtualized Traffic: Reconstructing Traffic Flows from Discrete Spatio-Temporal Data.

3. R. Gayle, W. Moss, M. C. Lin, and D. Manocha, "Multi-Robot Coordination using Generalized Social Potential Fields".

4. N. Raghuvanshi, R. Narain, and M. Lin, "Efficient and Accurate Sound Propagation Using Adaptive Rectangular Decomposition".

5. N. Galoppo, W. Moss, S. Curtis, J. Sewall, M. Otaduy, and M. Lin, "Controlling Deformable Models with Dynamic Morph Targets".

Invited Technical Magazine Articles

1. M. C. Lin and K. Salisbury, "Touch-Enabled Interfaces", IEEE Computer Graphics and Applications, November/December 2004.

2. M. C. Lin and K. Salisbury, "Haptic Rendering – Beyond Visual Display", IEEE Computer Graphics and Applications, March/April 2004.

3. T. Kim and M. Lin, "The Cold Facts About Ice Growth", Animation Reporter, September 2003.

Other Conference/Workshop Publications and Presentations

1. M. Piasecki, M. Amin, S. Dyke, M. Lin, U. Neumann, J. Rawlings, and B. Spencer, "Research Opportunities in CyberEngineering and Cyberinfrastructure Development", 40 pages, 2004.

Software Systems
More than 25,000 Web Downloads

1. I-COLLIDE: An Interactive and Exact Collision Detection System, Release 1.0,1.1,1.2 (Copyright 1995) – an interactive and exact collision detection library for large virtual environments composed of numerous convex polyhedra. Many non-convex polyhedra may be decomposed into a set of convex polyhedra, which may then be used with this library. I-COLLIDE exploits coherence and the properties of convexity to achieve interactive collision detection which is exact to the accuracy of the input models. This is the first well-known system which can perform the computation for collision detection at interactive rate for large-scaled simulated environments. The library has been tested in both an architectural walkthrough and multi-body simulations, impulse-based simulations. The time required for collision detection is typically small compared to the time to generate the graphics for these simulations. I-COLLIDE is based on Ming Lin's thesis and jointly developed by researchers at the University of North Carolina at Chapel Hill and the University of California at Berkeley.

2. RAPID: Rapid and Accurate Polygon Interference Detection Release 1.01, 1.03,1.04,2.00,2.01 (Copyright 1996) – a collision detection library for large environments composed of unstructured models, It is applicable to polygon soups - models which contain no adjacency information, and obey no topological constraints. The models may contain cracks, holes, self-intersections, degenerate polygons and non-generic (e.g. coplanar and collinear) configurations. It is numerically robust - the algorithm is not subject to conditioning problems, and requires no special handling of non-generic cases (such as parallel faces,

degenerate triangles, etc). RAPID has been developed by S. Gottschalk, under the supervision of M. C. Lin and D. Manocha at the University of North Carolina Chapel Hill.

3. V-COLLIDE, Release 1.0,1.1 (Copyright 1997) – a collision detection library for large environments of arbitrary polygonal objects. V-Collide uses a three-stage collision detection architecture: (1) An Nbody test finds possibly colliding pairs of objects, (2) A hierarchical oriented bounding box test finds possibly colliding pairs of triangles, and (3) An exact test determines whether or not a pair of triangles actually overlaps. V-Collide has been developed under the supervision of M. C. Lin and D. Manocha at the University of North Carolina at Chapel Hill.

4. S-COLLIDE: efficient and exact collision detection for spline models, Release 1.1 (Copyright 1999) – S-Collide performs fast and accurate interference detection between spline models based on the hierarchical representation of novel bounding volumes, called spherical shells. It uses a 2-level hierarchical approach: the top level eliminates pairs of objects that are not close to each other, while the bottom level performs fast and accurate intersection test between spline patches. S-Collide has been developed under the supervision of M. C. Lin and D. Manocha at the University of North Carolina at Chapel Hill.

5. PQP: fast proximity query package, Release 1.0 (Copyright 1999) – PQP is a library for performing three types of proximity queries on a pair of geometric models composed of triangles. The queries include collision detection, distance computation and tolerance verification. It uses a family of bounding volumes called swept sphere volumes and exploits coherence and priority-directed search to perform fast proximity queries. PQP has been developed under the supervision of M. C. Lin at the University of North Carolina at Chapel Hill.

6. SWIFT: Speedy Walking via Improved Feature Testing, Release 1.0 (Copyright 2000) – SWIFT is a library for collision detection, distance computation, and contact determination of three-dimensional polygonal objects undergoing rigid motion. SWIFT can handle geometric models that are closed and convex (or composed of convex pieces). It uses multiresolution representations and Voronoi marching to take advantage of coherence. SWIFT has been developed under the supervision of M. C. Lin at the University of North Carolina at Chapel Hill.

7. SWIFT++: Speedy Walking via Improved Feature Testing, Release 1.0, 1.1, 1.2 (Copyright 2001) – SWIFT++ is a library for collision detection, distance computation, and contact determination of three-dimensional polygonal objects undergoing rigid motion. It uses a hierarchical data structure built upon a surface decomposition of the models and the incremental query algorithms exploiting coherence. SWIFT++ has been developed under the supervision of M. C. Lin at the University of North Carolina at Chapel Hill.

8. PIVOT2D: Proximity Information from VOronoi Techniques, Release 1.0 (Copyright 2001) – PIVOT2D is a library for computing generalized proximity information of arbitrary 2D objects using graphics hardware. It supports the following proximity queries: collision detection, separation distance, penetration depth, contact points and normals. The main features include generality, simplicity, efficiency, no precomputation, robustness, bounded error approximation, and portability. PIVOT2D has been developed under the supervision of M. C. Lin and D. Manocha at the University of North Carolina at Chapel Hill.

9. DEEP: Dual-space Expansion for Estimating Penetration Depth Release 1.0 (Copyright 2002) – DEEP is a library for computing estimated penetration depth between two convex polyhedra using a greedy algorithm. It incrementally seeks a "locally optimal solution" by walking on the surface of the Minkowski sums. The surface of the Minkowski sums is computed implicitly by constructing a local Gauss map. In practice, the algorithm works well when there is high motion coherence in the environment and is able to compute the optimal solution in most cases. DEEP has been developed under the supervision of M. C. Lin and D. Manocha at the University of North Carolina at Chapel Hill.

10. dAb: Interactive Haptic Painting with 3D Virtual Brushes Release 1.0 (Copyright 2002) – dAb is a system for interactive painting with 3D virtual brushes and haptic interfaces. It uses a physically based,

deformable 3D brush model and bi-directional, two-layer paint model. These allow the user to produce complex brush strokes intuitively. The haptic feedback enhances the sense of realism and provides tactile cues that enable the user to better manipulate the paint brush. dAb has been developed under the supervision of M. C. Lin at the University of North Carolina at Chapel Hill.

11. IMPaSTo: A Realistic, Interactive Model for Paint Release 1.0 (Copyright 2004) – IMPaSTo is a novel paint model for use in interactive painting systems that captures a wide range of styles similar to oils or acrylics. The model includes both a numerical simulation to recreate the physical flow of paint and an optical model to mimic paint appearance. IMPaSTo has been developed under the supervision of M. C. Lin at the University of North Carolina at Chapel Hill.

12. V-Brush: A Versatile Interactive 3D Brush Model Release 1.0 (Copyright 2005) – V-Brush is a flexible brush modeling system capable of realistically simulating many varieties of brushes commonly used in real painting. The geometric model of brush heads is a combination of subdivision surfaces and hundreds of individual bristles represented by thin polygonal strips. It exploits bristle-to-bristle coherence, simulating only a fraction of the bristles and using interpolation for the remainder. Its dynamic model incorporates realistic physically-based deformation, including anisotropic friction, brush plasticity, and tip spreading. V-Brush has been developed under the supervision of M. C. Lin at the University of North Carolina at Chapel Hill.

Selected Press Coverage

1. GAMMA's research on GPGPU is covered in an article in Wired Magazine on "Supercomputing Next Revolution" on November 9, 2006.
2. A coverage on a new research project led by Manocha and Lin and funded by Senator Dole's Office was highlighted in Daily Tar Heel on October 4, 2006.
3. Research on haptic rendering and applications led by Lin was highlighted in 2006 NSF Annual Reports on scientific nuggets.
4. DARPA's Legacy press release on UNC's GPU accelerated algorithm's technology transfer to OneSAF on August 22, 2005.
5. Research on Adaptive Dynamics led by Lin was highlighted in a Gamasutra article on August 11, 2005.
6. A summary article about UNC GAMMA Group's research on GPGP: General Purpose Computation with Graphics Processors, Tom's Hardware Guide on June 30, 2005.
7. An article about GAMMA Group's GPU-Accelerated Computing, Slashdot News on June 29, 2005.
8. Cover Image created using IMPaSTo and dAb, IEEE Computer Graphics and Applications, November/December 2004.
9. Cover Image created using dAb, IEEE Computer Graphics and Applications, March/April 2004.
10. "Tool Blazes Virtual Trails", Technology Research News and MIT Technology Review on August 4, 2003.
11. A summary article about our work on Interactive Navigation in Complex Environments, ACM TECHNews, Vol. 5, Issue 537 on August 25, 2003

University Service and Pedagogical Activities

Department & University Committees
• Faculty Supervisor, UNC Robotics Club, 2007 - Present.
• Chair, Curriculum and Planning Committee, 2005 - Present.
• Chair, Colloquium Committee, 1998 - 2002, 2004 - 2005.
• Member, Provost's Task Force on Undergraduate Excellence, 2008-Present.
• Proposal Contributor, UNC's NSF ADVANCE Grant Proposal Writing Team, 2005-2006.
• Member, Study Group on UNC Chapel Hill North Project, 2005.

• Member, Graduate Committee, 2000 - 2005.
• Founder and Organizer, Carolina Women in Computer Science, 1999 - Present.

Student Supervision
      1. Erik Andersen (B.S. Honor Thesis 2007; University of Washington)
      2. William Baxter (Ph.D. 2004; OLM Digital, Inc.)
      3. Boriana Ditcheva (B.S. Honor 2005; Columbia University)
      4. Nico Galoppo (M.S. 2005; Ph.D. 2008)
      5. Russell Gayle (M.S. 2006; Ph.D. Expected 2009)
      6. Stephen Guy (M.S. 2008 Expected)
      7. Kenny Hoff III (M.S. 2001; Ph.D. ABD 2004; Sony R & D America)
      8. Nitin Jain (M.S. 2005)
      9. Ilknur Kabul (M.S. 2008 Expected)
      10. Theodore Kim (Ph.D. 2006; Cornell University)
      11. David Knott (M.S. 2006)
      12. Paul Mecklenburg (M.S. 2007; Google)
      13. Rahul Narain (M.S. 2008 Expected)
      14. Miguel Otaduy (Ph.D. 2004; ETH Zurich)
      15. Nikunj Raghuvanshi (M.S. 2008; Ph.D. expected in 2010)
      16. Vincent Scheib (M.S. 2002; Emergent Game Technologies)
      17. Jeffrey Schoner (M.S. 2005; Microsoft Corporation)
      18. Jason Sewall (M.S. 2008; Ph.D. expected in 2010)
      19. Kelly Ward (Ph.D. 2005; Walt Disney Animation Studios)
      20. Jeremy Wendt (M.S. 2007)

Postdoctoral Research Associates Supervision
      1. Mark Foskey (UNC-CH Radiology Department)
      2. Naga Govindaraju (Microsoft Research)
      3. Young Kim (EWHA University, Korea)
      4. Vivek Kwatra (Google Research)
      5. Theordore Kim (Cornell University)
      6. Stephane Redon (INRIA, France)
      7. Harald Schmidl (NCCU)
      8. Avneesh Sud (Microsoft Corporation)
      9. Jur Van den Berg
      10. Tianjun Wang (Harbin Normal University, China)

Other Professional Collaborators within the Last Five Years
      1. David Adalsteinsson (University of North Carolina at Chapel Hill)
      2. Gary Bishop (University of North Carolina at Chapel Hill)
      3. Fredrick Brooks (University of North Carolina at Chapel Hill)
      4. Greg Burdea (Rutgers University)
      5. Florence Bertails (IMAG/INRIA, France)
      6. Marie-Paule Cani (IMAG/INRIA, France)
      7. Mark Carlson (DreamWorks Animation Studio)
      8. John Canny (University of California at Berkeley; Thesis Advisor)
      9. Edward Chaney (University of North Carolina at Chapel Hill)
      10. Carolina Cruz-Neira (University of Louisiana at Lafayette);
      11. Michael Falvo (University of North Carolina at Chapel Hill)
      12. Nicola Ferrier (University of Wisconsin at Madison)
      13. Henry Fuchs (University of North Carolina at Chapel Hill)
      14. Markus Gross (ETH Zurich, Switzerland)
      15. S. K. Gupta (University of Maryland at College Park)
      16. Joerg Haber (Max-Planck-Institute for Informatik, Germany)
      17. Sunil Hadap (Adobe Research)

18. Roger Hubbold (University of Manchester, England)
19. Joaquim Jorge (Instituto Superior Tecnico, Portugal)
20. Gerard Kim (Korea University, Korea)
21. Tae-Yong Kim (Rhythm and Hues Studios)
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38. Kenneth Salisbury (Stanford University)
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40. Vadim Shapiro (University of Wisconsin at Madison)
41. William Sherman (Desert Research Institute)
42. Anthony Steed (University College London, England)
43. Richard Superfine (University of North Carolina at Chapel Hill)
44. Krishnan Suresh (University of Wisconsin at Madison)
45. Russell Taylor (University of North Carolina at Chapel Hill)
46. Rasmus Tamstorf (Walt Disney Feature Animation)
47. Mary Whitton (University of North Carolina at Chapel Hill)
48. Minerva Yeung (Intel Corporation)
49. Boon-Lok Yeo (Intel Corporation)
50. Benjamin Watson (North Carolina State University)
51. Hongtu Zhu (University of North Carolina at Chapel Hill)
52. Werner Purgathofer (Vienna University of Technology, Austria)

Proposal and Book Reviewer

1. NSF Panels for CISE/ACR, CISE/CCR, CISE/CPA, CISE/CRI, CISE/IIS, CISE/RHA, ENG/DMII, 1997-Present
2. Proposal Reviewer for Army Research Office
3. Proposal Reviewer for City University of Hong Kong.
4. Proposal Reviewer for Israel Science Foundation (ISF)
5. Proposal Reviewer for National Science Foundation
6. Proposal Reviewer for Netherlands Organization for Scientific Research (NWO).
7. Proposal Reviewer for Research Grants Council of Hong Kong.
8. Proposal Reviewer for Science Foundation Ireland (SFI)
9. Proposal Reviewer for University of California Micro Program.
10. Book Reviewer for ACM Press.
11. Book Reviewer for Cambridge University Press.
12. Book Reviewer for John Wiley & Sons
13. Book Reviewer for MIT Press.
14. Book Reviewer for Morgan Kaufmann Publisher.

Manuscript Reviewer

1. ACM SIGGRAPH
2. ACM Symposium on Solid Modeling and Applications
3. ACM Symposium on Computational Geometry
4. ACM Symposium on Interactive 3D Graphics
5. ACM SIGGRAPH/Eurographics Symposium on Computer Animation
6. ACM Sympisum on Virtual Reality Software and Technology
7. ACM Transactions on Graphics
8. Algorithmica
9. ASME Journal of Computing and Information Science in Engineering
10. Computer Aided Design Journal
11. Computer Graphics Forum
12. Computer Graphics International
13. E-Haptics
14. Eurographics
15. Eurographics Symposium on Virtual Environments
16. Eurographics Workshop on Computer Animation and Simulation
17. IEEE Computer (Special Issue on Virtual Reality)
18. IEEE Computer Graphics and Applications
19. IEEE Int. Conf. on Robotics and Automation
20. IEEE/RSJ Int. Conf. on Intelligent Robots and Systems
21. IEEE Transactions on Pattern Analysis and Machine Intelligence
22. IEEE Transactions on Robotics and Automation
23. IEEE Transactions on Visualization and Computer Graphics
24. IEEE Virtual Reality Conference
25. IEEE Visualization Conference
26. IEEE VR Symposium on Haptics
27. IIE Transactions on Virtual Manufacturing
28. Graphics Interfaces
29. International Journal of Computers and Graphics
30. International Journal on Robotics Research
31. International Workshop on Algorithmics of Robotics
32. Journal on Computer Graphics, Vision and Image Processing
33. Journal on Computing and Information Science in Engineering
34. Journal on Graphical Models
35. Journal of Graphical Tools
36. Journal on Graphical Models and Image Processing
37. Journal on Visual Computer
38. Journal on Visualization and Computer Animation
39. Pacific Graphics
40. Presence

Ming Lin

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Mark Foskey, Naga Govindaraju, Young Kim, Vivek Kwatra, Theodore Kim, Stephanie Redon, Harold Schmid, Avneesh Sud, Jur van den Berg

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

I'm part of the Provost's Task Force on Undergraduate Excellence that will be charged with developing comprehensive strategies to improve our ability to enroll a talented and diverse student body. The group will also be charged with making specific recommendations about new programs UNC might develop, or existing programs UNC might strengthen, in order to ensure that the University remains a compelling choice for outstanding students -- especially from North Carolina, but also from around the nation and the world.

c. Course development work undertaken (2-3 sentences per item)

As the Carolina Woman Scholar for Fall 2008, I have developed two undergrad courses:
- Computing in Everyday Life (First-Year Seminar) which will discuss the use of computing in aspects of our daily life, ranging from science, engineering, medicine, commerce, transportation, arts, music, education, to entertainment. I will describe how computing has made a significant impact in all these areas and present an overview of their use of computing.
- Introduction to Robotics (junior/senior level) which will give an overview on fundamental components of robotic systems, including the sensing and actuation, control and modeling of motion and perception, dynamics and kinematics, motion planning and manipulation of robots. Students will learn about implementation of basic simulation programs that produce interesting results and verify its correctness. The goal of this class is to get students an appreciation of computational methods and engineering issues for modeling robots.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

We release our software systems regularly at our research website, which has one of the highest web traffic on campus. Some of our collision detection and proximity queries libraries have been used by tens of thousands of software developers and engineers across the world for all types of applications, including robotics, CAD/CAM, virtual prototyping, design & automation, virtual environments, computer games, etc.

Our recent software systems, such as dAb (a virtual painting system) and a physics-based sound synthesis library (Symphony), are under consideration to be licensed by Microsoft Corporation.

Dinesh Manocha

Phi Delta Theta/Matthew Mason Distinguished Professor

Department of Computer Science
University of North Carolina

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Chapel Hill, NC 27599-3175

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Dinesh Manocha is currently a Distinguished Professor of Computer Science at the University of North Carolina at Chapel Hill. He co-leads a major research group with more than 24 members on geometric and simulation algorithms with applications to computer graphics, robotics and virtual environments. He is also involved in a number of inter-disciplinary activities and committees at the Department, College and the University Level. He has published more than 250 papers in the leading conferences and journals in computer graphics, robotics, computational geometry, databases, multimedia, high performance computing and symbolic computation, and received 10 best paper awards. Manocha has supervised more than 40 M.S. and Ph.D. students over the last 15 years at UNC Chapel Hill. His research group has developed many well known software packages for collision detection, triangulation, GPU-based algorithms, solid modeling and solving algebraic systems. These packages have been downloaded by more than 50,000 users worldwide and licensed to more than 40 industrial organizations including Intel, Microsoft, Disney, Ford, Kawasaki, Siemens, Phillips Labs, MSC Software, Lockheed Martin, Raytheon etc. His group is actively collaborating with many industrial organizations including Disney, Boeing, Intel, NVIDIA, Microsoft, SAIC, ARA and Lockheed. Manocha's research is currently supported by ARO, NSF, DARPA, RDECOM, ONR and many industrial partners.

EDUCATION
University of California at Berkeley
Ph.D. in Computer Science, May 1992

Thesis title: Algebraic and Numeric Techniques for Modeling and Robotics
Thesis supervisor: John F. Canny
Major: Geometric and Solid Modeling, Computer Graphics, Numeric and Symbolic Computation, Robotics
Minors: Mathematics and Software Systems

M.S. in Computer Science, 1990
Specialization in Computer Graphics and Geometric Modeling

Indian Institute of Technology, Delhi, India
B.E. in Computer Science and Engineering, 1987

APPOINTMENTS

- Phi Delta Theta/Matthew Mason Distinguished Professor, Department of Computer Science, Professor, University of North Carolina at Chapel Hill, July, 2006 –present.
- Visiting Senior Researcher, Microsoft, April – August, 2008.
- Professor, Department of Computer Science, University of North Carolina at Chapel Hill, January 2001-present.

HONORS AND AWARDS

1. 2008: Best Paper Award at CAD Conference
2. 2007: Best Paper Award at ACM VRST Conference
3. 2007: Simulation Technology Demonstration at the Capitol Hill (by invitation)
4. 2006: Awarded Phi Delta Theta/Matthew Mason Distinguished Professorship, UNC Chapel Hill
5. 2006: IndySort (Sort Benchmark) Co-winner, ACM SIGMOD
6. 2005: Best Paper, Research and Development Track, I/ITSEC
7. 2005: Best Paper Award, IEEE VR
8. 2004: Best Paper Award, Pacific Graphics
9. 2003: Best Paper Award, ACM/SIGGRAPH Conference on Solid Modeling and Applications

PROGRAM & WORKSHOP CHAIR & ADVISORY POSITIONS

1. Program Co-Chair, ACM Solid and Physical Modeling, 2008
2. Advisory Board, SIGGRAPH ASIA Program Committee, 2008, 2009
3. Workshop Co-Chair, Multi-Core and Many-Core Computing, ACM SuperComputing 2007
4. Program Co-Chair, ACM Solid and Physical Modeling, 2007
5. Workshop Co-Chair, EDGE Computing Workshop, 2006
6. Program Co-Chair, Pacific Graphics, 2005.
7. Workshop Co-Chair, ACM Workshop on General Purpose Computation using Graphics Processors, ACM SIGGRAPH, 2004.

EDITORIAL DUTIES

1. Editorial Board Member, *Journal of Applicable Algebra* (AAECC), 2003-Present
2. Associate Editor, *Graphical Models and Image Processing*, 1999-Present
3. Guest Co-Editor, *IEEE Computer Graphics and Applications*, special issue on handling large datasets, 2007
4. Co-Editor, *Proceedings of IEEE*, Special issue on Edge Computing, 2007.
5. Guest Co-Editor, *Parallel Computing*, Special issue on "Computing with Accelerators", 2007.
6. Guest Co-Editor, *Computer-Aided Design*, Special issue on Solid and Physical Modeling, 2007.
7. Guest Co-Editor, *Computer Aided Geometric Design*, Special issue on Solid and Physical Modeling, 2007.
8. Guest Co-Editor, *IEEE Transactions on Automation Science and Engineering*, Special issue on Solid and Physics Modeling, 2007.
9. Guest Co-Editor, *Computer-Aided Design*, Special issue on Solid and Physical Modeling, 2008.

10. Guest Co-Editor, *Computer Aided Geometric Design*, Special issue on Solid and Physical Modeling, 2008.
11. Guest Co-Editor, *IEEE Transactions on Automation Science and Engineering*, Special issue on Solid and Physics Modeling, 2008.

CONTRACTS AND GRANTS

Current Support

1. 2008-2009: "Experiential Technologies for Urban Warfare and Disaster Response", Army, RDECOM, PI (about $725K)
2. 2008-2010: "High Performance Many-Core Clusters for Modeling and Simulation", Army Research Office, Co-PI (about $150K)
3. 2008-2009: "Interactive Ray Tracing", PI, $25K (Direct Costs) + Equipment Support
4. 2007-2010: "Research in GPGPU and Many-Core Computing", Co-PI, Intel, $225K (Direct Costs) + Equipment support.
5. 2007-2008: "Research in Interactive Collision Detection and Cloth Simulation", PI, Disney, $50K (Direct Costs).
6. 2006-2009: "Multiresolution Algorithms for Processing Giga-Models: Real-time Visualization, Reasoning, and Interaction", Army Research Office, Co-PI, $420K.
7. 2005-2009: "Exploiting Cyber-Infrastructure for Creation and Use of Multi-Disciplinary Engineering Models", NSF, Co-PI, $1.150M.
8. 2004-2009: "Multiresolution Algorithms for Virtual Prototyping of Massive CAD Models", NSF, PI (about $384K).

Pending Support

9. 2009-2011: "Experiential Technologies for Urban Warfare and Disaster Response", Army, RDECOM, PI (about $2.5M)
10. 2009-2012: "Digital Layouts and Assemblies of Large CAD Structures", NSF, PI ($450K)

Past Support

11. 2006 – 2008: "Research in Edge Computing", Disruptive Technology Office, PI, $200K.
12. 2006-2008: "High Performance Clusters for Modeling and Simulation", Army Research Office, DURIP program, PI, $82K.
13. 2002-2007: "Handling Complex Datasets: Representation, Interactive Display and Interaction", Army Research Office, PI (about $395K).
14. 2006: "Support for EDGE Workshop", DARPA, DTO, NSF, NVIDIA and ATI, PI, $65K.
15. 2005-2009: "Computer Generated Force Scalability, Army RDECOM, PI (about $2.5M).
16. 2003-2007: "Enabling Real-Time Interaction for Moving Avatars in Virtual Environments", Office of Naval Research, Co-PI (about $660,000).
17. 2001-2006: "High Fidelity Virtual Touch: Algorithms, Applications and Evaluation", National Science Foundation, Co-PI (about $370K).
18. 2004-2006: "Portable Walkthrough and Computer Generated Force Computation", DOD, PI (about $80K).
19. 2005-2007: "Missile Plume Simulation Improvements using GPU Chemical Kinetics Coprocessor", $50K, PI, MDA.
20. 2001-2005: "Real time Physically-Based Modeling and Interaction", Intel, Co-PI ($225K, direct costs + $75K equipment).
21. 2005-2006: "Efficient layouts of large datasets", DOE LLNL, PI (about $30K)
22. 2004-2006: "Interactive OneSAF Computations using COTS Graphics Hardware", DARPA, PI (about $875K).
23. 2000-2005: "Real Time Interaction in Virtual Environments", Office of Naval Research, Co-PI (about $645K).
24. 1999-2005: "Research in Walkthroughs and Simulation", Alias/Wavefront, Principal Investigator ($495K software donation).

25. 1999-2004: "Real-Time Walkthroughs of Serious Synthetic Environments", National Science Foundation, Principal PI (about $480,000).
26. 2004: "Support for ACM Workshop on General Purpose Computation using Graphics Processors", NVIDIA, ATI, 3D Labs, RDECOM, PEO-STRI & Army Research office.
    Co-PI, (about $35K).

PROGRAM COMMITTEES
1. ACM Solid and Physical Modeling, 2003-2006, 2009
2. ACM SIGGRAPH, 2007-2008
3. ACM SIGGRAPH Asia, 2008
4. Shape Modeling, 2009
5. IEEE Conference on Interactive Ray Tracing, 2006-2008
6. ACM Symposium on Interactive 3D Graphics and Games, 2007-2009
7. 3D Data Processing, Visualization and Transmission 2006-2008
8. Robotics: Science and System: 2006-2008
9. ACM SIGGRAPH/Eurographics Workshop on Computer Animation, 2003-2008
10. ACM SIGGRAPH/Eurographics Workshop on Graphics Hardware, 2004-2008
11. Computer Animation and Social Agents, 2003-2009
12. ACM/Eurographics Symposium on Geometry Processing, 2003-2008
13. Computer Graphics International, 1998-2005
14. Eurographics, 2002-2004
15. Pacific Graphics, 2004-07
16. International Symposium on 3D Data Processing, Visualization and Transmission, 2004-2008
17. X Mathematics of Surfaces Conference, England, 2003
18. IEEE Visualization, 2001-2002, 2008

PANELS
- NSF Panels on New Technologies, Visualization, Geometric Computing, CPA, Compilers, Graphics, Engineering Design.
- NSF CISE Infrastructure Awards

INVITED TALKS AND DISTINGUISHED LECTURES
1. Keynote speaker, Computer Animation and Social Agents (CASA), Seoul, Korea, 2008
2. Invited speaker, Workshop on Geometric Modeling, SUNY, Stony Brook, NY, 2008
3. Invited speaker, Workshop on programming massively parallel processors, NCSA, UIUC, 2008
4. Invited speaker, Workshop on Motion in Games (MiG), Utretcht, Holland, 2008
5. Keynote speaker, TCS Workshop on Virtual Reality, New Delhi, India, 2008
6. Keynote speaker, IAPR International Conf. on Discrete Geometry for Computer Imagery, 2008
7. Invited speaker, DARPA workshop on Virtual Cityscapes, Reno, 2008
8. Invited speaker, Workshop on Algorithmic Motion Planning, IROS, 2007
9. Invited speaker, Workshop on Geometric Processing, Tsinghua University, June 2007
10. Invited Speaker, Workshop on Many-Core Computing, Microsoft Research, 2007
11. Invited speaker, Workshop on Non-Linear Computational Geometry, IMA, May 2007
12. Invited Speaker, Swarms Workshop, Univ. of Pennsylvania, May 2007
13. Invited speaker, DARPA workshop on Constructive Simulation, San Diego, January 2007.
14. Invited speaker, DARPA Workshop on Future Directions for High Performance Embedded Processing, Orlando, December 2006
15. Invited Speaker, GPGPU Workshop, ACM/IEEE SuperComputing 2006
16. Invited Workshop Speaker, Oak Ridge National Labs, September 2006.
17. Invited Panel Speaker, NSF DMII PI Meeting, July, 2006
18. Invited Speaker, Aiya Napa Workshop on Modeling and Rendering, June 2006
19. Keynote Speaker, Pacific Graphics, October 2005

20. First International Workshop on Data Management on New Hardware, Baltimore, MD, June 2005
21. Motion Planning Workshop, Toulouse, France, January 2005.
22. Workshop on Modeling & Simulation: The Next Decade, Las Cruces, NM, December 2004.
23. Inter-service/Industry, Training Simulation Conference (I/ITSEC), Orlando, FL, December 2004.
24. Dist. Lecture Series Speaker, Arizona State University, November 2004.
25. Keynote Speaker, Graphics Interface Conference, London, Ontario, May 2004.
26. DIMACS Workshop on Computer-Aided Design and Manufacturing, Rutgers, NJ, October 2003.

COURSES AND TUTORIALS

1. *State of the Art in Massive Model Visualization (with D. Kasik, B. Bruderlin, W. Correa, A. Dietrich, S. Yoon and P. Slusallek)* ACM SIGGRAPH 2007, 2008
2. *State of the Art in Interactive Ray Tracing* (with P. Shirley, I. Wald, W. Mark and P. Slusallek) ACM SIGGRAPH 2006.
3. *Query Co-Processing on Commodity Processors* (with A. Ailamaki, N. Govindaraju and S. Harizopoulos), VLDB 2006.
4. *Query Co-Processing on Commodity Processors* (with A. Ailamaki, N. Govindaraju and S. Harizopoulos), ICDE 2006.
5. *Realtime Interactive Massive Model Visualization* (with D. Kasik, I. Wald, B. Bruderlin, W. Correa, E. Gobbetti, Al. Hubrecht and P. Slusallek) Eurographics 2006.
6. *Query Co-processing on Commodity Hardware,* Co-organizer (with N. Govindaraju and Anastassia Ailamaki), International Conference on Data Engineering, 2006.
7. *Collision handling in dynamic simulation Environments,* Co-organizer (with M. Trescher), Eurographics, 2005.
8. *Interactive Geometric and Scientific Computations using Graphics Hardware,* Course Organizer, SIGGRAPH, 2003.

SELECTED PRESS COVERAGE

1. *Endeavor Magazine, University of North Carolina, May 2008*
2. *Art and Science Magazine,* College *of Arts and Sciences, UNC, April 2008*
3. *Bio-IT World, March 2008*
4. *Wired Magazine, November 2006*
5. *New York Times, November 2006*
6. *Daily Tar-Heel, October 2006*
7. *Durham Herald, October 2006*
8. *Slashdot News, May 2006*
9. *DARPA Legacy Press Release,* August 2005
10. *Tom's Hardware Guide,* June 2005
11. *Slashdot News,* June 2005

DEPARTMENT COMMITTEES

- Faculty Search Committee
- Graduate Admissions
- Publications Committee
- Department Colloquium Organizer
- Library Committee
- Department Chair polling committee
- Adhoc Committee on role of Research Faculty (chair)
- Exam Committee (chair)

UNIVERSITY COMMITTEES

- Graduate School Administrative Board

- Graduate School Fellowship Committee
- Polyani Lectureship Selection Committee

SOFTWARE SYSTEMS
1. HAVOC (2003): A GPU-based library to compute distance fields of 3D objects and proximity query applications.400+ download till.
2. GPUSORT (2005): A GPU-based Sorting algorithm and library. More than 2800 downloads..
3. OpenCCL (2005): A library to compute cache-oblivous layouts of larges meshes and graphs. More than 600+ downloads.
4. LUGPULIB (2005): A library to compute LU decomposition of dense matrices using graphics hardware. 1500+ downloads.
5. GPUFFTW (2006): A library to compute 1D FFT using GPUs. 2200+ downloads.
6. DeformCD (2007): A library for collision detection between deformable models, 150+ downloads.

PUBLICATIONS
Published more than 250 refereed papers in leading conferences and journals in Computer Graphics, Robotics, CAD/CAM, Virtual Reality,Databases, Multimedia, Symbolic Computation, Computational Biology and Computational Geometry.

Books and Monographs
1. *Proceedings of Pacific Graphics,* edited by Dinesh Manocha, Craig Gotsman and Enhua Wu. Published as special issue of Visual Computer. 2005.

2. *Proceedings of ACM Solid and Physical Modeling,* edited by Dinesh Manocha and Bruno Levy, ACM Press, 2007.

3. *Proceedings of ACM Solid and Physical Modeling,* edited by Bruno Levy, Dinesh Manocha, and Hiromasa Suzuki, ACM Press, 2008.

4. *Edge Computing*, edited by Ming C. Lin and Dinesh Manocha, Special issue of "Proceedings of IEEE", 2008.

5. *Massive Model Visualization,* Sungeui Yoon, Enrico Gobbetti, David Kasik and Dinesh Manocha. Morgan and Claypool Publishers. 2008.

Refereed Journal Publications
6. B. Lloyd, N. Govindaraju, C. Quammen, S. Molnar and D. Manocha, "Logarithmic Perspective Shadow Maps*", ACM Trans. on Graphics*, 51 pages (to appear), 2008.

7. P. Merrell and D. Manocha, "Continuous Model Synthesis", *ACM Trans. On Graphics*, 7 pages. Proc. Of ACM SIGGRAPH Asia Conference, 2008 (to appear).

8. A. Chandak, C. Lauterbach, Z. Ren, M. Taylor and D. Manocha, "Interactive Sound Propagation in Complex Environments using AD-FRUSTA", *IEEE Trans. on Visualization and Computer Graphics*, 2008, 8 pages (Proc. Of IEEE Visualization 2008), to appear.

9. M. Tang, S. Curtis, S. Yoon and D. Manocha, "ICCD: Interactive continuous collision detection between deformable models using connectivity-based culling", *IEEE Trans. on Visualization and Computer Graphics,* (selected papers from ACM Symposium on Solid and Physical Modeling, 2008), to appear.

10. W. Moss, M. C. Lin and D. Manocha, "Constraint-based motion synthesis for deformable models", *Computer Animation and Virtual Worlds*, 2008 (special issue on CASA'08).

11. R. Gayle, A. Sud, E. Andersen, S. Guy, M. Lin, and D. Manocha, "Interactive Navigation of Heterogeneous Agents using Adaptive Roadmaps", *IEEE Trans. on Visualization and Computer Graphics*, 2008, 14 pages. Special issue on ACM VRST 2007.

12. M. Tang, S. Yoon, and D. Manocha, "Adjacency Based Culling for Continuous Collision Detection", *The Visual Computer*, 2008, 10 pages.

13. A. Sud, E. Andersen, S. Curtis, M. Lin and D. Manocha, "Real-time planning for Virtual Agents in Dynamic Environments using multi-agent navigation graphs", *IEEE Trans. on Visualization and Computer Graphics*, 2008, 14 pages. Special issue on IEEE VR 2007.

14. L. Zhang, Y. Kim and D. Manocha, "Efficient distance computation in Configuration Space", *Computer-Aided Geometric Design*, 2008 vol. 25, no. 7, pp. 489-502. Special Issue on Selected Papers from ACM Solid and Physical Modeling Conference, 2007.

15. D. Kasik, D. Manocha and P. Slusallek, "Real-Time Interaction with Complex Models", *IEEE Computer Graphics and Applications*, 2007, pp. 17-20.

16. N. Raghuvanshi, C. Lauterbach, A. Chandak, D. Manocha and M. C. Lin, "Real-time sound synthesis and propagation for games", *Communications of ACM*, Special issue on Games, July 2007, 6 pages.

17. N. Govindaraju and D. Manocha, "Cache-Efficient Numerical Algorithms using Graphics Hardware", *Parallel Computing,* 2007. Special issue on *Computing with Accelerators*.

18. L. Zhang, Y. Kim and D. Manocha, "Efficient cell labeling and path non-existence using C-obstacle query", *International Journal of Robotics Research*, 2008 (to appear).

19. C. Lauterbach, A. Chandak and D. Manocha, "Frustum tracing for interactive sound rendering in complex dynamic scenes", *IEEE Trans. On Visualization and Computer Graphics*, (Proc. Of IEEE Visualization Conference), 2007, 8 pages.

20. L. Zhang, Y. Kim and D. Manocha, "L. Zhang, Y. Kim, G. Varadhan and D. Manocha, "Generalized penetration depth computation", *Computer-Aided Design*, 26 pages, 2007 (to appear). Special issue on ACM SPM'06.

21. A. Sud, L. Zhang and D. Manocha, "Homotopy preserving approximate Voronoi Diagram of 3D Polyhedron", *Computer Graphics Forum*, special issue on *Digital Geometry Processing*, 2007, 16 pages.

22. Y. Kim, S. Redon, M. Lin and D. Manocha, "Interactive continuous collision detection using swept volume of avatars", *Presence*, 24 pagers, 2007.

23. G. Varadhan and D. Manocha, "Star-shaped Roadmaps – A deterministic sampling approach for complete motion planning", *International Journal of Robotics Research,* 2007, 12 pages.

24. N. Govindaraju, Ilknur Kabul, Ming Lin, and Dinesh Manocha, "Fast Continuous Collision Detection among Deformable Models using Graphics Processors", *Elsevier Computers and Graphics,* Special issue on *Eurographics Workshop on Virtual Environments,* 2007.

25. A. Sud, N. Govindaraju, R. Gayle, I. Kabul and D. Manocha, "Fast proximity computation among deformable models using discrete Voronoi diagrams", *ACM Trans. On Graphics (Proc. of ACM SIGGRAPH),* 2006.

26. S. Yoon, C. Lauterbach and D. Manocha, "R-LODs: Fast LOD-based Ray Tracing of Massive Models", *Visual Computer (Proc. Of Pacific Graphics), 2006.*

27. S. Yoon and D. Manocha, "Cache-efficient layouts of bounding volume hierarchies", *Computer Graphics Forum (Proc. of Eurographics*), 2006.

28. A. Sud, M. Foskey and D. Manocha (2007). "Homotopy-preserving medial axis simplification." *International Journal on Computational Geometry,* vol, **17**, number **5**, pp. 423-451*,* 2007. Special issue on papers from ACM Solid and Physical Modeling.

29. I. Emiris, E. Fritzilas and D. Manocha, "Algebraic algorithms for structure determination in biological chemistry", *International Journal of Quantum Chemistry*, 24 pages, 2006.

30. S. Yoon, P. Lindstrom, V. Pascussi and D. Manocha (2005). "Cache-oblivious mesh layouts." *ACM Trans. On Computer Graphics (Proc. Of ACM SIGGRAPH),* 8 pages, 2005.

31. N. Govindaraju, D. Knott, N. Jain, I. Kabul, R. Tamstorf, R. Gayle, M. Lin and D. Manocha (2005). "Interactive collision detection between deformable models using chromatic decomposition." *ACM Trans. On Computer Graphics (Proc. Of ACM SIGGRAPH)*, 9 pages, 2005.

32. D. Manocha, "General Purpose Computation using Graphics Processors", *IEEE Computer*, August, 2005, 4 pages.

33. M. Verdesca, J. Munro, M. Hoffman, M. Bauer, and D. Manocha, "Using graphics processing units to accelerate OneSAF: A case study in technology transition", *Journal of Defense Modeling and Simulation* (special issue on selected papers from I/ITSEC'05), 2005.

34. N. Govindaraju, M. C. Lin and D. Manocha (2005), "Efficient collision culling among deformable objects using graphics processors", *Presence*, 2005. Special issue on papers from IEEE VR.

35. N. Jain, I. Kabul, N. Govindaraju, M. Lin and D. Manocha (2005). "Multi-resolution collision handling among cloth-like Objects", *Computer Animation and Virtual Worlds*, *2005.* Special issue on papers from *CASA 2005.*

36. S. Yoon, B. Salomon, R. Gayle and D. Manocha, "Quick-VDR: interactive view-dependent rendering of massive models", *IEEE Trans. On Visualization and Computer Graphics*, 14 pages, 2005. Special issue of papers from IEEE Visualization'04.

37. G. Varadhan and D. Manocha. "Accurate Minkowski sum approximation of polyhedral models." *Graphical Models*, 2005. Special issue of papers from Pacific Graphics'04.

38. N. Govindaraju, M. Lin and D. Manocha. "Fast and reliable collision culling using GPUs*." IEEE Trans. On Visualization and Computer Graphics*, 2005. Special issue on papers from VRST'04.

39. S. Redon. Y. Kim, M. C. Lin and D. Manocha. "Fast continuous collision detection for articulated models", *Computer-Aided Design*, 14 pages, 2005. Special issue on papers from ACM Solid Modeling'04.

40. G. Varadhan, S. Krishnan, TVN Sriram and D.Manocha. "A simple algorithm for complete motion planning of translating polyhedral robots." *International Journal of Robotics Research*, 16 pages, 2005. Special issue of papers from WAFR'04.

41. Sud, M. Otaduy and D. Manocha. (2004). "DiFi: Fast 3D distance field computation using graphics hardware." *Computer Graphics Forum (Proc. of Eurographics).*

42. Y. Kim, M. Lin and D. Manocha (2004). "Fast penetration depth computation between convex polytopes." *IEEE Transactions on Visualization and Computer Graphics*, 12 pages.

43. M. Foskey, M. Lin and D. Manocha (2004). "Efficient computation of a simplified medial axis." Special issue of *ASME Journal of Computing and Information Science in Engineering*.

44. Y. Kim, G. Varadhan and M. Lin and D. Manocha (2004). "Fast swept volume approximation of complex polyhedral models." Special issue of *Computer-Aided Design.*

45. T. Culver, J. Keyser and D. Manocha (2004). "Accurate computation of medial axis of a polyhedron." *Computer Aided Geometric Design*, 33 pages.

46. T. Culver, J. Keyser, S. Krishnan and D. Manocha (2003). "A hybrid approach for determinant signs of moderate-sized matrices." *International Journal of Computational Geometry and Applications*, 27 pages.

47. A. Wilson and D. Manocha (2003). "Simplifying complex environments using incremental textured depth meshes." *ACM Trans. On Computer Graphics (Proc. Of ACM SIGGRAPH)*, 10 pages.

48. N. Govindraju, B. Llyod, S. Yoon, A. Sud and D. Manocha (2003). "Interactive shadow generation in complex environments." *ACM Trans. On Computer Graphics (Proc. Of ACM SIGGRAPH)*, 10 pages.

49. J. Keyser, T. Culver, M. Foskey, S. Krishnan, and D. Manocha, (2003). "ESOLID- A system for exact boundary evaluation." *Computer-Aided Design, Special issue on ACM Solid Modeling* 2003, vol. 36(2), pp. 175-193.

50. Y. Kim, K. Hoff, M. Lin and D. Manocha (2003). "Closest point query among the union of convex polytopes using rasterization hardware." *Journal of Graphics Tools, Special issue on Graphics Hardware*, pp. 43-52, vol. 7(4).

Refereed Book Chapters
51. M. Lin, A. Sud, J. Berg, R. Gayle, S. Curtis, H. Yeh, S. Guy, E. Anderson, S. Patil, J. Sewall and D. Manocha (2008), "Real-time path planning and navigation for multi-agent and crowd simulation", in Proc. Of *Motion in Games, Lecture Notes in Computer Science,* Springer-Verlag.

52. M. Lin and D. Manocha (2008), "Collision Detection", in *Haptic Rendering: Foundations, Algorithms, and Applications*, editors M. C. Lin and M. Otaduy,

53. M. Lin and D. Manocha (2008), "Cutting edge computing using new commodity architectures", Special issue of *Proceedings of IEEE* on Edge Computing, 5 pages.

54. M. Lin and D. Manocha (2004). "Efficient data structures for collision detection." *Handbook of Data Structures*, eds. D. Mehta and S. Sahni, CRC Press, 20 pages.

55. J. Cohen and D. Manocha (2004). "Model simplification." *Handbook of Visualization*, eds. C. Hansen and C. Johnson, Academic Press, 14 pages.

56. M. Lin and D. Manocha (2004). "Collision and proximity queries." *Handbook of Computational Geometry*, eds. Joe O'Rourke and T N T Goodman, CRC Press, 20 pages.

Refereed Conference Publications *(including ACM SIGMOD, ACM Multimedia, ACM SuperComputing & Robotics Conferences)*

57. J. van der Berg, M. Stillman, J. Kuffner, M. Lin and D. Manocha, "Path Planning among Movable Obstacles: a Probabilistically Complete Approach", *Proc. Of Workshop on Algorithmic Foundations of Robotics,* 2008 (to appear).

58. L. Zhang and D. Manocha, "Constrained Motion Interpolation with Distance Constraints", *Proc. Of Workshop on Algorithmic Foundations of Robotics,* 2008 (to appear).

59. L. Zhang and D. Manocha, "An Efficient Retraction-based RRT Planner", *Proc. Of IEEE Conference on Robotics and Automation*, 2008.

60. C. Lauterbach, M. C. Lin, D. Manocha, S. Borkman, E. LaFave, G. Peele and M. Bauer, "Accelerating Line-of-Sight Computations in Dynamic Terrains and OneSAF", *Proc. Of I/ITSEC*, 2008, 8 pages (to appear).

61. H. Yeh, S. Curtis, S. Patil, J. van den Berg, D. Manocha, and Ming Lin, "Composite Agents*", Proc. Of ACM SIGGRAPH/Eurographics Symposium on Computer Animation*, 2008.

62. R. Gayle and D. Manocha, "Navigating Virtual Agents in Online Virtual Worlds", *Proc. Of ACM Web3D Conference*, 2008.

63. C. Lauterbach, S. Yoon, M. Tang and D. Manocha, "ReduceM: Interactive and Memory Efficient Ray Tracing of Large Models", *Eurographics Symposium on Rendering*, 2008.

64. L. Zhang, X. Huang, Y. Kim and D. Manocha, "D-Plan: Efficient collision-free path computation for part removal and disassembly", *Proc. Of CAD'08*, 2008. **Received Best Paper Award.**

65. M. Tang, S. Curtis, S. Yoon and D. Manocha, "Interactive continuous collision detection between deformable models using connectivity-based culling", Proc*. of ACM Symposium on Solid and Physical Modeling*, 2008.

66. J. van der Berg, M. C. Lin and D. Manocha, "Reciprocal Velocity Obstacles for Real-Time Collision Avoidance", *Proc. Of IEEE Conference on Robotics and Automation*, 2008.

67. D. Manocha, "Digital Geometry Processing using Topological Guarantees", *Proc. of International Conference on Discrete Geometry for Computer Imagery*, Springer-Verlag, 2008.

68. S. Curtis, R. Tamstorf and D. Manocha, "Fast Collision Detection for Deformable Models using Representative Triangles", *Proc. Of ACM Symposium on Interactive 3D Graphics and Games,* 2008

69. J. Van der Berg, S. Patil, J. Sewall, D. Manocha and M. Lin, "Interactive Navigation of Individual Agents in Crowded Environments", *Proc. Of ACM Symposium on Interactive 3D Graphics and Games,* 2008.

70. S. Yoon, S. Curtis and D. Manocha, "Ray Tracing Dynamic Scenes using Selective Restructuing", *Proc. Of Eurographics Symposium on Rendering* (2007).

71. A. Sud, R. Gayle, E. Andersen, S. Guy, M. Lin and D. Manocha, "Real-time navigation of independent agents using adaptive roadmaps", *Proc. Of ACM VRST* (2007). **Received best paper award.**

72. C. Lauterbach, S. Yoon and D. Manocha, "Ray-Strips: A Compact Mesh Representation for Interactive Ray Tracing", *IEEE Symposium on Interactive Ray Tracing* (2007).

73. B. Lloyd, N. Govindaraju, C. Quammen, S. Molnar and D. Manocha, "Practical logarithmic rasterization for low-error shadow maps", *ACM/SIGGRAPH Workshop on Graphics Hardware* (2007).

74. L. Zhang, Y. Kim and D. Manocha, "A hybrid approach for complete motion planning", *Proc. of IEEE IROS*, 2007.

75. R. Gayle, A. Sud, M. Lin and D. Manocha, "Reactive Deforming Roadmaps: Motion Planning of Multiple Robots in Dynamic Environments", *Proc. Of IEEE IROS, 2007*.

76. C. Lauterbach, A. Chandak and D. Manocha, "Adaptive sampling for frustum-based sound propagation in complex and dynamic environments", *Proc. Of 19th International Congress on Acoustics*, 2007.

77. L. Zhang, Y. Kim and D. Manocha, "A Fast and Practical Algorithm for Generalized Penetration Depth Computation", *Proc. Of Robotics: Science and System,* 2007.

78. L. Zhang, Y. Kim and D. Manocha, "C-DIST: Efficient Distance Computation for Rigid and Articulated Modeling in Configuration Space, *Proc. Of Solid and Physical Modeling*, 2007.

79. A. Sud, E. Andersen, S. Curtis, M. Lin and D. Manocha, "Real-time path planning for virtual agents in dynamic environments", *Proc. of IEEE VR*, 2007.

80. R. Gayle, S. Redon, A. Sud, M. Lin and D. Manocha,, "Efficient Motion Planning of Highly Articulated Chains using Physics-based Sampling", *Proc. of IEEE Conference on Robotics and Automatics*, 8 pages, 2007.

81. N. Govindaraju, J. Gray, R. Kumar and D. Manocha, "GPUTeraSort: High performance graphics coproeessor sorting for large database management", *Proc. of ACM SIGMOD*, 2006.

82. C. Lauterbach, S. Yoon, D. Tuft and D. Manocha, "RT-Deform: Interactive Ray Tracing of Dynamic Scenes using BVHs", *Proc. Of IEEE Symposium on Interactive Ray Tracing*, 2006.

83. G. Varadhan, S. Krishnan, L. Zhang and D. Manocha, "Reliable implicit surface polygonization using visibility mapping", *Proc. of Symposium on Geometry Processing*, 2006.

84. D. Kasik, D. Manocha, A. Stephens, B. Bruderlin, P. Slusallek, E. Gobbetti, W. Correa, and I. Quilez, "Real-time interactive massive model visualization", *Eurographics*, 2006.

85. L. Zhang, Y. Kim, and D. Manocha, "A simple path non-existence algorithm using C-obstacle query", *Proc. of Workshop on Algorithmic Foundations of Robotics*, 2006.

86. B. Lloyd, D. Tuft., S. Yoon and D. Manocha, "Warping and Partitioning for Low Error Shadow Maps", *Proc. Of Eurographics Symposium on Rendering*, 2006.

87. R. Gayle, M. Lin and D. Manocha, "Adaptive dynamics with efficient contact handling of articulated models*", Proc. of Robotics: Science and Systems*, 2006.

88. N. Govindaraju, S. Larsen, J. Gray, and D. Manocha, "A memory model for scientific algorithms on graphics processors", *Proc. of ACM SuperComputing,* 2006.

89. L. Zhang, Y. Kim, G. Varadhan and D. Manocha, "Fast C-obstacle query computation for motion planning", *Proc. of IEEE Conf. on Robotics and Automation*, 2006.

90. L. Zhang, Y. Kim, G. Varadhan and D. Manocha, "Generalized penetration depth computation", *Proc. of ACM Solid and Physical Modeling*, 2006.

91. G. Varadhan, Y. Kim, S. Krishnan and D. Manocha, "Topology preserving approximation of free configuration space", *Proc. of IEEE Conf. on Robotics and Automation*, 2006.

92. A. Sud, N. Govindraju, R. Gayle and D. Manocha, "Interactive 3D distance field computation using linear factorization", *Proc. of ACM Symposium on Interactive 3D Graphics*, 2006

93. N. Govindaraju, I. Kabul, M. Lin and D. Manocha, "Fast continuous collision detection among deformable models using graphics processors", *Proc..of Eurographics Symposium on Virtual Environments*, 2006.

94. Y. Kim, L. Zhang, M. Lin and D. Manocha, "*Fast penetration computation and its applicatiosn*", Proc. of Nicographics, 2006.

95. N. Govindaraju, M. C. Lin and D. Manocha (2005). "Quick-CULLIDE: Fast inter-and intra-Object collision culling using graphics hardware." *Proc. of IEEE Virtual Reality.* **Received best paper award.**

96. Nico Galoppo, N. Govindaraju, M. Henson and D. Manocha. "LU-GPU: Efficient algorithms for solving dense linear systems on graphics hardware", Proc. of *IEEE/ACM SuperComputing* 2005.

97. G. Varadhan and D. Manocha (2005). "Star-shaped roadmaps: A deterministic sampling approach for complete motion planning." *Proc. of Robotics: Science and Systems*, 8 pages.

98. A. Sud, N. Govindaraju and D. Manocha (2005), "Interactive computation of discrete generalized Voronoi diagrams using range culling", Proc. of *Voronoi Diagrams'05.*

99. N. Govindaraju and D. Manocha (2005). "Efficient relational database management on graphics processors", ACM Workshop on Data Management on New Hardware, 2005 (Invited paper), 8 pages.

100. R. Gayle, P. Segars, M. Lin and D. Manocha (2005). "Path planning for deformable robots in complex environments." *Proc. of Robotics: Science and Systems,* 8 pages.

101. S. Yoon, P. Lindstrom, V. Pascucci and D. Manocha, "Cache-Oblivious layouts of Polygonal Meshes", *Workshop on Massive Geometric Data Sets*, 2005, 6 pages.

102. A. Sud, M. Foskey and D. Manocha (2005). "Homotopy-preserving medial axis simplification." *Proc. of ACM Symposium on Solid and Physical Modeling,* 12 pages..

103. N. Govindaraju, N. Raghuvanshi and D. Manocha (2005). "Fast and approximate stream mining of quantiles and frequencies using graphics processors." *Proc. of ACM SIGMOD*, 12 pages.

104. M. Verdesca, J. Munro, M. Hoffman, M. Bauer and D. Manocha (2005). "Using Graphics Processor Units to Accelerate OneSAF: A Case Study in Technology Transition." *Proc. of I/ITSEC, 8 pages.*

105. R. Gayle, M. C. Lin and D. Manocha (2005). "Constraint-based motion planning of deformable robots." *Proc. of IEEE Int. Conf. on Robotics and Automation*, 8 pages.

106. N. Govindaraju, M. Henson, M. C. Lin and D. Manocha (2005). "Interactive visibility ordering and transparency ordering among geometric primitives in complex environments." *Proc. of ACM Symposium on Interactive 3D Graphics and Games,* 8 pages.

107. S. Redon. Y. Kim, M. C. Lin and D. Manocha (2004). "Fast continuous collision detection for articulated models." *Proc. of ACM Solid Modeling*, 12 pages.

108. Lloyd, J. Wendt, N. Govindaraju and D. Manocha (2004). "CC shadow volumes." *Proc. of Eurographics Symposium on Rendering*, 8 pages.

109. N. Govindaraju, B. Lloyd, W. Wang, M. Lin and D. Manocha (2004). "Fast database computations using graphics hardware." *Proc. of ACM SIGMOD*, 12 pages.

110. G. Varadhan, S. Krishnan, T.V.N Sriram and D. Manocha.(2004) "Topology preserving surface extraction using adaptive subdivision." *Proc. of Second Eurographics Symposium on Geometry Processing*, 10 pages.

111. S.Yoon, B. Salomon, M. C. Lin, and D. Manocha (2004). "Fast collision detection between massive models using dynamic simplification." *Proc. of Second Eurographics Symposium on Geometry Processing*, 10 pages.

112. G. Varadhan, S. Krishnan, T.V.N Sriram and D. Manocha (2004). "A simple algorithm for complete motion planning of translating polyhedral robots." *Proc. of Sixth International Workshop on the Algorithmic Foundations of Robotics*, 12 pages.

113. S. Yoon, B. Salomon, R. Gayle and D. Manocha (2004). "Quick-VDR: Interactive view-dependent rendering of massive models." *Proc. of IEEE Visualization*, 8 pages.

114. G. Varadhan and D. Manocha (2004). "Accurate minkowski sum approximation of polyhedral models." *Proc. of Pacific Graphics,* 8 pages*.* ***Received Best Paper Award*.**

115. N. Govindaraju, M. C. Lin and D. Manocha (2004). "Fast and reliable collision culling using graphics processors." *Proc. of ACM VRST*, 8 pages.

116. S. Redon, Y. Kim, M. C. Lin and D. Manocha, J. Templeman (2004). "Interactive continuous collision detection for avatars in virtual environments." *Proc. Of IEEE Virtual Reality*, 8 pages.

117. N. K. Govindaraju, A. Sud, S. Yoon and D. Manocha (2003). "Interactive visibility culling for complex environments using occlusion-switches." *Proc. of ACM SIGGRAPH Symposium on Interactive 3D Graphics*, 11 pages.

118. M. Foskey, M. Lin and D. Manocha (2003). "Efficient computation of a simplified medial axis." *Proc. of ACM SIGGRAPH Sympoisum on Solid Modeling*, pp. 96-107.

119. Y. Kim, G. Varadhan, M. Lin and D. Manocha (2003). "Fast approximation of swept volumes of complex polyhedral models." *Proc. of ACM SIGGRAPH Symposium on Solid Modeling*, pp. 11-22. **Received best conference paper award**.

120. B. Salomon, M. Garber, M. Lin and D. Manocha (2003). "Interactive navigation in complex environments using path planning." *Proc. of ACM SIGGRAPH Symposium on Interactive 3D Graphics*, 11 pages.

121. S. Yoon, B. Salomon and D. Manocha (2003). "Interactive view-dependent rendering with conservative occlusion culling in complex environments." *Proc. of IEEE Visualization*, 8 pages.

122. G. Varadhan, S. Krishnan, Y. J Kim and D. Manocha (2003). "Feature-sensitive subdivision and iso-surface reconstruction." *Proc. of IEEE Visualization*, 8 pages.

123. D. Manocha (2003), "Interactive display of complex environments", *Proc. of I/ITSEC*, 8 pages (invited submission).

124. G. Varadhan, S. Krishnan, Y. J Kim, S. Diggavi, and D. Manocha (2003). "Efficient max-norm distance computation and reliable voxelization." *Proc. of ACM/Eurographics Symposium on Geometry Processing*, 12 pages.

125. N. Govindraju, S. Redon, M. Lin and D. Manocha (2003). "CULLIDE: Interactive collision detection between complex models in large environments using graphics hardware." *Proc. of ACM/Eurographics Workshop on Graphics Hardware*, 10 pages.

Refereed Video Publications

126. N. Govindaraju, M. C. Lin and D. Manocha (2005). ``Reliable Collision Culling using Graphics Processors", *Proc. of 21st ACM Computational Geometry Conference, Video Publication*.

127. Y. J. Kim, M. Otaduy, M. C. Lin and D. Manocha (2003). "Fast penetration depth estimation using rasterization hardware and hierarchical refinement." *Proc. of 19th ACM Computational Geometry Conference, Video Publication*.

GRADUATE STUDENTS
　　Currently Supervised
1. Anish Chandak
2. Sean Curtis
3. Russell Gayle (jointly with Ming C. Lin)
4. Christian Lauterbach
5. Paul Merrell
6. Sachin Patil
7. Micah Taylor
8. Yero Yeh
9. Liangjun Zhang

　　Ph.D. Students Graduated
1. Naga Govindraju (Ph.D. Summer'04). First Appointment: Research Assistant Professor, UNC Chapel Hill. Currently a senior researcher at Microsoft.
2. Brandon Lloyd (Ph.D.Fall'07). First Appointment: Microsoft.
3. Avneesh Sud (Ph.D. Fall'06). First Appointment, Postdoc, UNC Chapel Hill. Currently a researcher at Microsoft.
4. Gokul Varadhan (Ph.D. Fall'05): First Appointment: Google Inc.
5. Sungeui Yoon (Ph.D. Fall'05): First Appointment: Lawrence Livermore Labs. Currently an Assistant Professor of Computer Science, KAIST, S. Korea.

　　M.S. Students Graduated
1. Sean Hanlon (M.S. Spring'05): Constella Group

POSTDOCS & VISITNG RESEARCHERS
　　Currently Supervised
Jur van der Berg (co-supervised with Ming C. Lin)

　　Previously Supervised
1. Mark Foskey (Co-Supervised with Ming C. Lin). Research Assistant Professor, UNC Chapel Hill.
2. Naga Govindaraju. Microsoft.
3. Young Kim (Co-Supervised with Ming C. Lin). Assistant Professor, Enwa University, S. Korea.
4. Vivek Kwatra (Co-Supervised with Ming C. Lin). Google Research, California.
5. Avneesh Sud (Co-Supervised with Ming C. Lin). Microsoft
6. Gokul Varadhan: Currently a member of Technical Staff at Google Inc.
7. Min Tang. Associate Professor, Zhejiang University, China.

PH.D. COMMITTEES & EXTERNAL REVIEWERS
1. Deepak Bandophaday (Ph.D. 2005)
2. William Baxter (Ph.D. 2004)
3. Nico Gallopo (in progress)
4. Karl Hillesland (Ph.D. 2005)
5. Jesse Cooper Himmelstein (University of Toulouse, Ph.D. 2008)
6. Rong Guodong (National University of Singapore, Ph.D. 2008)
7. Martin Isenburg (Ph.D. 2004)
8. Ted Kim (Ph.D. 2006)
9. Hanna Kurniawati (National University of Singapore, Ph.D. 2008)
10. Kok-Lim Low (Ph.D. 2005)
11. Yunshan Liu (in progress)
12. Ajith Masceranhas (Ph.D. 2005)
13. Bruce Merry (University of Cape Town, Ph.D. 2007)

14. Miguel Otaduy (Ph.D. 2004)
15. Nikunj Raghuvanshi (in progress)
16. David Rogers (INRIA, Grenoble, Ph.D. 2008)
17. Timothy Terriberry (Ph.D. 2006)
18. Andrew Thall (Ph.D. 2004)
19. Adrian Theetten (INRIA, Ph.D. 2007)
20. Kelly Ward (Ph.D. 2005)
21. Li Yi (Simon Fraser University, Ph.D. 2008)

INVITED COLLOQUIA

- **Bringing Realism to Virtual Environments: Physics, Sound and Crowd**
  1. Department of Computer Science, KAIST, September 2008

- **Motion Planning in Real and Virtual Worlds: Algorithms and Applications**
  1. University of Tokyo, February 2008
  2. Simon Fraser University, July 2008
  3. Korea Institute of Science and Technology, September 2008
  4. University of Pennsylvania, October 2006.
  5. Rensselaer Polytechnic Institute, October 2006.

- **Interactive Ray Tracing and Sound Rendering in Complex, Dynamic Environments**
  1. Department of Computer Science, Indian Institute of Technology, Delhi (April 2008)
  2. ACM SIGGRAPH Course, Los Angeles (August 2008)
  3. Department of Computer Science, Seoul National University (September 2008)

- **Interactive Rendering of Massive Models: Rasterization or Ray Tracing**
  1. Aiya Napa Seminar, Cyprus, June 2006
  2. Department of Computer Science, University of Stuttgart, July 2006

- **Discrete Geometric Processing with Topological Guarantees**
  1. Peking University, June 2007
  2. Tsinghua University, June 2007
  3. University of Minnesotta, May 2007

- **Real-Time Display & Walkthroughs of Massive Models**
  1. Pacific Graphics, October 2005
  2. Institute of Creative Technologies, September, 2004.
  3. Department of Computer Science, ETH, Swiss Federal Institute of Technology, Zurich, July 2004.
  4. ONR PI Meetings, Naval Research Labs, 2000-2004

- **General Purpose Computation using Graphics Processors**
  1. Microsoft Research, Asia, June 2007
  2. Intel, Santa Clara, March 2007
  3. MATREX Meeting, RDECOM, February, 2006
  4. SAIC, November 2005
  5. Hong Kong University of Science and Technology (HKUST), October 2005
  6. Workshop on High Performance Embedded Computing, September 2005
  7. Intel, Santa Clara, August 2005
  8. Army Research Labs, July 2005
  9. Army Modeling and Simulation Office, July 2005

10. High Performance Computing Symposium, June 2005
11. MERL, Cambridge, MA, June 2005
12. Army CERDEC, New Jersey, June 2005
13. Department of Computer Science, University of California at Irvine, September 2004.
14. National Simulation Center, February 2004
15. Intel, Oregon, October 2003.
16. I/ITSEC, November 2004

Dinesh Manocha

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Jur van den Berg, Mark Foskey, Naga Govindaraju, Young Kim, Vivek Kwatra, Avneesh Sud, Gokul Varadhan

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

Many new courses on Robotics, Robot Motion Planning, General Purpose Computation using GPUs, Sound Rendering, plus revising many current graduate courses.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

More than 10,000 downloads of software packages, more than 18 commercial licenses issued during 2003-2008.

Ketan Mayer-Patel

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Department of Computer Science, CB #3175   http://www.cs.unc.edu/~kmp
University of North Carolina, Chapel Hill

Education

Ph.D.   University of California, Berkeley, 1999
    Parallel Software-only Video Effects Processing

M.S.   University of California, Berkeley, 1997
    Design and Performance of the Berkeley Continuous Media Toolkit

B.A.   University of California, Berkeley, 1992
    Majors: Computer Science and Economics

Professional Experience

Associate Professor
    University of North Carolina, Chapel Hill, NC (August 2005 – present)

Assistant Professor
    University of North Carolina, Chapel Hill, NC. (January 2000 – August 2005)

Visiting Researcher
    Microsoft Bay Area Research Center (BARC), San Francisco, CA. (June 2003 – December 2003)

Graduate Student Researcher
    University of California, Berkeley, CA. (June 1993 – November 1999)

Graduate Student Instructor
    University of California, Berkeley, CA. (August 1997 – December 1997)

Programmer
    University of California, Berkeley, CA. (June 1992 – June 1993)

Programmer
    United States Department of Agriculture, Albany, CA. (May 1991 – June 1992)

Honors and Notables

- National Science Foundation CAREER Award, 2003
- Computer Science Student Association Teaching Award, 2003
- Invited to three major meetings (one domestic and two international) of top multimedia researchers to discuss future directions for the field.
- In the fifteen-year history of the ACM SIGMultimedia Conference, considered to be the premier conference in the field of multimedia, I have published twelve papers in ten different years.

Publications

Refereed Journals

K. Mayer-Patel and D. Gotz, "Scalable, Adaptive Streaming for Nonlinear Media," *IEEE Multimedia,* vol. 14, no. 3 (15 pages).

D. Ott and K. Mayer-Patel, "An open architecture for transport-level protocol coordination for distributed multimedia applications," *ACM Transactions on Multimedia Computing, Communications, and Applications*, vol. 3, no. 3 (22 pages).

D. Gotz and K. Mayer-Patel, "GAL: A middleware library for multidimensional adaptation," under review for *ACM Transactions on Multimedia Computing, Communications, and Applications* (21 pages).

K. Mayer-Patel, B. Smith, and L.A. Rowe, "The Berkeley software MPEG-1 video decoder," to appear in *ACM Transactions on Multimedia Computing, Communications, and Applications,* vol. 1, no. 1 (23 pages).

K. Mayer-Patel and S.-U. Kum, "Real-time multi depth stream compression," *ACM Transactions on Multimedia Computing, Communications, and Applications,* vol. 1, no. 2 (26 pages).

D. Gotz and K. Mayer-Patel, "A Framework for Scalable Delivery of Digitized Spaces," *International Journal on Digital Libraries*, vol. 5, no. 3 (14 pages).

J. Considine, K. Mayer-Patel, and J. Byers, "A case for testbed embedding services," *Computer Communication Review*, vol. 34, no. 1, January 2004, pp. 137-142.

Refereed Conferences and Workshops

K. Mayer-Patel, "Systems challenges of media collectives: Supporting media collectives with adaptive MDC," *Proceedings of the 15th International ACM Conference on Multimedia,* Augsberg, Germany, 2007, pp. 625-630.

S. Krishnan and K. Mayer-Patel, "A utility-driven framework for loss and encoding aware video adaptation," *Proceedings of the 15th International ACM Conference on Multimedia,* Augsberg, Germany, 2007, pp. 1026-1035.

D. Gotz and K. Mayer-Patel, "A general framework for multidimensional adaptation," *Proceedings of the 12th International ACM Conference on Multimedia,* New York, 2004, pp 612-619.

D. Ott and K. Mayer-Patel, "Coordinated multi-streaming for 3D tele-immersion," *Proceedings of the 12th International ACM Conference on Multimedia*, New York, NY, 2004, pp. 596-603.

D. Ott and K. Mayer-Patel, "Aggregate congestion control for distributed multimedia applications," *Proceedings of IEEE Infocom '04*, Hong Kong, 7-11 March 2004, vol. 1, pp. 13-23.

K. Mayer-Patel and W. Miaw, "Evaluating the effectiveness of automatic PVR management," *Proceedings of the SPIE Conference on Storage and Retrieval Methods and Applications for Multimedia*, San Jose, CA, January 2004, vol. 5307, pp. 360-365.

S.-U. Kum, K. Mayer-Patel and H. Fuchs, "Real-time compression for dynamic 3D environments," *Proceedings of the 11th International ACM Conference on Multimedia*, Berkeley, CA, 2003, pp. 185-194.

N. Kelshikar, X. Zabulis, J. Mulligan, K. Daniilidis, V. Sawant, S. Sinha, T. Sparks, S. Larsen, H. Towles, K. Mayer-Patel, H. Fuchs, J. Urbanic, K. Benninger, R. Reddy and G. Huntoon, "Real-time terascale implementation of tele-immersion," *Proceedings of the International Conference on Computation Science*, Melbourne, Australia, 2003, Springer-Verlag Lecture Notes in Computer Science vol. 2660, pp. 33-42.

Software Artifacts

mpeg_play
The first publicly available MPEG-1 video decoder originally released in 1993. Over 1,000,000 copies of this program have been downloaded. It has been used as a code base for innumerable research and open source systems. Mayer-Patel was the architect of the original code that was later refactored and maintained by a number of other individuals.

The Berkeley Continuous Media Toolkit
The Berkeley CMT provided a framework within which to develop experimental multimedia tools and applications. Although primarily used by researchers at UC Berkeley, it was employed by a number of different research groups world-wide. Development of CMT ended in approximately 1998.

MPEG2Event
This recently released C# library allows researchers to rapidly develop MPEG-2 analysis tools that are interested in the details of bit-level coding elements. Although currently in use by only a small number of researchers, it is freely available at http://www.cs.unc.edu/~kmp/mpeg2event. Further development of the library is on-going.

Teaching

COMP 416: Introduction to Web Programming
My goal with this course is to pique student interest for more detailed upper-division courses in operating systems, networking, databases, security, etc. while satisfying their practical interest in developing web programming skills. (Fall 2000, Fall 2001, Fall 2004, Fall 2007, Fall 2008)

COMP 832: Multimedia Computing and Networking
This course is an advanced graduate-level course that covers the fundamental concepts in multimedia computing and networking. Students are expected to complete an extensive final

project, some of which have led to publications in refereed conferences and workshops. (Spring 2001, Spring 2002, Spring 2003, Spring 2004, Spring 2007).

Research Areas

Coordinated Multistreaming
In this project, we are developing mechanisms to address the needs of distributed multimedia applications that employ many (i.e., 10's or 100's) of different media flows with complex inter-stream semantics and adaptation requirements. This project addresses fundamental problems in protocol coordination and aggregate congestion control.

Multidimensional Adaptation
We are developing a framework for compactly expressing and evaluating adaptation policies that must negotiate tradeoffs in real-time within very large multiresolutional datasets with high dimensionality.

StrandCast
StrandCast is an application-layer multicast protocol intended for latency-insensitive multimedia applications such as receiver-driven layered multicast and pyramid broadcasting. The design and implementation of StrandCast exploits the lax latency requirements of these applications to optimize for link stress, rapid joins and leaves, and robustness in the face of node failure.

Encoding and Transmission of 3D Scenes from Multiple Cameras
The project explores ways to efficiently transmit video data from a set of cameras viewing the same scene. This problem is at the heart of most tele-immersion applications. Our hypothesis is that it is possible to exploit depth information (even if imperfect) derived from stereo correlation between cameras to more efficiently encode the original color information.

Recoverable Video Adaptation
Existing video adaptation techniques generally lead to irreversibly loss of video quality. In this project, we are exploring adaptation techniques that can be used to recover high (or at least higher) quality video from a set of independently constructed lower quality representations.

Scalable Displays
As digital display technologies such as LCD, DLP, and OLED advance, the frame buffer interface between the graphics pipeline and the display increasingly becomes a resource bottleneck that stifles the development of scalable (i.e., high-resolution) and remote (i.e., networked) displays. In this line of investigation, we reconsider alternative display abstractions that allow applications to more flexibly configure and control display resources.

Funding

CAREER: Enabling Futuristic Distributed Applications with Integrative Multistream Networking
   PI's: K. Mayer-Patel
   Agency: National Science Foundation (ANI-0238260)
   Amount: $404,387
   Duration: 8/15/2003 – 8/14/2008

ITR: Protocol Coordination for Multi-Stream Applications
   PI's: K. Mayer-Patel
   Agency: National Science Foundation (ANI-0219780)
   Amount: $368, 047
   Duration: 10/1/2002 – 9/30/2005

RI: Tera-Pixels - Using High-Resolution Pervasive Displays to Transform Collaboration and Teaching
   PI's: K. Jeffay, A. Lastra, F.D. Smith, K. Mayer-Patel and L. McMillan
   Agency: National Science Foundation (EIA-0303590)
   Amount: $590,986
   Duration: 8/15/2003 – 8/14/2008

3D Telepresence for Medical Consultation: Extending Medical Expertise Throughout, Between, and Beyond Hospitals
   PI's: H. Fuchs, B. Cairns, K. Mayer-Patel, D. Sonnenwald, G. Welch
   Agency: National Library of Medicine
   Amount: $2,549,980
   Duration: 09/30/2003-09/29/2006

Video-Based Representation and Rendering of Large Real and Synthetic Environments
   PI's: D. Manocha and K. Mayer-Patel
   Agency: Office of Naval Research
   Amount: $112,384
   Duration: 01/01/2001-12/31/2003

Professional Activities
   Program Committees
   - Multimedia Interactive Protocols and Systems Workshop (2004, 2005)
   - IFIP Networking Conference (2005, 2007)
   - Multimedia Information Systems Conference (2004)
   - International World Wide Web Conference (2004)
   - ACM Multimedia (2000, 2003, 2004, 2006, 2007)
   - Workshop on Network and Operating System Support for Digital Audio and Video (2000, 2002, 2003, 2005, 2006)
   - SPIE Conference on Multimedia Computing and Networking (2001, 2002, 2003, 2006, 2007)

- IEEE International Conference on Distributed Computing Systems (2003)

Organizing Committees
- General Co-Chair, SPIE Multimedia Computing and Networking (2009)
- Technical Co-Chari, Multimedia Modeling (2009)
- General Co-Chair, Workshop on Network and Operating Systems Support for Digital Audio and Video (2005)
- Open Source Software Competition Chair, ACM Multimedia (2004, 2005)
- Tutorial Program Chair, ACM Multimedia (2003)

Other Professional Service
- Guest Editor, Special Issue of Multimedia Systems Journal featuring expanded papers from the SPIE Conference on Multimedia Computing and Networking, 2003.
- In 2004, participated in a by invitation-only meeting of leaders within ACM SIGMultimedia. A report of the meeting outlining important directions for multimedia research will appear in Transactions on Multimedia Computing, Communications, and Applications.
- Invited to an international meeting of leading multimedia researchers being organized for Spring 2005 in Dagstuhl, Germany to discuss the future of multimedia research.

Ph.D. Students
Advised
- David Ott, *Coordination mechanisms for distributed multistream applications*, November 2005.
- David Gotz, *Supporting adaptive scalable access to multiresolutional multidimensional data,* May 2005.
- Sang-Uok Kum, *Encoding and transmission of 3D depth streams*, expected December 2008.

Examining Committee
- Vassil Roussev, *Flexible sharing of distributed objects based on programming patterns*, May 2003.
- Anand Srinivasan, *Efficient and flexible fair scheduling of real-time tasks on multiprocessors*, May 2003.
- Michele Weigle, *Investigating the use of synchronized clocks in TCP congestion control*, May 2004.
- Philip Holman, *Implementation of Pfair-scheduled Multiprocessor Systems*, August 2004.
- Olufisayo Omojokun expected May 2005.
- Felix Hernandez expected May 2005.
- Long Le, expected May 2005.

<u>University Service</u>

Department Committees
- Graduate Admissions Committee (Spring 2001 – present).
- Examination Committee, (Fall 2004 – present).
- Buildings and Grounds Committee, (Spring 2000 – present).

Other Service
- Project UPLIFT participant (recruitment of minority high school students) (Summer 2001, Summer 2002, Summer 2004).
- Co-coach of the UNC ACM Programming Competition team (Fall 2000 – present).
- Participated in the UNC Summer Reading Program (Summer 2004).
- Ran for faculty senate (Fall 2002).

Ketan Mayer-Patel

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

COMP 416 - Web Programming
In conjunction with Prof. John Smith, this course has been developed as a service course for non-majors interested in the computer science concepts underlying the World Wide Web including the networking protocols used, the advantages of XML-based document standards, relational database concepts, and typical web application design patterns. Students gain practical experience with key server-side and client-side programming technologies such as PHP, JavaScript, and SQL.

COMP 832 - Multimedia Networking
I have developed COMP 832 as an advanced graduate-level course in order to explore fundamental concepts in multimedia computing and networking. Topics include video and audio compression, streaming protocols, forward error correction, layered and multiple description coding, and peer-to-peer communication. This course involves topics directly related to my overall research goals and provides a bridge between my teaching and research activities.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Leonard McMillan Jr.

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University of North Carolina
Department of Computer Science
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Chapel Hill, NC 27599-3175
(919) 962-1778
mcmillan@cs.unc.edu

Personal:

Leonard McMillan is an associate professor in computer science at the University of North Carolina at Chapel Hill. Leonard is a pioneer in the area of image-based rendering. Image-based rendering is a new approach to computer graphics where scenes are rendered directly from collections of reference images rather than from geometric models. Leonard's research interests include computational genetics, visualizations of high-dimensional data, computer graphics rendering, imaging methods and technologies, three-dimensional display technologies, computer graphics hardware, and the fusion of image processing, multimedia, and computer graphics.

Education:

School	Degree	Date
Georgia Institute of Technology	BSEE	1983
Georgia Institute of Technology	MSEE	1984
University of North Carolina at Chapel Hill	Ph.D.	1997

Professional Experience:

Employer	Position	Start	End
AT&T Bell Laboratories	Member of Technical Staff	June 1984	March 1988
Radiant Graphics	President	March 1988	Nov 1988
Sun Microsystems	Sr. Staff Engineer	Nov 1988	Jan 1993
MIT	Assistant Professor	April 1997	June 2001
MIT	Associate Professor	July 2001	Jan 2003
UNC-Chapel Hill	Visiting Professor	July 2002	Jan 2003
UNC-Chapel Hill	Associate Professor	Jan 2003	present

Honors and Awards Received:

Award	Date
NSF CAREER Grant	April 1999
Ruth and Joel Spira Teaching Award, MIT	May 2000
Bose Jr. Faculty Teaching Award, MIT	May 2001
NBX Professorship (Career Development Chair)	July 2001

Current Organization Memberships:

ACM, IEEE, IEEE Computer Society

Bibliography (In chronological order):

Proceedings of Refereed Conferences

Ziegler, Remo, Wojciech Matusik, Hanspeter Pfister, Leonard McMillan, "*3D Reconstruction Using Labeled Image Regions,*" **Eurographics/ACM SIGGRAPH Symposium on Geometry Processing (SGP 2003)**, (Aachen, Germany, June 23-25, 2003), pp. 248-257 (35% acceptance rate).

Stewart, Jason, Jingyi Yu, Steven J. Gortler, and Leonard McMillan, "*A New Reconstruction Filter for Undersampled Light Fields,*" **Eurographics/ACM SIGGRAPH Symposium on Rendering 2003**, (Leuven, Belgium, June 25-27 2003), pp. 150-156 (38 % acceptance rate).

Matusik, Wojciech, Hanspeter Pfister, Matt Brand, and Leonard McMillan, "*Efficient Isotropic BRDF Measurement,*" **Eurographics/ACM SIGGRAPH Symposium on Rendering 2003**, (Leuven, Belgium, June 25-27 2003) pp. 241-248 (38 % acceptance rate).

Briceño, Hector, Pedro Sander, Leonard McMillan, Steven Gortler, and Hugues Hoppe*, "Geometry Videos: A New Represenation for 3D Animations,"* **ACM/Eurographics Symposium on Computer Animation**, (San Diego, CA, July 26-27, 2003) pp. 136-146.

Sand, Peter, Leonard McMillan, and Jovan Popovic, "*Continuous Caputre of Skin Deformation,*" **ACM Transactions on Graphics,** (Proceedings of ACM SIGGRAPH 2003, San Diego, CA, July 27-31) pp. 578-586 (19% acceptance rate).

Matusik, Wojciech, Hanspeter Pfister, Matt Brand, and Leonard McMillan, "*A Data-Driven Reflectance Model,*" **ACM Transactions on Graphics** (Proceedings of ACM SIGGRAPH 2003, San Diego, CA, July 27-31) pp. 759-569 (19% acceptance rate).

Bennett, Eric and Leonard McMillan, "*Proscenium: A Framework for Spatio-Temporal Video Editing,*" **Proceedings of the 11th ACM International Conference on Multimedia,** 2003, (Berkeley, CA, Nov. 2-8) pp. 177-184 (acceptance rate 17%, selected as Best Student Paper).

Yu, Jingyi and Leonard McMillan, "*General Linear Cameras*," **The 8th European Conference on Computer Vision** (ECCV 2004, Prague, Czech Republic, May 11-14, 2004), vol. 2, pp. 14-27 (selected for oral presentation, acceptance rate 34%, 7% for oral presentation).

Sinha, Sidipta N., Marc Pollefeys, and Leonard McMillan, "*Camera Network Calibration from Silhouettes*," **IEEE Computer Society Conference on Computer Vision and Pattern Recognition,** (CVPR 2004, Washington, DC June 27 – July 2, 2004), vol 1., pp. 195-202, (acceptance rate 20%).

Yu, Jingyi and Leonard McMillan, "*A Framework for Multiperspective Rendering*," **Eurographics/ACM SIGGRAPH Symposium on Rendering (EGSR) 2004**, (Norrkoping, Sweden, June 21-23 2004) pp. 61-68 (acceptance rate 40%).

Cutler, Barbara, Julie Dorsey, and Leonard McMillan, "*Simplification and Improvement of Tetrahedral Models for Simulation,*" **Eurographics/ACM SIGGRAPH 2nd Eurographics Symposium on Geometry Processing (SGP) 2004,** (Nice, France, July 8-10, 2004) pp. 95-104.

Stewart, Jason, Eric Bennett, and Leonard McMillan, "*PixelVIEW: A View-Independent Graphics Rendering Architecture*," **Eurographics/ACM SIGGRAPH Graphics Hardware 2004**, (Grenoble, France, August 29-30 2004) (acceptance rate 33%).

Yu, Jingyi, Leonard McMillan, and Steven Gortler, "*Surface Camera (SCam) Light Field Rendering*", **International Journal of Image and Graphics (IJIG)**, Special Issue on Integrated Image and Graphics Technologies, Vol. 4, No. 4, October 2004, pp. 605-625.

Yu, Jingyi, Jason Yang, and Leonard McMillan, "*Real-time Reflection Mapping with Parallax*", **ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games** (I3D2005, Washington DC, April 3-6 2005) pp. 133-138.

Lui, Guodong, Jingdan Zhang, Wei Wang, and Leonard McMillan, "*A System for Analyzing and Indexing Human Motion Databases,*" (demo) **ACM SIGMOD 2005**, (Baltimore, MD, June 14-16, 2005) pp. 924-926.

Yu, Jingyi, and Leonard McMillan, "*Modelling Reflections via Multiperspective Imaging*," **IEEE Computer Society Conference on Computer Vision and Pattern Recognition,** (CVPR 2005, San Diego, CA June 20-26, 2005), pp. 117-124.

Bennettt, Eric, and Leonard McMillan, *"Video Enhancement Using Per-Pixel Virtual Exposures,"* **ACM Transactions on Graphics** (Proceedings of ACM SIGGRAPH 2005, Los Angeles, CA, July 31 – August 4) pp. 845-852.

Yang, Tynia, Jinze Liu, Leonard McMillan, and Wei Wang, "A fast approximation to multidimensional scaling, *Proceedings of the ECCV Workshop on Computation Intensive Methods for Computer Vision (CIMCV)*, 2006.

Liu, Guodong, Jingdan Zhang, Wei Wang, and Leonard McMillan, "Human motion estimation from a reduced marker set", *Proceedings of the Symposium on Interactive 3D Graphics and Games (SI3D)*, pp. 35-42, 2006.

Zhang, Jingdan, and Leonard McMillan, Jingyi Yu, "Robust Tracking and Stereo Matching under Variable Illumination," **IEEE Computer Society Conference on Computer Vision and Pattern Recognition** (CVPR 2006, New York, NY), pp. 871-878, 2006.

Liu, Guodong. and Leoanrd McMillan. "Segment-based human motion compression". **Proceedings of the 2006 ACM Siggraph/Eurographics Symposium on Computer Animation** (SCA2006, Vienna, Austria, September 02 - 04, 2006), 127-135, 2006.

Liu, Jinze, Qi Zhang, Wei Wang, Leonard McMillan, and Jan Prins. "Clustering pair-wise dissimilarity data into partially ordered sets", **Proceedings of the 12th ACM International Conference on Knowledge Discovery and Data Mining** (KDD2006), pp. 637-642, 2006.

Liu, Jinze, Qi Zhang, Wei Wang, Leonard McMillan, and Jan Prins, **"**Pocluster: loseless clustering of dissimilarity data", to appear in **Proceedings of 2007 SIAM International Conference on Data Mining** (SDM2007)**,** April, 2007.

Feng, Pan, Wei Wang, and Leonard McMillan, "*Accelerating Profile Queries in Elevation Maps*," **IEEE 23rd International Conference on Data Engineering** (**ICDE 2007**, April 15-20, 2007 Istanbul, Turkey), 2007.

Bennett, Eric P., John L. Mason, and Leonard McMillan, "Multispectral Bilateral Video Fusion", **IEEE Transactions on Image Processing**, 16-5, May 2007, pp. 1185-1194, 2007.

Roberts, Adam, Leonard McMillan, Wei Wang, Joel Parker, Ivan Rusyn, and David Threadgill, "Inferring missing genotypes in large SNP panels using fast nearest-neighbor searches over sliding windows", To appear in **Bioinformatics**, (Special issue of the *Proceedings of the 15th Annual International Conference on Intelligent Systems for Molecular Biology*—**ISMB 2007**), July 2007.

Zhang, Jingdan, Shaohua (Kevin) Zhou, Leonard McMillan, and Dorin Comaniciu, "Joint Real-time Object Detection and Pose Estimation Using a Probabilistic Boosting Network", **IEEE Computer Society Conference on Computer Vision and Pattern Recognition** (**CVPR 2007**, Minneapolis, MN), pp. 1-8, 2007.

Bennett, Eric P. and Leonard McMillan, *"Computational Time-Lapse Video",* **ACM Transactions on Graphics** (**SIGGRAPH 2007**, San Diego, CA, August 5-9, 2007) pp. 102-107, 2007.

Roberts, Adam, Fernando Pardo-Manuel de Villena, Wei Wang, and Leonard McMillan, and David W. Threadgill, "*The polymorphism architecture of mouse genetic resources elucidated using genome-wide resequencing data: implications for QTL discovery and systems genetics,*" **Mammalian Genome**, vol. 18, no. 6-7, pp. 473-481, July 2007.

Pan, Feng, Adam Roberts, Leonard McMillan, Fernando Pardo Manuel de Villena, David Threadgill, and Wei Wang, "*Sample selection for maximal diversity*", to appear at **2007 IEEE International Conference on Data Mining** (ICDM'07, Omaha, NE, USA, Oct. 28-31).

Yu, Jingyi, Yuanyuan Ding, and Leonard McMillan, "*Multiperspective Modeling and Rendering Using General Linear Cameras*", **Communications in Information and Systems**, Volume 7, Number 4 (2007), 359-384.

Zhang, Jingdan, Shaohua (Kevin) Zhou, Dorian Comaniciu, and Leonard McMillan, "*Learning Conditional Distributions via Regression with Application to Deformable Shape Segmentation*", **Computer Vision and Pattern Recognition** (**CVPR 2008**, Anchorage, AK, June 24-26, 2008).

Zhang, Qi, Wei Wang, Leonard McMillan, Jan Prins, Fernando Pardo-Manuel de Villena, and David Threadgill, "*Genotype Sequence Segmentation: Handling Constraints and Noise*", Proceedings of **8th Workshop on Algorithms in Bioinformatics** (WABI'08), 2008.

Zhang, Jingdan, Shaohua (Kevin) Zhou, Dorian Comaniciu, and Leonard McMillan, "*Discriminative Learning for Deformable Shape Segmentation: A Comparative Study,*" to appear in **Proceedings of ECCV 2008,** (Marseille, France, Oct 12-18, 2008).

Pan, Feng, Leonard McMillan, Fernando Pardo-Manuel de Villena, David Threadgill and Wei Wang, "*TreeQA: Quantitative Genome Wide Association Mapping Using Local Perfect Phylogeny Trees*", to appear in **Proceedings of the the 14th Pacific Symposium on Biocomputing** (PSB' 09).

Zhang, Qi, Wei Wang, Leonard McMillan, Fernando Pardo-Manuel de Villena, and David Threadgill, "*Inferring Genome-Wide Mosaic Structure*", to appear in **Proceedings of the 14th Pacific Symposium on Biocomputing** (PSB' 09).

Patents

W. Matusik, H. Pfister, P. Beardsley, and L. McMillian, **Image-Based 3D Photography**, United States Patent and Trademark Office No. 6,792,140, August 26, 2004.

W. Matusik, H. Pfister, A. Ngan, and L. McMillan, **Modeling 3D Objects with Opacity Hulls**, United States Patent and Trademark Office No. 6,791,542, September 14, 2004.

Invited Lectures

May 6, 2003, *"Data-Driven Modeling in Computer Graphics,"* **Cornell University Computer Science Department Spring 2003 Lecture Series**, Ithaca, NY.

May 27, 2003, *"Data-Driven Modeling in Computer Graphics,"* Computer Graphics Laboratory, ETH Zurich, Switzerland.

December 9, 2003, *"Data-Driven Modeling in Computer Graphics,"* **Computer Graphics and Visualization Laboratory**, Computer Science Department, Purdue University, West Lafayette, IN.

June 3, 2004, "*Architecture Futures for Point-Based Representations*," Invited Keynote Talk, 1st Symposium on Point-Based Graphics, ETH, Zurich, Switzerland.

October 1, 2004, "*A General Linear Camera Model with Applications*," **Robotics Institute Seminar:** Carnegie Mellon University, Pittsburgh, PA

October 25, 2004, "*A General Linear Camera Model with Applications*," **Broad Area Colloquium For AI-Geometry-Graphics-Robotics-Vision:** Stanford University, Palo Alto, CA

Teaching Record:

Term	Subject	Title	Role
FT03	COMP 120	Computer Organization	Lectures
ST04	COMP 236	Computer Graphics	Lectures
FT04	COMP 290	Data-Driven Modeling in Computer Graphics	Seminar
ST05	COMP 236	Computer Graphics	Lectures
FT05	COMP 121	Bioalgorithms (cotaught with Wei Wang)	Lectures
ST06	COMP 120	Computer Organization	Lectures
FT06	COMP 411	Computer Organization	Lectures
ST07	COMP 790	Xbox Science	Lectures
FT07	COMP 411	Computer Organization	Lectures
ST08	COMP 101	Intro. to Computation for non-majors	Lectures
FT08	COMP 665	Imaging, Graphics, and Visions	Lectures

Theses Supervised:

Summary	Total	Completed	In Progress
Master's	12	12	0
Doctoral	13	9	4

Master's Theses Titles

Peters, Matthew, "Multidimensional Image Morphs: Construction and User Interface," January 2003.
Yu, Jingyi, "Scam Light Field Rendering," January 2003.
Stewart, Jason, "A New Reconstruction Filter for Undersampled Light Fields," May 2004.

Doctoral Theses Titles

Barb Cutler, "Procedural Authoring of Solid Models" August 2003.
Hector Brinceno, "Geometry Videos: A New Representation for 3D Animations" September 2003.
Wojciech Matusik, "A Data-Driven Reflectance Model" September 2003.
Jason Yang, "Design and Analysis of a Two-dimensional Camera Array" February 2005.
Jingyi Yu, "General Linear Cameras: Theory and Applications" May 2006
Guodong Liu, "A Data-driven Piecewise Linear Approach to Modeling Human Motions" August 2006
Eric Bennett, "Computational Video Enhancement", May 2007

Grants and Contracts
Active Grants and Contracts

  Title: IIS: Visualizing and Exploring High-dimensional Data
  Funding Source: NSF Division of Information & Intelligent Systems
  Role: PI
  Co-PIs: Wei Wang (PI)
  Funds Requested: $ 309,419.00
  Date Awarded: 06/17/06

  Title: CCF: Tera-Pixels - Next Generation Display Architectures
  Funding Source: NSF Division of Computer and Communication Foundations
  Role: PI
  Co-PIs: Ketan Mayer-Patel (PI)
  Funds Requested: $373,937.00
  Date Awarded: 04/14/06

  Title: RI: Tera-pixels: Using High-resolution Pervasive Displays to Transform Collaboration and Teaching
  Funding Source: NSF CISE Infrastructure
  Role: Co-PI
  Co-PIs: Kevin Jeffay (PI), Ketan Mayer-Patel, Anselmo Lastra, and Don Smith
  Funds Requested: $1,066,316 (over 4 years)
  Funds Received: $590,986
  Date Awarded: 8/15/03

  Title: Meshless wavelets and their application to terrain modeling
  Funding Source: DARPA GEO*
  Role: Co-PI
  Co-PIs: Jack Snoeyink (PI), Leonard McMillan, Marc Pollefeys, Wei Wang, Charles Chui, Wenjie He (UMSL)
  Funds Requested: $2,344,263

  Title: Enhanced Night-Vision Via a Combination of Poisson Interpolation and Machine Learning
  Funding Source: DARPA Information Exploitation Office (IXO) Research Grant (FA8650-04-2-6543)
  Role: PI
  Co-PIs: Wei Wang
  Start date: 09/15/04
  Award: $240,648

Professional Service:

  Activity
  Co-organizer: 1st Annual Workshop on
  Image-Based Modeling and Rendering
  (Stanford University, Palo Alto, CA)

  Program Committee:
  ACM 2001 Symposium on
  Interactive 3D Graphics (I3D)

  Technical Papers Committee:
  Computer Vision and Pattern Recognition
  Annual Conference (CVPR 2003)

  Technical Papers Committee:
  SIGGRAPH '03, '04, 06

Leonard McMillan

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Fabian N. Monrose

UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL   *Phone*:   +919-962-1783
Computer Science Department   *Fax*:   +919-962-1799
Sitterson Hall, Chapel Hill, NC, 27599   *E-mail*:   fabian@cs.unc.edu

Education		
	Ph. D., Computer Science, New York University, New York, USA *Advisor*: Prof. Zvi Kedem	*Courant Institute of Mathematical Sciences* May, 1999
	M. Sc., Computer Science, New York University, New York, USA	*Courant Institute of Mathematical Sciences* May, 1996
	B. Sc., Computer Science, Miami, Florida, USA	*Barry University* May, 1993

Experience		
	ASSOCIATE PROFESSOR, Computer Science Department,	*University of North Carolina, Chapel Hill* July 2008 — present
	ASSOCIATE PROFESSOR, Computer Science Department,	*Johns Hopkins University* July 2007 —June 2008
	ASSISTANT PROFESSOR, Computer Science Department,	*Johns Hopkins University* November 2002 — June 2007
	RESEARCH SCIENTIST, Secure Systems Research,	*Bell Laboratories, Lucent Technologies* July 1999 — October 2002

Awards

- National Science Foundation CAREER Award,   February, 2006

Teaching Experience

JHU, *new course offering*
ADVANCED TOPICS IN NETWORK SECURITY,   Spring, 2004—2006

The course exposes students to a number of advanced research topics in Communications Security. Topics include multi-level traffic classification, payload attribution schemes, anonymous routing, multicast and broadcast authentication, secure overlays, inter-domain routing security, covert channels, secure and efficient metering, among others. Student projects stemming from this course have resulted in research papers accepted to peer reviewed conferences and workshops, theses, MSe and Masters in Security Informatics (MSSI) qualifying projects.

JHU, *new course offering*
NETWORK SECURITY,   Fall, 2003—2007

This course focuses on several practically-oriented topics in Network Security, including analysis of protocols, traffic monitoring, anonymity and privacy, DDoS and packet identification, secure routing and naming services, and Web security. A unique aspect of the course is the implementation and evaluation of security proposals within the context of a processor-based event-driven simulator, called *Simnet*, written specifically for this course.

JHU, *new course offering*
COMPUTER AND NETWORK FORENSICS,   Spring, 2007

The course exposes students to a myriad of fundamental concepts and techniques for recovering and inferring information in computer systems and networks. Topics include file system forensics, kernel-level rootkits, reconstructing malware evolution and dynamics, analysis of anonymization and privacy preserving techniques, advanced network traceback, biometrics and digital evidence, data integrity and audit trails, secure remote logging, and system call introspection.

JHU
M&MS: FRESHMAN EXPERIENCE,   Nov-Dec. 2006; Oct-Nov. 2007

Students are exposed to the discipline through vignettes of logic and algebra, computer systems and networks, algorithms, programming languages, computation theory, and selected applications.

**Research
Grants**

[G1] **Co-PI**, NSF *STI*: TOWARDS MORE SECURE INTER-DOMAIN ROUTING (with A. Rubin) for $616, 923.00. November 2003 — June 2006.

[G2] **PI**, NSF *Cyber Trust*: GENERATIVE MODELS FOR IMPROVING BIOMETRICALLY ENHANCED SYSTEMS (with D. Lopresti and M. K. Reiter) for $696, 553.00. December 2004 — October 2007 (extended to 2008).

[G3] **PI**, NSF *Cyber Trust*: CAREER:TOWARDS EFFECTIVE IDENTIFICATION OF APPLICATION BEHAVIORS IN ENCRYPTED TRAFFIC for $400, 000.00. September 2006 — August 2011.

[G4] **Co-PI**, NSF *Cyber Trust*: THINKING AHEAD: A PROACTIVE APPROACH FOR COUNTERING FUTURE INTERNET MALWARE (with A. Terzis) for $350, 000.00. September 2006 — August 2009.

[G5] **PI**, Department of Homeland Security, NEW FRAMEWORKS FOR DETECTING AND MINIMIZING INFORMATION LEAKAGE IN ANONYMIZED NETWORK DATA (with M. K. Reiter and F. Jahanian) for $962, 609.00. April 2008—March 2010.

[G6] **Co-PI**, NSF *Cyber Trust*: CLEANSE:CROSS-LAYER LARGE-SCALE EFFICIENT ANALYSIS OF NETWORK ACTIVITIES TO SECURE THE INTERNET (with W. Lee, N. Feamster,

J. Giffin, M.K. Reiter, F. Jahanian, P. Porras, P. Vixie, D. Dagon) for $1,839,297.00$, July 2008 — June 2012.

Refereed Conference Publications

[P1] *Towards Practical Biometric Key Generation with Randomized Biometric Templates*. Lucas Ballard, Seny Kamara, Fabian Monrose, and Mike Reiter. To appear in the 15th ACM Conference on Computer and Communications Security, Oct, 2008 (12 pages). (Acceptance rate=18.2%).   .

[P2] *All Your iFrames point to us: Characterizing the new malware frontier*. Niels Provos, Panayiotis Mavrommatis, Moheeb Rajab, and Fabian Monrose. In Proceedings of the 17th USENIX Security Symposium, July, 2008, (16 pages). (Acceptance rate=15.9%).

[P3] *To Catch a Predator: A Natural Language Approach for Eliciting Protocol Interaction*. Sam Small, Josh Mason, Fabian Monrose, Niels Provos and Adam Stubblefield. In Proceedings of the 17th USENIX Security Symposium, July, 2008, (16 pages). (Acceptance rate=15.9%).

[P4] *Peeking Through the Cloud: DNS-based client estimation techniques and its applications*. Moheeb Rajab, Niels Provos, Fabian Monrose and Andreas Terzis. In Proceedings of the 6th Applied Cryptography and Network Security conference (ACNS), June, 2008, (12 pages).

[P5] *Spot Me If You Can: recovering spoken phrases in encrypted VOIP conversations*. Charles Wright, Lucas Ballard, Scout Coull and Fabian Monrose. In Proceedings of IEEE Symposium on Security and Privacy, May, 2008 (17 pages).(Acceptance rate=11.2%).

[P6] *Taming the Devil: Techniques for Evaluating Anonymized Network Data*. Scott Coull, Charles Wright, Angelos Keromytis, Fabian Monrose, and Michael Reiter. In Proceedings of the 15th Annual Network and Distributed Systems Security Symposium, pages 125-146, Feb., 2008 (Acceptance rate=18%).

[P7] *On Web Browsing Privacy in Anonymized NetFlows*. Scott Coull, Michael Collins, Charles Wright, Fabian Monrose, and Michael Reiter. In Proceedings of the 16th USENIX Security Symposium, pages 339-352, August, 2007. (Acceptance rate=12.29%).

[P8] *Language Identification of Encrypted VoIP Traffic: Alejandra y Roberto or Alice and Bob?* Charles Wright, Lucas Ballard, Fabian Monrose and Gerald Masson. In Proceedings of the 16th USENIX Security Symposium, pages 43-54, August, 2007. (Acceptance rate=12.29%).

[P9] *Towards Valley-free Inter-domain Routing*. Sophie Qiu, Patrick McDaniel and Fabian Monrose. To appear in Proceedings of the IEEE International Conference on Communications, June, 2007. (8 pages)

[P10] *Playing Devil's Advocate: Inferring Sensitive Information from Anonymized Traces*. Scott Coull, Charles Wright, Fabian Monrose, Michael Collins and Michael Reiter. In Proceedings of the 14th Annual Network and Distributed Systems Security Symposium (NDSS), pages 35-47, February 2007. (Acceptance rate=15%).

[P11] *A Multifaceted Approach to Understanding the Botnet Phenomenon*. Jay Zarfoss, Moheeb Rajab, Fabian Monrose, and Andreas Terzis. In Proceedings of the ACM SIGCOMM/-USENIX Internet Measurement Conference (IMC), pages 41-52, October, 2006. (Acceptance rate=15.25%).

[P12] *Fast and Evasive Attacks: Highlighting the Challenges Ahead*. Moheeb Rajab, Fabian Monrose, and Andreas Terzis. In Proceedings of the 9th International Symposium on Recent Advances in Intrusion Detection (RAID), pages 206-225, September, 2006 (Acceptance rate=17.2%).

[P13] *Biometric Authentication Revisited: Understanding the Impact of Wolves in Sheep's Clothing*. Lucas Ballard, Fabian Monrose, and Daniel Lopresti. In Proceedings of the USENIX Security Symposium, pages 29-41, August 2006 (Acceptance rate=12.3%).

[P14] *On Origin Stability in Inter-Domain Routing*. Sophie Qui, Patrick McDaniel, Fabian Monrose and Aviel D. Rubin. In Proceedings of IEEE International Symposium on Computers and Communications (ISCC), pages 489-496, July, 2006.

[P15] *Memory Bound Puzzles: A Heuristic Approach*. Sujata Doshi, Fabian Monrose and Aviel D. Rubin. In Proceedings of the International Conference on Applied Cryptography and Network Security (ACNS), pages 98-113, June 2006 (Acceptance rate=15.13%).

[P16] *Achieving Efficient Conjunctive Searches on Encrypted Data*. Lucas Ballard, Seny Kamara and Fabian Monrose. In Proceedings of 7th International Conference on Information and Communications Security (ICICS), pages 414-426, December, 2005. (Acceptance rate=18%)

[P17] *On the Effectiveness of Distributed Worm Monitoring*. Moheeb Rajab, Fabian Monrose and Andreas Terzis. In Proceedings of 14th USENIX Security Symposium, pages 225-237, August, 2005. (Acceptance rate=14.8%)

[P18] *Scalable VPNs for the Global Information Grid*. Bharat Doshi, Antonio De Simone, Fabian Monrose, Samuel Small, and Andreas Terzis. In Proceedings of IEEE MILCOM, May, 2005. (7 pages)

[P19] *An Extensible Platform for Evaluating Security Protocols*. Seny Kamara, Darren Davis, Ryan Caudy and Fabian Monrose. In Proceedings of the 38th Annual IEEE Simulation Symposium (ANSS), pages 204-213, April, 2005.

[P20] *Efficient Time Scoped Searches on Encrypted Audit Logs*. Darren Davis, Fabian Monrose, and Michael Reiter. In Proceedings of the 5th International Conference on Information and Communications Security (ICICS), pages 532-545, October, 2004. (Acceptance rate=17%)

[P21] *On User-Choice in Graphical Password Systems*. Darren Davis, Fabian Monrose, and Michael Reiter. In Proceedings of the 13th USENIX Security Symposium, pages 151-164, August, 2004. (Acceptance rate=12%)

Refereed
Journal
Publications

[P22] *Forgery Quality for Behavioral Biometric Security.* Lucas Ballard, Daniel Lopresti and Fabian Monrose. Accepted to IEEE Transactions on System, Man and Cybernetics, (Special Issue on Biometric Security), pages 1107-1118, December, 2006. (Acceptance rate=18.75%).

[P23] *On Inferring Application Protocol Behaviors in Encrypted Network Traffic.* Charles Wright, Fabian Monrose, and Gerald Masson. Journal of Machine Learning Research (Special Issue on Machine Learning for Computer Security), Vol. 7, pages 2745-2769, December, 2006. (Acceptance rate=20%)

**Refereed
Workshop
Publications**

[P24] *My Botnet is Bigger than Yours (Maybe, Better than Yours): Why size estimates remain challenging.* Moheeb Rajab, Jay Zarfoss, Fabian Monrose and Andreas Terzis. In Proceedings of USENIX Workshop on Hot Topics in Understanding Botnets, April, 2007 (Acceptance rate=32.4%) (8 pages).

[P25] *Using Visual Motifs to Classify Encrypted Traffic.* Charles Wright, Fabian Monrose and Gerald Masson. In Proceedings of the ACM Workshop of Visualization for Computer Security (VizSEC), November, 2006 (Acceptance rate=34%) (8 pages).

[P26] *On the Impact of Dynamic Addressing on Malware Propagation.* Moheeb Rajab, Fabian Monrose, and Andreas Terzis. In Proceedings of the 4th ACM Workshop of Recurring Malcode (WORM), November, 2006 (Acceptance rate=29%) (8 pages)

[P27] *Efficient Techniques for Detecting False Origin Advertisements in Inter-domain Routing.* Sophie Qui, Patrick McDaniel, Fabian Monrose, and Andreas Terzis. In Proceedings of the 2nd Workshop on Secure Network Protocols, pages 12-19, November 2006. (Acceptance rate=40%).

[P28] *Evaluating the Security of Handwriting Biometrics.* Lucas Ballard, Daniel Lopresti and Fabian Monrose. In Proceedings of the 10th International Workshop on Frontiers in Handwriting Recognition, pages 461-466, October, 2006 (Acceptance rate=28.5%).

[P29] *Worm Evolution Tracking via Timing Analysis.* Moheeb Rajab, Fabian Monrose and Andreas Terzis. In Proceedings of the 3rd ACM Workshop on Recurring Malware (WORM), pages 52-59, November, 2005 (Acceptance rate=25%).

[P30] *HMM Profiles for Network Traffic Classification (extended Abstract).* Charles Wright, Fabian Monrose and Gerald Masson. In Proceedings of ACM Workshop on Visualization and Data Mining for Computer Security (VizSEC/DMSEC), pages 9-15, October, 2004.

Book Chapters

[B1] *Graphical Passwords (revisited).* Fabian Monrose and Micheal Reiter. *Security and Usability: Designing Security Systems That People Can Use.* Editors: Lorrie Cranor and Simson Garfinkel. OReilly & Associates, 2005.

Manuscripts under review

[M1] *A Multifaceted Approach to Unveiling Botnet Dynamics*. Moheeb Rajab, Jay Zarfoss, Fabian Monrose, Andreas Terzis and Neils Provos. Submitted to ACM Transactions on Information and System Security (TISSEC), April, 2007 (30 pages).

[M2] *Efficient Defenses Against Statistical Traffic Analysis*. Charles Wright, Scott Coull and Fabian Monrose. Submitted to the ACM Conference on Computer and Communications Security, April, 2008.

[M3] *Uncovering Spoken Phrases in Encrypted VoIP conversations.*. Charles Wright, Lucas Ballard, Scott Coull, Gerald Masson and Fabian Monrose. Submitted to ACM Transactions on Information and System Security (TISSEC), June, 2008 (24 pages).

Other Manuscripts

[M4] *Correlation Resistant Storage*. Lucas Ballard, Mathew Green, Breno *de* Medeiros and Fabian Monrose. Cryptology ePrint Archive Report 2005/417.

[M5] *Evaluating Biometric Security (Invited Paper)*. Daniel Lopresti, Lucas Ballard and Fabian Monrose. In Proceedings of the 1st Korea-Japan Workshop on Pattern Recognition, November 2006. (6 pages)

[M6] *Biometric Key Generation using Pseudo-Signatures* (Poster Presentation). Lucas Ballard, Jin Chen, Danile Lopresti and Fabian Monrose. In International Conference on Frontiers of Handwriting Recognition, Feb. 2008 (8 pages).

Patents

[P1] Robert Arlein, Ben Jai, Markus Jakobsson, Fabian Monrose and Michael Reiter. *Method & Apparatus for Providing Privacy-preserving Global Customization*. U.S. Patent No. 7,107,269, September, 2006.

[P2] Phil L. Bohannon, Markus Jakobsson, Fabian Monrose, Michael K. Reiter and Susanne Wetzel. *Generation of Repeatable Cryptographic Keys Based on Varying Parameters*. U.S. Patent No. 6,901,145, May 31, 2005.

[P3] Markus Jakobbson and Fabian Monrose. *System & Apparatus for Incorporating Advertising into Printed Images*. U.S. Patent No. 6,873,424, March, 2005.

Program Chair

- 18th USENIX Security Symposium   2009
- 1st USENIX Workshop on Large-scale Exploits & Emergent Threats   2008

**Program
Committees**

- 29th International Conference on Distributed Computing Systems 2009
- 16th Annual Network and Distributed Systems Security Symposium 2009
- 17th USENIX Security Symposium 2008
- 29th Annual IEEE Symposium on Security and Privacy 2008
- 15th Annual Network and Distributed Systems Security Symposium 2008
- 6th IEEE Biometrics Symposium 2008
- 14th Annual Network and Distributed Systems Security Symposium 2007
- 2nd USENIX Workshop on Hot Topics in Security 2007
- 10th Information Security Conference 2007
- 1st USENIX Workshop on Hot Topics in Understanding Botnets 2007
- 16th USENIX Security Symposium 2007
- 28th Annual IEEE Symposium on Security and Privacy 2007
- 15th USENIX Security Symposium 2006
- 4th ACM Workshop of Recurring Malware 2006
- 13th Annual Network and Distributed Systems Security Symposium 2006
- 14th USENIX Security Symposium 2005
- 25th International Conference on Distributed Computing Systems 2005
- 6th International Workshop on Information Security Applications 2005
- 12th International WWW Conference, *Security and Privacy Track* 2004
- 10th Network and Distributed Systems Security Symposium 2003
- 12th International WWW Conference, *Security and Privacy Track* 2003
- 4th International Workshop on Information Security Applications 2003

**Editorial
Boards**

- ACM Transactions of Information and System Security 2006 — *present*

**Organizing &
Steering
Committees**

- *Steering Committee*, Network & Distributed Systems Security Symposium   2007-10

- *Publicity Chair*, ACM Workshop on Rapid Malcode, Arlington   2006

- *Co-organizer,* DIMACS Workshop on Security and Usability, Rutgers   2004

Invited Talks

[T1] *Privacy Leaks In Encrypted Network Traffic*. Security and Privacy Day, Stonybrook University, May 2008.

[T2] *Traffic Analysis of Encrypted VoIP Communications*. École Polytechnique, Montreal, March, 2008. Host: José M. Fernandez.

[T3] *Covertly Tracking Malfeasance on the Net: Challenges, Pitfalls and some Opportunities*. University of North Carolina, Chapel Hill, Computer Science Department, December, 2007. Host: Mike Reiter.

[T4] *Playing Devil's Advocate: Inferring Sensitive Information from Anonymized logs*. Georgia Institute of Technology, February, 2007. Host: Wenke Lee.

[T5] *Covertly Tracking a Large Collection of Botnets: Challenges, Pitfalls, and Lots of Questions*. Security Seminar Series, Columbia University, December, 2006. Host: Angelos Keromytis.

[T6] *Traffic Classification in the Dark*. Toronto Networking Seminar Series, University of Toronto, Canada, November, 2006. Host: Stefan Saroiu.

[T7] *Unveiling the Dark Corners of the Internet: or, do you know who's using your computer?* Black Faculty and Staff Lecture Series, Johns Hopkins University, November, 2006

[T8] *Covertly Tracking a Large Collection of Botnets*. Security Group, Google Inc., Mountain View, September, 2006. Host: Niels Provos.

[T9] *Biometric Authentication Revisited: Understanding the Impact of Wolves in Sheep's Clothing*, Digital Security Group, Carleton University, Ottawa, April, 2006. Host: Paul van Oorchot.

[T10] (*Co-leader*) *Panel: Biometric Identification Systems*, NSF and Department of Treasury Special Workshop on Resilient Financial Information Systems, March, 2005

[T11] *On User Choice in Graphical Password Schemes*, DIMACS Workshop on Security and Usability, Rutgers, May, 2004

[T12] *Towards Cryptographic Key Generation from Biometrics*, CSE Lecture Series, Lehigh University, December, 2003. Host: Daniel Lopresti.

[T13] *On the Feasibility of Key Generation from non-static Biometrics*, CS Seminar Series, Steven's Institute of Technology, April, 2003. Host: Susanne Wetzel.

**Academic
Service**

[S1] NSF Exploratory Research panelist, 2006, 2007

[S2] NSF Cyber Trust panelist, 2006, 2007

[S3] NSF Networking Research panelist, 2004

[S4] NSF Advance Networking Infrastructure & Research panelist, 2003

[S5] JHUISI Admissions and Curriculum committees, 2003-2005

[S6] Computer Science Admissions committee, 2005—2007

[S7] Johns Hopkins Diversity Leadership Council, 2005—2007

[S8] Lecture Series, Johns Hopkins Parents College, 2006

**Ph.D.
Students**

- Sophie Qui (Co-Advisee), Spring 2007, (*Cisco Systems*)

- Charles Wright, Spring 2008, (*MIT Lincoln Labs*)

- Seny Kamara, Spring 2008, (*Microsoft Research*)

- Moheeb Rajab (Co-Advisee), Spring 2008, (*Google Inc.*)

- Lucas Ballard, Spring 2008, (*Google Inc.*)

- Scott Coull, Fall 2009, (*expected graduation*)

- Josh Mason (Co-Advisee), Spring 2010, (*expected graduation*)

**Thesis
Committees**

- (**Reader**) Breno de Medeiros, *New Cryptographic Primitives and Applications*, Ph.D., Johns Hopkins University, May 2004

- (**Reader**) Kendall Giles, *Knowledge Discovery in Computer Network Data: A Security Perspective*, Ph.D., Johns Hopkins University, October, 2006

- (**Advisor**) Sophie Qui, *Towards Stable, Reliable and Policy-Compliant Inter-domain Routing*, Ph.D., Johns Hopkins University, May, 2007

- (**Reader, external examiner**) Julie Thorpe, *On the Predictability and Security of User Choice in Passwords*, Ph.D., Carleton University, Fall, 2007

- (**Advisor**) Charles Wright, *On Information Leakage Attacks in Encrypted Network Traffic*, Ph.D., Johns Hopkins University, 2008

- (**Advisor**) Seny Kamara, *Improved Definitions and Efficient Constructions for Secure Obfuscation*, Ph.D., Johns Hopkins University, 2008

- (**Advisor**) Lucas Ballard, *Robust Techniques for Evaluating Biometric Cryptographic Key Generators*, Ph.D., Johns Hopkins University, 2008

- (**Co-Advisor**) Moheeb Rajab, *Towards a Better Understanding of Internet-Scale Threats*, Ph.D., Johns Hopkins University, 2008

**MSe Thesis
Advisor**

- Darren Davis, *Searching Encrypted Audit Logs Expeditiously*, MSe, Johns Hopkins University, May, 2004

- Jay Zarfoss, *A Scalable Architecture for Botnet Tracking*, MSe, Johns Hopkins University, January, 2007

- Charles Omstead, *Detecting Kernel-level Violations*, MSe, Johns Hopkins University, Spring, 2008

**Supervised
Ph.D. Projects**

- Scott Coull, *De-anonymizing Anonymous Logs*, Ph.D. qualifier 2006

- Sujata Doshi, *Memory Bound Puzzles*, Ph.D. qualifier, 2006

- Lucas Ballard, *Revisiting Biometric Authentication*, Ph.D. qualifier, 2006

- Samuel Small, *Scalable VPNs for the Global Information Grid*, Ph.D. qualifier, 2005

- Mathew Green, *Correlation-resistant Storage*, Ph.D. qualifier, 2005

- Moheeb Rajab, *On the Effectiveness of Distributed Telescopes*, Ph.D. qualifier, 2004

- Seny Kamara, *Secure Conjunctive Keyword Search*, Ph.D. qualifier, 2004

- Charles Wright, *Traffic Characterization using Profile HMMs*, Ph.D. qualifier, 2004

**Supervised
Masters
Projects**

- Xuesong Chen, MSSI, *Performance Analysis of Password-based Public-key Cryptographic Protocols*, 2008

- Dan Hopkins, MSe, *Designing a Web-based System for Visualization of Network Traffic*, 2008

- Kevin Thompson, MSe, *On Alternative Implementaions of Interactive Television*, 2008

- Kevin Snow, MSe, *A Framework for Realtime Encrypted Traffic Classification*, 2007

- Daniel Chou, MSSI, *Permutable Audio Watermarks*, 2006

- Kenneth Berends, MSSI, *Implementing a Network Tomography Exercise*, 2005

- Andrew Gibbs, MSSI, *Reconciling Anonymity and Accountability*, 2004

- Lucas Ballard, MSSI, *Statistical Attacks on Encrypted Data*, 2004

Fabian Monrose

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Marc Niethammer	POSITION TITLE Assistant Professor
eRA COMMONS USER NAME mniethammer	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Georgia Institute of Technology	M.Sc.	1999	Engineering Science
Universität Stuttgart, Germany	Dipl.-Ing.	2000	Engineering Cybernetics
Georgia Institute of Technology	M.Sc.	2002	Applied Mathematics
Georgia Institute of Technology	Ph.D.	2004	Electrical and Computer
Georgia Institute of Technology	Research	2005	Image Processing
Harvard Medical School	Post-doc	2005	Medical Image Analysis

Please refer to the application instructions in order to complete sections A, B, and C of the Biographical Sketch.

A. Positions and Honors. List in chronological order previous positions, concluding with your present position. List any honors. Include present membership on any Federal Government public advisory committee.

Positions and Employment
1997-1998 Research Assistant, Institute for System Dynamics and Control Theory, Universität Stuttgart.
1999 Research Assistant, School of Civil and Environmental Engineering, GaTech.
1999-2000 Internship, Daimler Chrysler, Esslingen, Germany.
2000-2001 Research Assistant, Institute for Systems Theory in Engineering, Universität Stuttgart.
2001-2004 Research Assistant, School of Electrical and Computer Engineering, GaTech.
2005 Research Engineer, School of Electrical and Computer Engineering, GaTech.
2005-2007 Officer in Psychiatry, Harvard Medical School.
2005-2007 Research Fellow, Psychiatry Neuroimaging Laboratory,
Brigham and Women's Hospital, Boston, MA.
2007 Instructor in Psychiatry, Harvard Medical School, Boston, MA.
2008 Assistant Professor, Department of Computer Science, UNC Chapel Hill.

Other Experience and Professional Memberships
2002- Member, Institute of Electrical and Electronics Engieers (IEEE).
2002-2004 Member, Society of Industrial and Applied Mathematics (SIAM).
2005- Member, Medical Image Computing and Computer Assisted Intervention Society.

Honors
1997 Outstanding pre-diploma in Engineering Cybernetics Award.
1998.1 German academic exchange service fellowship.
1998.2 German National Merit Foundation fellowship (Studienstiftung des deutschen Volkes).
2001 Procter and Gamble Award.
2001 Prof. P. Sagirow Award.
2001-2004 e-fellows fellowship.
2001-2003 Steve Chaddick fellowship.
2004 Marion and Henry Bourne fellowship.

B. Selected peer-reviewed publications (in chronological order). Do not include publications submitted or in preparation.

Articles in Journals

1. R. Benz, M. Niethammer, S. Hurlebaus, and L. J. Jacobs, "Localization of notches with Lamb waves," Journal of the Acoustical Society of America, vol. 114, no. 2, pp. 677-685, 2003.
2. M. Niethammer, S. Betelu, G. Sapiro, A. Tannenbaum, and P. J. Giblin, "Area-based medial axis of planar curves," International Journal of Computer Vision, vol. 60, no. 3, pp. 203-224, 2004.
3. M. Niethammer, P. A. Vela, and A. Tannenbaum, "On the evolution of vector distance functions of closed curves," International Journal of Computer Vision, vol 65, pp. 5-27, 2005.
4. M. Niethammer, W. D. Kalies, K. Mischaikow, and A. Tannenbaum, "Detecting simple points in higher dimensions using cubical homology," IEEE Transactions on Image Processing, vol 15, pp. 2462-2469, 2006.
5. M. Niethammer, A. Tannenbaum, and S. Angenent, "Dynamic active contours for visual tracking," IEEE Transactions on Automatic Control, vol. 51, pp. 562-579, 2006.
6. O. Kotte, M. Niethammer, and L. J. Jacobs, "Lamb wave characterization by differential reassignment and nonlinear anisotropic diffusion," NDT & E International, vol. 39, pp. 96-105, 2006.
7. H. Kuttig, M. Niethammer, S. Hurlebaus, and L. J. Jacobs, "Model-based analysis of dispersion curves," Journal of the Acoustical Society of America, vol. 119, pp. 2122-2130, 2006.
8. P. A. Vela, M. Niethammer, G. D. Pryor, and A. Tannenbaum, "Knowledge-based segmentation and active contours for missile tracking," accepted for publication in the IEEE Transactions on Control Systems Technology, 2006.
9. M. Niethammer, P. A. Vela, and A. Tannenbaum, "Geometric observers for dynamically evolving curves," accepted for publication in the IEEE Transactions on Pattern Analysis and Machine Intelligence, 2008.
10. S. Aja-Fernandez, M. Niethammer, M. Kubicki, M. E. Shenton, and C.-F. Westin, "Restoration of DWI data using a Rician LMMSE estimator," accepted for publication in the IEEE Transactions on Medical Imaging.

Articles in Academic Conferences

1. E. Pichon, M. Niethammer, and G. Sapiro, "Color histogram equalization through mesh deformation," in Proceedings of the International Conference on Image Processing, 2003, pp. 117-120.
2. M. Niethammer, E. Pichon, A. Tannenbaum, and P. J. Mucha, "A Stokes flow boundary integral measurement of tubular cross sections in two dimensions," in Proceedings of the International Conference on Image Processing, 2003, pp. 825-828.
3. M. Niethammer and A. Tannenbaum, "Dynamic level sets for visual tracking," in Proceedings of the Conference on Decision and Control, 2003, vol. 5, pp. 4883-4888.
4. M. Niethammer and A. Tannenbaum, "Dynamic geodesic snakes for visual tracking," in Proceedings of the Conference on Computer Vision and Pattern Recognition, 2004, vol. 1, pp. 660-667.
5. J. Ha, C. Alvino, G. Pryor, M. Niethammer, E. Johnson, and A. Tannenbaum, "Active contours and optical flow for automatic tracking of flying vehicles," in Proceedings of the American Control Conference, 2004, vol. 4, pp. 3441-3446.
6. P. A. Vela, M. Niethammer, J. Malcolm, and A. Tannenbaum, "Closed loop visual tracking using observer-based dynamic active contours," in Proceedings of the Conference on Guidance Navigation and Control, 2005.
7. M. Niethammer, P. A. Vela, and A. Tannenbaum, "Geometric observers for dynamically evolving curves," in Proceedings of the Conference on Decision and Control, 2005, pp. 6071-6077.
8. E. Pichon, D. Nain, and M. Niethammer, "A Laplace equation approach for shape comparison," in Proceedings of the SPIE Medical Imaging, 2006, vol. 6141.
9. M. Niethammer, R. San Jose Estepar, S. Bouix, M. Shenton, and C.-F. Westin, "On diffusion tensor estimation," in Proceedings of the International Engineering in Medicine and Biology Conference (EMBC), 2006, pp. 2622-2625.
10. M. Niethammer, S. Bouix, C.-F. Westin, and M. Shenton, "Fiber bundle estimation and parameterization," in Proceedings of the Medical Image Computing and Computer Assisted Intervention Conference (MICCAI), Lecture Notes in Computer Science, 2006, Volume 4191, pp. 252-259.
11. D. Nain, M. Styner, M. Niethammer, J. J. Levitt, M. Shenton, G. Gerig, and A. Tannenbaum, "Statistical shape analysis of brain structures using spherical wavelets," in Proceedings of the Fourth IEEE International Symposium on Biomedical Imaging, 2007, pp. 209-212.
12. V. Mohan, J. Melonakos, M. Niethammer, M. Kubicki, and A. Tannenbaum, "Finsler level set segmentation for imagery in oriented domains," in Proceedings of the British Machine Vision Conference, 2007.

13. M. Niethammer, M. Reuter, F.-E. Wolter, S. Bouix, N. Peinecke, M.-S. Koo, and M. E. Shenton, "Global medical shape analysis using the Laplace-Beltrami spectrum," in Proceedings of the Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2007, pp. 850-857.
14. M. Niethammer, S. Bouix, C.-F. Westin, and M.E. Shenton, "Outlier rejection for diffusion weighted imaging," in Proceedings of the Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2007, pp. 161-168.
15. S. Dambreville, M. Niethammer, A. Yezzi, and A. Tannenbaum, "A variational framework combining level-sets and thresholding," British Machine Vision Conference, 2007.
16. J. Melonakos, V. Mohan, M. Niethammer, K. Smith, M. Kubicki, and A. Tannenbaum, "Finsler tractography for white matter connectivity analysis of the cingulum bundle," in Proceedings of the Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2007, pp. 36-43.
17. G. Kindlmann, R.S. San Jose Estepar, S. Haker, M. Niethammer, and C.-F. Westin, "Geodesic-Loxodromes for Diffusion Tensor Interpolation and Difference Measurement," in Proceedings of the Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2007, pp. 1-9.
18. S. Dambreville, M. Niethammer, A. Yezzi, and A. Tannenbaum, "A variational segmentation framework using active contours and thresholding," Proceedings of the International Conference on Signal and Image Processing (SIP), 2007.
19. M. Reuter, M. Niethammer, F.-E. Wolter, Sylvain Bouix, and M. Shenton, "Global Medical Shape Analysis Using the Volumetric Laplace Spectrum," Proceedings of the Cyberworlds Conference, 2007.
20. J. Melonakos, M. Niethammer, V. Mohan, M. Kubicki, J. Miller, and A. Tannenbaum, "Locally-constrained region-based methods for DW-MRI segmentation," Proceedings of the Workshop on Mathematical Methods in Biomedical Image Analysis (MMBIA), 2007.
21. Y. Rathi, S. Dambreville, M. Niethammer, and A. Tannenbaum, "Segmenting Images Analytically in Shape Space," Proceedings of SPIE Medical Imaging, 2007.
22. V. Mohan, G. Sundaramoorthi, J. Melonakos, M. Niethammer, M. Kubicki, and A. Tannenbaum, "Tubular Surface Evolution for Segmentation of the Cingulum Bundle from DW-MRI," Workshop on Mathematical Foundations of Computational Anatomy, MICCAI, 2008.
23. M. Niethammer, C. Zach, J. Melonakos, and A. Tannenbaum, "Tubular Fiber Bundle Segmentation for Diffusion Weighted Imaging," Workshop on Diffusion Weighted Imaging, MICCAI, 2008.
24. C. Zach, D. Gallup, J.-M. Frahm, and M. Niethammer, "Fast global labeling for real-time stereo using multiple plane sweeps," Vision, Modeling, and Visualization Workshop, 2008.
25. H. Kim, M. Niethammer, ,B. .C. bernhardt, S. Bouix, N. Bernasconi, and A. Bernasconi, "SPHARM detects hippocampal subfield pathology in temporal lobe epilepsy," in Proceedings of the ISMRM, 2008.

Course Development

Spring 2008:
    COMP 875 Recent Advances in Image Analysis
Fall 2008:
    COMP 775 Introduction to Medical Image Analysis

Marc Niethammer

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

Aided by Steve Pizer, I developed Comp 875 (Recent Advances in Image Analysis), which was taught in Spring 2008 and Comp 775 (Introduction to Medical Image Analysis), which was taught in Fall 2008.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Stephen M. Pizer
Curriculum Vitae

PERSONAL

Born 4 October 1941, Boston, Massachusetts
U.S. citizen, married, two children

EDUCATION

Ph.D.	Harvard University, Computer Science, 1967
A.M.	Harvard University, Computer Science, 1964
A.B., Sc.B.	Brown University, Applied Mathematics, 1963

TEACHING AND RESEARCH EXPERIENCE

University of North Carolina at Chapel Hill

Department of Computer Science
Kenan Professsor, 1992 –
Professor, 1982- 1991
Associate Professor, 1971-81
Assistant Professor, 1967-71
Assistant Chairman, 1979-81

Biomedical Engineering
Faculty Member, Curriculum, 1975- 1991
Adjunct Professor, Department, 1991 –

Department of Radiology, School of Medicine
Adjunct Professor, 1982-
Adjunct Associate Professor, 1975-1982

Department of Radiation Oncology, School of Medicine
Adjunct Professor, 1988-

UNC Medical Image Display & Analysis Group, from 11 UNC Depts.
Head, 1985-

UNC Imaging Task Force Committee
Chair, 2002-

UNC Lineberger Comprehensive Cancer Center
Center Member, 1993-

Conference tutorials
Visualization in Biomedical Computing, *Cores*, 1994; *Scale Space* (with B. ter Haar Romeny), 1996

Medical Image Computing and Computer Aided Interventions, *Object Shape* (with C. Taylor, T. Cootes), 1998

CONFERENCE BOARD AND PROGRAM COMMITTEE MEMBERSHIPS

Medical Image Computing and Computer-Assisted Intervention, Board 1997-2003

OTHER PROFESSIONAL ACTIVITIES

Stephen M. Pizer
Curriculum Vitae

Co-founder of Morphormics, Inc., 2001

Editorial Board, *Computer Aided Surgery*, 1995-

Editorial Board, *J. of Mathematical Imaging and Vision*, 1994-

International Advisory Board, *Computational Imaging Series*, Kluwer Academic Publishers, 1993-

Associate Editor, *IEEE Transactions on Medical Imaging* , 1988-

PROFESSIONAL SOCIETIES

American Association of University Professors

Association for Computing Machinery

IEEE, Senior Member

Association of University Radiologists

RESEARCH GRANTS

NIH Program Project Grant: Medical Image Presentation, July 1, 1988 - 2007, program director.

NIH Grant: 3D Cerebral Vessel Location for Surgical Planning, 1997-, co-principal investigator

National Center for Research Resources and National Cancer Institute Grant: UNC Research Platform for Radiotherapy Stimulation, August 2003 – June 2008, co-principal investigator.

NIH Grant: Automation of Head and Neck Radiation Treatment Planning, July 2007 – June 2009, co-principal investigator.

PATENTS

M-rep based hexahedral meshes for deformable modeling, U.S. Patent pending, filed July 14, 2004.

Systems and Methods for Tubular Object Processing, U.S. Patent No. 6,690,816, dated Feb 10, 2004. Stephen Aylward is main inventor.

BIBLIOGRAPHY
* = principal author or co-principal author of book, chapter, article, or review. Articles with numbers followed by "=" or "< " are essentially equivalent to (=) or subsets of (<) other articles indicated.

BOOKS

Medial Representations: Mathematics, Algorithms and Applications, with Kaleem Siddiqi, Springer Publishers, 2008.

CHAPTERS

PT Fletcher, SM Pizer, S Joshi (2005). Shape Variation of Medial Axis Representations via Principal Geodesic Analysis on Symmetric Spaces. To appear in Statistics and Analysis of Shapes, eds. H. Krim and A. Yezzi, Springer-Verlag.

Stephen M. Pizer
Curriculum Vitae

PUBLISHED ARTICLES

(40)   Merck, D., Tracton, G., Saboo, R., Levy, J., Chaney, E., Pizer, S.M., and Joshi, S. (2008). Training Models of Anatomic Shape Variability, *to appear, Medical Physics.*

(39)   Jeong, J.-Y., Stough, J.V., Marron, J.S., Pizer, S.M. (2008). Conditional-Mean Initialization Using Neighboring Objects in Deformable Model Segmentation*, to appear in SPIE.*

(38)   Dam, E.B., Fletcher, P.T., Pizer, S. M. (2008). Automatic Shape Model Building Based on Principal Geodesic Analysis Bootstrapping, *ScienceDirect*, pp. 136-151.

(37)   Liu, X., Jeong, J.-Y., Levy, J., Saboo, R., Chaney, E.L., and Pizer, S.M. (2008). A Large-to-Fine Scale Shape Prior for Probabilistic Segmentations Using a Deformable M-rep*, submitted for conference review**

(36)   Levy, J., Pizer, S. M., and Foskey, M. (2008). Rotational Flows for Interpolation Between Sampled Surfaces, *Proc. of MMBIA Workshop*.

(35)   Lu, C., Pizer, S. M., Joshi, S., and Jeong, J-Y (2007). Statistical Multi-object Shape Models,   *Int J Comp Vis*, vol. 75, no. 3, pp. 387-404.

(34)   Gorczowski, K., Styner, M., Jeong, J-Y, Marron, J. S., Piven, J., Hazlett, H. C., Pizer, S. M., and Gerig G. (2007). Discrimination Analysis using Multi-object Statistics of Shape and Pose," *Proc SPIE*, vol. 6512, pp. 1-8.

(33)   Han, Q. , Merck, D., Levy, J., Villarruel, C., Chaney, E., and Pizer, S. M. (2007).   Geometrically Proper Models in Statistical Training, *Proc. of Information Processing in Medical Imaging*, (Nico Karssemeijer and Boudewijn Lelieveldt, eds.), vol. 4584, pp. 751-762.

(32)   Crouch J., Pizer, S. M., Chaney, E. L., Hu, Y., Mageras, G. S., and Zaider, M. (2007). "Automated Finite Element Analysis for Deformable Registration of Prostate Images," *IEEE Transactions on Medical Imaging*, vol. 26, no. 10, pp. 1379-1390.

(31)   Joshua Stough, Robert E. Broadhurst, Stephen M. Pizer, and Edward L. Chaney (2007). Clustering on Local Appearance for Deformable Model Segmentation," in *Biomedical Imaging: From Nano to Macro 2007, ISBI 2007.*

(30)   Levy, J. H., Broadhurst, R. E., Ray, S., Chaney, E. L., and Pizer, S. M. (2007). Signaling Local Non-credibility in an Automatic Segmentation Pipeline, in *Medical Imaging 2007: Image Processing*, (Josien P. W. Pluim and Joseph M. Reinhardt, eds.), published as *Procedures of SPIE*, vol. 6512, no. 2007.

(29)   Levy J. H., Gorczowski K., Liu X., Pizer S.M., and Styner M (2007). Caudate Segmentation using Deformable M-reps, in *MICCAI Workshop: 3D Segmentation in the Clinic: A grand challenge*, Oct. 2007.

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(27)   Gorczowski, K., Styner M., Jeong, J-Y., Marron, J.S, Piven J., Hazlett, H. C., Pizer, S. M., and Gerig, G., Statistical Shape Analysis of Multi-Object Complexes, *CVPR*, no. , pp. 1-8, June 2007.

(26)   Stough, J., R. E. Broadhurst, S. M. Pizer, and E. L. Chaney (2007). Regional Appearance in Deformable Model Segmentation. *To appear in Information Processing in Medical Imaging*, N. Karssemeijer, B. Lelieveldt, editors, Springer.

Stephen M. Pizer
Curriculum Vitae

(25)   Han, Q, D. Merek, J. Levy, C. Villarruel, E. Chaney, and S. M. Pizer (2007). Proper Training. *To appear in Information Processing in Medical Imaging*, N. Karssemeijer, B. Lelieveldt, editors, Springer.

(24)   Styner, M., Gorczowski, K., Fletcher, T., Jeong, J-Y, Pizer, S. M. and Gerig, G. (2006). Statistics of Pose and Shape in Multi-Object Complexes using Principal Geodesic Analysis, in *Proc. MIAR conference*, Aug. 2006.

(23)   Pizer, S. M., Broadhurst, R. E., Jeong, J-Y, Han, Q., Saboo, R., Stough, J., Tracton, G., and Chaney, E. L. (2006). Intra-Patient Anatomic Statistical Models for Adaptive Radiotherapy, in *MICCAI Workshop From Statistical Atlases to Personalized Models: Understanding Complex Diseases in Populations and Individuals*, pp. 43-46.

(22)   Han, Q, SM Pizer, D Merck, S Joshi, and JY Jeong (2005). Multi-figure Anatomical Objects for Shape Statistics. *Information Processing in Medical Imaging (IPMI)*, Lecture Notes in Computer Science, Springer **3565**: 701-712.

(21)   Pizer, SM, JY Jeong, RE Broadhurst, S Ho, and J Stough (2005). Deep Structure of Images in Populations via Geometric Models in Populations. *International Workshop on Deep Structure, Singularities and Computer Vision (DSSCV)*. Proceedings in print: 48-58.

(20)   Pizer, SM, JY Jeong, C Lu, K Muller, and S Joshi (2005). Estimating the Statistics of Multi-Object Anatomic Geometry Using Inter-Object Relationships. *International Workshop on Deep Structure, Singularities and Computer Vision (DSSCV)*. Proceedings in print: 59-70.

(19)   Broadhurst, RE, J Stough, SM Pizer, and EL Chaney (2005). Histogram Statistics of Local Model-Relative Image Regions. *International Workshop on Deep Structure, Singularities and Computer Vision (DSSCV)*. Proceedings in print: 71-82.

(18)   Pizer, SM, PT Fletcher, S Joshi, AG Gash, J Stough, A Thall, G Tracton, EL Chaney (2004). A Method & Software for Segmentation of Anatomic Object Ensembles by Deformable M-Reps. *MedicalPhysics.* **32**(5): 1335-1345.

(17)   Crouch, J, SM Pizer, EL Chaney, M Zaider (2004). Medial Techniques to Automate Finite Element Analysis of Prostate Deformation. To appear, IEEE Transactions on Medical Imaging.

(16)   Fridman, Y, SM Pizer, S Aylward, and E Bullitt (2004). Extracting Branching Tubular Object Geometry via Cores. *Medical Image Analysis Journal, Special MICCAI issue.* **8**(3): 169-176.

(15)   Dam, E, PT Fletcher, SM Pizer, G Tracton, J Rosenman (2004). Prostate Shape Modeling based on Principal Geodesic Analysis Bootstrapping. *Medical Image Computing and Computer-Assisted Intervention (MICCAI 2004),* C Barillot, DR Haynor, and P Hellier, eds. Lecture Notes in Computer Science, **3217**(Part II): 1008-1016.

(14)   Han, Q, C Lu, S Liu, SM Pizer, S Joshi, A Thall (2004). Representing Multi-Figure Anatomical Objects. *IEEE International Symposium on Biomedical Imaging (ISBI 2004)*, CD Proceedings: 1251-1254.

(13)   Stough, J, SM Pizer, EL Chaney, M Rao (2004). Clustering on Image Boundary Regions for Deformable Model Segmentation. *IEEE International Symposium on Biomedical Imaging (ISBI 2004)*, CD Proceedings: 436-439.

(12)   Fletcher, PT, C Lu, SM Pizer, S. Joshi (2004). Principal Geodesic Analysis for the Study of Nonlinear Statistics of Shape. *IEEE Transactions on Medical Imaging, IPMI 2003 special issue*, **23**(8): 995-1005.

(11)   Vetsa, YSK, M Styner, SM Pizer, JA Lieberman, and G Gerig (2003). Caudate Shape discrimination in Schizophrenia using Template-free non-parametric tests. *Medical Image Computing and Computer-Assisted Intervention (MICCAI 2003),* RE Ellis and TM Peters, eds. Lecture Notes in Computer Science, **2879**: 661-669.

Stephen M. Pizer
Curriculum Vitae

(10) Crouch, J, SM Pizer, EL Chaney, M Zaider (2003). Medially Based Meshing with Finite Element Analysis of Prostate Deformation. *Medical Image Computing and Computer-Assisted Intervention (MICCAI 2003),* RE Ellis and TM Peters, eds. Lecture Notes in Computer Science, **2878**: 108-115.

(9) Fridman, Y, SM Pizer, S Aylward, and E Bullitt (2003). Segmenting 3D Branching Tubular Structures using Cores. *Medical Image Computing and Computer-Assisted Intervention (MICCAI 2003),* RE Ellis and TM Peters, eds. Lecture Notes in Computer Science, **2879**: 570-577.

(8) Pizer, S (2003). Guest Editorial – Medial & Medical: A Good Match for Image Analysis. IJCV Special UNC-MIDAG issue, **55**(2/3): 79-84.

(7) Pizer, S, PT Fletcher, S Joshi, A Thall, Z Chen, Y Fridman, D Fritsch, G Gash, J Glotzer, M Jiroutek, K Muller, G Tracton, P Yushkevich, E Chaney (2003). Deformable M-reps for 3D Medical Image Segmentation. IJCV Special UNC-MIDAG issue, **55**(2/3): 85-106.

(6) Yushkevich, P, S Joshi, SM Pizer, JG Csernansky, and LE Wang (2003). Feature Selection for Shape-Based Classification of Biological Objects. *Information Processing in Medical Imaging (IPMI 2003)*, C Taylor and JA Noble, eds., Lecture Notes in Computer Science, Springer **2732**: 114-125.

(5) Fletcher, PT, S Joshi, C Lu, and S Pizer (2003). Gaussian Distributions on Lie Groups and Their Application to Statistical Shape Analysis. *Information Processing in Medical Imaging (IPMI 2003)*, C Taylor and JA Noble, eds., Lecture Notes in Computer Science, Springer **2732**: 450-462.

(4) Lu, C, S Pizer, S Joshi (2003). A Markov Random Field Approach to Multi-scale Shape Analysis. Scale Space Methods in Computer Vision (Scale Space 2003). LD Griffin and M Lillholm, eds. Lecture Notes in Computer Science **2695**: 416-431.

(3) = 222 Pizer, SM, PT Fletcher, A Thall, M Styner, G Gerig, S Joshi (2003). Object models in multiscale intrinsic coordinates via m-reps. *Image and Vision Computing*, Special Issue on Generative Model-based Vision, **21**(1): 5-15.

(2) = 224 Yushkevich, P, PT Fletcher, S Joshi, A Thall, S Pizer (2003). Continuous Medial Representations for Geometric Object Modeling in 2D and 3D. *Image and Vision Computing,* Special Issue on Generative Model-based Vision, **21**(1): 17-27.

(1) Pizer, SM (2003). The Medical Image Display and Analysis Group at the University of North Carolina: Reminiscences and Philosophy. IEEE Transactions on Medical Imaging, **22**(1): 2-10.

ARTICLES IN REVIEW

Ja-Yeon Jeong, Joshua V. Stough, J. Stephen Marron, and Stephen M. Pizer (2008). "Conditional-Mean Initialization Using Neighboring Objects in Deformable Model Segmentation", to appear in SPIE 2008.

S. DiMaio, T. Kapur, K. Cleary, S. Aylward, P. Kazanzides, K. Vosburgh, R. Ellis, J. Duncan, K. Farahani, H. Lemke, T. Peters, B. Lorensen, D. Gobbi, J. Haller, L. Clarke, S. Pizer, R. Taylor, B. Galloway, G. Fichtinger, N. Hata, K. Lawson, C. Tempany, R. Kikinis, F. Jolesz (2007). Challenges in Image-Guided Therapy System Design. To appear in NeuroImage 2007.

Stephen M. Pizer, Robert E. Broadhurst, Joshua Levy, Xiaoxiao Liu, Ja-Yeon Jeong, Joshua Stough, Gregg Tracton, and Edward L. Chaney (2007). Segmentation by Posterior Optimization of M-reps: Strategy and Results.

Rohit R Saboo, Christina Villarruel, Edward M Chaney, Julian G Rosenman, and Stephen M Pizer (2007). Segmentation of Tubular Objects by Posterior Optimization of M-reps.

Merck, D, S Joshi, G Tracton, SM Pizer (2005). On single figure statistical m-rep model construction. In preparation.

Stephen M. Pizer
Curriculum Vitae

Pilgram, R, PT Fletcher, SM Pizer, O Pachinger, R Shubert (2004). Common Shape Model and Inter-individual Variations of the Heart using Medial Representation. Submitted to *IEEE-TMI*

TECHNICAL REPORTS

Foskey, M., Gash, A.G., Han, Q., Tracton, G., Joshi, S., Pizer, S., and Chaney, E. (2007). A Software Toolkit for Multi-Image Registration and Segmentation in IGRT and ART.

Merck, D., Pizer, S., and Rosenman, J. (2007). Visualizing Anatomic Changes over Multi-Day Radiotherapy.

Fridman, Y and SM Pizer (2004). Extracting the Geometry of Branching Slabs via Cores. University of North Carolina Computer Science technical report TR04-016. Submitted to CVAMIA 2004.

Yushkevich, P, S Joshi, S Pizer (2002). Feature Selection for Shape-Based Classification of Biological Objects. Submitted to CVPR 2003. Accepted at IPMI 2003.

Lu, C, S Pizer and S Joshi (2003). Multi-scale Shape Modeling by Markov Random Fields. Submitted to IPMI 2003.

Crouch, J, S Pizer, E Chaney, and M Zaider (2003). Medially Based Meshing with Finite Element Analysis of Prostate Deformation. Submitted to IPMI 2003.

Yushkevich, P, S Joshi, S Pizer, J Csernansky, and LE Wang (2003). Feature Selection for Shape-Based Classification of Biological Objects. Submitted to IPMI 2003.

PUBLISHED ABSTRACTS or ABSTRACTS IN REVIEW

Chaney, E, SM Pizer, S Joshi, R Broadhurst, PT Fletcher, G Gash, Q Han, JY Jeong, C Lu, D Merck, J Stough, and G Tracton (2004). Automatic Male Pelvis Segmentation from CT Images via Statistically Trained Multi-Object Deformable M-rep Models. *Submitted to* 45th Annual Meeting of the American Society for Therapeutic Radiology and Oncology (ASTRO).

DISSERTATIONS SUPERVISED AS PRINCIPAL OR CO-PRINCIPAL ADVISOR

Completed
Paul Yushkevich, 2003
Gregory Clary, 2003
Jessica Crouch, 2003
Erik Dam (co-supervised), 2003
Andrew Thall, 2004
Yonatan Fridman, 2004
Tom Fletcher, 2004

In progress
Qiong Han
Joshua Stough
Ja-Yeon Jeong
Robert Broadhurst
Joshua Levy

Steve Pizer

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

I helped design a new image analysis curriculum (with Marc Niethammer and Svetlana Lazebnik). I also helped Marc Niethammer design a new medical image analysis course.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

The spinoff company, Morphormics, which I co-founded in 2002, has received a phase 2 SBIR grant from NIH and has concluded a contract with Accuray, Inc. to produce a product to largely automatically segment male pelvic organs from CT and MR images in planning the treatment of prostate cancer. The Morphormics product is intended to become part of the Accuray radiation treatment planning system. Morphormics now employs ten individuals, of whom seven have or once had a UNC connection.

Resume of David A. Plaisted

Personal Data:

Home: 202 Hideaway Drive
        Chapel Hill, North Carolina 27514
        (919) 967-9238

Work: Department of Computer Science
        CB# 3175, 352 Sitterson Hall
        University of North Carolina at Chapel Hill
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        (919) 962-1751
        Email: plaisted@cs.unc.edu

Born: February 9, 1948
Marital status: Married
Citizenship: U.S.A.

Education:
B.S. Mathematics University of Chicago June 1970
Ph.D. Computer Science Stanford University September 1976

Areas of Interest:
Mechanical Theorem Proving
Term Rewriting Systems
Algorithms
Logic Programming

Employment:
Professor, University of North Carolina at Chapel Hill   July 1985 - present
Visiting Professor, University of North Carolina at Chapel Hill   January - June 1985
Visiting Fellow, SRI International   January 1982 - May 1983
Associate Professor, Department of Computer Science, University of Illinois
                        1980 - 1985, (Promoted to Full Professor in 1985)
Assistant Professor, Department of Computer Science, University of Illinois
                                        1974-1980

Professional Activities:
Program Committee, FTP2003.
Program Committee, CADE 2004.
Program Committee, TABLEAUX 2005
Program Committee, CADE 2009

University and Department Service:
Member, Admissions Committee, several years
Member, Doctoral Written Exam committee, several years

Book:

The Efficiency of Theorem Proving Strategies: A Comparative and Asymptotic Analysis (Vieweg, Wiesbaden, 1997), 170 pp, with Yunshan Zhu.

Publications in journals and articles in books:

David Plaisted and Adnan Yahya, A relevance restriction strategy for automated deduction, Artificial Intelligence 144 (2003) 59-93.

David A. Plaisted, Armin Biere, Yunshan Zhu, A satisfiability procedure for quantified Boolean formulae, Discrete Applied Mathematics 130 (2003) 291-328.

D. Plaisted, An abstract programming system, in: Leading Edge Computer Science Research, Susan Shannon, ed., Nova Science Publishers, 2005, pp. 85-129.

D. Plaisted, Theorem Proving, in Encyclopedia of Computer Science and Engineering, Benjamin Wah, editor, John Wiley and Sons, 2008.

Vladimir Lifschitz, Leora Morgenstern, and David Plaisted, Knowledge Representaion and Classical Logic, in Handbook of Knowledge Representation, F. van Harmelen, V. Lifschitz, and B. Porter, eds., 2008, Elsevier, pp. 3-88.

Other publications:

Swaha Miller and David A. Plaisted, The Space Efficiency of OSHL, International Conference on Automated Reasoning with Analytic Tableaux and Related Methods (TABLEAUX 2005), Bernhard Beckert, editor, Koblenz, Germany, Sept 14-17, 2005.

Swaha Miller and David A. Plaisted, Performance of OSHL on Problems Requiring Definition Expansion, 7th International Workshop on First-Order Theorem Proving, Reinhold Letz, editor, Koblenz, Germany, September 15-17, 2005.

David Plaisted and Swaha Miller, The Relative Power of Semantics and Unification, Workshop on Programming Logics in memory of Harald Ganzinger, Andreas Podelski, Andrei Voronkov and Reinhard Wilhelm, eds, Saarbruecken, Germany, June 3-4, 2005.

Invited talks:

Five talks, Propositional Approaches to First-Order Theorem Proving, Taiwan, May-June, 2004.

Distinguished Lecture, Propositional Approaches to First-Order Theorem Proving, University of Houston, Texas, February 2, 2005.

David Plaisted

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

CURRICULUM VITAE Marc Pollefeys

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Personal information
Born May 1, 1971, in Anderlecht (Belgium)
Belgian nationality, US permanent resident

Education
1999 Ph.D. Electr. Eng. K.U.Leuven (with greatest distinction)
1994 M.S. Electr. Eng. K.U.Leuven

Professional experience
2/2007 - 4/2007	Visiting Associate Professor
	Computer Science Department, Stanford University
7/2005 - present	Associate Professor
	Computer Science Department, UNC – Chapel Hill
7/2002 - 6/2005	Assistant Professor
	Computer Science Department, UNC – Chapel Hill

Awards
2005 Packard Fellowship
2003 NSF CAREER award

Professional activities
• Member editorial board
> *International Journal on Computer Vision (IJCV),* 2006-present.
> *Transactions on Pattern Analysis and Machine Intelligence (PAMI),* 2005-present.
> *Foundations and Trends in Computer Graphics and Computer Vision,* 2003-present.

• Editor
> *3D Structure from Multiple Images,* Marc Pollefeys, Luc Van Gool, Andrew Zisserman, Andrew Fitzgibbon (Eds.), Lecture Notes in Computer Science, Vol. 2018, Springer-Verlag. *Special Issue of the International Journal on Computer Vision (IJCV) on Vision and Modelling of Dynamic Scenes,* Andrew Fitzgibbon, Marc Pollefeys, Luc Van Gool, Andrew Zisserman (Eds.), Vol.68, Nr. 1.
> *3D Imaging for Safety and Security,* Anreas Koschan, Marc Pollefeys, Mongi Abidi (Eds.), Kluwer/Springer, (in preparation).

• Conference organizer
> General/Program Chair for 3DPVT 2006
> Workshop Chair for IEEE CVPR Conference 2005

• Workshop organizer
> Workshop on Visual Representations and Modeling of Large-Scale environments (VRML), J.-M. Frahm, M. Pollefeys, F. Dellaert, J. Kosecka, 2007.
> Workshop on Omnidirectional Vision, Camera Networks and Non-traditional Sensors (OMNIVIS), C. Geyer, M. Pollefeys and X. Ying (organizers), Beijing, China, Oct 21, 2005.
> Workshop on Advanced 3D Imaging for Safety and Security, A. Koschan, M. Abidi and M. Pollefeys (organizers), June 25, 2005.

• Special session organizer
> Special Session at the International Symposium on 3D Data Processing Visualization Transmission, 2004

• Conference/Workshop Program Committee member
> Int. Conf. on Computer Vision (ICCV) 2003, 2005
> Int. Conf. on Computer Vision and Pattern Recognition (CVPR) 2003, 2004, 2006, 2007
> European Conference on Computer Vision (ECCV) 2004, 2006, 2008 (area chair)
> Workshop on Omnidirectional Vision, Camera Networks and Non-traditional Sensors (OMNIVIS) 2007
> Workshop on Benchmarking Calibration, Orientation and Surface Reconstruction from Images 2005, 2007
> Workshop Beyond Multiview Geometry: Robust Estimation and Organization of Shapes from Multiple Cues 2007
> Workshop on 3D Virtual Rec. and Vis. of Complex Architectures - 3D-Arch'2005, 2007
> Indian Conference on Computer Vision, Graphics & Image Processing 2006 (ICVGIP)
> Asian Conference on Computer Vision 2006 (ACCV)
> ISPRS Commission III Symposium - Photogrammetric Computer Vision 2006
> ISPRS Commission V Symposium 2006
> International Conference on Pattern Recognition 2006 (ICPR)(Computer Vision Track)
> Workshop on 25 Years of RANSAC 2006
> IEEE Workshop on Three-Dimensional Cinematography (3DCINE'06)
> International Conference on 3D Digital Imaging and Modelling 2003, 2005
> Workshop on Dynamical Vision 2005, 2006
> IEEE International Workshop on Projector-Camera Systems 2005, 2006 (ProCams)
> Virtual Systems and Multi-Media 2005
> International Workshop on real-time 3D sensors and their uses 2004 (co-located with CVPR)

European Conference on Visual Media Production 2004, 2005
International Symposium on Visual Computing 2005
Workshop on Motion and Video Computing (MOTION) 2005
Euroconference on Virtual Archaeology - VAST 2003, 2004, 2005
Vision, Modeling and Visualization (VMV) 2004, 2005
International Symposium on 3D Data Processing Visualization Transmission 2004
ISPRS Congress 2004
Workshop on Higher-Level Knowledge in 3D Modeling & Motion Analysis 2003
EuroGraphics 2003
GRAPHITE 2003
ISPRS Conference on Photogrammetric Image Analysis 2003

• Panels/project review

NSF Robotics and Human Augmentation/Computer Vision (3 panels), Computer Graphics. Army Research Office; Israeli Science Foundation; Indian Swiss Joint Research Program; Canada Foundation for Innovation; EPSRC; Research Grants Council of Hong Kong; Kentucky Science & Engineering Foundation; Netherlands Organization for Scientific Research; Research Office Limburgs Universitair Centrum

• Invited conference/workshop speaker

Workshop on Mathematical Methods in Computer Vision 2006 (Banff Int. Research Station)
Packard Fellows Meeting 2006
Vision colloquium 2006 (TU Graz)
Workshop on Comp. Vision for Interactive and Intelligent Environments 2005 (Univ. of Kentucky)
CVR Conference on Computational Vision in Biological and Machine Systems 2005 (York Univ.)
Int. Fall Workshop on Vision, Modeling and Visualization 2004 (Stanford Univ.)
Int. Symposium on 3D Data Processing, Visualization, and Transmission 2004
Advanced Concepts for Intelligent Vision Systems 2004 (keynote)
DIMACS Workshop on Surface Reconstruction 2003

• Conference Courses

Course on Video-based rendering at SIGGRAPH 2005 (co-organizer/lecturer).
Course on 3D modeling with a hand-held camera at International Symposium on 3D Data Processing Visualization Transmission 2004 and Congres of ISPRS 2004 (organizer/lecturer).
Course on 3D Models from Photo and Video at Siggraph 2003 (organizer/lecturer with Luc Van Gool)
Course on Interactive Geometric and Scientific Computations Using Graphics Hardware at Siggraph 2003 (lecturer)
Short course on Multiple view geometry CVPR2003 (co-organizer/lecturer with Andrew Zisserman)

• Ph.D. or M.S. committee member
    Henrik Aanaes, Ph.D. Technical University of Denmark, 20 Oct. 2003.
    Oscar Pizaro, Ph.D., MIT/WHOI, 13 Aug. 2004.
    Srikumar Ramalingam, M.S., UCSC, Sept. 2004.
    Jean-S´ebastien Franco, Ph.D., INRIA-grenoble, 13 Dec. 2005
    David Neil Ross McKinnon, Ph.D., University of Queensland, 2006
    Kok-Lim Low, Ph.D., UNC, 16 Aug. 2005
    Sang-Uok Kum, Ph.D., UNC, 5 May 2006
    Scott Larsen, Ph.D., UNC, 27 Oct. 2006
    Greg Coombe, Ph.D., UNC, 20 Nov. 2006
    Jingyu Yan, Ph.D., UNC, 28 Nov. 2006 (advisor)
    Eric Bennett, Ph.D., UNC, 22 Mar. 2007

• Membership
    member of IEEE and ACM Siggraph

• Miscellaneous
    Research Associate of the Research Laboratory for Archaeology (UNC) (2004-present)
    Chair of ISPRS intercommission III/V workinggroup on Image Sequences (2000-2004/2004-2008).
    Member of Honorary Committee Imagina 2003, 2004.

Current Ph.D./M.S. student supervision
- Guan Li, Fall 2004-present, current research: Dynamic reconstruction from active PTZ camera networks.
- Sriram-Thirthala Venkata, summer 2004-present (on leave), current research: omnidirectional vision and camera networks.
- David Gallup, summer 2005-present, current research: Urban modeling from video.
- Brian Clipp, summer 2005-present, current research: Urban modeling from video.
- Paul Merrell, Fall 2005-present, current research: Urban modeling from video.
- ChangChangWu, Fall 2005-present, current research: 3D Terrain modeling and image registration.
- Xiaowei Li, Fall 2006-present, current research: Large-Scale Structure from Motion.

Postdoctoral advisees
- Jan-Michael Frahm, 07/05-present, current research: urban modeling from video.
- Philippos Mordohai, 08/05-present, current research: urban modeling from video.
- Jean-Sébastien Franco, 02/06-present, current research: 3D modeling of dynamic scenes.

Graduated students
- Jingyu Yan, Ph.D. 2006, Articulated Non-rigid Shapes, Motions and Kinematic Chains from Video.
- Jason Repko, M.S., May 2005.

Projects and grants

UNC
- Packard Fellowship for Science and Engineering, recipient, The David and Lucile Packard Foundation, 11/05-10/10, $625,000.
- VACEIII: 3D Content Extraction from Video Streams, PI, DTO, 10/06-10/08, $1,000,000.
- Transportable Computing Clusters for Real World Acquisition, Display, and Immersive Training, Co-PI (with Henry Fuchs (PI), Greg Welch (Co-PI)), ONR, 04/06-06/07, $133,000.
- UrbanScape, UNC PI, DARPA, 03/05-03/08, UNC budget $1,300,000.
- Geo*: Meshless wavelets and their application to terrain modeling, Co-PI (with Jack Snoeyink (PI), Leonard McMillan, Wei Wang, Charles Chui, Wenjie He (Co-PIs)), DARPA, 03/05-02/10, $2,300,000.
- Calibration and 3D modeling from pan-tilt-zoom camera networks, PI, Siemens Ph.D. student support, 08/04-08/05, $31,000.
- ITR: Converting 2D video to 3D with Applications to 3D-TV, Video Analysis and Compression, PI, NSF, 08/03-07/06, $286,000 (including REU supplement).
- UrbanScape seedling, UNC PI, DARPA, 07/03-06/04, $120,000.
- CAREER: Visual 3D Acquisition, Modeling and Rendering of the Real World, PI, NSF, 02/03-02/08, $400,000.

K.U.Leuven
- ATTEST - Advanced Three-dimensional TElevesion System Technology, local project leader, European IST project, 03/02-02/04, approx. $200,000.
- InViews – Interactive and Immersive Video from Multiple Images, local project leader, European IST project, 12/01-5/04, approx. $350,000.
- Combined geometric and image-based approaches to virtual and augmented reality, co-principal investigator, Flemish FWO research project, 01/01-12/04, approx. $110,000

Publications

Journals
(CI: ISI Citation Index 2002, CR: ISI Cited References (04/04),
CS: CiteSeer citation count (excluding self-citations; 08/04))
1. S. Sinha, J.-M. Frahm, M. Pollefeys, Y. Genc, Feature Tracking and Matching in Video Using Programmable Graphics Hardware, Machine Vision and Application, to appear.

2. S. Sinha, M. Pollefeys, Pan-Tilt-Zoom Camera Calibration and High-Resolution Mosaic Generation, Computer Vision and Image Understanding, 103(3), 170-183, 2006.

3. R. Yang, M. Pollefeys, A Versatile Stereo Implementation on Commodity Graphics Hardware, Journal of Real-Time Imaging, Volume 11, Issue 1, February 2005, pp.7-18.

4. M. Pollefeys, L. Van Gool, M. Vergauwen, F. Verbiest, K. Cornelis, J. Tops, R. Koch, Visual modeling with a hand-held camera, International Journal of Computer Vision 59(3), 207-232, 2004.CI:2.034

5. R. Yang, M. Pollefeys, H. Yang, G. Welch, A Unified Approach to Real-Time, Multi-Resolution, Multi-Baseline 2D View Synthesis and 3D Depth Estimation using Commodity Graphics Hardware, International Journal of Image and Graphics, Vol. 4, No. 4 (2004) 627-651.

6. K. Landzettel, K. Arbter, B. Brunner, B.-M. Steinmetz, M. Pollefeys, M. Vergauwen, R. Moreas, F. Xu, L. Steinicke, B. Fontaine, "A Micro-Rover Navigation and Control System for Autonomous Planetary Exploration", Advanced Robotics, Vol. 18, No.3, pp.285-314, 2004.(overview paper reporting on ESA project, contribution as local project leader)

Proceedings (refereed)
(24 in top conferences ICCV, CVPR and ECCV, as in most areas of CS those conference are as important as journals)
(AR: Acceptance Ratio)

7. L. Guan, J.-S. Franco, M. Pollefeys, 3D Occlusion Inference from Silhouette Cues, Proc. CVPR'07 (IEEE Conf. on Computer Vision and Pattern Recognition), AR oral: ±7%

8. H. Yang, M. Pollefeys, G. Welch, J.-M. Frahm, A. Ilie, Differential Camera Tracking through Linearizing the Local Appearance Manifold, Proc. CVPR'07 (IEEE Conf. on Computer Vision and Pattern Recognition), AR oral: ± 7%

9. D. Gallup, J.-M. Frahm, P. Mordohai, Q. Yang, M. Pollefeys, Real-Time Plane-sweeping Stereo with Multiple Sweeping Directions, Proc. CVPR'07 (IEEE Conf. on Computer Vision and Pattern Recognition), AR: ± 25%

10. S. J. Kim, D. Gallup, J.-M. Frahm, A. Akbarzadeh, Q. Yang, R. Yang, D. Nistr, M. Pollefeys, Gain Adaptive Real-Time Stereo Streaming, Proc. Int. Conf. on Computer Vision Systems, 2007.

11. J. Yan, M. Pollefeys, "Recovering Articulated Non-rigid Shapes, Motions and Kinematic Chains From Video", AMDO'06 (Conference on Articulated Motion and Deformable Objects), 2006.

12. J.-M. Frahm, M. Pollefeys, "RANSAC for (Quasi-)Degenereate data (QDEGSAC)", Proc. CVPR'06 (IEEE Conf. on Computer Vision and Pattern Recognition), 2006. AR oral: ± 7%

13. J. Yan, M. Pollefeys, "Automatic Kinematic Chain Building from Feature Trajectories of Articulated Objects", Proc. CVPR'06 (IEEE Conf. on Computer Vision and Pattern Recognition), (to appear), 2006. AR: ± 25%

14. A. Akbarzadeh, J.-M. Frahm, P. Mordohai, B. Clipp, C. Engels, D. Gallup, P. Merrell, M. Phelps, S. Sinha, B. Talton, L. Wang, Q. Yang, H. Stewenius, R.

Yang, G. Welch, H. Towles, D. Nister and M. Pollefeys, "Towards Urban 3D Reconstruction From Video", Proc. 3DPVT'06 (Int. Symp. on 3D Data, Processing, Visualization and Transmission), 2006.

15. L. Guan, S. Sinha, J.-S. Franco and M. Pollefeys, "Visual Hull Construction in the Presence of Partial Occlusion", Proc. 3DPVT'06 (Int. Symp. on 3D Data, Processing, Visualization and Transmission), 2006.

16. S. Larsen, P. Mordohai, M. Pollefeys and H. Fuchs, "Simplified Belief Propagation for Multiple View Reconstruction", Proc. 3DPVT'06 (Int. Symp. on 3D Data, Processing, Visualization and Transmission), 2006.

17. H. Yang, G. Welch and M. Pollefeys, "Illumination Insensitive Model-Based 3D Object Tracking and Texture Refinement", Proc. 3DPVT'06 (Int. Symp. on 3D Data, Processing, Visualization and Transmission), 2006.

18. J. Yan, M. Pollefeys, "A General Framework for Motion Segmentation: Independent, Articulated, Rigid, Non-rigid, Degenerate and Non-degenerate", Proc. ECCV'06 (European Conference of Computer Vision). AR: 25%

19. S. Sinha, M. Pollefeys, "Multi-view Reconstruction using Photo-consistency and Exact Silhouette Constraints: A Maximum-Flow Formulation", Proc. ICCV'05 (International Conf. on Computer Vision), Vol. 1, pp. 349-356, 2005. AR: 20%

20. S. Thirthala, M. Pollefeys, "Multi-view geometry of 1D radial cameras and its application to omnidirectional camera calibration.", Proc. ICCV'05 (International Conf. on Computer Vision), Vol. 2, pp. 1539-1546, 2005. AR: 20%

21. S. Thirthala and M. Pollefeys, "Trifocal Tensor for Heterogeneous Cameras", Omnivis'05 (in conjunction with ICCV'05).

22. J. Yan and M. Pollefeys, "Articulated Motion Segmentation Using RANSACWith Priors",Workshop on Dynamic Vision (in conjunction with ICCV'05)

23. J. Yan, M. Pollefeys, "A factorization approach to articulated motion recovery", Proc. CVPR'05 (IEEE Conf. on Computer Vision and Pattern Recognition), Vol. 2, pp. 815-821, 2005. AR: 26.8%

24. S. Thirthala, M. Pollefeys, "The Radial Trifocal Tensor: A Tool for Calibrating Radial Disortion of Wide-Angle Cameras", Proc. CVPR'05 (IEEE Conf. on Computer Vision and Pattern Recognition), Vol. 1, pp. 321-328, 2005. AR: 26.8%

25. J. Repko, M. Pollefeys, "3D Models from Extended Uncalibrated Video Sequences: Addressing Key-frame Selection and Projective Drift", Proc. 3DIM'05, pp. 150-157, 2005.

26. S. Sinha, M. Pollefeys, S.J. Kim, "High-Resolution Multiscale Panoramic Mosaics from Pan-Tilt- Zoom Cameras", Proc.of 4th Indian Conference on Computer Vision, Graphics & Image Processing (ICVGIP 2004), pp. 28-33, 2004.

27. N. Williams, K.-L. Low, C. Hantak, M. Pollefeys, and A. Lastra. "Automatic Image Alignment for 3D Environment Modeling", Proc. of the 17th Brazilian Symposium on Computer Graphics and Image Processing (SIBGRAPI), Curitiba, Brazil, pp. 388-395.

28. S. Sinha, M. Pollefeys. "Visual-Hull Reconstruction from Uncalibrated and Unsynchronized Video Streams", Second International Symposium on 3D Data Processing, Visualization & Transmission, 2004 (invited).

29. J. Yan, M. Pollefeys, "Video Synchronization via Space-Time Interest Point Distribution", Advanced Concepts for Intelligent Vision Systems, 2004, 5 pages.

30. S. Sinha, M. Pollefeys, "Calibrating a network of cameras from live or archived video", Advanced Concepts for Intelligent Vision Systems, 2004, 7 pages.

31. S. Sinha, M. Pollefeys. "Synchronization and Calibration of Camera Networks from Silhouettes", International Conference on Pattern Recognition 2004, Vol. 1, pp. 116-119, 2004. AR oral: 16.5%

32. A. Raij, M. Pollefeys. "Auto-Calibration of Multi-Projector Display Walls", International Conference on Pattern Recogniton 2004, Vol. 1, pp. 14-17, 2004. AR oral: 16.5%

33. R. Yang, M. Pollefeys, and S. Li, "Improved Real-Time Stereo on Commodity Graphics Hardware", Workshop on Real Time 3D Sensors and Their Use 2004 (in conjunction with CVPR), 7 pages.

34. S. Sinha, M. Pollefeys. Camera Network Calibration from Dynamic Silhouettes, Proc. CVPR'04 (IEEE Conf. on Computer Vision and Pattern Recognition), pp. 195-202, 2004. AR: 29.3%

35. S.J. Kim, M. Pollefeys. Radiometric Self-Alignment of Image Sequences, Proc. CVPR'04 (IEEE Conf. on Computer Vision and Pattern Recognition), pp. 645-651, 2004. AR: 29.3%

36. S. Sinha, M. Pollefeys. "Towards Calibrating a Pan-Tilt-Zoom Cameras Network", OMNIVIS 2004, ECCV Conference Workshop CD-rom proceedings, 2004, 13 pages.

37. M. Pollefeys, S. Sinha. Iso-disparity surfaces for general stereo configurations, T. Pajdla and J. Matas (Eds.), Computer Vision - ECCV 2004 (European Conference on Computer Vision), LNCS, Vol. 3023, pp. 509-520, Springer-Verlag, 2004. AR: 34.5%

38. R. Yang, M. Pollefeys, and G. Welch. Dealing with Textureless Regions and Specular Highlight: A Progressive Space Carving Scheme Using a Novel Photo-consistency Measure, Proc. ICCV'03 (International Conference on Computer Vision), pp. 576-584, 2003. AR: 20.6%

39. R. Yang and M. Pollefeys. Multi-Resolution Real-Time Stereo on Commodity Graphics Hardware, Proc. CVPR'03 (IEEE Conf. on Computer Vision and Pattern Recognition), pp. 211-218, 2003. AR: 23% CS: 6

40. J. Cosmas, T. Itegaki, D. Green, N. Joseph, L. Van Gool, A. Zalesny, D. Vanrintel, F. Leberl, M. Grabner, K. Schindler, K. Karner, M. Gervautz, S. Hynst, M. Waelkens, M. Vergauwen, M. Pollefeys, K. Cornelis, T. Vereenooghe, R. Sablatnig, M. Kampel, P. Axell, E. Meyns, "Providing multimedia tools for recording, reconstruction, visualisation and database storage/access of archaeological excavations", Proceedings 4th international symposium on virtual reality, archaeology and intelligent cultural heritage - VAST2003, pp. 183-192, November 5-7, 2003, Brighton, United Kingdom

Book/Proceeding editor

41. A. Koschan, M. Pollefeys, and M. Abidi (Eds.), 3D imaging for Safety and Security, Kluwer/Springer, 2006, in preparation.

Contributions to books (refereed or invited)

42. M. Pollefeys, S. Sinha, J. Yan, "Calibration and Shape Recovery from Videos of Dynamic Scenes", Computational Vision in Neural and Machine Systems, L. Harris and M. Jenkin (Eds.), Cambridge University Press, (in preparation).

43. M. Pollefeys, "3D from Image Sequences: Calibration, Motion and Shape Recovery", Mathematical Models of Computer Vision: The Handbook, N. Paragios, Y. Chen, O. Faugeras, Springer, 2006.

44. M.Waelkens, M. Pollefeys, L. Van Gool, "Sagalassos: Reconciling on-going large scale excavations with the natural and human environment", Interpreting the Past (Presenting Archaeological Sites to the Public), D. Callebaut, A. Killebrew, N. Silberman (Eds.), pp.55-75, 2004.

45. A. Heyden and M. Pollefeys, Multi-view Geometry, in Emerging Topics in Computer Vision, G. Medioni and S. B. Kang (Eds.), Prentice-Hall, pp. 45-107, 2004.

46. L. Van Gool, M. Pollefeys,M. Proesmans, A. Zalesny, MURALE : modelling Sagalassos, A.K.Bowman, J.M. Brady (eds.), Images and Artefacts of the Ancient World, (Oxford University Press, British Academy, June 2005).

Video proceedings

47. J. Yan, M. Pollefeys, Automatic Kinematic Chain Building from Feature Trajectories of Articulated Objects, CVPR'06 video proceedings, accepted.

48. S. Sinha, M. Pollefeys, Synchronization and Calibration of a Camera Network for 3D Event Reconstruction from Live Video, CVPR'05 video proceedings, p. 1196.

49. S. Thirthala, S. Sinha,M. Pollefeys, Calibration of Pan-Tilt-Zoom (PTZ) Cameras and Omni-Directional Cameras, CVPR'05 video proceedings, p. 1198.

50. J. Yan, M. Pollefeys, A Factorization-Based Approach to Articulated Motion Recovery, CVPR'05 video proceedings, p. 1203.

Marc Pollefeys

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Jan-Michael Frahm, Seon Joo Kim, Christopher Zach, Gabriel Brostow, Friedrich Fraundorfer, Dong Wuk Kyoung

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Curriculum Vitae
Diane Pozefsky

Office: **Home:**
Department of Computer Science   2100 Tadley Drive
Campus Box 3175, Brooks Building   Chapel Hill, NC 27514
UNC-Chapel Hill   919 929-9051
Chapel Hill, NC 27599-3175 USA
919 962-1817
pozefsky@cs.unc.edu

Education:
Ph.D., Department of Computer Science, University of North Carolina at Chapel Hill,
Dissertation: "Building Efficient Pass-Oriented Attribute Grammar Evaluators", April 1979.
Sc.B., Applied Mathematics, Brown University, Providence, RI, June 1972.

Work Experience:
UNC-Chapel Hill July 2006 – present
    Adjunct Professor and Industry Partnership Program Director, Department of Computer
        Science
UNC-Chapel Hill July 2004 – June 2006
    Research Professor and Industry Partnership Program Director, Department of Computer
        Science
    Scientist, Renaissance Computing Institute
IBM June 1979 – June 2004
    Assignments

Faculty loan at UNC	Mar 2003 – June 2004
Lotus client architecture	Mar 2002 – Mar 2003
Director, storage networking architecture	Aug 2000 – Mar 2002
CIO Office	Aug 1998 – Aug 2000
Nagano and Sydney Olympics	Feb 1997– Aug 1998
Chief architect and development lead for AnyNet	1989 – 1997
SNA Architecture, including lead architect for APPN	1979 – 1989

    Other activities
        Led calendar awareness services project
        Founded corporate and NC Women in Technology conferences
        Perennial chair of local Engineers Week (e-week) effort and founder and co-chair of
            NC Coalition for e-week
    Recognitions
        8 Formal Achievement Awards
        Named Master Inventor in 1996
        Named IBM Fellow in 1994
        Elected to the IBM Academy of Technology 1990
            Elected to two terms on governing council

Current Research Grants:
NIH grant, Carolina Exploratory Center for Cheminformatics Research (Alex Tropsha, PI)

Published papers:
"iFold: a platform for interactive folding simulations of proteins" with Sharma et al in Bioinformatics
22(21): 2693-2694, 2006.
 "Storage Networking: More than an SNA Anagram" in *NCP and 3745/46 Today*, Summer 2001.
 "MPTN Transport Gateway", with D. Ogle in SNA and TCP/IP Enterprise Networking, Manning
Publications Co, 1997.

 "Multiprotocol Transport Networking: Eliminating Application Dependencies on Communications Protocols" with R. Turner et al, IBM Systems Journal volume 34 issue 3, pp. 472-500, July 1995.
"Multiprotocol Transport Networking: A General Internetworking Solution" with K. Britton et al, Proceedings of 1993 International Conference on Network Protocols, pp. 14-26, IEEE Computer Society Press, October 1993.
"SNA's Design for Networking" with D. Pitt and J. Gray, IEEE Network volume 6 number 6, pp. 16-31, November 1992.

US Patents:

7,395,221 "Intelligent free-time search" with Doss et al, issued July 1, 2008
7,318,040 "Predicting and adjusting users' working hours and electronic calendar events" with Doss et al, issued January 8, 2008
7,284,002 "Calendar-enhanced awareness for instant messaging systems and electronic status boards" with Doss et al, issued October 16, 2007
7,191,298 "Flexible system and method for mirroring data" with Kaminsky et al, issued March 13, 2007
7,096,232 "Calendar-enhanced directory searches including dynamic contact information" with Doss et al, issued August 22, 2006
7,035,865 "Calendar-enhanced awareness for instant messaging systems and electronic status boards" with Doss et al, issued April 25, 2006
6,988,128 "Calendar events and calendar-driven application technique" with Alexander et al, issued January 17, 2006
6,731,323 "Media-enhanced greetings and/or responses in communication systems" with Doss et al. issued May 4, 2004
6,654,790 "Technique for enabling wireless message systems to use alternative message delivery mechanisms" with Ogle et al, issued November 25, 2003
6,430,604 "Technique for Enabling Messaging Systems to Use Alternative Message Delivery Mechanisms" with Ogle et al, issued August 6, 2002
5,802,053 "Transport Gateway Between a Native Network and a Mixed Network" with Bollella et al, issued September 1, 1998
5,491, 693 "General Transport Layer Gateway for Heterogeneous Networks" with Britton et al, issued February 13, 1996
5,425,028 "Protocol Selection and Address Resolution for Programs Running in Heterogeneous Networks" with Britton et al, issued June 13, 1995
5,361,256 "Inter-Domain Multicast Routing" with Doeringer et al, issued November 1, 1994
5,224,098 "Compensation for Mismatched Transport Protocols in a Data Communications Network" with Bird et al, issued June 29, 1993
5,109,483 "Node Initiating XID Exchanges Over an Activated Link Including an Exchange of Sets of Binding Signals Between Nodes for Establishing Sessions" with Baratz et al, issued April 28, 1992
5,101,348 "Method of Reducing the Amount of Information Included in Topology Update Messages in a Data Communications Network" with Arrowood et al, issued March 31, 1992
4,967,345 "Method of Selecting Least Weight Routes in a Communications Network" with Clarke et al, issued October 30, 1990
4,954,821 "Method of Establishing Transmission Group Numbers for Network Links" with Gray et al, issued September 4, 1990
4,914,571 "Locating Resources in Computer Networks" with Baratz et al, issued April 3, 1990
4,873,517 "Method for Selecting Least Weight End Node to Ned Node Route in a Data Communications Network" with Baratz et al, Issued October 10, 1989
4,827,411 "Method of maintaining a Topology database" with Arrowood et al, issued May 2, 1989
4,736,369 "Adaptive Session Pacing" with Barzilai et al, issued April 5, 1988

Diane Pozefsky

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

Comp 185/585 – Serious Games

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

CURRICULUM VITAE

Dr. Jan F. Prins
October 2008

Department of Computer Science
CB 3175 F. P. Brooks Building
University of North Carolina
Chapel Hill, NC 27599-3175

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Fax: +1-919-962-1799
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http://www.cs.unc.edu/~prins/

Education

Ph.D.	1987	Computer Science	Cornell University
	1986-87	Programming Languages Group	Univ. of Wisconsin at Madison
	1983-84	Programming Research Group	Oxford University, UK
M.Sc.	1983	Computer Science	Cornell University
B.Sc.	1978	Mathematics (Honors)	Syracuse University

My thesis research was supervised by David Gries at Cornell University and described a framework for reusability and rapid prototyping in program development; my minor concentration was in neurobiology. I was a member of the Programming Research Group at Oxford University during the 1983-84 academic year and spent an undergraduate year in 1977 at the Technische Hogeschool Eindhoven (The Netherlands) with the research group directed by Edsger Dijkstra.

Academic Experience

7/04–   Department Chair, Department of Computer Science, University of North Carolina at Chapel Hill.

4/01–   Faculty member, Program in Bioinformatics and Computational Biology, UNC-CH.

5/98–   Faculty member, Program in Molecular and Cellular Biophysics, UNC-CH.

7/96–7/97   Visiting Professor, Institute for Theoretical Computer Science, Swiss Federal Institute of Technology (ETH), Zürich, Switzerland.

8/87–   Assistant Professor (8/87 – 12/93), Associate Professor (1/94 – 12/01), Full Professor (1/02 –), Department of Computer Science, University of North Carolina, Chapel Hill, NC.

6/87–6/94   Instructor, IBM University-Level Course Curriculum. Condensed one-week courses taught in various locations around the country. Courses taught include Algorithms, Programming Languages & Environments, and Software Engineering Principles.

9/86–8/87   Research Associate to Tom Reps, Department. of Computer Sciences, University of Wisconsin - Madison, Madison, WI. Investigation of issues in programming languages and systems.

6/84–7/84   Instructor, Johns Hopkins Center for Academically Talented Youth. An intensive introduction to the mathematical foundations of computer science for nationally selected students aged 12-15.

1/80–5/81   Teaching Fellow, Cornell University, Ithaca, NY. Instructor for two introductory programming courses based on *APL* and PASCAL respectively.

Industry Experience

5/00 – 8/00   3rdTech, Inc. Consultant and software developer for DeltaSphere 3D Laser Scanner system.

4/95 – 7/96   Gerald Pechanek, IBM MWAVE group, RTP, NC (spun-out to create BOPS, Inc.). Consultant on parallel computing issues in DSP chip and system design.

6/81 – 8/83   Ken Wilson, Department of Physics, Cornell University, Ithaca, NY. Development of a machine code optimizer for the FPS array processors using stochastic methods.

4/78 – 8/81   STSC, Inc., Rockville, MD. Systems Programmer. Member of the four man development team responsible for the design and implementation of the *APL*PLUS* interpreters, primarily the production time-sharing system programmed in IBM 370 assembler code.

9/75 – 1/81   Digital Effects, Inc., New York. Founding member. Development of an animation production system and rendering software, used to produce computer generated film sequences for the television and motion picture industry. Sample productions include portions of the film "TRON".

Research Areas

High-performance computing: algorithms, programming languages, compilers and architectures.

Scientific computing with focus on computational biology and bioinformatics.

High-level programming languages and problem solving environments.

Formal techniques in program development.

Post-doctoral Supervision

Susan Paulsen, Ph.D. 1994 Quantitative Genetics, Duke University (2003 - 2007),

Martin Simons, Ph.D. 1996 Computer Science, Technische Universität Berlin (1998-1999).

Lars Nyland, Ph.D. 1991 Computer Science, Duke University (1991-1997)

PhD and MS Student Supervision

Ph.D. committee memberships: 56 Ph.D. committees, 7 as supervisor, 10 as committee chair, 2 as external examiner.

Ph.D. students supervised:

Edoardo S. Biagioni, Ph.D. May 1992 (Co-advisor with G. Magó), *Scan-Directed Load Balancing*, Systems Scientist, Carnegie Mellon University (FOX group on foundations of programming languages); Associate Professor, Univ. of Hawaii.

Daniel W. Palmer, Ph.D. Nov. 1996, *Compiling High-Level Data-Parallel Programs for Parallel Execution*, Professor, John Carroll University.

Rickard E. Faith, Ph.D. Dec. 1997*, Debugging Programs After Structure-Changing Transformation*, Member of the Technical Staff, NetApp, Inc.

James W. Riely, Ph.D. Aug. 1999, *Abstract Values and Cost Models for Concurrent Programs*, Research Associate, Concurrency and Functional Languages project, University of Sussex, Brighton, England; Associate Professor, DePaul University.

Wolf Pfannenstiel, Ph.D. Dec. 2000 (TU Berlin), *Piecewise Execution of Nested Data Parallel Programs*, (Co-advisor with S. Jaehnichen, TU Berlin), Member of the Technical Staff, VW Gedas, Berlin.

Jun (Luke) Huan, Ph.D. Oct. 2006, *Discovering Patterns in Families of Protein Structures*, (Co-advisor with W. Wang), Assistant Professor, Department of EECS, Kansas University.

Stephen L. Olivier, (current Ph.D. candidate) *Scalable Load Balancing Techniques.*

MS committee memberships: 8 MS (thesis-option) committees, 1 as advisor and committee chair.

MS student supervised:

J. Christopher Ramming, M.Sc. Sep. 1989, *LLPT: A Little-Language Prototyping Tool*, DARPA Strategic Technology Office Program Manager.

Honors

Fellow of the Institute of Arts and Humanities, Fall 2006.

Outstanding Teaching Award, CSSA May 2001

Research Development Award, UNC-CH 1995

Junior Faculty Development Award, UNC-CH 1989

Professional Activities (2003 – 2008)

Journal Editorial Boards

Journal of Scientific Programming (2004-).

International Journal of High Performance Computer Graphics, Multimedia and Visualisation (2000–).

Co-editor, special issue of Scientific Programming on High Performance Computing on Cell B.E. Processors (2008).

Program committee member, 5th IEEE International Workshop on High Performance Computational Biology (HiCOMB 2006).

Panelist, NSF-CRA Workshop on "Computer Science outside of the Box", Washington DC, Nov 10, 2008.

Chair, Advisory Committee for Administration and Allocation of NIH Computing Resource "Biomedical Analysis and Simulation Supercomputer (BASS)" (2008–)

University Activities (2003 – 2008)

Provost's Committee on Research Computing at UNC (2008-)

Internal Review Committee member, Department of Operations Research and Statistics 10-year Review (Feb 2008)

Planning Committee for Curriculum in Applied Science and Engineering (2008-)

Provost's Advisory Group on Classroom Technology Planning (2008)

RENCI /ITS Advisory Board for Research Computing (2008-)

IAH Fellow in Academic Leadership Program (2006-)

Search Committee for the Dean of Arts and Sciences (2006-07)

Advisory Board member, School of Information and Library Science (2006-)

AGEP Program liaison for Computer Science (2006-)

Award Recommendation Panel, UNC General Administration, Office of the President (2005).

Executive Advisory Committee, Bioinformatics and Computational Biology training program (2003 – 2007).

Departmental Activities (2003 – 2008)

Chair (2004-)

Committee memberships

10-year Departmental Review
F. P. Brooks Computer Science Building
Graduate Studies Committee
Undergraduate Studies Committee
General Education Committee

Research Support (2003 – 2008)

Role	Agency	Title	Total Award	Dates
Co-PI	NSF	III-Core: Discovering and Exploring Patterns in Subspaces (IIS-0812464)	$444,711	9/1/08 – 8/31/11
SI	NSF	CRI-IAD: Integrated Projector-Camera Modules for the Capture and Creation of Wide-Area Immersive Experiences	$310,000	4/1/2008 – 3/31/2011
PI	IBM	Novel Applications for Cell B.E. (Faculty Research Award)	$15,000	2006-07
Co-PI	NIH	Protein Structure/Function Specific Packing Motifs (1R01GM068665-01A3)	$1,089,388	9/1/06- 8/31/10/
PI	IBM	Shared University Research (Equipment Grant)	$83,000	2006-07
SI	NIEHS	Superfund Basic Research Program - Mathematical and Statistical Analysis and Modeling Core (P42ES05948)	$5,000,000	10/1/2006 – 9/30/2010
Co-PI	NSF	Identifying Spatial Motifs for Classification of Protein Structure and Function (CCF-EMT 0523875)	$300,000	7/15/05 – 7/14/08
Co-PI	EPA	Carolina Environmental Bioinformatics Research Center (EPA R832720)	$4,000,000	8/1/05 – 7/31/10
SI	ARO	Computer Generated Force Scalability using GPUs	$2,400,000	1/15/05 – 1/14/08
Co-PI	NIH	(P20) Carolina Center for Experimental Genetic Analysis (P20-RR2075)	$1,795,000	10/1/04 – 9/30/07
Co-PI	NSA	Parallel Unbalanced Tree Search	$500,000	5/1/04 – 12/31/06
SI	UNC GA	UNC Training Program in Bioinformatics	$450,000	4/19/02 – 8/31/05
Co-PI	NSA	Parallel Programming Paradigms for Distributed Memory and DSM multiprocessors	$345,000	4/1/02 – 8/30/03
Co-PI	DOE	Environmental Modeling System	$969,000	2/1/02 – 1/31/05
Co-PI	NSF	A Distributed, High-Performance Computing Environment for the Applied Sciences	$1,024,000	9/01/01 – 8/31/04
Co-PI	NSF	ITR-ACS: Self-Scheduling N-body simulation algorithms	$450,649	10/1/00 – 9/30/03
SI	NIH	Parallel Computing in Structural Biology	$2,500,000	10/1/98 – 9/30/03

Courses Taught

Parallel Computing
    High Performance Computing (UNC COMP 633 graduate core course)
    Parallel Computing: Theory and Practice (ETH D-INFK undergraduate course)
    Parallel and Distributed Computing (with P. Widmayer, ETH D-INFK, graduate course)
    Parallel Algorithms (UNC COMP 790 graduate course)
    Parallel Programming Languages (UNC COMP 790 graduate course)

Compiler Construction
    Advanced Compiler Design (UNC COMP 720 graduate course)
    Compilers (UNC COMP 520 undergraduate course)

Algorithms and Theory of Computation
    Parallel Algorithms (UNC COMP 790 graduate course)
    Models of Languages and Computation (UNC COMP 455 undergraduate course)
    Algorithm Design and Analysis (IBM internal course)

Programming Languages
    Advanced Topics in Programming Languages (UNC COMP 724 graduate course)
    Programming Paradigms (UNC COMP 790 graduate course)
    Comparative Programming Languages (UNC COMP 590)
    Programming Languages and Programming Environments (IBM internal course)

Software Engineering
    Formal Methods in Software Engineering (CMU SEI/UNC graduate course)
    Software Engineering (IBM internal course)

Introduction to Programming
    Introduction to Functional Programming (UNC COMP 121 undergraduate core course)
    Introduction to Programming (UNC COMP 110 undergraduate core course)

Publications (2003 – 2008)

I. Book Chapters, Edited Volumes, and Journal Articles

1. M. Gschwind, F. Gustavson, J. Prins, eds, High Performance Computing on Cell B.E. Processors, *Scientific Programming* **16,** IOS, 2008.

2. J. Dinan, S. Olivier, G. Sabin, J. Prins, P. Sadayappan, C-W Tseng, A Message Passing Benchmark for Unbalanced Applications, *Simulation Modeling Practice and Theory* **16** (8), Elsevier, 2008.

3. L. Nyland, M. Harris, J. Prins, "Fast N-Body Simulation with CUDA" in *GPU Gems* 3, H. Nguyen, ed., Addison Wesley, 2007 (pp 677 – 696).

4. J. Huan, J. Prins, W. Wang, "Local Structure Comparison of Proteins", *Computational Biology and Bioinformatics* (*Advances in Computers* **68***)*, C.-W. Tseng (ed.), Elsevier, 2006 (pp 178 – 253).

5. D. Bandyopadhyay, J. Huan, J. Liu, J. Prins, J. Snoeyink, W. Wang, A. Tropsha, "Structure-based function inference using protein family-specific fingerprints", *Protein Science* **15** (6), 2006 (pp 1537 – 1543).

6. J. Huan, W. Wang, D. Bandyopadhyay, J. Snoeyink, J. Prins, and A. Tropsha, "Comparing graph representations of protein structure for mining family-specific residue-based packing motifs", *Journal of Computational Biology* (JCB) **12** (6), 2005 (pp 657 – 671).

7. C. Pan, J. Prins, C. Miller, "A High-performance Lattice Boltzmann Implementation to Model Flow in Porous Media", *Computer Physics Communications* **158**, 2004 (pp 89 – 105).

II. Refereed Conference Papers

8. D. Bandyopadhyay, J. Huan, J. Liu, J. Prins, J. Snoeyink, W. Wang, and A. Tropsha, "Functional Neighbors: Relationships between Non-homologous Protein Families Inferred Using Family-Specific Fingerprints", in *Proc. of 2008 Conf. on Bioinformatics and Biomedicine (BIBM'08)*, IEEE, 2008.

9. Q. Zhang, W.Wang, L. McMillan, J. Prins F. Pardo-Manuel de Villena, D. Threadgill, Genotype Sequence Segmentation: Handling Constraints and Noise, *Proceedings of the 8th Workshop on Algorithms in Bioinformatics* (WABI), 2008.

10. S. Olivier, J. Prins, "Scalable Load Balancing Using UPC", *Proc. Intnl Conf on Parallel Programming* (ICPP), IEEE 2008.

11. S. Olivier, J. Prins, J. Derby, K. Vu, "Porting the GROMACS Molecular Dynamics Code to the Cell Processor", *Proc. of 8th IEEE Intl. Workshop on Parallel and Distributed Scientific and Engineering Computing* (PDSEC-07), 2007.

12. J. Dinan, S. Olivier, J. Prins, G. Sabin, P. Sadayappan, C.-W. Tseng, "Dynamic Load Balancing of Unbalanced Computations Using Message Passing", Proc. of 6th Intl. Workshop on Performance Modeling, Evaluation, and Optimization of Parallel and Distributed Systems (PMEO-PDS 2007), 2007.

13. J. Liu, Q. Zhang, W. Wang, L. McMillan, J. Prins, "Poclustering: lossless clustering of dissimilarity data", *Proc 7th SIAM Conference on Data Mining* (SDM), 2007.

14. S. Olivier, J. Huan, J. Liu, J. Prins, J. Dinan, P. Sadayappan, C.-W. Tseng, "UTS: An Unbalanced Tree Search Benchmark", *19th International Workshop on Languages and Compilers for Parallel Computing* (LCPC), 2006.

15. J. Liu, Q. Zhang, W. Wang, L. McMillan, J. Prins, "Clustering pair-wise dissimilarity data into partially ordered sets", *Proc. 12th ACM International Conference on Knowledge Discovery and Data Mining* (SIGKDD), 2006.

16. J. Huan, D. Bandyopadhyay, J. Prins, J. Snoeyink, A. Tropsha, W. Wang, "Distance-based Identification of Spatial Motifs in Proteins Using Constrained Frequent Subgraph Mining", *Computational Systems Bioinformatics Conference* (CSB), 2006.

17. J. Liu, S. Paulsen, X. Sun, W. Wang, A. Nobel, J. Prins, Mining Approximate Frequent Itemsets In the Presence of Noise: Algorithm and Analysis, *SIAM Conference on Data Mining* (SDM), 2006.

18. J. Huan, D. Bandyopadhyay, J. Liu, J. Prins, J. Snoeyink, A. Tropsha, W. Wang, "Rapid determination of local structural features common to a set of proteins" (demo), *Proceedings of the 13th International Conference on Intelligent Systems for Molecular Biology (ISMB)*, 2005.

19. J. Liu, S. Paulsen, W. Wang, A. Nobel, J. Prins, "Mining Approximate Frequent Itemsets from Noisy Data", *Proceedings of the 5th IEEE International Conference on Data Mining* (ICDM), 2005

20. D. Bandyopadhyay, J. Huan, J. Liu, J. Prins, J. Snoeyink, A. Tropsha, and W. Wang, "Function inference using family-specific subgraph fingerprints mined from protein families", *Proceedings of the 13th International Conference on Intelligent Systems for Molecular Biology (ISMB)*, 2005.

21. J. Huan, W, Wang, J. Prins, J. Yang, "SPIN: Mining Maximal Frequent Subgraphs from Graph Databases", in *Proceedings of the 10th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (KDD), 2004.

22. M. Farthing, C. Miller, D. Sassen, J. Prins, "A problem solving environment for subsurface flow and transport phenomena", in *International Conference on Computational Methods in Water Resources* XV (CMWR), Elsevier, 2004.

23. J. Huan, W. Wang, D. Bandyopadhyay, J. Snoeyink, J. Prins, A. Tropsha, "Mining Protein Family Specific Residue Packing Patterns From Protein Structure Graphs", in *Proceedings of the Intl Conf on Research in Computational Molecular Biology* (RECOMB), 2004.

24. C. Miller, C. Abhishek, A. Sallerson, J. Prins, M. Farthing, "A comparison of computational and algorithmic advances for solving Richards' equation" in *International Conference on Computational Methods in Water Resources* XV (CMWR), Elsevier, 2004.

25. J. Huan, W. Wang, A. Washington, J. Prins, R. Shah, A. Tropsha, "Accurate classification of protein structural families using coherent subgraph analysis", in *Proceedings of the Pacific Symposium on Biocomputing* (PSB), 2004.

26. K. Berlin, J. Huan, J. Prins, W. Pugh, P. Sadayappan, J. Spacco, C.-W. Tseng, "Evaluating the Impact of Programming Language Features on the Performance of Parallel Applications

on Cluster Architectures", *Proceedings of the 14th International Workshop on Languages and Compilers for High Performance Computing* (LCPC), 2003.

27. J. Huan, W. Wang, J. Prins, "Efficient mining of frequent subgraphs in the presence of isomorphism", *Proceedings of the 3rd IEEE International Conference on Data Mining* (ICDM), 2003.

28. J. Huan, J. Prins, W. Wang, T. Vision, "Reconstructing of ancestral gene order after segmental duplication and gene loss", *Proceedings of the IEEE Computer Society Bioinformatics Conference* (CSB), 2003.

29. C. Pan, J. Prins, and C. Miller, "A High-Performance Lattice Boltzmann Implementation of Multiphase Flow in Porous Media", *Workshop on Simulation and Optimization*, Statistical and Applied Mathematical Sciences Institute, Research Triangle Park, North Carolina, 2003.

Jan Prins

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – (2003-2007) Susan Paulsen, Ph.D. 1994 Quantitative Genetics, Duke University.

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

Continuous revision of the department's core course in high performance and parallel computing (COMP 633) to incorporate rapid changes in programming models, parallel computing systems, and performance analysis.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Timothy L. Quigg

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Education
1971   BA – Political Science, Wake Forest University
1979   MPA – concentration in computer science, North Carolina State University

Honors and Awards
2004   Distinguished Faculty - Society of Research Administrators International
2004   Excellence in Research Administration (inaugural) Award from UNC-Chapel Hill
2007   Career Excellence Award in Research Administration from Society of Research Administrators International
2008   Establishment of the "Tim Quigg Can Do" Award at UNC-Chapel Hill. This annual endowed award honors a university staff member for excellence in customer service, problem solving, streamlining programs and procedures, and creative and resourceful handling of challenges

Major Invited Talks
2004   Wake Forest University Life Sciences Annual meeting "Characteristics of Successful Managers"
2004   Louisiana Professional Development and Grantsmanship Conference (Southern University) "Effective Grantsmanship"
2004   Society for Life Sciences and UNC Post doc Association "Managing the Scientific Enterprise"
2005   Puerto Rico Research Management Conference (San Juan) "Effective Research Management"
2006   Institutes for Molecular Biology and Neuroscience, University of Oregon "Managing Academic Research Organizations"
2006   ADARUQ Conference (Quebec City) "Canada and the US: Contrasting Challenges in Research Administration"
2007   Rutgers University Research Management "Managing Research Administration Offices"
2008   INORMS (International Network of Research Management Societies) Conference (Liverpool, UK) "Comparative Case Studies of the Management and Organization of Research Support"

Professional Training

2004-08   Management training for post docs, staff scientists and administrators at the National Cancer Institute, the National Institute for Environmental Health Sciences and the National Institute for Child Health and Development

2004-06   Creator and lead trainer for the Departmental Research Administrator Certification Program (DA101, 201, 202) through the Society of Research Administrators International

2004-05   Future Faculty Program (UNC Center for Teaching & Learning) – Grantsmanship training workshop

2005   Training in Estonia as part of a five person team sponsored by the European Union to assist Estonian Universities increase their capacity in administering research

2005-07   Training in Vancouver, Ottawa and Montreal for the Canadian Research Manager Certificate program

2005-07   Creator and lead trainer for the Tar Heel Certificate in Research Administration program at UNC-Chapel Hill

Professional Activities

2004   President, Society of Research Administrators International (Southern Section)

2004-05   Board of Directors, Society of Research Administrators International

2007-08   Advisory Board member North Carolina State University Master of Public Administration (MPA) program

UNC Committees

2004-08   Chair, College of Arts and Sciences Conflict of Interest Committee

2004-08   Advisory Board, Office of Technology Development

2004-08   Advisory Board, Office of Economic Development

2006-07   Chair, University Resource Use for Entrepreneurial Purposes policy ad-hoc review committee

2007-08   Chair, Office of Research Services ad-hoc review committee

2007-08   Patent Policy ad-hoc review committee

Teaching

Comp 918 - Research Administration for Scientists

Guest Lecturer in Comp 916 - Seminar in Professional Practices

Guest Lecturer - Biologists as Entrepreneurs

Publication

2006   "Departmental Administrators' Roles, Responsibilities and Structures" a chapter in *Research Administration and Management* by Kulakowski and Chronister, published by Jones and Bartlett Publishers.

Tim Quigg

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Michael K. Reiter

Activities since 2003
Last Updated: September 26, 2008

Awards and Honors

Awards for scientific papers
- Best Paper Award. 12th ISOC Network and Distributed System Security Symposium (for [30]).

Papers invited from the following conferences to appear in journals
- 13th ACM Conference on Computer and Communications Security ([52] invited, appears as [8])
- 13th ACM Symposium on Access Control Models and Technologies ([75] invited)

Scholarships, fellowships, and research awards
- IBM Faculty Partnership Award, 2002–2003.
- Intel Research Gift, 2008.

Scientific Lectures

Dr. Reiter has delivered numerous scientific lectures at scientific symposia, leading universities, and industrial research institutions.   Below is a sample of noteworthy invited lectures since 2003.

- Department colloquium, Department of Computer Science, Yale University (New Haven, CT, USA). April 3, 2003.
- Information Security Institute Seminar, Johns Hopkins University (Baltimore, MD, USA). April 8, 2003.
- 2nd NJITES Symposium on Cybersecurity and Trustworthy Software, Stevens Institute of Technology (Hoboken, NJ, USA). April 28, 2003.
- Triangle Computer Science Distinguished Lecture, hosted by Duke University, North Carolina State University, and the University of North Carolina (North Carolina, USA). March 1, 2004.
- Conference on Future Directions in Informatics, School of Informatics, Indiana University (Bloomington, IN, USA), September 11, 2004.
- Keynote address, 7th International Conference on Information Security and Cryptology (Seoul, Korea). December 2, 2004.
- Distinguished Lecture, Computer Science Department, Stony Brook University (Stony Brook, NY, USA), March 11, 2005.
- Department colloquium, Department of Computer Science, Columbia University (New York, NY, USA). April 6, 2005.
- Institute for Security Technology Studies, Dartmouth College (Hanover, NH, USA). May 19, 2005.
- Advanced Networks Colloquium, hosted by the Center for Satellite and Hybrid Communication Networks, the Department of Electrical and Computer Engineering, and the Institute for Systems Research at the University of Maryland (College Park, MD, USA). September 16, 2005.
- Cornell Computer Science 40th Anniversary Symposium, Cornell University (Ithaca, NY, USA). October 1, 2005.

- Distinguished Lecture, Information Trust Institute, University of Illinois at Urbana-Champaign (Urbana, IL, USA). January 18, 2006.
- Information Science & Technology Colloquium, NASA Goddard Space Flight Center (Greenbelt, MD, USA). February 8, 2006.
- ZISC Information Security Colloquium, ETH Zurich (Zurich, Switzerland). May 30, 2006.
- Information Security Institute Seminar, Johns Hopkins University (Baltimore, MD, USA). November 29, 2006.
- Department colloquium, Department of Computer Science, University of North Carolina (Chapel Hill, NC, USA). December 13, 2006.
- Second Workshop of the EU-US Summit Series on Cyber Trust: System Dependability and Security, hosted by the Information Trust Institute, University of Illinois at Urbana-Champaign (Monticello, IL, USA). April 26, 2007.
- Keynote address, 12th European Symposium on Research in Computer Security (Dresden, Germany). September 24, 2007.
- Distinguished Lecture, Department of Computer and Information Science, University of Pennsylvania (Philadelphia, PA, USA). October 9, 2007.
- A 30-Year Perspective on Replication (Monte Verita, Ascona, Switzerland). November 7, 2007.
- 3rd Bertinoro Ph.D. School on Security of Wireless Networking (Bertinoro, Italy). July 27 − August 1, 2008.
- Department colloquium, Department of Computer Science, University of California at Irvine (Irvine, CA, USA). November 21, 2008.
- Keynote address, 10th International Symposium on Stabilization, Safety, and Security of Distributed Systems (Detroit, MI, USA). November 23, 2008.

Professional Service

Journal editorships
- *ACM Transactions on Information and System Security*
  Associate Editor (January 2000−July 2004)
  Editor-in-Chief (August 2004−present)
- *Communications of the ACM*
  Editorial Board member (November 2007−present)
- *IEEE Transactions on Software Engineering*
  Associate Editor (2000−2004)
- *International Journal on Information Security*
  Associate Editor (2001−2006)
- *IEEE Transactions on Dependable and Secure Computing*
  Associate Editor (2004)
  Note: Position resigned in 2005 due to other obligations.
- *IEEE Internet Computing*
  Guest Editor, special issue on Homeland Security (November/December 2004 issue)

Conference program committees

> * = *Program Chair or Co-Chair;* + = *Program Subcommittee Chair*

ACM Conference on Computer and Communications Security (CCS)	2003, 2008
ACM Conference on Electronic Commerce	2003, 2005*
ACM Conference on Information, Computer and Communications Security	2006
ACM Conference on Principles of Distributed Computing (PODC)	2005
ACM SIGCOMM Conference	2008
Asia Conference on Computer and Communication Security	2008
DARPA Information Survivability Conference and Exposition	2003
IEEE Computer Security Foundations (CSF)	2004
IEEE Symposium on Reliable Distributed Systems (SRDS)	2005
IEEE Symposium on Security and Privacy	2004, 2005
IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)	2006, 2007, 2008, 2009
Information Hiding Workshop	2004*
Information Security Conference (ISC)	2003, 2004
International Conference on Distributed Computing Systems (ICDCS)	2005+, 2008
International Conference on Principles of Distributed Systems	2005
International Symposium on Distributed Computing (DISC)	2004, 2007
Network and Distributed System Security Symposium (NDSS)	2003*, 2004*, 2007, 2009
Privacy Enhancing Technologies Workshop (PET)	2006, 2007
USENIX Security Symposium	2006, 2008, 2009
Workshop on Secure Network Protocols	2008
World Wide Web Conference (WWW)	2006

IEEE Technical Committee on Security and Privacy
- **Chair** (2002−2003)

Board of Visitors member, Software Engineering Institute, Carnegie Mellon University (July 2003−present)
> The Board of Visitors of the Software Engineering Institute (SEI) advises the Carnegie Mellon University provost and the SEI director on SEI plans and operations. It monitors SEI activities and reports to the provost on the state of the SEI and recommendations for improvement. For more information, see http://www.sei.cmu.edu/about/bov/.

U.S. Government service
- Chair, National Science Foundation Principal Investigator Meeting (August 2004)
- Organizing Committee, National Science Foundation Study on Grand Challenges in Distributed Computing (July−September 2005)
- NSF Global Environment for Network Innovations (GENI)
  - Distributed Services Working Group (December 2005 – May 2007)
  - Planning Group (March 2006 – May 2007)
- IARPA NICIAR Study on Safely Taking on New Executable Stuff of Uncertain Provenance (May 2008 – August 2008)
- Department of Commerce Emerging Technology and Research Advisory Committee (September 2008 onward)

U.S. Government Research Funding

The table below outlines Dr. Reiter's research funding from U.S. government sources. The "Amount" column indicates the funds received by Dr. Reiter's institution, which might be less than the total funds received by the project in the case of a multi-institution project. The "Role" column should be interpreted as follows: "PI" indicates principal investigator; "IPI" indicates that Dr. Reiter was the principal investigator at his institution on a multi-institution project for which another of the institutions was the lead; and "co-PI" indicates that Dr. Reiter was not the lead investigator at his institution on the project.

DARPA	Client security in scalable and survivable object	PI	Sep 2002	Aug 2004	$379,872
NSF	ITR: Meme like propagation of security services	IPI	Sep 2002	Aug 2005	$599,265
NSF	Security and privacy for publish-subscribe systems	PI	Sep 2002	Aug 2005	$539,216
NSF	Automated diversity for improving computer systems security	IPI	Aug 2003	Aug 2006	$499,997
NSF	Collaborative ITR: 100 megabits per second to 100 million households	co-PI	Sep 2003	Aug 2008	$3,415,936
Navy	Distributed system security via logical frameworks	co-PI	Jun 2004	May 2006	$795,171
DARPA	Increasing intrusion tolerance via scalable redundancy	PI	Jul 2004	Dec 2005	$1,369,241
NSF	Using generative models to evaluate and strengthen biometrically enhanced systems	IPI	Sep 2004	Aug 2007	$90,081
NSF	Cyber Trust center: Security through interaction modeling	PI	Oct 2004	Sep 2009	$6,399,993
AFRL	Joint Battlespace Infosphere	IPI	Feb 2005	Oct 2005	$82,999
NSF	Team for research in ubiquitous secure technology (TRUST)	IPI	Jul 2005	Jun 2010	$3,200,000
AFRL	Pollux: Enhancing the quality of service of the global information grid	IPI	Feb 2006	Jan 2009	$237,500
NSF	User-controllable security and privacy for pervasive computing	co-PI	Sep 2006	Aug 2010	$1,100,000
DTO	Accountability for information flow via explicit formal proof	co-PI	Feb 2007	Jul 2008	$750,000
DHS	New frameworks for detecting and minimizing information leakage in anonymized network data	co-PI	Mar 2008	Mar 2010	$264,268
NSF	CLEANSE: Cross-Layer Large-Scale Efficient Analysis of Network Activities to SEcure the Internet	IPI	Oct 2008	Sep 2011	$500,000

Scientific Publications

Publications in refereed journals

[1]   D. Malkhi, Y. Mansour and M. K. Reiter. **Diffusion without false rumors: On propagating updates in a Byzantine environment**. *Theoretical Computer Science* 299:289−306, 2003.

[2]   D. Malkhi, M. Merritt, M. K. Reiter, and G. Taubenfeld. **Objects shared by Byzantine processes**. *Distributed Computing* 16(1):37−48, 2003.

[3]   P. MacKenzie and M. K. Reiter. **Networked cryptographic devices resilient to capture**. *International Journal of Information Security* 2(1):1−20, November 2003.

[4]   P. MacKenzie and M. K. Reiter. **Delegation of cryptographic servers for capture-resilient devices**. *Distributed Computing* 16(4):307–327, December 2003.

[5]   P. MacKenzie and M. K. Reiter. **Two-party generation of DSA signatures**. *International Journal of Information Security* 2(3−4):218–239, August 2004.

[6]   X. Wang and M. K. Reiter. **A multi-layer framework for puzzle-based denial-of-service defense**. *International Journal of Information Security*, August 2007. Combines and extends [11][27].

[7]   M. K. Reiter and A. Samar. **Quiver: Consistent object sharing for edge services**. *IEEE Transactions on Parallel and Distributed Systems* 19(7):878−889, July 2008.

[8]   X. Wang, Z. Li, J. Xu, M. K. Reiter, C. Kil and J. Y. Choi. **Packet vaccine: Black-box exploit detection and signature generation**. *ACM Transactions on Information and System Security*, 2008. To appear. Preliminary version appears as [52].

[9]   D. Gao, M. K. Reiter and D. Song. **Beyond output voting: Detecting compromised replicas using HMM-based behavioral distance**. *IEEE Transactions on Dependable and Secure Computing*. To appear. Preliminary version appears as [50].

[10]   X. Wang and M. K. Reiter. **Using web-referral architectures to mitigate denial-of-service threats**. *IEEE Transactions on Dependable and Secure Computing*. To appear. Preliminary version appears as [51].

Symposium, conference, and workshop publications

[11]   X. Wang and M. K. Reiter. **Defending against denial-of-service attacks with puzzle auctions**. In *Proceedings of the 2003 IEEE Symposium on Security and Privacy*, pages 78−92, May 2003.

[12]   A. Akella, A. Bharambe, M. Reiter and S. Seshan. **Detecting DDoS attacks on ISP networks**. In *Proceedings of the ACM SIGMOD/PODS Workshop on Management and Processing of Data Streams,* June 2003.

[13]   M. K. Reiter, A. Samar and C. Wang. **The design and implementation of a JCA-compliant capture protection infrastructure**. In *Proceedings of the 22nd IEEE Symposium on Reliable Distributed Systems*, October 2003.

[14]   P. MacKenzie, A. Oprea, and M. K. Reiter. **Automatic generation of two-party cryptographic protocols**. In *Proceedings of the 10th ACM Conference on Computer and Communications Security*, pages 210−219, November 2003.

[15]   P. MacKenzie, M. K. Reiter and K. Yang. **Alternatives to non-malleability: Definitions, constructions and applications**. In *Theory of Cryptography: Proceedings of the 1st Theory of Cryptography Conference*, (Lecture Notes in Computer Science 2951), pages 171−190, February 2004.

[16]   B. Levine, M. K. Reiter, C. Wang, and M. Wright. **Timing attacks in low-latency mix-based systems**. In *Financial Cryptography: 8th International Conference, FC 2004* (Lecture Notes in Computer Science 3110), pages 251−265, February 2004.

[17]   M. Collins and M. K. Reiter. **An empirical analysis of target-resident DoS filters**. In *Proceedings of the 2004 IEEE Symposium on Security and Privacy*, pages 103–114, May 2004.

[18]   G. Perng, C. Wang and M. K. Reiter. **Providing content-based services in a peer-to-peer environment**. In *Proceedings of the 3rd International Workshop on Distributed Event-Based Systems*, May 2004.

[19]   L. Kissner, A. Oprea, M. K. Reiter, D. Song, and K. Yang. **Private keyword-based push and pull with applications to anonymous communication**. In *Proceedings of the 2nd International Conference on Applied Cryptography and Network Security* (Lecture Notes in Computer Science 3089), pages 16–30, June 2004.

[20]   G. Goodson, J. Wylie, G. Ganger and M. K. Reiter. **Efficient Byzantine-tolerant erasure-coded storage**. In *Proceedings of the 34th IEEE/IFIP International Conference on Dependable Systems and Networks*, June 2004.

[21]   D. Gao, M. K. Reiter, and D. Song. **On gray-box program tracking for anomaly detection**. In *Proceedings of the 13th USENIX Security Symposium*, pages 103–118, August 2004.

[22]   D. Davis, F. Monrose and M. K. Reiter. **On user choice in graphical password schemes**. In *Proceedings of the 13th USENIX Security Symposium*, pages 151–164, August 2004.

[23]   Y. Xie, H. Kim, D. R. O'Hallaron, M. K. Reiter and H. Zhang. **Seurat: A pointillist approach to anomaly detection**. In *Recent Advances in Intrusion Detection: 7th International Symposium, RAID 2004* (Lecture Notes in Computer Science 3224), pages 238–257, September 2004.

[24]   C. Fry and M. K. Reiter. **Nested objects in a Byzantine quorum-replicated system**. In *Proceedings of the 23rd IEEE Symposium on Reliable Distributed Systems*, pages 79–89, October 2004.

[25]   D. Davis, F. Monrose, and M. K. Reiter. **Efficient time-scoped searching of encrypted audit logs**. In *Information and Communications Security: 6th International Conference, ICICS 2004* (Lecture Notes in Computer Science 3269), pages 532–545, October 2004.

[26]   M. K. Reiter and X. Wang. **Fragile mixing**. In *Proceedings of the 11th ACM Conference on Computer and Communications Security*, pages 227–235, October 2004.

[27]   X. Wang and M. K. Reiter. **Mitigating bandwidth-exhaustion attacks using congestion puzzles**. In *Proceedings of the 11th ACM Conference on Computer and Communications Security*, pages 257–267, October 2004.

[28]   D. Gao, M. K. Reiter and D. Song. **Gray-box extraction of execution graphs for anomaly detection**. In *Proceedings of the 11th ACM Conference on Computer and Communications Security*, pages 318–329, October 2004.

[29]   V. Sekar, Y. Xie, D. Maltz, M. K. Reiter and H. Zhang. **Toward a framework for Internet forensic analysis**. In *Proceedings of the 3rd Workshop on Hot Topics in Networks* (HOTNETS-III), November 2004.

[30]   A. Oprea, M. K. Reiter and K. Yang. **Space-efficient block storage integrity**. In *Proceedings of the 12th Network and Distributed System Security Symposium*, February 2005. Received **Best Paper Award**.

[31]   J. M. McCune, E. Shi, A. Perrig and M. K. Reiter. **Detection of denial-of-message attacks on sensor network broadcasts**. In *Proceedings of the 2005 IEEE Symposium on Security and Privacy*, pages 64–78, May 2005.

[32]   L. Bauer, S. Garriss and M. K. Reiter. **Distributed proving in access-control systems**. In *Proceedings of the 2005 IEEE Symposium on Security and Privacy*, pages 81–95, May 2005.

[33]   J. M. McCune, A. Perrig and M. K. Reiter. **Seeing-is-believing: Using camera phones for human-verifiable authentication**. In *Proceedings of the 2005 IEEE Symposium on Security and Privacy*, pages 110–124, May 2005.

[34]   Y. Xie, V. Sekar, D. A. Maltz, M. K. Reiter and H. Zhang. **Worm origin identification using random moonwalks**. In *Proceedings of the 2005 IEEE Symposium on Security and Privacy*, pages 242–256, May 2005.

[35]   M. K. Reiter, X. Wang and M. Wright. **Building reliable mix networks with fair exchange**. In *Applied Cryptography and Network Security: Third International Conference, ACNS 2005* (Lecture Notes in Computer Science 3531), pages 378–392, June 2005.

[36] G. Perng, M. K. Reiter and C. Wang. **Censorship resistance revisited**. In *Information Hiding: 7th International Workshop, IH 2005* (Lecture Notes in Computer Science 3727), pages 62–76, June 2005.

[37] A. Gupta, B. M. Maggs, F. Oprea and M. K. Reiter. **Quorum placement in networks to minimize access delays**. In *Proceedings of the 24th ACM Symposium on Principles of Distributed Computing*, pages 87−96, July 2005.

[38] L. Bauer, S. Garriss, J. McCune, M. K. Reiter, J. Rouse and P. Rutenbar. **Device-enabled authorization in the Grey system**. In *Information Security: 8th International Conference, ISC 2005* (Lecture Notes in Computer Science 3650), pages 431−446, Springer-Verlag, September 2005.

[39] D. Gao, M. K. Reiter and D. Song. **Behavioral distance for intrusion detection**. In *Recent Advances in Intrusion Detection: 8th International Symposium, RAID 2005* (Lecture Notes in Computer Science 3858), pages 63–81, September 2005.

[40] M. Abd-El-Malek, G. R. Ganger, G. R. Goodson, M. K. Reiter and J. J. Wylie. **Fault-scalable Byzantine fault-tolerant services**. In *Proceedings of the 20th ACM Symposium on Operating Systems Principles*, pages 59−74, October 2005.

[41] M. K. Reiter, A. Samar and C. Wang. **Distributed construction of a fault-tolerant network from a tree**. In *Proceedings of the 24th IEEE Symposium on Reliable Distributed Systems*, pages 155−165, October 2005.

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[45] G. Perng, M. K. Reiter and C. Wang. **M2: Multicasting mixes for efficient and anonymous communication**. In *Proceedings of the 26th International Conference on Distributed Computing Systems*, July 2006.

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[47] A. Oprea and M. K. Reiter. **On consistency of encrypted files**. In *Distributed Computing: 20th International Symposium, DISC 2006* (Lecture Notes in Computer Science 4167), pages 254−268, September 2006.

[48] M. P. Collins and M. K. Reiter. **Finding peer-to-peer file-sharing using coarse network behaviors**. In *Computer Security − ESORICS 2006: 11th European Symposium on Research in Computer Security* (Lecture Notes in Computer Science 4189), pages 1−17, September 2006.

[49] D. Garg, L. Bauer, K. Bowers, F. Pfenning and M. K. Reiter. **A linear logic of authorization and knowledge**. In *Computer Security − ESORICS 2006: 11th European Symposium on Research in Computer Security* (Lecture Notes in Computer Science 4189), pages 297−312, September 2006.

[50] D. Gao, M. K. Reiter and D. Song. **Behavioral distance measurement using hidden Markov models**. In *Recent Advances in Intrusion Detection: 9th International Symposium, RAID 2006* (Lecture Notes in Computer Science 4219), pages 19−40, September 2006.

[51] X. Wang and M. K. Reiter. **WRAPS: Denial-of-service defense through web referrals**. In *Proceedings of the 25th IEEE Symposium on Reliable Distributed Systems*, pages 51−60, October 2006.

[52] X. Wang, Z. Li, J. Xu, M. K. Reiter, C. Kil and J. Y. Choi. **Packet vaccine: Black-box exploit detection and signature generation**. In *Proceedings of the 13th ACM Conference on Computer and Communications Security*, pages 37−46, October 2006.

[53] Y. Xie, V. Sekar, M. K. Reiter and H. Zhang. **Forensic analysis for epidemic attacks in federated networks**. In *Proceedings of the 14th IEEE International Conference on Network Protocols*, pages 43−53, November 2006.

[54] Y. Xie, M. K. Reiter and D. R. O'Hallaron. **Protecting privacy in key-value search systems**. In *Proceedings of the 22nd Annual Computer Security Applications Conference*, pages 493−504, December 2006.

[55] S. Coull, C. Wright, F. Monrose, M. P. Collins and M. K. Reiter. **Playing devil's advocate: Inferring sensitive information from anonymized network traces**. In *Proceedings of the 14th Network and Distributed System Security Symposium*, pages 35−47, February 2007.

[56] K. Bowers, L. Bauer, D. Garg, F. Pfenning and M. K. Reiter. **Consumable credentials in linear-logic-based access-control systems**. In *Proceedings of the 14th Network and Distributed System Security Symposium*, pages 143−157, February 2007.

[57] J. Cornwell, I. Fette, G. Hsieh, M. Prabaker, J. Rao, K. Tang, K. Vaniea, L. Bauer, L. Cranor, J. Hong, B. McLaren, M. Reiter and N. Sadeh. **User-controllable security and privacy for pervasive computing**. In *Proceedings of the 8th IEEE Workshop on Mobile Computing Systems and Applications*, February 2007.

[58] J. M. McCune, B. Parno, A. Perrig, M. K. Reiter, and A. Seshadri. **Minimal TCB code execution (extended abstract)**. In *Proceedings of the 2007 IEEE Symposium on Security and Privacy*, pages 267−272, May 2007.

[59] F. Oprea and M. K. Reiter. **Minimizing response time for quorum-system protocols over wide-area networks**. In *Proceedings of the 37th IEEE/IFIP International Conference on Dependable Systems and Networks*, pages 409−418, June 2007.

[60] L. Bauer, L. Cranor, M. K. Reiter and K. Vaniea. **Lessons learned from the deployment of a smartphone-based access-control system**. In *Proceedings of the 3rd Symposium on Usable Privacy and Security*, pages 64−75, July 2007.

[61] A. Oprea and M. K. Reiter. **Integrity checking in cryptographic file systems with constant trusted storage**. In *Proceedings of the 16th USENIX Security Symposium*, pages 183−198, August 2007.

[62] S. Coull, M. P. Collins, C. Wright, F. Monrose and M. K. Reiter. **On web browsing privacy in anonymized NetFlows**. In *Proceedings of the 16th USENIX Security Symposium*, pages 339−352, August 2007.

[63] J. Hendricks, G. R. Ganger and M. K. Reiter. **Verifying distributed erasure-coded data**. In *Proceedings of the 26th ACM Symposium on Principles of Distributed Computing*, pages 139−146, August 2007.

[64] M. P. Collins and M. K. Reiter. **Hit-list worm detection and bot identification in large networks using protocol graphs**. In *Recent Advances in Intrusion Detection: 10th International Symposium, RAID 2007* (Lecture Notes in Computer Science 4637), pages 276−295, August 2007.

[65] M. G. Merideth and M. K. Reiter. **Probabilistic opaque quorum systems**. In *Distributed Computing: 21st International Symposium, DISC 2007* (Lecture Notes in Computer Science 4731), pages 403−419, September 2007.

[66] L. Bauer, S. Garriss and M. K. Reiter. **Efficient proving for practical distributed access-control systems**. *Computer Security − ESORICS 2007: 12th European Symposium on Research in Computer Security* (Lecture Notes in Computer Science 4734), pages 19−37, September 2007.

[67] J. Hendricks, G. R. Ganger and M. K. Reiter. **Low-overhead Byzantine fault-tolerant storage**. In *Proceedings of the 21st ACM Symposium on Operating Systems Principles*, pages 73−86, October 2007.

[68]   S. E. Coull, C. V. Wright, A. D. Keromytis, F. Monrose and M. K. Reiter. **Taming the devil: Techniques for evaluating anonymized network data**. In *Proceedings of the 15th Network and Distributed System Security Symposium*, February 2008.

[69]   J. M. McCune, B. Parno, A. Perrig, M. K. Reiter and A. Seshadri. **How low can you go? Recommendations for hardware-supported minimal TCB code execution**. In *Proceedings of the 13th International Conference on Architectural Support for Programming Languages and Operating Systems*, pages 14−25, March 2008.

[70]   J. M. McCune, B. Parno, A. Perrig, M. K. Reiter, and H. Isozaki. **Flicker: An execution infrastructure for TCB minimization**. In *Proceedings of the 3rd ACM SIGOPS/EuroSys European Conference on Computer Systems*, pages 315−328, April 2008.

[71]   L. Bauer, L. F. Cranor, R. W. Reeder, M. K. Reiter, and K. Vaniea. **A user study of policy creation in a flexible access-control system**. In *Proceedings of the 26th ACM Conference on Human Factors in Computing Systems*, pages 543−552, April 2008.

[72]   R. W. Reeder, L. Bauer, L. F. Cranor, M. K. Reiter, K. Bacon, K. How, and H. Strong. **Expandable grids for visualizing and authoring computer security policies**. In *Proceedings of the 26th ACM Conference on Human Factors in Computing Systems*, page 1473−1482, April 2008.

[73]   M. K. Reiter, A. Samar, and C. Wang. **Self-optimizing distributed trees**. In *Proceedings of the 22nd IEEE International Parallel and Distributed Processing Symposium*, April 2008.

[74]   V. Sekar, M. K. Reiter, W. Willinger, H. Zhang, R. R. Kompella and D. G. Anderson. **cSAMP: A system for network-wide flow monitoring**. In *Proceedings of the 5th USENIX Symposium on Network Systems Design and Implementation*, pages 233−246, April 2008.

[75]   L. Bauer, S. Garriss and M. K. Reiter. **Detecting and resolving policy misconfigurations in access-control systems**. In *Proceedings of the 13th ACM Symposium on Access Control Models and Technologies*, pages 185−194, June 2008.

[76]   Z. Li, X. Wang, Z. Liang, and M. K. Reiter. **AGIS: Towards automatic generation of infection signatures**. In *Proceedings of the 38th IEEE/IFIP International Conference on Dependable Systems and Networks*, June 2008.

[77]   T.-F. Yen and M. K. Reiter. **Traffic aggregation for malware detection**. In *Detection of Intrusions and Malware, and Vulnerability Assessment, 5th International Conference, DIMVA 2008* (Lecture Notes in Computer Science 5137), pages 207−227, July 2008.

[78]   L. Ballard, S. Kamara and M. K. Reiter. **The practical subtleties of biometric key generation**. In *Proceedings of the 17th USENIX Security Symposium*, pages 61−74, August 2008.

[79]   M. P. Collins and M. K. Reiter. **On the limits of payload-oblivious network attack detection**. In *Recent Advances in Intrusion Detection: 11th International Symposium, RAID 2008* (Lecture Notes in Computer Science 5230), pages 251–270, September 2008.

[80]   D. Gao, M. K. Reiter and D. Song. **BinHunt: Automatically finding semantic differences in binary programs**. In *Proceedings of the 10th International Conference on Information and Communications Security*, October 2008. To appear.

[81]   L. Ballard, S. Kamara, F. Monrose and M. K. Reiter. **Towards practical biometric key generation with randomized biometric templates**. In *Proceedings of the 15th ACM Conference on Computer and Communications Security*, November 2008. To appear.

[82]   M. G. Merideth and M. K. Reiter. **Write markers for probabilistic quorum systems**. In *Proceedings of the 12th International Conference on Principles of Distributed Systems*, December 2008. To appear.

Other reviewed publications

[83]   F. Monrose and M. K. Reiter. **Graphical passwords**. In L. F. Cranor and S. Garfinkel, eds., *Security and Usability*, pages 169−186, O'Reilly Media Inc., 2005. Invited paper.

Mike Reiter

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Lujo Bauer

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

At CMU, developed the curriculum for the M.S. in Information Security Technology and Management, and developed and taught two courses in that curriculum. This degree program is still highly enrolled today. At UNC, developed and taught two courses in computer security, and am presently working to help develop a broad computer security curriculum spanning both undergraduate and graduate courses.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

I licensed a system called "Grey" to a startup company that is presently pursuing commercialization of it.

MONTEK SINGH

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PERSONAL INFORMATION

Research Interests
Design and test of asynchronous circuits and systems
CAD tools for asynchronous design
Heterogeneous mixed-timing systems
Power-aware graphics hardware
Hardware security and authentication

Education

Columbia University, New York, NY	Computer Science	Ph.D., February 2002
Columbia University, New York, NY	Computer Science	M.S., October 1996
Indian Institute of Technology, Delhi, India	Electrical Engineering	B.Tech, May 1993

Professional Experience

2007-present	Associate Professor, Dept. of Computer Science, University of North Carolina at Chapel Hill
2007-present	Ad-hoc Faculty Member, ECE Dept., Duke University, Durham, NC
2001-2007	Assistant Professor, Dept. of Computer Science, University of North Carolina at Chapel Hill
1994-2001	Graduate Research Assistant, Dept. of Computer Science, Columbia Univ., NY
2000	Fall Research Intern, IBM T.J. Watson Research Center, Yorktown Heights, NY
1999	Summer Academic Visitor, Amulet Group, University of Manchester, Manchester, UK
1997	Summer Summer Intern, Intel Corp., Santa Clara, CA
1992	Summer Practical Trainee, Bhabha Atomic Research Center, Bombay, India

RECENT AWARDS AND HONORS

- ➢ **Best Paper Award,** 6th IEEE ASYNC Symposium, Eilat, Israel, April 2000. (International Symposium on Asynchronous Circuits and Systems)
- ➢ **Best Paper Finalist,** 8th IEEE ASYNC Symposium, Manchester, UK, April 2002. (International Symposium on Asynchronous Circuits and Systems)
- ➢ UNC Junior Faculty Development Award, December 2002.
- ➢ IBM Faculty Award, August 2004.

RESEARCH SUPPORT

External Funding

- ➢ NSF (pending): *"Power-Aware Graphics Hardware,"* co-PI (PI: Prof. Anselmo Lastra). Submitted October 2006, $500K.
- ➢ NSF (pending): *"CAREER: Design and Test of Novel Asynchronous High-Speed VLSI Architectures for Stream Processing,"* PI. Submitted July 2006, $570K.
- ➢ DARPA (pending): *"TRUSTed Hardware Authentication,"* co-PI (PI: Dr. Warren Snapp, Boeing Inc.). Submitted August 2006. UNC share: $300K; total $15M.

  > I was invited by Boeing to be a part of the team (consisting of two major companies and four universities) that has proposed a major research effort in hardware security and authentication. The objective is to detect malicious modifications to microelectronic chips. My work is on the key aspect of timing fingerprint generation and timing-fingerprint-based authentication.

- ➢ DARPA: *"High-Speed Clockless Pipeline Design Flow,"* PI (subcontract via Boeing), under the CLASS program ("Clockless Logic Analysis, Synthesis, and Systems"), March 2005-present. UNC share: $275K; total $14M.

  > I am part of a multi-group team, led by Boeing, which has been awarded the largest grant in asynchronous design in the U.S. in over 20 years. There were over twenty proposals, and only one team was awarded. I was invited to the join the program for Phases 2 and 3 in order to fill a critical need. I am playing the crucial role of develop an automated high-speed pipeline synthesis flow, building upon my research in high-speed asynchronous pipeline circuits. My task has become the single high-speed design option for the entire program. In collaboration with Handshake Solutions (a Philips spin-off), we have successfully developed a new experimental high-speed pipeline design flow based on their Haste flow.

  > *Follow-Up DARPA Funding* (pending): I was invited by Boeing to be part of the team that is aiming for a follow-up contract. Discussions are currently underway between Boeing and DARPA. My role will be on further development and optimization of the high-speed pipeline synthesis flow, including system-level performance analysis and optimization tools, and on test and design-for-testability.

- ➢ IBM: *"Design of Latency-Insensitive Systems,"* PI (IBM Faculty Award), August 2004-July 2005. $20K

Internal Funding

UNC: Junior Faculty Development Award, December 2002, $5,000.
UNC: University Research Council Research Grant, December 2002, $2,300.

Funding Awards for My Students

- ➢ NSF Graduate Fellowship: Gennette Gill, Mar 2004. Approx. $40K/year for 3 years = $120K.
- ➢ Dept. of Defense Graduate Fellowship (NDSEG): Gennette Gill, April 2004. Approx. $40K/year for 3 years = $120K.

➢ ATI Graduate Fellowship: Justin Hensley, May 2004. Approx. $35/year for 2 years = $70K.
➢ NSF East-Asia Summer Fellowship: Todd Gamblin, Feb 2004. Approx. $10K.

PATENTS ISSUED

➢ Circuits and methods for high-capacity asynchronous pipeline processing, US Patent 7,053,665 granted May 30, 2006.
➢ Asynchronous pipeline with latch controllers, US Patent 6,958,627 granted October 25, 2005.
➢ Circuits and methods for high-capacity asynchronous pipeline, US Patent 6,867,620 granted March 15, 2005.
➢ High-throughput asynchronous dynamic pipelines, US Patent 6,590,424 granted July 8, 2003.

RESEARCH PUBLICATIONS

JOURNAL ARTICLES (in preparation; imminent submission)

- "An Adaptively-Pipelined Mixed Synchronous-Asynchronous Digital FIR Filter." To be submitted Spring 2007 to *Journal of Solid-State Circuits (JSSC).*
- "Low-Overhead Testing of Ultra-High-Speed Asynchronous Pipelines." To be submitted Spring 2007 to *IEEE Trans. on Computer-Aided-Design of Integrated Circuits and Systems (TCAD).*
- "High-Speed Non-Linear Asynchronous Pipelines." To be submitted Spring 2007 to *IEEE Trans. On VLSI Systems (TVLSI).*

JOURNAL ARTICLES (published, refereed)

- M. Singh and S.M. Nowick. "The Design of High-Performance Dynamic Asynchronous Pipelines: Lookahead Style." To appear in *IEEE Transactions on VLSI Systems (TVLSI),* 14 pages, accepted November 2006.
- M. Singh and S.M. Nowick. "The Design of High-Performance Dynamic Asynchronous Pipelines: High-Capacity Style." To appear in *IEEE Transactions on VLSI Systems (TVLSI),* 14 pages, accepted November 2006.
- M. Singh and S.M. Nowick. "MOUSETRAP: High-Speed Transition-Signaling Asynchronous Pipelines." To appear in *IEEE Transactions on VLSI Systems (TVLSI),* 14 pages, accepted October 2006.

CONFERENCE PAPERS (published, refereed)

- G. Gill, J. Hansen and M. Singh. "Loop Pipelining for High-Throughput Stream Computation Using Self-Timed Rings." *Proc. of Intl. Conf. on Computer-Aided Design (ICCAD-06),* San Jose, CA, November 2006.
- M. Ampalam and M. Singh. "Counterflow Pipelining: Architectural Support for Preemption in Asynchronous Systems using Anti-Tokens." *Proc. of Intl. Conf. on Computer-Aided Design (ICCAD-06),* San Jose, CA, November 2006.
- G. Gill, A. Agiwal, M. Singh, F. Shi, and Y. Makris. "Low-Overhead Testing of Delay Faults in High-Speed Asynchronous Pipelines." *Proc. of the 12th IEEE Intl. Symp. on Async. Circ. and Syst. (ASYNC-06),* Grenoble, France, March 2006.

- Agiwal and M. Singh. "An Architecture and Wrapper Synthesis for Multi-Clock Latency-Insensitive Systems." *Proc. of Intl. Conf. on Computer-Aided Design (ICCAD-05),* San Jose, CA, November 2005.
- F. Shi, Y. Makris, S.M. Nowick and M. Singh. "Test Generation for Ultra-High-Speed Asynchronous Pipelines." *Proc. of Intl. Test Conference (ITC-05),* Austin, TX, November 2005.
- J. Hensley, T. Scheuermann, G. Coombe, A. Lastra and M. Singh. "Fast Summed-Area Table Generation and its Applications." *Proc. of Eurographics 2005,* Dublin, Ireland, August 2005.
- J. Hensley, M. Singh, A. Lastra. "A Fast, Energy-Efficient Z-Comparator." *Proc. of the ACM SIGGRAPH/EUROGRAPHICS Conference on Graphics Hardware (GHW-05),* Los Angeles, CA, July 2005.
- Agiwal and M. Singh. "Multi-Clock Latency-Insensitive Architecture and Wrapper Synthesis." *Proc. of the Second Intl. Workshop on Formal Methods for Globally Asynchronous Locally Synchronous Design (FMGALS-05),* in cooperation with ACM SIGDA and SIGARCH, Verona, Italy, July 2005. Published in Electronic Notes in Theoretical Computer Science, vol. 146, no. 2, January 2006. (ISSN: 1571-0661, Elsevier)
- J. Hensley, A. Lastra and M. Singh. "A Scalable Counterflow-Pipelined Asynchronous Radix-Four Booth Multiplier." *Proc. of the 11th IEEE Intl. Symp. on Async. Circ. and Syst. (ASYNC-05),* New York City, NY, March 2005.
- J. Hensley, A. Lastra and M. Singh. "An Area- and Energy-Efficient Asynchronous Booth Multiplier for Mobile Devices." *Proc. of IEEE Intl. Conf. on Computer Design (ICCD-04),* San Jose, CA, October 2004.
- M. Singh and M. Theobald. "Generalized Latency-Insensitive Systems for Single-Clock and Multi- Clock Architectures." *Proc. of ACM/IEEE Design, Automation and Test in Europe (DATE-04),* Paris, France, February 2004.

WORKSHOP PAPERS (refereed, limited distribution in workshop proceedings)

- G. Gill and M. Singh. "Robust Synthesis of Asynchronous Burst-Mode Machines." *Proc. of the 14th Intl. Workshop on Logic and Synthesis (IWLS-05),* Lake Arrowhead, CA, June 2005.
- G. Gill and M. Singh. "Synthesizing Asynchronous Burst-Mode Machines without the Fundamental-Mode Timing Assumption." *Proc. of the ACM/IEEE Intl. Workshop on Timing Issues in the Specification and Synthesis of Digital Systems (TAU-05),* San Francisco, CA, February 2005.
- M. Singh and M. Theobald. "Generalized Latency-Insensitive Systems for GALS Architectures." *Proc. of the Workshop on Formal Methods for Globally Asynchronous Locally Synchronous (GALS) Architecture (FMGALS-03),* held in conjunction with the 12th International Formal Methods Europe Symposium, Pisa, Italy, September 2003.

POSTERS, SKETCHES and ABSTRACTS (refereed)

- J. Hensley, T. Scheuermann, M. Singh, and A. Lastra. "Fast, Approximate HDR Image-Based Lighting Using Summed-Area Tables." Poster to be presented at Symposium on Interactive 3D Graphics and Games (i3D-07), Seattle, WA, April 2007.
- G. Gill and M. Singh. "Ray Tracing on Asynchrounous Supercomputing Stream Processors." Poster presented at the IEEE Symposium on Interactive Ray Tracing, Salt Lake City, Utah, September 2006.

- G. Gill, J. Hansen and M. Singh. "High-Throughput Looping in Stream Processors Using Self-Timed Architectures." Poster and abstract at the Workshop on Edge Computing Using New Commodity Architectures (EDGE), Chapel Hill, NC, May 2006.
- J. Hensley, T. Scheuermann, M. Singh, and A. Lastra. "Fast Summed-Area Table Generation for Glossy Environmental Reflections," Sketch presented at SIGGRAPH 2005, Los Angeles, CA, August 2005.

PROFESSIONAL ACTIVITIES

CONFERENCE ACTIVITIES

- ➢ Program Committee Co-Chair, *13th International Symposium on Asynchronous Circuits and Systems (ASYNC-07),* Berkeley, CA, March 2007.
- ➢ Publicity Co-Chair, *12th International Symposium on Asynchronous Circuits and Systems (ASYNC-06),* Grenoble, France, March 2006.
- ➢ Program Committee Co-Chair, *2nd International Workshop on Formal Methods for Globally Asynchronous Locally Synchronous Design (FMGALS-05),* Verona, Italy, July 2005.
- ➢ Local Arrangements Co-Chair, *11th International Symposium on Asynchronous Circuits and Systems (ASYNC-05),* New York, NY, March 2005.
- ➢ Publicity Chair, *11th International Symposium on Asynchronous Circuits and Systems (ASYNC-05),* New York, NY, March 2005.
- ➢ Invited Speakers Chair, ASYNC 2003 *9th International Symposium on Asynchronous Circuits and Systems (ASYNC-03),* Vancouver, Canada, May 2003.

TECHNICAL PROGRAM COMMITTEES

13th IEEE International Symposium on Asynchronous Circuits and Systems (ASYNC), 2007
ACM/IEEE Design, Automation and Test in Europe (DATE), 2007
ACM/IEEE International Workshop on Timing Issues in the Specification and Synthesis of Digital Systems (TAU), 2007
IEEE International Conference on Computer Design (ICCD), 2006
12th IEEE International Symposium on Asynchronous Circuits and Systems (ASYNC), 2006
ACM/IEEE Design, Automation and Test in Europe (DATE), 2006
ACM/IEEE International Workshop on Timing Issues in the Specification and Synthesis of Digital Systems (TAU), 2006
IEEE International Conference on Computer Design (ICCD), 2005
2nd Workshop on Formal Methods for Globally Asynchronous Locally Synchronous Architectures (FMGALS), 2005
11th IEEE International Symposium on Asynchronous Circuits and Systems (ASYNC), 2005
ACM/IEEE Design, Automation and Test in Europe (DATE), 2005
ACM/IEEE International Workshop on Timing Issues in the Specification and Synthesis of Digital Systems (TAU), 2005
10th IEEE International Symposium on Asynchronous Circuits and Systems (ASYNC), 2004
ACM/IEEE International Workshop on Timing Issues in the Specification and Synthesis of Digital Systems (TAU), 2004
1st Workshop on Formal Methods for Globally Asynchronous Locally Synchronous Architectures (FMGALS), 2003
9th IEEE International Symposium on Asynchronous Circuits and Systems (ASYNC), 2003

OTHER CONFERENCE ACTIVITIES

Session Chair, Keynote Session, 9th IEEE International Symposium on Asynchronous Circuits and Systems (ASYNC), 2003
Session Chair, "Design and Test," 10th IEEE International Symposium on Asynchronous Circuits and Systems (ASYNC), 2004

GOVERNMENT REVIEW PANELS
(Dates and program names not provided to ensure confidentiality.)

NSF proposal review panel, 2004
NSF proposal review panel, 2005

JOURNAL AND CONFERENCE REFEREEING

IEEE Transactions on Circuits and Systems (TCAS)
IEEE Transactions on Computers (TC)
IEEE Transactions on VLSI (TVLSI)
IEEE International Symposium on Asynchronous Circuits and Systems (ASYNC)
Design Automation Conference (DAC)
European Solid-State Circuits Conference (ESSCIRC)
IEEE Computer Society Annual Symposium on VLSI (ISVLSI)
IEEE/ACM International Workshop on Logic and Synthesis (IWLS)
Conference on Advanced Research in VLSI (ARVLSI)
International Conference on Computer Design (ICCD)
IEEE Proceedings
Microprocessors and Microelectronics Journal (M&M)

PROFESSIONAL SOCIETY MEMBERSHIPS

IEEE Computer Society
ACM SIGDA (Design Automation)

INVITED TALKS

Duke University, Durham, NC: "Design of Asynchronous Pipelined Systems," February 2007. Host: Prof. Krish Chakrabarty.
Achronix Semiconductor/Cornell University: "Design of Asynchronous Pipelined Systems," January 2007. Host: Prof. Rajit Manohar.
Univ. of British Columbia, Vancouver, Canada: "Design of Asynchronous Pipelined Systems," January 2007. Host: Prof. Mark Greenstreet.
IBM T. J. Watson Research Center, Yorktown Heights, NY: "Design of Asynchronous Pipelined Systems," December 2006. Host: Dr. Jose Tierno.
Columbia University, New York, NY: "Design of Asynchronous Pipelined Systems," December 2006. Host: Prof. Steven Nowick.
Univ. of Utah, Salt Lake City, Utah: "Design of Asynchronous Pipelined Systems," November 2006. Hosts: Prof. Al Davis and Prof. Erik Brunvand.
Univ. of Southern California, Los Angeles, CA: "Design of Asynchronous Pipelined Systems," November 2006. Host: Prof. Peter Beerel.
Univ. of California, Berkeley, CA: "Design of Asynchronous Pipelined Systems," November

2006. Hosts: Dr. Marly Roncken and Dr. Ivan Sutherland.
Sun Microsystems Laboratories, Mountain View, CA: "Design of Asynchronous Pipelined Systems," November 2006. Host: Dr. Jo Ebergen.
IBM T. J. Watson Research Center, Yorktown Heights, NY: "Grappling with Latency in the Nanoscale Era," October 29, 2004. Host: Dr. Jose Tierno.
Columbia University, New York, NY: "Challenges in Hardware Design in the Nanoscale Era," Mar 22, 2004. Host: Prof. Steven M. Nowick.
DARPA Clockless Logic Workshop, San Jose, CA: "High-Level Synthesis of Asynchronous and Mixed-Timing Digital Systems," September 2003. Host: Dr. Robert Reuss.

TECHNOLOGY TRANSFER

Boeing and Handshake Solutions (a Philips spin-off): *Development of a high-speed pipeline synthesis flow* (2005-present).

> I was invited in 2005 to join the DARPA CLASS program, a major ($14M) initiative in asynchronous design, to transfer another of my pipeline styles (the "MOUSETRAP" style) for potential commercial use. In particular, I am leading the effort to combine the high performance of my pipeline circuits with the industrial-strength asynchronous CAD flow called Haste, developed by Handshake Solutions (a Philips spin-off). We have successfully created an experimental automated pipeline synthesis flow for high-performance system implementation. My pipeline circuits were chosen for this project because of their uniqueness in offering high performance yet ease-of-construction. Upon successful completion and commercialization, this project has the potential to impact a large number of microelectronic companies by making asynchronous design technology available for large-scale industrial use.

TEACHING AND SERVICE

DEPARTMENT COMMITTEES

Graduate Admissions Committee (2002-2007)
Ad-Hoc Qualifying Exam Restructuring Committee (Spring 2003)

PH.D. STUDENTS GRADUATED

Justin Hensley (Fall 2003-Fall 2006), joint with Prof. Anselmo Lastra: Graduated with Ph.D. degree; employed by AMD/ATI. Ph.D. Thesis: *Improving the Rendering Quality of Graphics Hardware.*

M.S. STUDENTS GRADUATED

Manoj Ampalam (Fall 2005-Spring 2006): Graduated with M.S. degree; employed by Microsoft Research. M.S. Thesis: *Counterflow Pipelining for Preemption in Asynchronous Systems.*
Ankur Agiwal (Fall 2004-Fall 2005): Graduated with M.S. degree; employed by Microsoft Research.

CURRENT PH.D. STUDENTS

Gennette Gill (Fall 2003-present). Research topic: Design, optimization and testing of large-scale asynchronous systems.
John Hansen (Fall 2005-present). Research topic: Silicon compilers for high-performance asynchronous design.
Vishal Gupta (Fall 2006-present). Research topic: Optimization and formal verification of counter-flow pipelines with anti-tokens.

PH.D. PROPOSAL COMMITTEES (external)

Lara Oliver, Ph.D. proposal committee, Duke University, December 2006.
Sudarshan Bahukudumbi, Ph.D. proposal committee, Duke University, March 2007.

OTHER MENTORING ACTIVITIES

ACM programming team coach (joint with Prof. Kevin Jeffay): Fall 2003.
Faculty advisor to Bhangra Elite, a campus South-Asian nationally-competitive dance team: Fall 2004-present.
Faculty advisor to Tamasha, a campus South-Asian cultural and outreach organization: Fall 2005-present.

Montek Singh

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

Our research was a critical component of a major US government-sponsored initiative (sponsored by DARPA, led by Boeing) to push asynchronous circuit and system design into the mainstream. We collaborated with Handshake Solutions (a subsidiary of Philips Semiconductors of the Netherlands) to migrate our circuit and system design methods into a prototype industrial-strength computer-aided design flow for the development of high-speed asynchronous chip implementations.

FRANK DONELSON SMITH, JR. (DON)

Department of Computer Science
University of North Carolina at Chapel Hill
Chapel Hill, NC 27599-3175

(919) 962-1884
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EDUCATION

Ph.D. 1978, University of North Carolina at Chapel Hill, Computer Science
M.S. 1964, University of Tennessee at Knoxville, Industrial Management
B.S. 1962, University of Tennessee at Knoxville, Chemistry

ACADEMIC EXPERIENCE

University of North Carolina at Chapel Hill, Department of Computer Science
   Research Professor, March 1997 - present
   Adjunct Associate Professor, Jan. 1993 - Feb. 1997 (part-time)
   Visiting Associate Professor, Jan. 1991 - Dec. 1992 (on assignment from IBM)
   Adjunct Associate Professor, July 1989 - Dec. 1990 (on assignment from IBM)

Carnegie Mellon University, Pittsburgh, PA
   Assistant Director, Information Technology Center:
      Andrew Project, 1983-1986 (on assignment from IBM)

INDUSTRIAL EXPERIENCE

IBM Corporation
   Senior Technical Staff Member, 1992-1997
   Manager, Experimental Systems, 1987-1989
   Manager, Architecture Technology, 1979-1982
   Advisory Engineer, 1972-1979
   Staff Engineer, 1969-1972
   Systems Engineer, 1965-1968

Union Carbide Corporation, Oak Ridge, TN
   Scientific Programmer, 1963-1965

PUBLICATIONS

L. Zhang, Z. Zhu, K. Jeffay, J. S. Marron, and F. D. Smith, "Multi-Resolution Anomaly Detection for the Internet", *IEEE Workshop on Automated Network Management*, April 2008.

L. Le, J, Aikat, K. Jeffay, and F.D. Smith, "The Effects of Active Queue Management and Explicit Congestion Notification on Web Performance", *IEEE/ACM Transactions on Networking*, Vol 15, No. 6, December 2007, pp 1217-1230.

S. Rewaskar, J. Kaur, and F.D. Smith, "A Performance Study of Loss Detection/Recovery in Real-world TCP Implementations", *Proceedings of IEEE ICNP 2007*, October 2007, pp. 256-265.

F. Hernández-Campos, K. Jeffay, F. D. Smith, "Modeling and Generating TCP Application Workloads" (invited paper) *Proceedings of IEEE Broadnets 2007*, September 2007.

M.C. Weigle, K. Jeffay, and F.D. Smith, "Quantifying the Effects of Recent Protocol Improvements to TCP: Impact on Web Performance", *Computer Communications*, Vol 29, No 15, September 2006, pp. 2853-2866.

S. Rewaskar, J. Kaur, and F.D. Smith, "A passive state-machine approach for accurate analysis of TCP out-of-sequence segments", *ACM SIGCOMM Computer Communication Review*, Vol. 36, No. 3, July 2006, pp. 51-64.

M. C. Weigle, P. Adurthi, F. Hernández-Campos, K. Jeffay, F. D. Smith, "Tmix: a tool for generating realistic TCP application workloads in ns-2", *ACM SIGCOMM Computer Communication Review*, Vol. 36, No. 3, July 2006, pp. 65-76.

L. Le, K. Jeffay, and F.D. Smith, "A Loss and Queuing-Delay Controller for Router Buffer Management", *Proceedings of IEEE ICDCS 2006*, July 2006.

F. Hernández-Campos, A. B. Nobel, F. D. Smith, and K. Jeffay, "Understanding Patterns of TCP Connection Usage with Statistical Clustering", *Proceedings of MASCOTS 2005*, October 2005, pp. 35-44.

C. Park, F. Hernández-Campos, J. S. Marron, and F.D. Smith, "Long-Range Dependence in a Changing Internet Traffic Mix," *Computer Networks*, Vol. 48, No. 3, June 2005, pp. 401-422.

M. C. Weigle, K. Jeffay, and F.D. Smith, "Delay-Based Early Congestion Detection and Adaptation: Impact on Web Performance," *Computer Communications*, Vol. 28, No. 8, May 2005, pp. 837-850.

F. Hernández-Campos, J. S. Marron, G. Samorodnitsky and F. D. Smith, "Variable Heavy-Tails in Internet Traffic', *Performance Evaluation*, vol. 58, no.2-3, November 2004, pp. 261-284.

L. Le, J, Aikat, K. Jeffay, and F.D. Smith, "Differential Congestion Notification: Taming the Elephants," *Proceedings of IEEE ICNP*, October 2004, pp. 118-128.

J. Cao, W.S. Cleveland, Y. Gao, K. Jeffay, F.D. Smith, and M.C. Weigle, "Stochastic Models for Generating Synthetic HTTP Source Traffic," *Proceedings of INFOCOM 2004*, pp. 1546-1557

A. Budhiraja, F. Hernández-Campos, V.G. Kulkarni, and F. D. Smith, " Stochastic Differential Equation for TCP Window Size: Analysis and Experimental Validation", *Probability in the Engineering and Informational Sciences*, vol. 18, no. 1, January 2004, pp. 111-140.

J. S. Marron, F. Hernandez-Campos, and F.D. Smith, "A SiZer Analysis of IP Flow Start Times", in Institute of Mathematical Statistics Lecture Notes-Monograph Series, Volume 44, J. Rojo and V. Perez-Abreu (Eds), 2004, pp. 87-105.

Jan Hannig, J.S. Marron, Gennady Samorodnitsky and F.D. Smith, "Log-Normal Durations Can Give Long Range Dependence", in Institute of Mathematical Statistics Lecture Notes-Monograph Series, Volume 42, M. Moore, S. Froda and C. L´eger, (Eds), 2004, pp. 333-345.

J. Aikat, J. Kaur, F. D. Smith, and K.Jeffay, "Variability in TCP Round-trip Times," in *Proceedings of the ACM SIGCOMM Internet Measurement Conference*, Miami, FL, October 2003, pp. 279-284.

F. Hernández-Campos, Kevin Jeffay and F. D. Smith, "Tracking the Evolution of Web Traffic: 1995-2003", *Proceedings of ACM/IEEE MASCOTS 2003*, October 2003, pp 16-25.

M.C. Weigle, K. Jeffay, and F.D. Smith, "Quantifying the Effects of Recent Protocol Improvements to Standards-Track TCP", *Proceedings of ACM/IEEE MASCOTS 2003*, October 2003, pp 226-229.

L. Le, J, Aikat, K. Jeffay, and F.D. Smith, "The Effects of Active Queue Management on Web Performance", *Proceedings of ACM SIGCOMM 2003*, August 2003, pp. 265-276.

UNITED STATES PATENT

F. Hernández-Campos, K. Jeffay, F.D. Smith, A. Nobel, "Methods, Systems, and Computer Program Products for Modeling and Simulating Application-Level Traffic Characteristics in a Network Based on Transport and Network Layer Header Information", USPTO Notice of Allowance, June 30, 2008.

EXTERNAL RESEARCH FUNDING

F. D. Smith, IBM Faculty Award, October 2007, $15,000.

Collaborative Research: CRI:CRD Synthetic Traffic Generation Tools and Resources: A Community Resource for Experimental Networking Research K. Jeffay, F.D. Smith, M.C. Weigle, A. Vahdat, P. Barford, National Science Foundation, Award 0709081, August 2007, 3 years, $799,923 (UNC-$473,580, ODU-$201,974, UCSD-$65,800, U. Wisc.-$58,569)

F. D. Smith, IBM Faculty Award, October 2006, $30,000.

Generation and Validation of Synthetic Internet Traffic, K. Jeffay, A. Nobel, F.D. Smith, National Science Foundation, Award ANI-0323648, September 2003, 4 years, $470,000.

RI: Tera-pixels: Using High-resolution Pervasive Displays to Transform Collaboration and Teaching, K. Jeffay, A. Lastra, K. Mayer-Patel, L. McMillan, and F.D. Smith, National Science Foundation, Award EIA-0303590, September 2003,5 years, $962,902.

Don Smith

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

I developed a new course in Operating Systems Implementation in 2006-2007. This is an advanced course for graduate students who have completed at least one course in operating systems at the graduate level.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

Software for TCP workload generation in network experiments (called Tmix) has been adopted by the Transport Modeling Research Group (TMRG) of the Internet Research Task Force (IRTF). It will be used as part of a standard evaluation suite for TCP protocols. The software has been distributed to several outside research groups developing and using the TCP evaluation suite. This research also resulted in a US Patent covering the underlying technology (see CV for title).

John B. Smith

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919-967-2001 (home)
jbs@cs.unc.edu

Education
- B.A. The University of the South (Sewanee), Mathematics, 1962.
- M.A. The University of South Carolina, English, 1964.
- Ph.D. The University of North Carolina, English, 1970.

Professional Employment

The University of North Carolina
- 1995 - present Professor of Computer Science
- 1984 - 1995 Associate Professor of Computer Science

The Pennsylvania State University
- 1974 - 1983 Associate Professor of English
- 1970 - 1974 Assistant Professor of English
- 1970 - 1977 Research Consultant, Computation Center

Consulting
Amherst College, Arizona State University, Brown University, Bucknell University, Center for Creative Leadership, Citicorp, City University of New York, Columbia University, Data General, Duke University, Getty Trust, Glaxo, IBM, MCNC, Monsanto, Newberry Library, North Carolina State University, Princeton University, Research Triangle Institute, Rutgers University, SAS, University of Chicago, University of Pennsylvania, U.S. General Accounting Office.

On-Line Materials
- *Java- and WWW-Related Tutorials and Summary Discussions:* ~80 lessons.
- *A Strategic Method for Writing.*

Current Research Interests
- J2EE Architecture, Design, and Implementation: simplifying design and development of J2EE systems through more basic layered architecture and automatic generation of code.

- Object-Oriented Content: exploring dividing documents and other content into small components, storing them in a database, and providing tools for their reuse and extension to produce new documents.
- Multi-Node Enterprise Systems: exploring multiple configurations and their effects on performance for different types of J2EE applications.

Grants/Contracts/Awards
- IBM Corporation: Faculty Award, *Eclipse as a Context and Tool for Learning J2EE Architecture and Building Layered Applications*, 2005, $35,000.
- IBM Corporation: Shared University Equipment Grant, *Enterprise Computing: Teaching and Research*, 2005, $40,000.

Professional Memberships
- Association for Computing Machinery
- Computer Society of the IEEE
- Sigma Xi

Professional Activities
- Reviewer, National Science Foundation, 1986-present.

Graduate Committees

Ph.D.
- John Menges, *Concur: Supporting Low Latency in Centralized Synchronous Distributed Collaborative Systems through Role Migration* , current (member).

Service

University
- University Faculty Council (2001 - 2004)
- Faculty Information Technology Advisory Committee (2001 - 2005)

Department
- Building Committee (1998 - present)
- Grievance Committee, chair (1986-present)

Community
- Board of Directors, Orange Water and Sewer Authority: 1999 - 2004.
- Orange County Information Technology Advisory Committee: 1998 - 2005.

John Smith

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

I have developed a two-course sequence of undergraduate courses in Web-based systems, entitled Advanced WWW Programming (426) and Enterprise Systems (536). During the past five years, I have updated their content regularly and have this year obtained approval for permanent listing for 536.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

Research on radically simplifying the design and development of J2EE systems has been presented to several IBM internal meetings and symposia.

Jack Scott Snoeyink

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University of North Carolina at Chapel Hill   fax: +1 (919) 962–1799
CB 3175 Brooks Building   snoeyink@cs.unc.edu
Chapel Hill, NC 27599–3175 USA   Citizenship: USA
`http://www.cs.unc.edu/~snoeyink`

Education:

9/85–9/90	STANFORD UNIVERSITY, Stanford, CA, USA
	Ph.D., Computer Science
	Advisor: Leonidas J. Guibas
	Thesis: Topological approaches in computational geometry.
9/81–6/85	CALVIN COLLEGE, Grand Rapids, MI, USA
	B.S., Mathematics
	B.S., Computer Science
	Honors Thesis: A theoretical and practical analysis of three algorithms for linear programming.

Academic Experience:

since 7/99	Professor, UNIV. NORTH CAROLINA AT CHAPEL HILL, USA
3/07–6/07	Visiting professor, ETH ZURICH, Switzerland
1/07–2/07	Visiting faculty, NAT'L UNIV SINGAPORE, Singapore
8/06–12/06	Visiting researcher, BIOCHEMISTRY, UNIV. WASHINGTON, Seattle, USA
7/96–2/00	Associate professor with tenure, UNIV. BRITISH COLUMBIA, Vancouver, Canada
10/97–6/98	Visiting researcher, INRIA SOPHIA-ANTIPOLIS, France
7/97–12/97	Visiting associate professor, THE JOHNS HOPKINS UNIVERSITY, Baltimore, USA
8/91–6/96	Assistant professor, UNIVERSITY OF BRITISH COLUMBIA, Vancouver, Canada
9/90–7/91	Postdoctoral researcher, UTRECHT UNIVERSITY, Utrecht, the Netherlands

Fellowships and Awards:

For research:
> Reynolds Competitive Fellowship, 2006.
> Killam Research Prize at UBC, 1998.
> Charles A. McDowell Award for Excellence in Research at UBC, 1997.
> Killam Faculty Research Fellowship, 1997–98.
> IBM Research Professorship in Computer Science, since 1996.
> Fellow, BC Advanced Systems Institute, 1993–1996.
> Research Fellowship, Max-Planck-Institut for Computer Science, April 1993.
> Rinke Award in Mathematics, Calvin College, 1985.
> 'Outstanding' Paper, COMAP Applied Mathematics Contest, 1985.

For teaching:
> Excellence in Teaching, UNC CS Student Association, 2006.
> Incredible Instructor, UBC CS Dept: Award 1995, 1994; Honorable mention 1999, 1993.

For service:

Inaugural ASI Faculty Award, BC Advanced Systems Institute, October 1996. ("For outstanding service ... fostering University/Industry collaborations")

Of students:

Timothy Chan: 1997 NSERC Doctoral Prize; (four awarded Canada-wide in sci/eng).
Timothy Chan: 1996 UBC Governor General's gold medal for PhD thesis.

Research

Geometric computation plays an increasingly important role in information systems, simulation, and graphics; I focus on practical applications in Molecular Biology and Geographic Information Systems (GIS). I also investigate theoretical questions about the intrinsic complexity of geometric computation. I am especially interested in problems in which explicit representations or approximations of geometric structures are important.

Group at UNC:

PhD students: Shawn Brown, David Millman, Catalin Constantin, Chris Sheldahl, Matt O'Meara
MSc students: Vishal Verma, Georgi Tsankov
Funding from NSF, NIH, Darpa.

Publication Summary:

1. Refereed a) Journals, b) Conf. Proc., c) Video/Interactive
2. Non-refereed a) Journals, b) Conf. Proc., c) Posters/Interactive
3. Books a) Authored, b) Edited, c) Chapters
4. Artistic Works

Category	1a	1b	1c	2a	2b	2c	3a	3b	3c	4
Career Total	78	86	9	1	41	14		1	4	1
Last 5 Year Total	23	22	2	0	12	7		0	0	0

1a. Refereed Journals

1. Arkin, E. M., Mitchell, J. S. B., and Snoeyink, J. Capturing crossings: Convex hulls of segment and plane intersections. *Information Processing Letters*, 2008. Accepted. Full version of CCCG'07 paper.

2. Wang, X. and Snoeyink, J. Defining and computing optimum RMSD for gapped and weighted multiple structure alignment. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, 2008. Accepted to special issue from WABI'07.

3. Reinbacher, I., Benkert, M., van Kreveld, M., Mitchell, J. S., Snoeyink, J., and Wolff, A. Delineating boundaries for imprecise regions. *Algorithmica*, 50(3):386–414, 2008. doi: 10.1007/s00453-00709042-5.

4. Liu, Y. and Snoeyink, J. Faraway point: a sentinel point for delaunay computation. *International Journal of Computational Geometry & Applications*, 18(4):343–355, 2008. Full version of paper from 2nd Voronoi conference.

5. Razen, A., Snoeyink, J., and Welzl, E. Number of crossing-free geometric graphs vs. triangulations. *Electronic Notes in Discrete Mathematics*, 31:195–200, 2008.

6. Wang, X., Kapral, G., Murray, L., Richardson, D., Richardson, J., and Snoeyink, J. Rnabc: forward kinematics to reduce all-atom steric clashes in rna backbone. *J Math Biology*, 56:253–278, 2008. doi: 10.1007/s00285-007-0082-x.

7. Bandyopadhyay, D. and Snoeyink, J. Almost-Delaunay simplices: Nearest neighbor relations for imprecise 3D points using CGAL. *Computational Geometry: Theory and Applications*, 38(1-2):4–15, 2007.

8. Leaver-Fay, A., Liu, Y., and Snoeyink, J. Faster placement of hydrogens in protein structures by dynamic programming. *ACM Journal of Experimental Algorithms*, 12, 2007. Expanded for special issue from papers in ALENEX'04.

9. Leaver-Fay, A., Butterfoss, G., Snoeyink, J., and Kuhlmann, B. Maintaining solvent accessible surface area under rotamer substitution for protein design. *J Comput Chem*, pages 1336–1341, Feb. 2007.

10. Snoeyink, J. Maximum independent set for intervals by divide and conquer with pruning. *Networks*, pages 158–159, 2007. Preliminary version in *CCCG*, 2005.

11. Davis, I. W., Leaver-Fay, A., Chen, V. B., Block, J. N., Kapral, G. J., Wang, X., Murray, L. W., Arendall III, W. B., Snoeyink, J., Richardson, J. S., and Richardson, D. C. MolProbity: all-atom contacts and structure validation for proteins and nucleic acids. *Nucleic Acids Research*, 35:W375–W383, 2007. Web server issue. doi:10.1093/nar/gkm216.

12. Carr, H., Möller, T., and Snoeyink, J. Artifacts caused by simplicial subdivision. *IEEE Transactions on Visualization and Computer Graphics*, 12(2):231–242, 2006.

13. Boissonnat, J.-D. and Snoeyink, J. Editorial. *Computational Geometry: Theory and Applications*, 35(1-2):1, 2006. CGTA special issue of papers invited from ACM SoCG 2004.

14. Boissonnat, J.-D. and Snoeyink, J. Guest editors' forward. *Discrete & Computational Geometry*, 36(4):501–502, 2006. DGC special issue of papers invited from ACM SoCG 2004.

15. Isenburg, M., Liu, Y., Shewchuk, J., and Snoeyink, J. Streaming computation of delaunay triangulations. *ACM Trans. Graph.*, 25(3):1049–1056, 2006. (Proc. SIGGRAPH'06).

16. Bandyopadhyay, D., Huan, J., Liu, J., Prins, J., Snoeyink, J., Wang, W., and Tropsha, A. Structure-based function inference using protein family-specific fingerprints. *Protein Science*, 15:1–7, 2006.

17. Huan, J., Bandyopadhyay, D., Wang, W., Snoeyink, J., Prins, J., and Tropsha, A. Comparing graph representations of protein structure for mining family-specific residue-based packing motifs. *Journal of Computational Biology*, 12(6):657–671, 2005.

18. Liu, Y. and Snoeyink, J. A comparison of five implementations of 3d delaunay tessellation. In Goodman, J. E., Pach, J., and Welzl, E., editors, *Combinatorial and Computational Geometry*, volume 52 of *MSRI Publications*, pages 435–453. Cambridge, 2005.

19. Isenburg, M., Lindstrom, P., and Snoeyink, J. Lossless compression of predicted floating-point geometry. *CAD*, 37(8):869–877, July 2005.

20. Snoeyink, J., Suri, S., and Varghese, G. A lower bound for multicast key distribution. *Computer Networks*, 47(3):429–441, 2005.

21. Chen, D., Daescu, O., Hershberger, J., Kogge, P., Mi, N., and Snoeyink, J. Polygonal path simplification with angle constraints. *Computational Geometry: Theory and Applications*, 32(3):173–187, 2005.

22. Ahn, H.-K., Cheng, S.-W., Cheong, O., and Snoeyink, J. The reflex-free hull. *International Journal of Computational Geometry & Applications*, 14(6):453–474, 2004. Preliminary version in *CCCG*, 2001.

23. Cabello, S., Liu, Y., Mantler, A., and Snoeyink, J. Testing homotopy for paths in the plane. *Discrete & Computational Geometry*, 31:61–81, 2004.

1b. Formally-Reviewed Conference Proceedings

1. Löffler, M. and Snoeyink, J. Delaunay triangulations of imprecise points in linear time after preprocessing. In *Proceedings of the Twenty-fourth Annual ACM Symposium on Computational Geometry*, pages 298–304, 2008. Invited to special issue of Discrete & Computational Geometry.

2. Leaver-Fay, A., Snoeyink, J., and Kuhlman, B. On-the-fly rotamer pair energy evaluation in protein design. In *Proc. 4th Int'l. Symp. Bioinf. Research & App. (ISBRA)*, volume 4983 of *Lecture Notes in Computer Science*, pages 343–354. Springer-Verlag, 2008.

3. Wang, X. and Snoeyink, J. Defining and computing optimum RMSD for gapped multiple structure alignment. In *Wkshp Algorithms in Bioinf (WABI)*, number 4645 in LNBI, pages 196–207. Springer-Verlag, 2007.

4. Wang, X., Huan, J., Snoeyink, J., and Wang, W. Mining rna tertiary motifs with structure graphs. In *Stat and Sci DB Manag. (SSDBM)*, page 31, 2007.

5. Liu, Y. and Snoeyink, J. Quadratic and cubic B-splines by generalizing higher-order Voronoi diagrams. In *Proc. 23rd Annual Symposium on Computational Geometry*, pages 150–157. ACM Press, 2007.

6. Huan, J., Bandyopadhyay, D., Snoeyink, J., Prins, J., Tropsha, A., and Wang, W. Distance-based identification of spatial motifs in proteins using constrained frequent subgraph mining. In *IEEE Comp. Systems Bioinformatics*, pages 227–238, Aug. 2006.

7. Isenburg, M. and Snoeyink, J. Early-split coding of triangle mesh connectivity. In *Proc. Graphics Interface*, pages 89–97, Quebec, Canada, 2006.

8. Xie, Y., Snoeyink, J., and Xu, J. Efficient algorithm for approximating maximum inscribed sphere in high dimensional polytope. In *Proceedings of the Twenty-second Annual ACM Symposium on Computational Geometry*, pages 21–29, 2006.

9. Isenburg, M., Liu, Y., Shewchuk, J., Snoeyink, J., and Thirion, T. Generating raster DEM from mass points via TIN streaming. In *Proc. GIScience*, number 4197 in Lecture Notes in Computer Science, pages 186–198. Springer-Verlag, 2006.

10. Wang, X. and Snoeyink, J. Multiple structure alignment by optimal rmsd implies that the average structure is a consensus. In *IEEE Comp. Systems Bioinformatics*, pages 79–87, Aug. 2006.

11. Liu, Y. and Snoeyink, J. Sphere-based computation of delaunay diagrams on points from 4d grids. In *3nd Intl Symp on Voronoi Diagrams in Sci and Eng*, pages 60–65, Banff, Alberta, Canada, 2006.

12. Healey, C. and Snoeyink, J. VisTRE: A visualization tool to evaluate errors in terrain representation. In *Proc. 3D Data Processing, Visualization, and Transmission (3DPVT)*, pages 1056–1063, 2006.

13. Leaver-Fay, A., Kuhlman, B., and Snoeyink, J. An adaptive dynamic programming algorithm for the side chain placement problem. In *et al.*, R. B. A., editor, *Pacific Symposium on Biocomputing*, pages 16–27. World Scientific, 2005.

14. Liu, Y. and Snoeyink, J. The "far away point" for Delaunay diagram computation in E^d. In *2nd Intl Symp on Voronoi Diagrams in Sci and Eng*, pages 236–243, Hanyang University, Seoul, Korea, 2005.

15. Liu, Y. and Snoeyink, J. Flooding triangulated terrain. In Fisher, P., editor, *Developments in Spatial Data Handling: 11th Int'l Symp Spatial Data Handling*, pages 137–148. Springer-Verlag, 2005.

16. Leaver-Fay, A., Kuhlman, B., and Snoeyink, J. Rotamer-pair energy calculations using a trie data structure. In *Proc. 5th Workshop Algo. Bioinf. (WABI)*, volume 3692 of *Lecture Notes in Computer Science*, pages 389–400, Mallorca, Spain, 2005. Springer-Verlag.

17. Liu, Y. and Snoeyink, J. TESS3: a program to compute 3D Delaunay tessellations for well-distributed points. In *2nd Intl Symp on Voronoi Diagrams in Sci and Eng*, pages 225–234, Hanyang University, Seoul, Korea, 2005.

18. Bandyopadhyay, D. and Snoeyink, J. Almost-Delaunay simplices: Nearest neighbor relations for imprecise points. In *ACM-SIAM Symp on Discrete Algorithms*, pages 403–412, 2004.

19. Isenburg, M., Mascarenhas, A., Pascucci, V., and Snoeyink, J. Encoding volumetric grids for streaming isosurface extraction. In *Proc. 3D Data Processing, Visualization, and Transmission (3DPVT)*, pages 665–672, 2004.

20. Leaver-Fay, A., Liu, Y., and Snoeyink, J. Faster placement of hydrogens in protein structures by dynamic programming. In *Proc. 6th Wkshp Algorithm Eng and Exper*, pages 39–48. SIAM, 2004.

21. Huan, J., Wang, W., Bandyopadhyay, D., Snoeyink, J., Prins, J., and Tropsha, A. Mining protein-family-specific residue packing patterns from protein structure graphs. In *RECOMB'04*, pages 308–315, 2004.

22. Noonan, K., O'Brien, D., and Snoeyink, J. Probik: Protein backbone motion by inverse kinematics. In *WAFR*, 2004.

1c. Formally-Reviewed Videos and Interactive Presentations

1. Isenburg, M., Liu, Y. L., Shewchuk, J., and Snoeyink, J. Illustrating the streaming construction of 2d Delaunay triangulations. In *Proceedings of the Twenty-second Annual ACM Symposium on Computational Geometry*, pages 481–482, 2006. Video Review of Computational Geometry.

2. Mascarenhas, A. and Snoeyink, J. Implementing time-varying contour trees. In *Proceedings of the Twenty-first Annual ACM Symposium on Computational Geometry*, pages 370–371, 2005. Video Review of Computational Geometry.

2b. Non-refereed Conference Proceedings

1. Nussinov, R., Ju, T., Bhat, T., Snoeyink, J., and Ramani, K. Bio-geometry: challenges, approaches, and future opportunities in proteomics and drug discovery. In *Symposium on Solid and Physical Modeling*, pages 417–418, 2008. abstract of invited panel.

2. Millman, D. and Snoeyink, J. Degree-driven algorithm design for computing the Voronoi diagram. In *18th Fall Workshop Comp. Geom.*, 2008.

3. Biedl, T., Durocher, S., and Snoeyink, J. Reconstructing polygons from scanner data. In *18th Fall Workshop Comp. Geom.*, 2008.

4. Arkin, E. M., Mitchell, J. S. B., and Snoeyink, J. Capturing crossings: Convex hulls of segment and plane intersections. In *Canadian Conf Comp Geom (CCCG)*, pages 9–11, 2007.

5. Anuradha, V., Jain, C., Snoeyink, J., and Szabo, T. How long can a graph be kept planar? In *17th Fall Wkshp Comput. and Combin. Geometry*, 2007.

6. Basu, S. and Snoeyink, J. Terrain representation using right-triangulated irregular networks. In *Canadian Conf Comp Geom (CCCG)*, pages 133–136, 2007.

7. Snoeyink, J. and Streinu, I. Computing rigid components of pseudo-triangulation mechanisms in linear time. In *Proceedings of the Seventeenth Canadian Conference on Computational Geometry*, pages 223–226, University of Windsor, Ontario, Canada, 2005.

8. Snoeyink, J. Maximum independent set for intervals by divide-prune-and-conquer. In *Proceedings of the Seventeenth Canadian Conference on Computational Geometry*, pages 264–265, University of Windsor, Ontario, Canada, 2005.

9. Falls, C., Liu, Y., Snoeyink, J., and Souvaine, D. L. Testing shortcuts to maintain simplicity in subdivision simplification. In *Proceedings of the Seventeenth Canadian Conference on Computational Geometry*, pages 35–38, University of Windsor, Ontario, Canada, 2005.

10. Mantler, A. and Snoeyink, J. Banana spiders: A study of connectivity in 3d combinatorial rigidity. In *Proceedings of the Sixteenth Canadian Conference on Computational Geometry*, pages 44–47, 2004.

11. O'Brien, D. and Snoeyink, J. Computing four-body protein energy potentials with incremental 3d Delaunay triangulation in CGAL. In *2nd CGAL Users Workshop*, June 2004.

2c. Non-refereed Posters

1. Verma, V. and Snoeyink, J. Upending a sphere. In *17th Fall Wkshp Comput. and Combin. Geometry*, 2007. poster and abstract.

2. Kapral, G., Wang, X., Murray, L., Viada, A., Arendall, B., Richardson, D., Richardson, J., and Snoeyink, J. RNABC: Improving RNA backbone through forward kinematics. poster at RNA Society Annual Meeting, 2006.

3. Bandyopadhyay, D., Huan, J., Liu, J., Prins, J., Snoeyink, J., Tropsha, A., and Wang, W. Function inference using family-specific subgraph fingerprints mined from protein families. ISMB poster, 2005.

4. Huan, J., Bandyopadhyay, D., Liu, J., Prins, J., Snoeyink, J., Tropsha, A., and Wang, W. Rapid determination of local structural features common to a set of proteins. ISMB demo, 2005.

5. Bandyopadhyay, D., Huan, J., Snoeyink, J., and Wang, W. A fast subgraph search method using a local index for functional annotation of protein structures. ISMB/ECCB poster, 2004.

6. Bandyopadhyay, D., Huan, L., Wang, W., Snoeyink, J., Prins, J., and Tropsha, A. Graph representations and algorithms for protein family classification and functional annotation. In *ISMB 1st Structural Bioinf. 3D SIG*, July 2004. http://3dsig.weizmann.ac.il/usersfiles/3dsig/abstracts/2004/108.html.

7. Huan, J., Wang, W., Bandyopadhyay, D., Snoeyink, J., Prins, J., and Tropsha, A. Mining spatial motifs from protein graph databases. In *RECOMB'04 posters*, 2004.

Researchers Supervised

PhD students:

aug08–	M. O'Meara, Scoring and protein design
jan08–	C. Sheldahl, Knowledge-based potentials for hydrogen bonds
aug07–	C. Constantin, terrain compression
aug07–	D. Millman, Arithmetic precision as a resource in developing geometric algorithms

aug05–	S. Brown, Filtering and classifying large LIDAR data sets
aug04–may08	X. Wang, Asst. Prof, Northwest Nazareene University
	Thesis: Exploring RNA and Protein 3D structures By Geometric Algorithms
aug01–dec06	A. Leaver-Fay
	Thesis: Capturing Atomic Interactions with a Graphical Framework in Computational Protein Design
aug01–dec07	Y. Liu, technical staff, Geomagic, Inc.
	Thesis: Computations of Delaunay and higher order triangulations, with applications to splines
may00–dec05	A. Mascarenhas, postdoc, Lawrence Livermore Nat'l Lab
	Thesis: Computational Topology for Time-varying Volume Visualization
jun01–aug05	D. Bandyopadhyay, postdoc, J&J Pharmaceuticals
	Thesis: A Geom. Framework for Robust Nearest Neighbor Analysis of Protein Structure and Function
jan00–nov04	M. Isenburg, staff, Lawrence Livermore Nat'l Labs
	Thesis: Compression and Streaming of Polygon Meshes
jan00–may04	H. Carr (co-supervised, D. Kirkpatrick), lecturer, UC Dublin
	Thesis: Topological Manipulation of Isosurfaces

Service in Discipline since 2004

Review & Steer
committees:

NSERC Grant Committee Member for 331/333.: 2008–
Computational geometry steering committee (elected): 2000–2004.

Program
committees:

ACM SoCG'09, co-chair'04, New York: Symposium on Computational Geometry.
SMI '08,'07,'06,'05,'04: Shape Modeling International.
SPM '08,'07,'06,'05: ACM Solid and Physical Modeling Conference.
ISVC '08,'07,'06, Nevada: Int'l Symp. Visual Computing.
FWCG '07, NY: Fall workshop on Computational Geometry.
WAFR '06,'04: Workshop on Algorithmic Foundations of Robotics.
3DPVT '06, Chapel Hill, NC, USA.
IEEE Vis'05.
ISAAC '04, Hong Kong.

Wkshop/conf
organization:

Co-organizer, Rigidity, Flexibility, and Motion: Theory, Computation and
   Applications to Biomolecules, Banff '08
Chair, Video review 22nd ACM Symp Comp Geom, June 2006.
Conference co-chair, ACM Symp. on Computational Geometry, New York, June 2004.
Co-organizer, Special Session on Protein Geometry, AMS NE Section, April 2004.

Examining:

External Examiner: Burkay Genc, PhD in Computer Science, University of Waterloo,
   Jan 2008.
Rapporteur: Sebastien Loriot, PhD Mathematiques, Université de Bourgogne, Nov
   2008.

Rapporteur: Luca Castelli Aleardi, Docteur de l'Ecole Polytechnique, spécialité : informatique, Oct 2006

PhD examining committee (other than supervisor): UNC: Martin Styner, John Keyser, Yoni Friedman, Erin Parker, Shelby Funk, Swaha Das Miller, Miguel Otaduy, Gokul Varadhan, Brad Davis, Luke Huan, Qiong Han;

Current Committies:

Bioinforatics & Computational Biology (BCB) Curriculum

BBSP Admissions

Jack Snoeyink

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

1. I developed and maintain COMP 116: Introduction to Scientific Computing as a service course to non-major undergraduates. I teach this every other year, and grad students teach other sections using my materials and assistance. This course has been increasingly popular among the science students: in the fall, I taught a section with 90 and two graduate students taught sections of 30 each.

2. I developed a First Year Seminar entitled "Folding: from paper to proteins" which combines the art of origami and the science of protein folding. In fact, it is a stealth discrete and combinatorial geometry course, in which we consider graph drawing, rigidity of linkages, robot motion planning, and polyhedra, in addition to origami and protein structure and function.

3. On sabbatical in 06-07 I developed a course on Geometric Algorithms in Molecular Biology at the graduate level, and taught this course at ETH Zurich. (I was also scheduled to teach it at KAIST in Korea, but visa issues prevented that.) This draws on modules that I have lead for the BCB program.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

CURRICULUM VITAE

P. David Stotts, Jr.

EDUCATION

- **Ph.D.** Computer Science, Univ. of Virginia, August 1985. *Dissertation:* "A Hierarchical Graph Model of Concurrent Real-Time Software Systems." Advisor: Terrence W. Pratt.
- **M.S.** Computer Science, Univ. of Virginia, August 1981. *Thesis:* "A Formal Semantic Definition of Modula."
- **B.S.** *summa cum laude*, Mathematics and Physics, Univ. of Richmond, May 1979.

EXPERIENCE IN ACADEMICS

- *8/97 to present*, Associate Chair for Academic Affairs, Dept. of Computer Science, University of North Carolina, Chapel Hill.
- *8/92 to present*, Associate Professor, Dept. of Computer Science, University of North Carolina, Chapel Hill.
- *9/92 to present*, Research Associate, CESDIS, NASA Goddard SFC.
- *8/91 to 7/92*, Associate Professor, Computer and Information Sciences, University of Florida, Gainesville.
- *6/89 to 8/91*, Staff Scientist, CESDIS, NASA Goddard SFC (joint appointment as UMd faculty).
- *5/87 to 8/91*, Applied Mathematics adjunct faculty, University of Maryland, College Park.
- *9/86 to 8/91*, Research faculty, Inst. for Advanced Computer Studies, Univ. of Maryland, College Park.
- *8/85 to 8/91*, Assistant Professor, Computer Science Department, Univ. of Maryland, College Park.
- *9/84 to 5/85*, acting Assistant Professor, Computer Science Department, University of Virginia.

HONORS AND AWARDS

- Member, Phi Beta Kappa (University of Richmond, 1978).
- Member, Tau Beta Pi (University of Virginia, 1981).
- Best Paper Award, XP/Agile Universe Conference, Calgary, Aug 15-18, 2004.

BIBLIOGRAPHY

Refereed Books and Chapters

1. J. Mc. Smith and D. Stotts, "Elemental Design Patterns and Compositional Detection Methods for Object Oriented Source Code," *Design Pattern Formalization Techniques*, T. Taibi (ed.), IGI Publishing, 2007, pp. 123-155.
2. D. Stotts, "Perl," *The Internet Encyclopedia*, H. Bidgoli (ed.), John Wiley, vol. 3, pp. 34-50, 2004.

Refereed Articles

1. D. Stotts, K. Lee, and I. Rusyn, "Supporting Computational Systems Science: Genomic Analysis Tool Federations using Aspects and AOP," Proc. of the Intl. Symp. on Bioinformatics Research and Applications (ISBRA '08), Atlanta, GA, May 6-9, 2008; in Lecture Notes in Bioinformatics 4983, Mandoiu, Sunderraman and Zelikovsky (Eds.), Springer-Verlag, 2008, pp. 457-468.
2. D. Miller, K. Gyllstrom, J. Culp, and D. Stotts, "Semi-transparent Video Interfaces to Assist Deaf Persons in Meetings", ACMSE: 45th ACM Southeast Conference, Wiston-Salem, NC, March 23-24, 2007, pp. 501-506.
3. K. Gyllstrom, D. Miller, and D. Stotts, "Techniques for Improving the Visibility and `Sharability' of Semitransparent Video in Shared Workspaces", ACMSE: 45th ACM Southeast Conference, Wiston-Salem, NC, March 23-24, 2007, pp. 425-430.
4. D. Miller, K. Gyllstrom, J. Culp, and D. Stotts; "Facetop tablet: Note-taking assistance for deaf persons," Proc. of the 8th Int'l. ACM SIGACCESS Conference on Computers and Accessibility, Portland, OR, Oct. 2006, pp. 247-248 (refereed poster presentation).
5. K. Navoraphan, E. F. Gehringer, J. Culp, K. Gyllstrom, and D. Stotts; "Next-generation DPP with Sangam and Facetop," Proc. of the 2006 OOPSLA Workshop on Eclipse Technology eXchange, Portland, OR, Oct. 2006, pp. 6-10.
6. J. McC. Smith and D. Stotts, "SPQR: Formalized Design Pattern Detection and Software Architecture Analysis," Working IEEE/IFIP Conference on Software Architecture (WICSA), Pittsburgh, PA, Nov. 6-10, 2005.
7. D. Stotts, J. Smith, and K. Gyllstrom, "Support for Distributed Pair Programming in the Transparent Video Facetop," XP/Agile Universe 2004, Calgary, Aug 15-18, pp. 92-104. (25% acceptance rate); received Best Paper award.
8. D. Stotts, J. Smith, and K. Gyllstrom, "FaceSpace: Endo- and Exo-Spatial Hypermedia in the Transparent Video Facetop," ACM Hypertext 2004, Santa Cruz, Aug 15-18, pp. 48-57 (25% acceptance rate).

9. D. Stotts and R. Furuta, "Language-theoretical Classification of Hypermedia Paths," ACM Hypertext 2004, Santa Cruz, Aug 15-18, pp. 40-41. (25% acceptance rate).
10. D. Stotts, J. Smith, and Dennis Jen, "The Vis-a-Vid Transparent Video FaceTop" User Interface Software and Technology (UIST), Vancouver, Nov. 3-5, 2003, pp. 57-58. (paper and demo presentation).
11. Herington, D., and D. Stotts, "DeCo: A Declarative Coordination Framework for Scientific Model Federations," Automated Software Engineering 2003, Montreal, Oct. 6-10, 2003, pp. 60-69. (22 of 170 acceptance rate, 13%).
12. Smith, J., and D. Stotts, "SPQR: Flexible Automated Design Pattern Extraction from Source Code," Automated Software Engineering 2003, Montreal, Oct. 6-10, 2003, pp. 215-224. (22 of 170 acceptance rate, 13%).
13. Stotts, D., L. Williams, N. Nagappan, P. Baheti, D. S. Jen, and A. Jackson, "Virtual Teaming: Experiments and Experiences with Distributed Pair Programming," XP Universe 2003, New Orleans, Aug. 10-13, 2003, LNCS 2753 (Springer), pp. 129-141 (30% acceptance rate).

PANELS, SEMINARS, AND INVITED LECTURES

1. "Facetop: Integrating Video Conferencing with Collaborative Desktop Information," SURA/ViDe 2006, Atlanta, GA, March 28, 2006.
2. "Advances in Assistive Technology," IBM University Day, RTP, NC, Oct. 27, 2005.
3. "The Transparent Video Facetop and Collaborative Video Conferencing," Tarheel Mac Users Group, Chapel Hill, NC, March 1, 2005.
4. "The Transparent Video Facetop and Collaborative Video Conferencing," IBM University Day, RTP, NC, Oct. 14, 2004.
5. "Distributed Pair Programming and the Transparent Video Facetop," Multimedia Users Group, NC State, Oct. 7, 2004.
6. "Distributed Pair Programming and the Transparent Video Facetop," IBM Tech Conference, April 21, 2004.
7. "Experiments and Experiences with Distributed Pair Programming," Univ. of Richmond Computer Science Dept., Dec. 1, 2003.
8. "Towards a Formal Design Calculus for Software-Intensive Systems," NSF Workshop on Science of Design, Airlie Center, VA, Nov. 2-4, 2004.
9. "Federated Scientific Models," Carolina Environmental Program, Oct. 3, 2003.

GRADUATE STUDENT ADVISING

PhD Students
Henry McEuen, 9/05 to present (est PhD 12/08), *"Model Federations for Large Bioinformatics and Genomics Problems"*.
Karl Gyllstrom, 9/03 to present (est PhD 5/08), *"Collaboration with the Transparent Video Facetop"*.

Dorian Miller, 9/03 to present (est PhD 5/07), *"Assistive Technologies for Pair Programming and Synchronous Collaborations"*.
Jason Smith, 6/98 to 12/05, *"Elemental Design Patterns for Automated Discovery of Software Architecture"*.
Jaime Navon, 8/93 to 12/03, "*Analysis of collaboration protocols in Hypermedia"*.

MS theses
Dean Herington, 6/2000 to 8/03, framework for environmental model interopreation.

Research Supervised (MS level and prior to PhD proposal)
James Culp, 9/05 to present, *Collaboration technology for remote medical records.*
Keith Lee, 8/04 to present, *development and experimentation with the Transparent Video Facetop.*
William Luebke, 6/03 to 6/05, *grid techniques for scientific model federations.*
Dennis Jen, 9/02 to 6/03, distributed Pair Programming
Karl Gyllstrom, 1/03 to 8/03, automated testing

RESEARCH GRANTS AND CONTRACTS

- Co-PI, "The Carolina Environmental Bioinformatics Research Center," $4,250,000, 10/1/05 to 9/30/10, US Environmental Protection Agency.
- PI, "Providing access to UML Diagrams in Eclipse to the community of visually-impaired programmers," IBM Eclipse Innovation Award, 6/1/05 -- 5/31/06, $20,000 (to UNC CS).
- Co-Investigator (joint with CEP and Pechan, Inc.), "Methods for Cooperative Geographic Data Interchange," Western States Environmental Research Coucil, 2/1/04 -- 08/31/06, $60,127 (to UNC CS).
- IBM Dissertation Fellowship, for Dorian Miller, 9/1/05 -- 8/31/06, $25,000 (to UNC CS).
- PI, "Collaborative Interfaces for Medical Information Systems," Washington Hospital Centers, 6/1/05 -- 12/31/05, $8,000 (to UNC CS).
- Co-PI (joint with NCSU and NCSC), "Integrating Watershed Models into MIMS," EPA, 9/1/02 -- 08/31/04, $301,167.

PATENT ACTIVITY

- "Methods and Systems for Controlling a Computer using Video Image and For Combining the Video Image with a Computer Desktop," U.S. Patent Application Serial No. PCT/US04/22268, David Stotts and Jason Smith, filed by UNC Chapel Hill May 2004, with provisional coverage to May 2003.

- "Methods and Systems for Identifying Computer Program Source Code Constructs," U.S. Provoisional Patent Application Serial No. 60/527,418, Jason Smith and David Stotts, filed by UNC Chapel Hill November 2003.

PROFESSIONAL SERVICE

- Science Advisory Board, Craniofacial Outcomes Registry, Miami Children's Hospital and UNC Dental School, 5/99 to present.
- Editorial board member
    - 2007-present, *The Open Information Systems Journal*, Bentham Science Publishers.
    - 2004-present, *Journal of the Association for Software Testing (JAST)*, Association for Software Testing.
    - 2001-present, *World Wide Web: Internet and Web Information Systems*, Kluwer Academic Publishers.
    - 1996-present, *Journal of Digital Information*, British Computer Society and Oxford University Press.
- Review panel member
    - NSF Science of Design planning meeting, Airlie, VA, Nov. 2004
- Program committee member
    - Int'l Conf. on the Virtual Computing Initiative, IBM, RTP.
    - IASTED Int'l Conf. on Knowledge Sharing and Collaborative Engineering (KSCE 2006), St. Thomas, USVI, USA, Nov. 29 - Dec. 01, 2006.
    - International Workshop on Visual Languages and Computing (VLC2006), Aug. 30 to Sept. 1, 2006, Grand Canyon AZ.
    - 2006 SURA/ViDe Conference (IP-Digital Video), Atlanta, March 2006.
    - Eclipse Technology eXchange (eTX) Workshop, OOPSLA 2005, San Diego, October 2005.
    - IASTED Int'l Conf. on Internet and Multimedia Systems and Applications (EuroIMSA 2006), Innsbruck, Austria, February 13-15, 2006
    - ACM Hypertext 2004, Santa Cruz, CA, Aug 2004.
    - 2004 Agile Development Conf. Salt Lake City, June 2004.
    - XP/Agile Universe 2004, Calgary, Aug. 2004.
    - Int'l Workshop on Visual Languages and Computing (VLC 2004), San Francisco, CA, Sept. 24-26, 2004
    - Int'l Conf on Web Engineering (ICWE'04), July 2004, Munich.
    - WWW2003, Budapest, Hungary, May 2003.
    - Int'l Workshop on Visual Languages and Computing (VLC 2003), Miami, FL, Sept. 24-26, 2003

UNIVERSITY SERVICE

University of North Carolina
        University Research Council, 2001-02, 2002-03, 2003-04
        CS Department Assoc. Chair for Academic Affairs: 1997-present
        CS Summer School Coordinator: 1999-present
        CS Undergraduate CAPCOM: 2004, 2005, 2006
        CS Exams committee: 2002-03, 2003-04
        CS Undergraduate studies committee: 1997-2004
        CS Graduate studies committee: 1998-99, 2002-04

EXPERIENCE IN INDUSTRY AND CONSULTING

- *1/04 to present*, System Architect, Craniofacial Outcomes Registry, Miami Children's Hospital.
- *6/03 to present*, Consultant, Fish and Richardson, Boston.
- *6/01 to present*, Software Consultant, MicroStock Inc, RTP, North Carolina.
- *3/01 to present*, Consulting computer scientist, Kenyon and Kenyon, California.
- *6/94 to present*, Member, Scientific Advisory Board, Cato Creative Systems, RTP, North Carolina.

RECENT REVIEWING ACTIVITIES

Paper referee
        Hypermedia, World Wide Web
        ACM Trans. on Software Engineering and Methodology;
        ACM Trans. on Information Systems;
        IEEE Trans. on Software Engineering; IEEE Computer; IEEE Software;
        IEEE Trans. on Knowledge and Data Engineering;
        Journal of Software Testing
        Journal of Parallel and Distributed Computing;
        Journal of Computer and System Sciences;
        Journal of Visual Languages and Computing;
        Canadian Journal of Information Systems;
        Electronic Publishing-Origination, Dissemination, and Design.

Proposal reviewer
        National Science Foundation: 1986-2006

Book reviewer
        Wiley, Prentice-Hall, McMillan, Addison Wesley, Benjamin Cummings, Irwin

David Stotts

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Styner Martin, PhD	POSITION TITLE Assistant Professor at Department of Computer Science and Psychiatry
eRA COMMONS USER NAME MARTIN_STYNER	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Swiss Federal Institute of Technology, ETH Zurich,	M.Sc	1997	Computer Science
University of North Carolina at Chapel Hill	Ph.D.	2001	Computer Science

A.   Positions and Honors.
Professional Experience
2002-2004   Head of Medical Image Analysis Group at the M.E. Müller Institute for Surgical Technology and Biomechanics, University of Bern, Switzerland
2002-2004   Deputy project leader of Swiss ORTHOMIS project (Orthopaedic Minimally Invasive Surgical), Computer Aided and Image Guided Medical Interventions, Switzerland
2004-2008   Research Assistant Professor, Departments of Computer Science and Psychiatry, UNC Chapel Hill, USA
2004-2007   Co-director Neuro Image Analysis Laboratory, Department of Psychiatry, UNC Chapel Hill, USA
2004-present Co-director Developmental Neuroimaging Core, Neurodevelopmental Disorders Research Center, UNC Chapel Hill, USA
2007-present Associate Director Neuro Image Research and Analysis Laboratory, Department of Psychiatry, UNC Chapel Hill, USA (starting July 2007)
2004-2008   Assistant Professor, Departments of Computer Science and Psychiatry, UNC Chapel Hill, USA

Awards and Other Professional Activities
Reviewer for Medical Image Analysis, IEEE Trans. Medical Imaging, IEEE Pattern Analysis and Machine Intelligence, Information Fusion Journal, J. Biomechanics, IEEE Trans. Information Technology in Biomedicine, IEEE Trans. Biomedical Engineering, Medical Image Computing and Computer-Assisted Interventions MICCAI, Biological Psychiatry, Cerbral Cortex, Psychiatry Research: Neuroimaging, Academic Radiology, American Journal of Neuroradiology, Proceedings of the National Academy of Science, NeuroImage, InsightJournal.
Editorial Board Medical Image Analysis, Elsevier, Program Committee Image Processing Conference of the SPIE Symposium on Medical Imaging

B.   Selected peer-reviewed publications (in chronological order).
Levitt JJ, **Styner M,** Niethammer M, Bouix S, Koo M, Voglmaier MM, Dickey CC, Niznikiewicz MA, Kikinis R, McCarley RW, Shenton ME, Shape Abnormalities of Caudate Nucleus in Schizotypal Personality Disorder, Schizophrenia Research, in print

Kubicki M, **Styner M,** Bouix S, Gerig G, Markant D, Smith K, Kikinis R, McCarley RW, Shenton ME. Reduced Interhemispheric Connectivity in Schizophrenia-Tractography Based Segmentation of the Corpus Callosum., Schizophr Resarch, in print

Grauer D, Cevidanes LHS, **Styner MA**, Ackerman J, Proffit WR. Airway Volume and Shape from Cone-Beam CT: Relationship to Facial Morphology. Amer. Journal of Orthod and Dentofac Orthop, in print Jan 2008.

Gouttard S, **Styner M,** Prastawa M, Piven J, Gerig G, Assessment of Reliability of Multi-site Neuroimaging via Traveling Phantom Study, MICCAI 2008, LNCS 5242, Springer, pp.

Cates J, Fletcher PT, **Styner MA,** Hazlett HC, Whitaker R, Particle-Based Shape Analysis of Multi-Object Complexes, MICCAI 2008, LNCS 5241, Springer, pp. 477-485

Z Zhao, W D Taylor, **M Styner**, D C Steffens, K R R Krishnan, J R Macfall, Hippocampus shape analysis and

394

Principal Investigator/Program Director (Last, First, Middle):   Peterson, Robert E., Ph.D.

late-life depression, PLoS ONE (2008) vol. 3 (3) pp. e1837

Peterhans M, Talib H, **Styner M**, González Ballester MA, A method for the Frame-by-Frame US to CT Registration in a Joint Calibration and Registration Framework, ISBI 2008, pp. 1131 - 1134

Oguz I, Cates J, Fletcher T, Whitaker R, Cool D, Aylward S, **Styner M**, Entropy-based Particle Systems and Local Features for Cortical Correspondence Optimization, ISBI 2008, pp. 1637- 1640.

Styner M, Oguz I, Heimann T, Gerig G, Minimum Description Length with Local Geometry, Proc IEEE Symposium on Biomedical Imaging 2008, pp. 1283 - 128

Sen S, Foskey M, Marron J, **Styner M**, Support Vector Machine For Data on Manifolds: an Application to Image Analysis, Proc IEEE Symposium on Biomedical Imaging 2008, pp. 1195 - 1198

Styner M, Knickmeyer R , Coe C , Short SJ , Gilmore J, Automatic Regional Analysis of DTI Properties in the Developmental Macaque Brain, Proc SPIE Medical Imaging Conference, in print, 2008

Shun X, **Styner M**, Gilmore J, Gerig G: Multivariate Longitudinal Statistics for Neonatal-Pediatric Brain Tissue Development, Proc SPIE Medical Imaging Conference, in print, 2008

van Ginneken B, Heimann,T, **Styner M**, 3D Segmentation in the Clinic: A Grand Challenge, Workshop at Medical Image Computing and Computer Assisted Intervention, MICCAI 2007, pp. 7-15, 2007.

Kubicki M, **Styner M**, Markant D, Dreusicke M, Kikinis R, McCarley R, Shenton M. Interhemispheric connectivity and schizophrenia-diffusion tensor imaging study. Schizophrenia Bulletin 2007(33) pp. 340-340

Huang X, Lee YZ, McKeown M, Gerig G, Gu H, Lin W, Lewis MM, Ford S, Troster AI, Weinberger DR, **Styner M**. Asymmetrical ventricular enlargement in Parkinson's disease. Mov Disord. 2007 Jun 22;

Cates J, Fletcher PT, **Styner MA**, Shenton M, Whitaker R, Shape Modeling and Analysis with Entropy-Based Particle Systems, Information Processing in Medical Imaging 2007, 20:333-45.

Gorczowski K**, Styner MA**, Jeong J, Marron JS, Piven J, Hazlett HC, Pizer SM, Gerig G, Statistical Shape Analysis of Multi-Object Complexes, CVPR 2007, 1 - 8,

Rajamani KT, **Styner MA**, Talib H, Zheng G, Nolte LP, Ballester MA, Statistical deformable bone models for robust 3D surface extrapolation from sparse data, Med Image Anal. 2007 Apr;11(2):99-109.

Cevidanes LH, Bailey LJ, Tucker SF, **Styner MA**, Mol A, Phillips CL, Proffit WR, Turvey T. Three-dimensional cone-beam computed tomography for assessment of mandibular changes after orthognathic surgery. Am J Orthod Dentofacial Orthop. 2007 Jan;131(1):44-50.

Styner M, Xu SC, El-Sayed M, Gerig G, Correspondence Evaluation in Local Shape Analysis and Structural Subdivision, IEEE Symposium on Biomedical Imaging ISBI 2007, 1192 - 1195

Cevidanes L.H.S., **Styner M.A.,** Phillips C., Oliveira, A.E.F., Tulloch J.F.C., 3D Morphometric Changes 1 Year After Jaw Surgery, IEEE Symposium on Biomedical Imaging ISBI 2007, 1332 - 1335

Nain D, **Styner M,** Niethammer M, Levitt JJ, Shenton ME, Gerig G, Bobick A, Tannenbaum A, Statistical Shape Analysis of Brain Structures Using Spherical Wavelets, IEEE ISBI 2007, 209 - 212

Talib H, **Styner M**, Rudolph T, Gonźalez Ballester MA, Dynamic Registration Using Ultrasound for Anatomical Referencing, IEEE Symposium on Biomedical Imaging ISBI 2007, 1164 - 1167

Zhou C, Park DC, **Styner M**, Wang YM, ROI Constrained Statistical Surface Morphometry, IEEE Symposium on Biomedical Imaging ISBI 2007, 1212 - 1215

S. Gouttard**, M. Styner**, S. Joshi, and G. Gerig. Subcortical structure segmentation using probabilistic atlas prior. In Proc SPIE Vol 6512, Medical Imaging, 2007, pp. 65122J-1 - 65122J-11.

M. Styner, R. Knickmeyer, S. Joshi, C. Coe, S. J. Short, and J. Gilmore. Automatic brain segmentation in rhesus monkeys. In Proc SPIE Vol 6512, Medical Imaging, 2007, pp. 65122L-1 – 65122L-8..

M. Styner, I. Oguz, S. Xu, D. Pantazis, and G. Gerig. Statistical group differences in anatomical shape analysis using hotelling T^2 metric. Proc SPIE Vol 6512, Medical Imaging, 2007, pp. 65123Z-1 – Z-11.

M. Styner, R. G. Smith, M. M. Graves, M. W. Mosconi, S. Peterson, S. White, J. Blocher, M. El-Sayed, and H. C. Hazlett. Asymmetric bias in user guided segmentations of brain structures. In Proc SPIE Vol 6512, Medical Imaging, 2007, pp 65120K-1 – 65120K-8

C Cascio**, M Styner**, RG Smith, M Poe, G Gerig, H Hazlett, M Jomier, R Bammer, J Piven, Reduced relationship to cortical white matter revealed by tractography-based segmentation of the corpus callosum in yound children with developmental delay, Am J Psychiatry, 2006, (163) 2157-2163, December.

R Sidler, MA Gonzalez Balletser, HM Bonel, **M Styner**, Thibaut Bardyn, LP Nolte, NP Suedkamp, W Koestler, Computer-assisted athroplasty using bioengineered autografts, IEEE Engineering in Medicine and Biology Magazine, 2006 July: 25(4) 63-69.

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Principal Investigator/Program Director (Last, First, Middle): Peterson, Robert E., Ph.D.

G Zheng, MA Gonzalez Ballester, **M Styner,** LP Nolte: Reconstruction of Patient-specific 3D Bone Surface from 2D Calibrated Fluoroscopic Images and Point Distribution Model, MICCAI 2006, LNCS 4190, 25-32.

Cevidanes LH, **Styner MA**, Proffit WR: Image analysis and superimposition of 3-dimensional cone-beam computed tomography models. Am J Orthod Dentofacial Orthop. 2006 May;129(5):611-8.

M. Styner, M. Jomier, G. Gerig: Closed and Open Source Neuroimage Analysis Tools and Libraries at UNC: IEEE Symposium on Biomedical Imaging ISBI 2006 702-705.

G. Gerig, S. Joshi, T. Fletcher, K. Gorczowski, S. Xu, S. M. Pizer, **M. Styner**: Statistics of populations of images and its embedded objects: Driving applications in neuroimaging ISBI 2006, 1120-1123.

H Talib, K Rajamani, J Kowal, LP Nolte, **M Styner**, MA Ballester : A comparison study assessing the feasibility of ultrasound-initialized deformable bone models, Comput Aided Surg. 2005 Sep;10(5):293-9.

LH Cevidanes, LJ Bailey, GR Tucker, **M Styner**, A Mol, CL Phillips, WR Proffit, T. Turvey: Superimposition of 3D cone-beam CT models of orthognathic surgery patients, Dentomaxillofac Radiol. 2005 Nov;34(6):369-75.

M Styner, JA Lieberman, RK McClure, DR Weingberger, DW Jones, G Gerig: Morphometric analysis of lateral ventricles in schizophrenia and healthy controls regarding genetic and disease-specific factors, Proceedings of the National Academy of Science, 2005, Vol 102, No. 12, March 29, p 4872-4877.

I. Pappas, **M. Styner**, P.Malik, L. Remonda, M. Caversaccio: Automatic Method to Assess Local CT-MR Imaging Registration Accuracy on Images of the Head, American J. of Neuroradiology, 26:137-144, 2005

M. Styner, R. Gimpel Smith, C. Cascio, I. Oguz, M. JomierL: Corpus Callosum Subdivision based on a Probabilistic Model of Inter-hemispheric Connectivity, MICCAI 2005, LNCS 3750, pp. 765-772.

R. Sidler, M.A. Gonzalez Ballester, **M. Styner,** T. Bardyn, L-P. Nolte, N. Suedkamp, W. Koestler: Computer-assisted ankle joint arthroplasty using bio-engineered autografts, MICCAI 2005, LNCS 3749, pp. 474-481.

S. Olmos, M. Bossa, **M. Styner**: PCA-based filtering for hypothesis testing on hippocampus shape differences between schizophrenics and normals, MIUA 2005, Bristol, pp. 167-170.

M. Styner, J.A. Lieberman, D. Pantazis, G. Gerig: Boundary and Medial Shape Analysis of the Hippocampus in Schizophrenia, Medical Image Analysis, 2004, pp 197-203.

D. Pantazis, R.M. Leahy, T.E.Nichols**, M. Styner**: Statistical Surface Based Morphometry Using a Non-Parametric Approach, IEEE Symposium on Biomedical Imaging ISBI 2004,1283-1286.

K. Rajamani, S.C. Joshi, **M. Styner**: Bone model morphing for enhanced visualization, IEEE Symposium on Biomedical Imaging ISBI 2004,1255-1258

C. Amstutz, M. Caversaccio, J. Kowal, R. Bächler, L.-P. Nolte, R. Häusler, **M. Styner**: Ultrasound A-Mode Based Registration in Computer Aided Surgery of the Skull, Archives of Otolaryngology, Head and Neck Surgery, 2003 Dec;129(12):1310-6.

M. Styner, G. Gerig, J. Lieberman, D. Jones, D. Weinberger: Statistical shape analysis of neuroanatomical structures based on medial models, Medical Image Analysis, 7 (3), 2003, pp. 207-220.

S.M. Pizer , T. Fletcher, A. Thall, **M. Styner**, G. Gerig, S. Joshi: Object Models in Multiscale Intrinsic Coordinates via M-reps, Image and Vision Computing, (10), January 2003, pp 5-15.

M. Styner, G. Gerig: Automatic and Robust Computation of 3D Medial Models Incorporating Object Variability, International Journal of Computer Vision, 55 (2/3), 2003, pp. 107-122.

M. Styner, K. Rajamani, L.P. Nolte, G. Zsemlye, G. Szekely, C. Taylor, R. H. Davies: Evaluation of 3D Correspondence Methods for Model Building, IPMI 2003, p 63-75.

S.Vetsa, **M. Styner**, S. Pizer, J. Lieberman, G. Gerig: Caudate shape discrimination in schizophrenia using template-free non-parametric tests, MICCAI 2003, pp.661-669

M. Styner, J. Lieberman, G. Gerig: Boundary and medial shape analysis of the hippocampus in schizophrenia, MICCAI 2003, II, pp. 464-471.

G. Gerig, K. Muller, E. Kistner, Y. Chi, **M. Styner**, J. Lieberman: Age and treatment related local hippocampal changes in schizophrenia explained by a novel shape analysis method, MICCAI 2003, II, pp. 651-660.

C. Ongoing Research Support

R41 NS059095-01A1   Styner (PI)   07/01/07 – 06/30/09   1.8 Mts   NIH $400,000
High Throughput web-based Image Analysis of Mouse Brain MR Imaging Studies

This STTR grant is to develop a web-based system for the handling of murine imaging studies, related data and automatic brain image analysis. Modules for the fully automatic analysis of mouse brain images are a primary focus. Role: Principal Investigator

2-P30-HD003110-41 Piven (PI)   07/01/08 - 06/30/13   2.4 Mts   NIH-NICHD $ 157,319

Child Development and Mental Retardation, Morphology Core

The major goals of the Neurodevelopmental Disorders Research Center are to promote and support basic and applied research on the pathogenesis and treatment of developmental disabilities. Role: Co-director Developmental Neuroimaging Core

| U54 EB005149 | Kikinis (PI) | 9/17/04 – 8/31/09 | 1.8 Mts | NIH | $ 196,514 |

National Alliance for Medical Image Computing (NA-MIC)

The NA-MIC consortium develops resources and tools for clinical studies in medical image analysis. Methods and tools are to be made available via a standardized toolkit and tested on image data of the clinical partner groups. Role: Core 1 UNC site PI

| NIH AI067518 | Coe (PI), Gilmore (UNC PI) | 12/01/05 - 11/30/10 | 1.2 Mts | NIH | $1,685,022 |

Maternal flu infection and brain development in primates

The goal of this project is to study the effect of maternal influenza infection during pregnancy on neonatal brain development in primates with MRI. Role: Co-investigator

| 2 P50 MH064065-06 | Gilmore (PI) | 08/01/07-07/31/12 | 0.6 Mts | NIMH | $1,398,473 |

Prospective Studies of the Pathogenesis of Schizophrenia, Silvio O. Conte Center for the Neuroscience of Mental Disorders

The Center entitled will attempt to answer very important questions in an effort to better understand the neurodevelopmental mechanisms, genetic vulnerability, and the development of schizophrenia. Role: Co-PI Neuroimaging Core

| 1 R01 HD055741-01 | Piven (PI) | 06/01/07-05/30/12 | 2.4 Mts | NIH NICHD | $ 495,782 |

A Longitudinal MRI Study of Infants at Risk for Autism: Autism Centers of Excellence (ACE) Network

The center proposes a collaborative network to examine the brain structure and behavior of siblings of autistic individuals using a longitudinal design from six to twenty-four months of age. The neuroimaging core is responsible for development, validation and application of image analysis to over 400 subject MRI scans acquired at 4 different imaging sites. Role: Co-PI Imaging Core

| R01 NS061965-01 | Maria Escolar | 07/01/08-06/30/13 | 0.6 Mts | NIH | $ 463,255 |

DTI as a tool to identify infants with Krabbe Disease in need of urgent treatment

Krabbe disease can be treated by umbilical cord transplantation only at the presymptomatic phase. We plan to utilize DTI as an early diagnostic tool for evaluating the necessity of treatment. Role: Co-investigator

| U24-NS059696-01A1 | Joe Kornegay (PI) | 05/01/08 – 04/31/13 | 0.6 Mts | NIH/NINDS | $ 171,915 |

National Center for Canine Models of DMD (NCDMD)

We have formulated a research initiative titled the National Center for Canine Models of Duchenne Muscular Dystrophy (NCDMD) with the goal of developing and sustaining dog models of DMD for investigators pioneering translational research. The NCDMD will provide facilities and services to support pre-IND application. Role: Co-PI Imaging Core,

| P01 DA022446-01 | Johns (PI) | 07/01/08 - 06/30/13 | 1.2 Mts | NIH (NIDA) | $ 419,242 |

Neurobiological and Behavioral Consequences of Cocaine Use in Mother-Infant Dyads.

This program employs animal and human projects to elucidate the neurobiological and behavioral characteristics of mothers and offsprings exposed to cocaine during pregnancy. The imaging core is responsible for image transfer, quality control, processing and validation, and quantitative analysis of brain MRI/DTI of humans and animals. Role: PI Imaging Core

Martin Styner

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – Zhexing Liu

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Russell M. Taylor II

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Date of Birth: Nov 3, 1966
Married
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Computer Science, CB #3175
University of North Carolina
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taylorr@cs.unc.edu

Education:

Program for Technology Managers, Kenan-Flagler School of Business Administration, University of North Carolina – Chapel Hill (Spring 2000).

Ph.D. Computer Science, **University of North Carolina at Chapel Hill** (May 1994)
"The Nanomanipulator: A Virtual-Reality interface to a Scanning Tunneling Microscope", under F.P. Brooks, Jr.

M.S. Computer Science, **University of North Carolina at Chapel Hill** (May 1991)

B.S. Mathematics with highest honors, **UNC, Chapel Hill** (May, 1989)

Experience:

Research Professor of Computer Science, Physics & Astronomy, and Applied Sciences & Engineering:

UNC Chapel Hill.   July 2006-present

Director, Biomedical Analysis and Simulation Supercomputer. Co-Director (with Richard Superfine), Nanoscale Science Research Group (NSRG). Laid out research plan, obtained funding. Advised graduate and undergraduate students. Served on student committees. Designed "Visualization in the Sciences" course (annual course for computer science and natural science graduate students); materials used by others to give the course at UNC Wilmington, Duke University, Iowa State University, and Appalachian State; co-taught in 2006 at NC A&T University; formed the basis for SIGGRAPH 2003 course; formed the basis for the Hamburg course. Guest lecturer in *Virtual Worlds* CS graduate course, *Nanotechnology* Physics seminar, and *Fractals* Mathematics freshman seminar.

VP of Systems, Megawatt Solar, Inc.:   April 2007-present

A company developing utility-scale concentrated solar power solutions. Member of the board of directors (through December 2007). Oversight of tracking and control system architecture. Development of closed-loop maximum-power tracking algorithms.

Partner, Navitas Research LLC: December 2005-present

A company providing advice and consulting for the electric power industry. Initial project is the development of a reduced-cost solar-concentration electric power source.

Research Associate Professor of CS, P&A, CAMS: UNC Chapel Hill.   Spring 2000-June 2006

Chairman of the Board: NanoManipulator, Incorporated.   Spring 2000-present

A company that sells and supports a commercial version of the nanoManipulator system developed by the NSRG, winner of an R&D magazine R&D 100 award for 2001, which recognizes "the 100 most technologically significant new products of the year."

Funding (as Principal Investigator or Co-PI):

NSF DMR Instrumentation: "Development of the Multiscope: An array microscope for high throughput microliter rheology," $443K. 2008-2010. Co-PI.

NIH 1S10RR023069-01: "Supercomputer Instrumentation for Biomedical Image Analysis and Simulation," $1.9M, 2007-2008. PI.

NC Museum of Life and Science: "Two Haptic Interactives: Shaky, Sticky, Bumpy & Nanoscale Materials Stretching," $22.5K, 2007, Co-PI.

NIH 5-P41-RR02170-21: "Computer-Integrated Systems for Microscopy and Manipulation," $4.5M, 2005-9. Co-PI.

NSF NER: "Modeling and Simulation of Fibrin Fibers," $100K, 2004-5. Co-PI.

Keck Foundation: "AIMS: Atomic Imaging and Manipulation System," $1M, 2001. Co-PI.

NIH 5-P41-RR02170-18: "Interactive Graphics for Molecular Studies & Microscopy," $3.6M, 2001-4. PI.

NSF ROLE: "Investigating Viruses With Touch: Nanotechnology and Science Inquiry," $821K, 2001-3. Co-PI.

NSF ITR: "Rate-Based Scheduling Technology for Latency-Sensitive Graphics Applications," $350K, 2000-3. Co-PI.

NSF ECS: "Biomolecular Motor/Nanotube integration for actuating nanotechnology," $1.1M, 2000-3. Co-PI.

Intellectual Property:

Kalpit Desai, Thomas G. Bishop, Leandra Vicci, Russell M. Taylor II, Richard Superfine, "Agnostic tracking". Provisional patent application 421/202. 2007.

David Borland, John P. Clarke, Russell M. Taylor II, "Methods, Systems, and Computer program products for processing three-dimensional image data to render an image from a viewpoint within or beyond an occluding region of the image data". International patent application 60/662,042. March 15, 2006.

James Clemens, Charles Evans, Russell Taylor, "Triple-junction silicon concentrated solar collector," Invention disclosure OTD05-143, November 1, 2005 (licensed to Megawatt Solar, LLC).

Russell M. Taylor II, "Thank-you Ware," Invention disclosure OTD05-0056. January 12, 2005.

Taylor II, Russell M., "A method for rendering non-polygonal surfaces on programmable graphics hardware," Provisional patent application made on February 20, 2004.

Book Sections:

E. Tim O'Brien, Jeremy Cribb, David Marshburn, Russell M. Taylor II, Richard Superfine, "Magnetic Manipulation for Force Measurements in Cell Biology," Chapter 16 in *Methods in Cell Biology*. Elsevier. pp. 433-450. 2008.

Wen Qi, Russell M. Taylor II, Chris Healey, Jean-Bernard Martens, "3D Interaction with Scientific Data through Virtual Reality and Tangible Interfacing," in User Centered Design for Medical Visualization. Idea Group Publishing. ISBN: 978-1-59904-777-5, May 2008.

Russell M. Taylor II. "Haptics for Scientific Visualization," in Haptic Rendering: Foundations, Algorithms, and Applications, A.K. Peters. Ming Lin and Miguel Otaduy, editors. 2008.

J. K. Fisher, L. Vicci, K. Bloom, E. Timothy O'Brien, C.W. Davis, R. M. Taylor, II, R. Superfine, "Magnetic Manipulation for the Biomedical Sciences," in the Handbook of Nanoscale Science, Engineering, and Technology, Second Edition. Taylor and Francis. 2007.

Taylor II, R. M., D. Borland, F. P. Brooks Jr., M. Falvo, M. Guthold, T. Hudson, K. Jeffay, G. Jones, D. Marshburn, S. J. Papadakis, L.-C. Qin, A. Seeger, F. D. Smith, D. H. Sonnenwald, R. Superfine, S. Washburn, C. Weigle, M. C. Whitton, P. Williams, L. Vicci and W. Robinett. "Visualization and Natural Control Systems for Microscopy." In: Visualization Handbook; Edited by C. Johnson and C. Hansen. Harcourt Academic Press. 2004. pp. 875-900.

Jones, G., A. Bokinski, T. Tretter, A. Negishi, D. Kubasko, R. Superfine and R. M. Taylor II, "Atomic force microscopy with touch: Educational applications," in: Science, Technology and Education of Microscopy: an Overview. A. Mendez-Vilas. Madrid, Spain, Formatex. 2003.

Journal Articles and SIGGRAPH (* denotes most significant):

Kalpit V. Desai, T. Gary Bishop, Leandra Vicci, E. Timothy O'Brien, Sr., Russell M. Taylor, II and Richard Superfine, "Agnostic Particle Tracking for Three-Dimensional Motion of Cellular Granules and Membrane-Tethered Bead Dynamics," *Biophysical Journal*, 94. pp. 2374-2384. 2008.

J.K. Fisher, L. Vicci, J. Cribb, E.T. O'Brien, R.M. Taylor II, R. Superfine, "Magnetic force micromanipulation systems for the biological sciences," *NANO* 1(3), 2006. pp. 1-16.

Hirotoshi Matsui, Victoria E Wagner, David B Hill, Ute E Schwab, Troy D Rogers, Brian Button, Russell M Taylor, Richard Superfine, Barbara H Iglewski, Richard C Boucher, "A physical linkage between CF airway surface dehydration and *P. aeruginosa* biofilms," *PNAS* 103(48), 2006. pp. 18131-18136.

O. J. Sul, M. R. Falvo, R. M. Taylor, II, S. Washburn, and R. Superfine, "Thermally actuated untethered impact-driven locomotive microdevices," Applied Physics Letters 89(20), 2006. (3 pages)

Fielding JR, Borland D, Lee KH, Clarke JP, Wallen E, Pruthi R, Taylor RM. "Virtual pyeloscopy using volumetric depth peeling." *Acad Radiol*, 13 (6). (June 2006) pp. 759-763.

Fisher, J.K., Cribb, J., Desai, K.V., Vicci, L., Wilde, B., Keller, K., Taylor II, R. M., Haase, J., Bloom, K., O'Brien, E. Timothy, and R. Superfine, "Thin-foil magnetic force system for high-numeric-aperture microscopy," *Review of Scientific Instruments* 77, February 2006. 9 pages.

Fisher, J., J. Cummings, K. V. Desai, L. Vicci, B. Wilde, K. Keller, C. Weigle, G. Bishop, R. M. Taylor II, C. W. Davis, R. Boucher, E. T. O'Brien and R. Superfine (2005). "Three-dimensional force microscope: A nanometric optical tracking and magnetic manipulation system for the biomedical sciences." *Review of Scientific Instruments* 76(5): 053711-053722. (11 pages.)

Mark Hollins, Florian Lorenz, Adam Seeger, Russell Taylor, "Factors Contributing to the Integration of Textural Qualities: Evidence from Virtual Surfaces," *Somatosensory and Motor Research*, 22 (3), September 2005. pp. 193-206.

C. Dwyer, L. Vicci, J. Poulton, R. Taylor, "DNA Self-assembled Parallel Computer Architectures", Nanotechnology, vol. 15, 2004. pp. 1688-94.

Mark Hollins, Adam Seeger, Gabriele Pelli, Russell Taylor, "Haptic perception of virtual surfaces: Scaling subjective qualities and interstimulus differences," *Perception*, vol. 33. pp. 1001-1019. 2004.

M. Guthold, W. Liu, B. Stephens, S. T. Lord, R. R. Handtgan, D. A. Erie, R. M. Taylor, and R. Superfine, "Visualization and Mechanical Manipulations of Individual Fibrin Fibers Suggest that Fiber Cross-Section has Fractal Dimension 1.3," *Biophysics Journal* 87 (6), December., 2004. pp. 4226-4236.

* Dwyer, C., Erie D., Superfine R., Washburn, S., L. Vicci, Taylor R., "The Design of DNA Self-Assembled Computing Circuitry," *IEEE Trans. on VLSI*, vol. 12, no. 11, 2004. pp. 1214-1220.

* Dwyer C., Taylor R., Vicci L., "Performance Simulation of Nanoscale Silicon Rod Field-Effect Transistor Logic", *IEEE Transactions on Nanotechnology*, 2 (2): 69-74, 2003.

Jones, G., T. Andre, R. Superfine and R. M. Taylor II, "Learning at the Nanoscale: The Impact of Students' Use of Remote Microscopy on Concepts of Viruses, Scale, and Microscopy," *Journal of Research in Science Teaching* 40(3): 303-322. 2003.

Adam Seeger, Charalampos Fretzagias, Russell Taylor II, "Software Acceleration Techniques for the Simulation of Scanning Electron Microscope Images," *Scanning*, Vol. 25, (2003) pp. 264-273.

Other Publications and Abstracts (* denotes most significant):

Ricky Spero and Russell M. Taylor II, "Scalar Potential Topography can Simplify Interpretation of 2D Vector Fields," University of North Carolina at Chapel Hill Technical Report RT08-008. pp. 1-7. 2008. http://www.cs.unc.edu/Research/tech-report.html.

Quammen, C.W., Richardson, A., Haase, J., Harrison, B.,Taylor II, R.M., Bloom, K.S. "*FluoroSim: A Visual Problem Solving Environment for Fluorescence Microscopy*" In proceedings of Visual Computing for Biomedicine, Oct. 6-7, 2008, Delft, Netherlands. (8 pages).

Alain Burette, David Feng, David Marshburn, Dennis Jen, Richard Weinberg, Russell M. Taylor II, "ToolBox: Stepping into the third dimension," *Journal of Neuroscience*. Nov 2007; 27: 12757 - 12760;.2007.

Brian Eastwood, Russell Taylor, "Occlusion Removal in Video Microscopy," *Proceedings of the 12th International Conference on Computer Analysis of Images and Patterns*, August 2007. pp. 125-132.

David Borland, Russell M. Taylor II, "Rainbow Color Map (Still) Considered Harmful," IEEE Computer Graphics and Applications, 27 (2). March 2007. pp. 14-17.

Wen Qi, Chris Healey, Russell Taylor, "A comparison of user performance in an immersive HMD, a *fish tank* VR, and a *fish tank* with haptic displays for visualization of volumetric data," Proceedings of *Applied Perception in Graphics and Visualization 2006*. (8 pages).

Jeff Schoner, Ming Lin, Richard Superfine, Mike Falvo, Russell M. Taylor II, Susan Lord, "Interactive Simulation of Fibrin Fibers in Virtual Environments," Proceedings of *IEEE VR 2006*. March 25-29, Alexandria Virginia. pp. 27-34. (28% acceptance rate)

* David Borland, John Clarke, Julia Fielding, Russell M. Taylor II, "Volumetric depth peeling for medical image display," IS&T/SPIE Symposium on Electronic Imaging, 15-19 January 2006, San Jose. (8 pages)

* David Marshburn, Chris Weigle, Benjamin G. Wilde, Kalpit Desai, J.K. Fisher, Jeremy Cribb, E. Timothy O'Brien, R. Superfine, Russell M. Taylor II, "The Software Interface to the 3D-Force Microscope," *Proceedings of IEEE Visualization 2005*. pp. 455-462. (33% acceptance rate)

Borland, D., Clarke, J. P., and Taylor II, R. M. "Volumetric depth peeling for virtual arthroscopy," Electronic Imaging, 16(2). 2005.

* Chris Weigle and Russell M. Taylor II, "Visualizing intersecting surfaces with nested-surface techniques," *Proceedings of IEEE Visualization 2005*. pp. 503-510. (33% acceptance rate)

Jones, M. G., Minogue, J., Tretter, T., Negishi, A., & Taylor, T. "Haptic augmentation of science instruction: Does touch matter?" *Science Education*, 90, 111-123.

* Dennis Jen, Peter Parente, Jonathan Robbins, Christopher Weigle, Alain Burette, Richard Weinberg, and Russell M. Taylor II, "ImageSurfer: A Tool for Visualizing Correlations between Two Volume Scalar Fields," *IEEE Visualization 2004 Proceedings*, October 10-15, Austin Texas, pp. 529-536.

Russell M. Taylor II, "Directly Rendering Non-Polygonal Objects on Graphics Hardware using Vertex and Fragment Programs," University of North Carolina at Chapel Hill Computer Science Technical Report number TR04-023. http://www.cs.unc.edu/Research/tech-report.html.

Jones, M. G., Andre, T., Kubsko, D., Bokinsky, A., Tretter, T., Negishi, A., Taylor, R., & Superfine, R. "Remote Atomic Force Microscopy of microscopic organisms: Technological innovations for hands-on science with middle and high school students." *Science Education*. Vol. 88, 2004. pp. 55-71.

Jones, M. G., Tretter, T., Bokinsky, A., & Negishi, A. "Haptic technology and learning." *Haptics-e*. (in press)

C. Dwyer, R. Taylor, L. Vicci, J. Poulton, "Parallel Computer Architectures Enabled by Self-Assembly," *Proceedings of the 1st Conference on the Foundations of Nanoscience,* 379, April, 2004.

* R.M. Taylor II, Colin Ware, Victoria Interrante, "Perceptually-Based Visualization Design," *Course notes for SIGGRAPH '2003 course #45,* Full-day course on visualization organized by R.M. Taylor II. San Diego. July 26-31. pp. 1-281.

Systems Built:

Research:

3DFM User Interface: Led a team of students and staff in the development of this stereo 3D graphics plus force-feedback haptic control system for the CISMM NIH Resource's 3D magnetic force microscope system. This Java/Swing system is built on top of the open-source Visualization ToolKit, adding real-time video and the ability to render real-time data feeds from the microscope. The UI integrates the output from and control of operations on four computers (bead feedback control, video input, magnetic control, graphics and haptics interface). CISMM lab personnel and visitors report new insights gained using the UI.

nanoManipulator: www.nanomanpulator.com, www.nanomanipulator.org. This system, my dissertation work and following, provides an immersive teleoperation interface to scanned-probe microscopes. Distributed, heterogeneous real-time system running on UNC PixelFlow graphics engine, Onyx/IR or PC/Win32 (graphics and user interface), PC/WinNT (force-feedback controller) and PC/Win3.1 or PC/Win32 (Microscope controller) that provides direct, natural control over microscope experiments as if the scientist were interacting directly with the surface itself. Research system used at three university sites

in U.S. and Europe, WPAFB, and NIST. Commercial development begun in spring 2000 has resulted in about a dozen U.S. and international installations (www.3rdtech.com).

Infrastructure:

VRPN: *Virtual-Reality Peripheral Network* open-source library and servers that provides a common interface for fast local and remote network access to VR input and output devices (trackers, buttons, force display, sound servers, cameras, A/D and D/A devices). VRPN has been widely adopted internationally and has been ported to form the device-control layer for systems in industry (Virtools VR Pack, WorldViz' Virtual Reality Toolkit Vizard, Disney VR Studio's Panda3D, Sense8's WorldToolKit, 3rdTech Hiball tracker, VRCO's TrackD for CAVELib) and research (Beckman Institute's Visual Molecular Docker, UIUC's Syzygy toolkit, Fraunhofer Institute for Media Communication's AVANGO VR framework, OpenSceneGraph, OpenTracker, Georgia Tech's DART toolkit, Virginia Tech's DIVERSE, University of Manchester's Maverick/DEVA system, Naval Postgraduate School's Bamboo VR framework). The VRPN mail list has 109 members from US and international universities, companies, and national laboratories. www.vrpn.org.

Presentations (invited):

"Scientific Visualization," S-STEM External Scholar Talk, Appalachian State University, September 25, 2008.

"Computer-Integrated Systems for Microscopy and Manipulation Software," presentation at Advanced Techniques in Live Cell Microscopy, University of Connecticut, October 24, 2007.

"Visualization in the Sciences," Visualization Friday Forum, Duke University, Oct 12, 2007

"Introduction to Visualization," and "Hands-on Visualization Workshop," DOD Minority-Serving Institutions CSE-HPC Faculty Training Workshop, NCA&T University, July 2007.

"What its like to be a computer scientist", Ligon Middle School Career Day, speaking to six classes. 2007.

"Introduction to Visualization, a Hands-on Workshop," DOD Minority Outreach Program, Supercomputing 2006, November 12th and again November 13th.

"Introduction to Visualization," and "Hands-on Visualization Workshop," DOD Minority-Serving Institutions CSE-HPC Faculty Training Workshop, NCA&T University, July 2006.

"Visualization and Problem-Solving Environments for Nanoscale Science," IBM University Day, Research Triangle Park, April 26, 2006.

Participated in the "Design and Evaluation in Visualization Research" panel at IEEE Visualization 2005.

Participated in "Visualization of Large Biomolecular Complexes" workshop, September 2005, SDSC.

"Nanotechnology and Computer Graphics", Sterling Montessori school in Apex, three middle-school classes. November 29, 2004.

"Nanomanipulation – The Scientific Method and its Impact on Biomedicine," International Workshop on Biomedicine, Hamburg, Germany, July 2-4, 2004.

"Virtual Reality and Visualization: Recent progress in acquiring and displaying 3D scenes and multiple data sets," CERN Computing Seminar, June 1, 2004.

"Using Computers to bring Eyes, Hands, and Models into the nanoWorld," DTU/MIC Danish Technical University Microelectronic Center, Copenhagen, May 25, 2004.

"Multidisciplinary Nanoscale Science and Education," and "Virtual-Environment Systems for Nanomanipulation," Two 1.5-hour lectures during a 2-day Spring School on "Interdisciplinary Nanoscience: From Basic Research to Applications", University of Hamburg, May 18-19, 2004.

"Using Computers to bring Eyes, Hands, and Models into the nanoWorld," External speaker seminar series, Faculty of Informatics, University of Hamburg, April 19, 2004.

"Direct Viewing and Control Interfaces for Tele-operation Across Distance and Scale," IEEE/RSJ IROS 2003 Workshop on Robotics for Nanosciences and Nanotechnology, Las Vegas, October 2003.

Professional Activities:

Member, Morehead Planetarium and Science Center Faculty Advisory Board, 2008.
Visualization Contest Chair, IEEE Visualization 2008 conference.
Visualization Contest Chair, IEEE Visualization 2007 conference.
Visualization Contest Co-chair, IEEE Visualization 2006 conference.
Networking and Equipment Co-chair, IEEE Visualization 2004 conference.
National Nanotechnology Initiative Workshop on Nanotechnology in Space Exploration, Aug 24-26, 2004.

Other Service:

Curriculum on Applied Sciences and Engineering Executive Committee, UNC-CH	Sept 2008-present
BME faculty search committee	Fall 2007
Chairman, HPCC area hiring committee for CS faculty search	Fall 2006.
Commencement address, UNC Physics department graduation ceremony	Spring 2006.
Organizer, UNC-CS "Are We Ready for the Future?" lecture trilogy	Fall 2004.
Institute for Advanced Materials Steering Committee, UNC-CH	Fall 2003-present
Applied and Materials Sciences Curriculum Advisory Board, UNC-CH	July 2001-Sept 2008

Student Advising:

Postdocs Supervised: Kalpit Desai.

Ph. D. Advisor: Chris Dwyer, Tom Hudson, Adam Seeger, Chris Weigle, David Borland, Brian Eastwood, Cory Quammen, David Feng.

Ph. D. Committee Member: Greg Welch, Kevin Arthur, David Glick (Phys), Phillip Williams (Phys), Gentaro Hirota, Chun-Fa Chang, Brent Insko, Danette Allen, Peter Brown, Miguel Otaduy, Peter Parente, Onejae Sul (Phys), Kalpit Desai (BME), Wen Qi (Netherlands), Derek Merck, Luv Kohli, Ilknur Kabul.

Masters Advisor: Charalampos Fretzagias, Tom Lassanske, Amy Henderson, Jeff Juliano, Leila Plummer, Xiaohu Guan, Aron Helser, Chris DiMattia, Renee Maheshwari, Peter Parente, Alvin Richardson, Ben Wilde.

Research Supervisor: Edward Dale, Serhat Tekin, Ben Wilde, Kent Rosenkoetter, Ja-Yeon Jeong, Dennis Jen, Alvin Richardson, Jonathan Robbins, Andrea Marie Hilchey, Yonatan Friedman, Tanner Lovelace, Mark Foskey, Ramkumar Parameswaran, Stephen Ehmann, Zhi Chen, Gokul Varadhan, Michele Clark, Ashes Ganguly, Jason Clark, Kelly Van Busum, Gokul Varadhan, Tom Lassanske, Stefan Sain, Daniel Rohrer, Alexandra Bokinsky, Sang-Uok Kum, Sharif Razzaque, Jun Chen, Brian Grant, Kimberly Passarella-Jones, Dongxiang Wu, Christine Yao, Lin Cui, Mave Houston, Qiang Liu, Noel Llopis-Artime, Shoji Okimoto, Mark Finch.

Masters Committee Member: Gongpu Zhao (Phys), Jerome Carpenter (Phys).

Russell Taylor

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs - Kalpit Desai

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

I have run a series of independent-study courses with incoming freshman who are interested in the intersection between art/design and computer science. Kendall McKenzie was the first, and she produced a pilot computer-animated 3D video showing how mucus clearance happens inside the lung, combining actual lung scans with simulation data and hand-drawn artwork. Callie Holderman is finalizing this work for YouTube deployment and developing the next version, which is to be interactive.

c. Course development work undertaken (2-3 sentences per item)

The "Visualization in the Sciences" course was adapted for presentation at DOE Underrepresented Faculty conferences at NC A&T and at the Supercomputing conference. It was also co-taught one semester with NC A&T and it has been exported to Duke University and Appalachian State University.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

See attached Dissemination document for our CISMM resource. Both tons of open-source software used all over and commercialization of the nanoManipulator.

Curriculum Vitae of Leandra Vicci

Current Appointment: 1981 – Lecturer of Computer Science and Director of the Applied Engineering Laboratory (previously, *Microelectronic Systems Laboratory*), Department of Computer Science, University of North Carolina, Chapel Hill, NC.

Previous Appointments:

⋆ 1978 – Engineer, Electro Scientific Industries, Portland, OR;

⋆ 1975 – Supervisor, University of Oregon, Eugene, OR;

⋆ 1972 – Engineer, Oregon Graduate Center, Beaverton, OR;

⋆ 1965 – Engineer, Boeing Aerospace, Seattle, WA;

⋆ 1962 – Lab Technician, Scripps Institute or Oceanography, La Jolla, CA;

⋆ 1961 – Coop Intern, Woods Hole Oceanographic Institution, Woods Hole, MA;

⋆ 1960 – Coop Bench Technician, ACF Industries, Paramus, NJ;

⋆ 1960 – Coop Research Assistant, Florida State University, Tallahassee, FL.

Education:

⋆ Antioch College, Physics, B.S., 1964.

Awards:

⋆ 1996 UNC Chapel Hill Chancellor's Award for Innovation in Research.

⋆ 1996 North Carolina Governor's Award for Innovation.

Recent Publications:

BOOK CHAPTERS

⋆ Taylor II, R. M., D. Borland, F. P. Brooks Jr., M. Falvo, M. Guthold, T. Hudson, K. Jeffay, G. Jones, D. Marshburn, S. J. Papadakis, L.-C. Qin, A. Seeger, F. D. Smith, D. H. Sonnenwald, R. Superfine, S. Washburn, C. Weigle, M. C. Whitton, P. Williams, L. Vicci and W. Robinett, "Visualization and Natural Control Systems for Microscopy," in *Visualization Handbook*, edited by C. Johnson and C. Hansen, Harcourt Academic Press, 2004, pp.875-900.

REFEREED JOURNALS

⋆ Spero, R. C., L. Vicci, J. Cribb, D. Bober, V. Swaminathan, E. T. O'Brien, S. Rogers, R. Superfine, "High Throughput system for magnetic manipulation of cells, polymers, and biomaterials," *Review of Scientific Instruments,* **79**, 083707 (2008) (7 pages), August 2008.

⋆ Desai, K. V., G. Bishop, L. Vicci, E. T. OBrien, R. M. Taylor II, R. Superfine, "Agnostic particle tracking for three-dimensional motion of cellular granules and membrane-tethered bead dynamics," *Biophysical Journal,* vol. 94 no. 6, pp. 2374-84, 15 March 2008.

⋆ E. L. Bouzarth, A. Brooks, R. Camassa, J. Hao, T. J. Leiterman, R. M. McLaughlin, R. Superfine, J. Toledo, L. Vicci, "Epicyclic orbits in a viscous fluid about a precessing rod: Theory and experiments at the micro- and macro-scales," *Physical Review E,* vol. 76 no. 1, July 2007.

⋆ Spero, R. C., B. Smith, L. Vicci, J. Cribb, E. T. O'Brien, S. T. Lord, R. Superfine, "High throughput microbead rheology of fibrin gels," *Biophysical Journal,* vol. 92 no. 1, Suppl. S, Jan 2007.

⋆ Cribb, J., D. B. Hill, R. M. Taylor II, L. Vicci, J. Fisher, K. V. Desai, M. G. Forest, R. Superfine, "Nonlinear rheology of entangled lambda-DNA solutions via driven microbead rheology" *Biophysical Journal,* vol. 92 no. 1, Suppl. S, Jan 2007.

⋆ Fisher, J. K., L. Vicci, J. Cribb, E. T. O'brien, R. M. Taylor, R. Superfine, "Magnetic force micromanipulation systems for the biological sciences," *NANO,* vol. 1, no. 3, pp. 191-205, November 2006.

⋆ Hall, A. R., An, L., Liu, J., Vicci, L., Falvo, M. R., Superfine, R., Washburn, S., "Experimental measurement of single-wall carbon nanotube torsional properties," *Physical Review Letters,* vol. 96, no. 25, pp. 256102/1-4, 30 June 2006.

⋆ Fisher, J., J. Cribb, K. Desai, L. Vicci, B. Wilde, K. Keller, R. Taylor II, J. Haase, K. Bloom, T. O'Brien, R. Superfine, "Thin-foil magnetic force system for high-numerical-aperture microscopy," *Review of Scientific Instuments,* (pub. on-line) 14 February 2006.

⋆ Desai, K. V., G. Bishop, L. Vicci, E. T. OBrien, R. M. Taylor II, R. Superfine, "Agnostic Tracking: A New Era for Laser Interferometry in Biology," *Biophysical Journal,* vol. 90 no. 1, Jan 2006.

⋆ Fisher, J., L. Vicci, J. Cummings, K. Keller, B. Wilde, T. O'Brien, K. Desai, C. Weigle, G. Bishop, R. Taylor II, C. Davis, R. Boucher, R. Superfine, "Three-dimensional force microscope: A nanometric optical tracking and magnetic manipulation system for the biomedical sciences," *Review of Scientific Instuments,* vol. 76 no. 5, May 2005.

⋆ Meehan, T.D,. Vicci, L., O'Brien, E.T., Fisher, J., Superfine, R., "Quantitative study of the magnetophoresis of ferritin labeled beads," *Biophysical Journal,* vol. 88 no. 1, Jan 2005.

⋆ Cribb, J., Hill, D.B., Taylor, R.M., Vicci, L., Fisher, J., Desai, K.V., Wilde, B., Sheehan, J., Forest, M.G., Superfine, R., "Measuring local microrheological properties of human mucus with magnetically driven microbeads," *Biophysical Journal,* vol. 88 no. 1, Jan 2005.

⋆ Dwyer, C., L. Vicci, J. Poulton, D. Erie, R. Superfine, S. Washburn, R. M. Taylor II, "The design of DNA self-assembled computing circuitry," *IEEE Tran. VLSI Systems,* vol. 12, pp. 1214-20, November 2004.

⋆ Papadakis, S. J., A. R. Hall, P. A. Williams, L. Vicci, M. R. Falvo, R. Superfine, S. Washburn, "Resonant Oscillators with Carbon-Nanotube Torsion Springs," *Physical Review Letters*, vol. 93, p. 146101, 1 October 2004.

⋆ Dwyer, C., J. Poulton, R. Taylor, L. Vicci, "DNA self-assembled parallel computer architectures," *Nanotechnology*, vol. 15, pp. 1688-94, October 2004.

⋆ Dwyer, C., L. Vicci, and R. M. Taylor, "Performance simulation of nanoscale silicon rod field-effect transistor logic," *IEEE Trans. Nanotechnology,* vol. 2, pp. 69 V74, June 2003.

CONFERENCES

- ⋆ Desai, K. V., G. Bishop, L. Vicci, E. T. OBrien, R. M. Taylor II, R. Superfine, "Agnostic Tracking: in situ and on-the-fly calibration for 3D position tracking," *Biomedical Engineering Society meeting,* 2006.

- ⋆ Hao, J., B. Wilde, R. M. Taylor II, L. Vicci, R. M. McLaughlin, R. Camassa, T. J. Leiterman, R. Superfine, "Nanoscale Fluidics: Modeling Cilia with a Rotating Magnetic Nanowire," *Materials Research Soc.* Annual Fall Mtg, 2005.

- ⋆ Carroll, R. L., B. Wilde, R. M. Taylor, L. Vicci, S. Washburn, and R. Superfine, "Biomimetic Flexible Polymer Rods–Artificial Cilia," *American Physical Soc.* Southern Section Annual Mtg., 2003.

- ⋆ Desai, K. V., G. Welch, G. Bishop, L. Vicci, R. M. Taylor, R. Superfine, "3D Tracking of a Particle in 3DFM," *American Physical Soc.* Southern Section Annual Mtg., 2003.

- ⋆ Hao, J., B. Wilde, J. Cribb, C. Dwyer, J. Fisher, K. Desai, L. Vicci, R. M. Taylor II, R. Superfine, "Nanoscale Fluidics: Using Magnetic Nanorods as Model Cilia," *American Physical Soc.* Southern Section Annual Mtg., 2003.

- ⋆ Superfine, R., L. Vicci, J. Hao, J. Fisher, B. Wilde, R. M. Taylor, E. T. O'Brien, "Magnetic pole structures for biological force measurements," *2003 Biomedical Engineering Society Meeting,* October 2003.

- ⋆ Fisher, J., R. Superfine , T. O'Brien, R. M. Taylor II, C. W. Davis, H. Matsui, L. Vicci, G. Matthews and B. Wilde "Motion and force generation of cilia in human lung cell cultures," *47th Biophysical Society Annual Meeting,* San Antonio, TX, March 1-5, 2003.

- ⋆ Sill, D., J. Hao, D. Brandl, B. Wilde, J. Fisher, L. Vicci, R. M. Taylor II, R. Superfine, "Microfabricated magnetic pole structures for biological force measurements," *47th Biophysical Society Annual Meeting,* San Antonio, Texas., March 1-5, 2003.

TECHNICAL REPORTS

- ⋆ Vicci, Leandra "The 3DFM Magnet Drive Amplifier," TR05-002, Department of Computer Science, UNC at Chapel Hill, January 2005.

- ⋆ Vicci, Leandra "Analytical bead force model for the 3DFM," TR03-029, Department of Computer Science, UNC at Chapel Hill, September 2003.

- ⋆ Vicci, Leandra "B&K 4370 Accelerometer and Charge Amplifier Manual," TR03-002, Department of Computer Science, UNC at Chapel Hill, January 2003.

Intellectual Property

PATENTS

- ⋆ Vicci, Leandra and R. Superfine, "Methods and systems for three-dimensional motion control and tracking of a mechanically unattached magnetic probe," U.S. Pat. No. 7,305,319; 4 December 2007.

- ⋆ Vicci, Leandra and R. Superfine, "Methods and systems for controlling motion of and tracking a mechanically unattached probe," U.S. Pat. No. 7,191,092; 13 March 2007.

- ⋆ Vicci, Leandra and R. Superfine, "Methods and systems for controlling motion of and tracking a mechanically unattached probe," U.S. Pat. No. 7,189,969; 13 March 2007.

⋆ Vicci, Leandra and R. Superfine, "Methods and systems for controlling motion of and tracking a mechanically unattached probe," U.S. Pat. No. 7,119,645; 10 October 2006.

⋆ Vicci, Leandra, "Methods and systems for reactively compensating magnetic current loops," U.S. Pat. No. 6,960,984; 1 November 2005.

⋆ Vicci, Leandra, "Magnetic-flux conduits," U.S. Pat. No. 6,720,855; 13 April 2004.

Professional activities and service:

⋆ Member of IEEE, ACM

⋆ Conference committee, ARVLSI95

⋆ Nine MCNC technical advisory committees, 1982-1991

⋆ UNC Patent Committee 1988-1998

⋆ UNC College of Arts and Sciences Conflict of Interest Oversight Committee 1996-2006

Leandra Vicci

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs –

I have informally mentored several in the hard sciences, but not as a formal supervisor. Stergios Papadakis and Adam Hall in Physics and Astronomy come to mind. None in Computer Science however.

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

N/A

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

I developed much of the enabling technology for the CISMM program.
In particular, the force generating magnetics and control circuitry for the 3D Force Microscope (3DFM) were of my conception, design and construction.
I was also a major contributor to the 3DFM interferometric 3D tracking subsystem.
I have (jointly) been awarded several patents for my work in this area, with which we are pursuing commercialization of the High Throughput version of this technology.

J. M. Walsh — Curriculum Vita

OFFICE
Department of Computer Science
The University of North Carolina
Chapel Hill, NC 27599-3175
Voice: (919) 962-1816
Web: www.cs.unc.edu/~walsh

HOME
309 Rhododendron Drive
Chapel Hill, NC 27517
(919) 932-6873
Fax: (919) 962-1799
E-mail: walsh@cs.unc.edu

Education

Master of Science in Business Education–emphasis in Information Systems and Computer Education, Oklahoma State University, Stillwater, OK, Dec. 1984

Courses included: Programming (intro and advanced structured COBOL); management of information processing; small business computers; systems analysis and design; methods of teaching data processing; graduate readings in information systems; statistics; business education seminar; business curriculum; written and verbal communications.

Cumulative GPA: 4.00

Honors, awards: Delta Pi Epsilon Honor Society.

Bachelor of Science in Business Administration, majored in Business Education, Oklahoma State University, Stillwater, OK, Dec. 1982

Courses included: Methods of teaching accounting, typewriting, shorthand, and basic business/economics; also, courses in marketing, management, data processing, accounting, finance, written communications, economics, and statistics.

Cumulative GPA: 3.95; **GPA in major (and at OSU):** 4.00

Honors, awards: President's Honor Roll every semester; Phi Kappa Phi Honor Society; Outstanding Business Education Senior (NBEA award); recipient, Raymond D. Thomas Memorial Scholarship.

Associate of Science, majored in legal studies, Mount Wachusett Community College, Gardner, MA, June 1971

Courses included: Accounting, business law, legal office management.

Cumulative GPA: 3.90; **GPA in major:** 4.00

Honors, awards: Class Valedictorian, Recipient of President's Key, June 1971; Who's Who in American Junior Colleges; Phi Theta Kappa Honor Society; Dean's List every semester.

Selected work experience

July 2005–present:

Senior Lecturer and Director of General Studies, Department of Computer Science, The University of North Carolina, Chapel Hill, NC 27599-3175 (Senior Lecturer as of 1 July 2005).

Courses taught:

COMP 101 (formerly 4)—COMPUTERS: Power Tools for the Mind. Includes managing and coordinating activities of COMP 4 staff: three graduate teaching assistants and one undergraduate laboratory assistant. Course topics include: history of computing; data representation, memory, storage, and processing; hardware and software components; telecommunications concepts; societal issues of computing (privacy, crime, security, intellectual property rights/conflicts). Hands-on instruction, provided by instructor, supplemented by graduate TAs under my supervision, includes operation of a personal computer using the Windows OS, the Microsoft Office Professional suite (word processing, spreadsheet, database, and presentation software), and an introduction to programming in the Turing language.

COMP 90—Power Tools: APPLES Service Learning Experience. The course provides remote-site hands-on service-learning experiences for interested COMP 4 students. Students assist various audiences from the community—ranging from young children to the elderly—to use a computer effectively. COMP 90 students identify what computer concepts are the most difficult for beginners to grasp; prepare detailed individualized lesson plans; teach either one-on-one or in small groups; learn to recognize the important qualities required of an effective teacher; learn alternative teaching strategies for

students with different needs; learn why community service is important to today's university student and to the community at large.

COMP 380 (formerly 96)—Computers and Society. Present and discuss issues pertaining to information technology's affects on the individual and on society. Topics include (but are not limited to): how computers work (hardware, software); software reliability and critical systems; e-democracy; virtual communities and social changes; anonymity and accountability; censorship and the First Amendment; intellectual property; informational and workplace privacy; the hacker ethic; digital manipulation; simulations; future applications); telecommuting; gender issues; and implications of pursuing artificial intelligence.

July 1999–June 2005:

Lecturer and Director of General Studies, Department of Computer Science, The University of North Carolina, Chapel Hill, NC 27599-3175 (Senior Lecturer as of 1 July 2005).

July 1991–June 1999:

Lecturer and Publications Director, Department of Computer Science, The University of North Carolina, Chapel Hill, NC 27599-3175

Lecturer (see above; added COMP 96 during spring 1994)

Publications Director and Editor, Department publications

Overall management and production of most official Department Web pages (since 1995), research and admissions brochures, semester alumni newsletters, and admissions posters. Creation of and ongoing responsibility for centralized textual database.

Served as Chair of the Department's Publications Committee.

Additional responsibilities

Served as consultant to accounting staff for automated accounting system (through 1997).

Helped to train new staff members on hardware and software operations.

Summers: Coordinated special projects for Chairman and Associate Chairman for Administration. E.G.:

Wrote user manuals for administrative staff members, including basic computer terminology and concepts, electronic mail and news, Unix text editors, Unix commands and features, Macintosh features, and general Department information.

Analyzed the University's manual purchase requisition system, and studied the new on-line system for implementation in the Department. Wrote user manuals, data entry forms, and supporting documentation, and trained our accounting staff on the system. Copies to UNC Purchasing Department.

Dec 1986–June 1991:

Research Associate and Publications Director, Department of Computer Science, The University of North Carolina at Chapel Hill

Administrator

Administrator for multiple research projects partially funded by a five-year, $5 million contract from the Office of Naval Research: all budgeting, forecasting, and expenditure responsibilities; report writing and editing of semi-annual and annual reports; coordination of arrangements for annual site visits, which included presenting a financial report, and composing drafts of other administrative presentations; miscellaneous reports to Executive Committee.

Outreach, service, guest lectures

Organized campus volunteer group for the Disabilities Awareness Council project—to teach the DAC board members to be fluent in information technology so that they, in turn, can teach disabled members of our community.

Club advisor for two undergraduate student organizations: Technology Without Borders, and Psi Phi. Fall 2005 to the present.

Invited instructor, C.S. Department Admin Staff seminar, 27 July 2005. *Word and Excel tips and tricks.*

Invited guest lecturer, COMP 4, spring 2005: *Telecommunications concepts.*

Publications

Walsh, J. M. *Power Tools for the Mind: Office 2003 Workbook,* Kendall/Hunt Publishing Company, 2005, 328 pgs.

Have served as external book and/or chapter reviewer for several textbooks and articles (for Addison-Wesley; Prentice-Hall; John Wiley & Sons, and others).

Selected Conferences/Forums

Co chair of the *Security and Liberty Forum,* co-sponsored by the Dept. of Computer Science and the NC Chapter of the ACLU, UNC at Chapel Hill, 14 April 2007.

Course Technology's National Conference for Computer Educators, San Antonio, TX, 24-26 March 2004.

Organization memberships

Association for Computing Machinery (ACM) and ACM's SIGCAS

Beta Gamma Sigma Honor Society for Business

Computer Professionals for Social Responsibility (CPSR)

Delta Pi Epsilon Graduate Honor Society in Business Education

National Business Education Association

Phi Kappa Phi Honor Society

Privacy and Technology Committee, N.C. Chapter of the ACLU

Committee memberships

UNC at Chapel Hill

Member, University Hearing Board (Honor Court), UNC-Chapel Hill, spring 2002 to present

Department of Computer Science

Chair, COMP 101/102 Subcommittee, fall 2005 through spring 2007.

Chair, General Education Subcommittee, spring 2002; fall 2004 through fall 2006

Chair, Department Web and Publicity Committee, fall 2006 to the present

Publications Advisory Committee, 1988-2004. (Chair from 1988 to 2001)

Teaching Tune-Up Committee (ad hoc), fall 1995-fall 2004 (often have served as subcommittee chair)

Undergraduate Curriculum Committee, 1999-2004

References, Dept. of Computer Science, CB#3175, Chapel Hill NC 27599

- Jan Prins, Professor and Chair
  Ph: 919-962-1913   prins@cs.unc.edu
- Stephen F. Weiss, Professor (Chair, 1 Jan. 1989 through 30 June 2004)
  Ph: 919-962-1888   weiss@cs.unc.edu
- David Stotts, Professor and Associate Chair for Academics
  Ph: 919-962-1833   stotts@cs.unc.edu
- Timothy Quigg, Lecturer and Associate Chair for Administration and Finance
  Ph: 919-962-1777   quigg@cs.unc.edu   Oct 2008

Jeannie Walsh

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

I have served as Director of General Studies:
To ensure that the CS dept better serves our non-CS-major undergraduate population through the improvement of existing courses, the addition of new courses (including First-Year seminars and flavors of existing courses), surveys of current and former students, and additional advertising (such as on Facebook and at CTOPS). To that end, have served as chair of the General Studies Curriculum subcommittee

I have served on the Undergraduate Curriculum Committee.

I have taught a number of independent study courses for non-CS undergraduate students who expressed a desire to better understand the various ways in which IT can be both useful and risky.

c. Course development work undertaken (2-3 sentences per item)

We've seen the demand for enrollment in COMP 380--Computers in Society increase tremendously over the past several years. The course satisfies not only the Philosophical & Moral Reasoning Approach, but with a few substantial changes, it also satisfies (in the new curriculum) the Communications Intensive Perspective.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

I have served as chair of the department's Web and Publicity Committee, an advisory committee to the chair which has studied more effective ways to promote our department and its offerings to numerous and varied external audiences.

I started an on-campus group of volunteers (faculty, staff, students) who will work to help members of the Disabilities Awareness Council to be fluent in information technology so that they, in turn, can work with disabled members of our community with their IT needs and training issues. These efforts will soon be coordinated with a local branch of the United Way.

Wei Wang, Ph. D.

Associate Professor
Computer Science Department
University of North Carolina, Chapel Hill
Chapel Hill, NC 27599
Voice: (919)962-1744
E-mail: weiwang@cs.unc.edu
URL: http://www.cs.unc.edu/~weiwang/

RESEARCH INTERESTS

Data Mining, Bioinformatics, Database Systems.

EDUCATION

Jul. 1999	Ph.D., Department of Computer Science, UCLA.
May 1995	M.S., Department of Systems Science and Industrial Engineering, SUNY at Binghamton.

WORK EXPERIENCE

2005 - present	Associate Professor at Department of Computer Science, University of North Carolina at Chapel Hill
2002 - 2005	Assistant Professor at Department of Computer Science, University of North Carolina at Chapel Hill
1999 - 2002	Research Staff Member at IBM T.J. Watson Research Centers

HONORS AND AWARDS

Best Research Paper Award, SIGKDD 2008 for the paper "FastANOVA: an efficient algorithm for genome-wide association study".
Best Student Paper Award, ICDE 2008 for the paper "CARE: finding local linear correlations in high dimensional data".
Phillip and Ruth Hettleman Prize for Artistic and Scholarly Achievement, UNC, 2007.
Microsoft Research New Faculty Fellow, Microsoft, 2005.
Faculty Early Career Development (CAREER) Award, NSF, 2005.
Junior Faculty Development Award, UNC, 2003.

PROFESSIONAL ACTIVITIES

- Associate Editor of the ACM Transactions on Knowledge Discovery in Data (2005 - present)
- Guest Editor of the ACM Transactions on Knowledge Discovery in Data Special Issue on Bioinformatics (2007)
- Associate Editor of the Knowledge and Information Systems (2007 - present)
- Review Board Member of the Proceedings of the VLDB Endowment (2008 - present)

- Editorial Board Member of the Open Artificial Intelligence Journal (2007 - present)
- Editorial Board Member of the International Journal of Data Mining and Bioinformatics (2005 - present)
- Associate Editor of the IEEE Transactions on Knowledge and Data Engineering (2003 - 2007)
- Editorial Board Member of the Journal of Database Management (2000 - 2005)
- Guest Editor of the IEEE Transactions on Knowledge and Data Engineering Special Issue on Mining Biological Data vol. 17 no. 8 (2005)
- Intensive Working Group Member of the ACM SIGKDD Curriculum Committee (2003 - present)
- Panelist of the NIH BDMA program (2007)
- Panelist of the NIH CSR program (2007)
- Panelist of the NIH System Biology program (2007)
- Panelist of the NSF IIS program (2007)
- Panelist of the NIH BDMA program (2006)
- Panelist of the NIH CSR program (2006)
- Panelist of the NSF EMT program (2006)
- Panelist of the EPA SBIR program on Computational Toxicology (2005)
- Panelist of the NSF SEIII program (2005)
- Panelist of the NSF BDI program (2005)
- Panelist of the NSF BDI program (2004)
- Panelist of the NSF ITR Medium Award (2003)
- Vice Chair of the 26th International Conference on Data Engineering (2010)
- Program Committee Co-Chair of the 8th IEEE International Conference on Data Mining (2009)
- Program Committee Member of the 35th International Conference on Very Large Data Bases (2009)
- Awards Chair of the 15th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (2009)
- Publicity Co-Chair of the SIAM International Conference on Data Mining (2009) Program Committee Member of the 14th International Conference on database Systems for Advanced Applications (2009)
- Vice Chair of the 25th International Conference on Data Engineering (2009)
- Program Committee Member of the 8th IEEE International Conference on Data Mining (2008)
- Program Committee Member of the 17th ACM Conference on Information and Knowledge Management (2008)
- Program Committee Member of the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (2008)
- Program Committee Member of the 34th International Conference on Very Large Data Bases (2008)
- Program Committee Member of the 14th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2008)
- Program Committee Member of the 8th International Workshop on Data Mining in Bioinformatics (2008)

- Area Chair of the 12th Pacific-Asia Conference on Knowledge Discovery and Data Mining (2008)
- Proceedings Chair and Program Committee Member of the SIAM International Conference on Data Mining (2008)
- Program Committee Member of the 24th IEEE International Conference on Data Engineering (2008)
- Program Committee Member of the 13th International Conference on Database Systems for Advanced Applications (2008)
- Program Committee member of the 16th ACM Conference on Information and Knowledge Management (2007)
- General Co-chair of the 2nd International Workshop on Data and Text Mining in Bioinformatics in Conjunction with the 16th ACM Conference on Information and Knowledge Management (2007)
- Vice Chair of the 7th IEEE International Conference on Data Mining (2007)
- Program Committee Co-chair of the Workshop on Mining and Management of Biological Data, in Conjunction with the 7th IEEE International Conference on Data Mining (2007)
- Program Committee member of the 2nd Workshop on Data Mining ihn Bioinformatics in Conjunction with the 33rd International Conference on Very Large Data Bases (2007)
- Program Committee Member of the 9th International Conference on Data Warehousing and Knowledge Discovery (2007)
- Program Committee Member of the 13th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2007)
- Program Committee Member of the ACM SIGMOD International Conference on Management of Data (2007)
- Area Chair of the 11th Pacific-Asia Conference on Knowledge Discovery and Data Mining (2007) Program Committee Member of the SIAM International Conference on Data Mining (2007)
- Program Committee Member of the 12th International Conference on Database Systems for Advanced Applications (2007)
- Program Committee Member of the 6th IEEE International Conference on Data Mining (2006)
- Program Committee Member of the 13th International Conference on Management of Data (2006)
- Program Committee Member of the 15th ACM Conference on Information and Knowledge Management (2006)
- Program Committee Member of the 17th European Conference on Machine Learning and the 10th European Conference on Principles and Practice of Knowledge Discovery in Databases (2006)
- Program Committee Member of the 32nd International Conference on Very Large Data Bases (2006)
- Program Committee Member of the Ph.D. Workshop in Conjunction with the 32nd International Conference on Very Large Data Bases (2006)
- Program Committee Member of the Workshop on Data Mining in Bioinformatics in Conjunction with 32nd Int. Conference on Very Large Data Bases (2006)

- Program Committee Member of the 8th International Conference on Data Warehousing and Knowledge Discovery (2006)
- Senior Program Committee Member of the 12th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2006)
- Program Committee Member of the 6th International Workshop on Data Mining in Bioinformatics in Conjunction with 12th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2006)
- Program Committee Member of the 2nd International Conference on Advanced Data Mining and Applications (2006)
- Program Committee Member of the 11th International Conference on Database Systems for Advanced Applications (2006)
- Program Committee Member of the 22nd IEEE International Conference on Data Engineering (2006)
- Program Committee Member of the International Conference on Semantics of a Networked World (2006)
- Program Committee Member of the 10th International Conference on Extending Database Technology (2006)
- Program Committee Member of the 4th Asia-Pacific Bioinformatics Conference (2006)
- Program Committee Member of the 5th IEEE International Conference on Data Mining (2005)
- Program Committee Member of the 5th IEEE Symposium on Bioinformatics and Bioengineering (2005)
- Program Committee Member of the 6th International Conference on Web-Age Information Management (2005)
- Program Committee Member of the 31st International Conference on Very Large Data Bases (2005)
- Program Committee Member of the Ph.D. Workshop at the 31st International Conference on Very Large Data Bases (2005)
- Program Committee Member of the 3rd International Workshop on Biological Data Management in Conjunction with the 16th International Conference on Database and Expert Systems Applications (2005)
- Program Committee Member of 11th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2005)
- Program Committee Co-chair of the 5th Workshop on Data Mining in Bioinformatics in Conjunction with the 11th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2005)
- Program Committee Member of the 1st International Conference on Advanced Data Mining and Applications (2005)
- Program Committee Member of the IEEE Workshop on Computer Vision methods for Bioinformatics in Conjunction with IEEE International Conference on Computer Vision and Pattern Recognition (2005)
- Program Committee Member of the ACM SIGMOD International Conference on Management of Data (2005)
- Corporate Sponsor Committee Member of the ACM SIGMOD International Conference on Management of Data (2005)

- Program Committee Member of the 7th Asia Pacific Web Conference (2005)
- Program Committee Member of the ACM Symposium on Applied Computing (2005)
- Scientific Committee Member of the International Conference on Computational and Information Sciences (2004)
- Program Committee Member of the 13th ACM Conference on Information and Knowledge Management (2004)
- Program Committee Member of the 4th IEEE International Conference on Data Mining (2004)
- Program Committee Member of the ICDM'04 Workshop on Life Sciences Data Mining (2004)
- Program Committee Member of the 1st International Workshop on Knowledge Discovery in Data Streams in conjunction with the 15th European Conference on Machine Learning (2004)
- Program Committee Member of the 2nd International Workshop on Biological Data Management in conjunction with the 15th International Conference on Database and Expert Systems Applications (2004)
- Program Committee Member of the 10th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2004)
- Program Committee Member of the 4th Workshop on Bioinformatics in Data Mining in conjunction with the 10th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2004)
- Program Committee Member of the 5th International Conference on Software Engineering, Artificial Intelligence, Networking, and Parallel/Distributed Computing (2004)
- Program Committee Member of the 2nd International Conference on Software Engineering Research, Management & Applications (2004)
- Program Committee Member of the 6th Asia Pacific Web Conference (2004)
- Scientific Committee Member of the IADIS International Conference on Applied Computing (2004)
- Program Committee Member of the ACM Symposium on Applied Computing (2004)
- Proceedings Chair of the 4th International Conference on Web-Age Information Management (2003)
- Program Committee Member of the 4th International Conference on Web-Age Information Management (2003)
- Program Committee Member of the 15th International Conference on Scientific and Statistical Database Management (2003)
- Session Chair of the 24th IEEE International Conference on Data Engineering (2008)
- Session Chair of the 7th IEEE International Conference on Data Mining (2007)
- Session Chair of the SIAM International Conference on Data Mining (2007)
- Session Chair of the 12th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2006)
- Session Chair of the 22nd IEEE International Conference on Data Engineering (2006)

- Session Chair of the 11th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2005)
- Session Chair of the ACM SIGMOD International Conference on Management of Data (2005)
- Session Chair of the 4th IEEE International Conference on Data Mining (2004)
- Session Chair of the 10th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (2004)
- Referee for ACM SIGMOD, ACM SIGMETTRICS, VLDB, ACM SIGKDD, ICDE, FODO conferences (1997-present)

SERVICES
Undergraduate Review Committee Member, UNC (2004)
Graduate Admission Committee Member, UNC (2003-present)

PUBLICATIONS
ARTICLES IN REFEREED CONFERENCES

1. TreeQA: quantitative genome wide association mapping using local perfect phylogeny trees, by Feng Pan, Leonard McMillan, Fernando Pardo-Manuel de Villena, David Threadgill and **Wei Wang**. *Proceedings of the the 14th Pacific Symposium on Biocomputing (PSB)*, 2009.
2. Inferring genome-wide mosaic structure, by Qi Zhang, **Wei Wang**, Leonard McMillan, Fernando Pardo-Manuel de Villena, and David Threadgill. *Proceedings of the the 14th Pacific Symposium on Biocomputing (PSB)*, 2009.
3. FastChi: an efficient algorithm for analyzing gene-gene interactions, by Xiang Zhang, Fei Zou, and **Wei Wang**. *Proceedings of the the 14th Pacific Symposium on Biocomputing (PSB)*, 2009.
4. REDUS: finding reducible subspaces in high dimensional data, by Xiang Zhang, Feng Pan, and **Wei Wang**. *Proceedings of the 17th ACM Conference on Information and Knowledge Management (CIKM)*, 2008.
5. Genotype sequence segmentation: handling constraints and noise, by Qi Zhang, **Wei Wang**, Leonard McMillan, Jan Prins, Fernando Pardo-Manuel de Villena, and David Threadgill. *Proceedings of the 8th Workshop on Algorithms in Bioinformatics (WABI)*, 2008.
6. Mining non-redundant high order correlations in binary data, by Xiang Zhang, Feng Pan, **Wei Wang**, and Andrew Nobel. *Proceedings of the 34th International Conference on Very Large Data Bases (VLDB)*, pp. 1178-1188, 2008.
7. FastANOVA: an efficient algorithm for genome-wide association study, by Xiang Zhang, Fei Zou, and **Wei Wang**. *Proceedings of the 14th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (SIGKDD)*, pp. 821-829, 2008. (**Best Research Paper**)
8. CRD: a general framework for fast co-clustering on large datasets utilizing sample-based matrix decomposition, by Feng Pan, Xiang Zhang, and **Wei Wang**. *Proceedings of the ACM SIGMOD International Conference on Management of Data (SIGMOD)*, pp. 173-184, 2008.

9. CARE: finding local linear correlations in high dimensional data, by Xiang Zhang, Feng Pan, and **Wei Wang**. *Proceedings of the 24th IEEE International Conference on Data Engineering (ICDE)*, pp. 130-139, 2008. (**Best Student Paper**)

10. Mining approximate order preserving clusters in the presence of noise, by Mengsheng Zhang, **Wei Wang**, and Jinze Liu. *Proceedings of the 24th IEEE International Conference on Data Engineering (ICDE)*, pp. 160-168, 2008.

11. Approximate clustering on distributed data streams, by Qi Zhang, Jinze Liu, and **Wei Wang**. *Proceedings of the 24th IEEE International Conference on Data Engineering (ICDE)*, pp. 1131-1139, 2008.

12. A general framework for fast co-clustering on large datasets using matrix decomposition, by Feng Pan, Xiang Zhang, and **Wei Wang**. *Proceedings of the 24th IEEE International Conference on Data Engineering (ICDE)*, pp. 1337-1339, 2008.

13. Sample selection for maximal diversity, by Feng Pan, Adam Roberts, Leonard McMillan, Fernando Pardo Manuel de Villena, David Threadgill, and **Wei Wang**. *Proceedings of the 7th IEEE International Conference on Data Mining (ICDM)*, pp. 262-271, 2007.

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16. An efficient algorithm for mining coherent patterns from heterogeneous Microarrays, by Xiang Zhang and **Wei Wang**. *Proceedings of the 19th International Conference on Scientific and Statistical Database Management (SSDBM)*, pp. 32, 2007.

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24. Mining coherent patterns from heterogeneous microarray data, by Xiang Zhang, and **Wei Wang**. *Proceedings of the 15th ACM Conference on Information and Knowledge Management (CIKM)*, pp. 838-839, 2006.
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37. A framework for ontology-driven subspace clustering, by Jinze Liu, **Wei Wang**, and Jiong Yang. *Proceedings of the 10th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (SIGKDD)*, pp. 623-628, 2004.
38. SPIN: Mining maximal frequent subgraphs from graph databases, by Jun Huan, **Wei Wang**, Jan Prins, and Jiong Yang. *Proceedings of the 10th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (SIGKDD)*, pp. 581-586, 2004.
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40. Biclustering of gene expression data by tendency, by Jinze Liu, Jiong Yang, and **Wei Wang**. *Proceedings of the IEEE Computational Systems Bioinformatics Conference (CSB)*, pp. 182-193, 2004.
41. BASS: approximate search on large string databases, by Jiong Yang, **Wei Wang**, and Philip Yu. *Proceedings of the 16th International Conference on Scientific and Statistical Database Management (SSDBM)*, pp. 181-192, 2004.
42. Fast computation of database operations using graphics processors, by Naga Govindaraju, Brandon Lloyd, **Wei Wang**, Ming Lin, and Dinesh Manocha. *Proceedings of the ACM SIGMOD International Conference on Management of Data (SIGMOD)*, pp. 215-226, 2004.
43. Understanding social welfare service patterns using sequential analysis, by Hye-Chung Kum, Dean Duncan, and **Wei Wang**. *Proceedings of the NSF National Conference on Digital Government Research (DG.O)*, 2004.
44. Successfully adopting IT for social welfare program management, by Dean Duncan, Hye-Chung Kum, Kimberly Flair, and **Wei Wang**. *Proceedings of the NSF National Conference on Digital Government Research (DG.O)*, 2004.
45. Successfully adopting IT for social welfare program management (demo), by Dean Duncan, Hye-Chung Kum, Kimberly Flair, and **Wei Wang**. *Proceedings of the NSF National Conference on Digital Government Research (DG.O)*, 2004.
46. Mining spatial motifs from protein structure graphs, by Jun Huan, **Wei Wang**, Deepak Bandyopadhyay, Jack Snoeyink, Jan Prins, and Alex Tropsha. *Proceedings of the 8th Annual International Conference on Research in Computational Molecular Biology (RECOMB)*, pp. 308-315, 2004.
47. Accurate classification of protein structural families using coherent subgraph analysis, by Jun Huan, **Wei Wang**, Anglina Washington, Jan Prins, Ruchir Shah, and Alex Tropsha. *Proceedings of the Pacific Symposium on Biocomputing (PSB)*, pp. 411-422, 2004.
48. OP-Cluster: clustering by tendency in high dimensional space, by Jinze Liu and **Wei Wang**. *Proceedings of the 3rd IEEE International Conference on Data Mining (ICDM)*, pp. 187-194, 2003.

49. Efficient mining of frequent subgraph in the presence of isomorphism, by Jun Huan, **Wei Wang**, and Jan Prins. *Proceedings of the 3rd IEEE International Conference on Data Mining (ICDM)*, pp. 549-552, 2003.

50. Discovering compact and highly discriminative features or feature combinations of drug activities using support vector machines, by Hwanjo Yu, Jiong Yang, **Wei Wang**, and Jiawei Han. *Proceedings of the IEEE Computer Society Bioinformatics Conference (CSB)*, pp. 220-228, 2003.

51. Reconstructing of ancestral gene order after segmental duplication and gene loss, by Jun Huan, Jan Prins, **Wei Wang**, and Todd Vision. *Proceedings of the IEEE Computer Society Bioinformatics Conference (CSB)*, pp. 484-485, 2003.

52. Social welfare program administration and evaluation and policy analysis using knowledge discovery and data mining (KDD) on administrative data, by Hye-Chung Kum, Dean Duncan, Kimberly Flair, and **Wei Wang**. *Proceedings of the NSF National Conference on Digital Government Research (DG.O)*, pp. 39-44, 2003.

53. Management assistance for Work First via a dynamic website, by Hye-Chung Kum, Dean Duncan, Kimberly Flair, and **Wei Wang**. *Proceedings of the NSF National Conference on Digital Government Research (DG.O)*, pp. 296, 2003.

54. STAMP: discovery of statistically important pattern repeats in a long sequence, by Jiong Yang, **Wei Wang**, and Philip Yu. *Proceedings of the 3rd SIAM International Conference on Data Mining (SDM)*, pp. 224-238, 2003.

55. ApproxMAP: approximate mining of consensus sequential patterns, by Hye-Chung Kum, Jian Pei, **Wei Wang**, and Dean Duncan. *Proceedings of the 3rd SIAM International Conference on Data Mining (SDM)*, pp. 311-315, 2003.

56. Enhanced biclustering on gene expression data, by Jiong Yang, Haixun Wang, **Wei Wang**, and Philip Yu. *Proceedings of the 3rd IEEE Conference on Bioinformatics and Bioengineering (BIBE)*, pp. 321-327, 2003.

57. CLUSEQ: efficient and effective sequence clustering, by Jiong Yang and **Wei Wang**, *Proceedings of the 19th IEEE International Conference on Data Engineering (ICDE)*, pp. 101-112, 2003.

ARTICLES IN REFEREED JOURNALS

1. The polymorphism architecture of mouse genetic resources elucidated using genome-wide resequencing data: implications for QTL discovery and systems genetics, by Adam Roberts, Fernando Pardo-Manuel de Villena, **Wei Wang**, Leonard McMillan, and David Threadgill, *Mammalian Genome*, vol. 18, no. 6, pp. 473-481, 2007.

2. Benchmarking the effectiveness of sequential pattern mining methods, by Hye-Chung Kum, J. H. Chang, and **Wei Wang**, *Data and Knowledge Engineering*, vol. 60, no. 1, pp. 30-50, 2007.

3. Structure-based function inference using protein family-specific fingerprints, by Deepak Bandyopadhyay, Jun Huan, Jinze Liu, Jan Prins, Jack Snoeyink, **Wei Wang**, and Alexander Tropsha. *Protein Science*, vol. 15, pp. 1537-1543, 2006.

4. Sequential pattern mining in multi-databases via multiple alignment, by Hye-Chung Kum, Joong-Hyuk Chang, and **Wei Wang**, *Data Mining and Knowledge Discovery (DMKD)*, vol. 12, no. 2-3, pp. 151-180, 2006.

5. Comparing graph representations of protein structure for mining family-specific residue-based packing motifs, by Jun Huan, **Wei Wang**, Deepak Bandyopadhyay, Jack Snoeyink, Jan Prins, and Alexander Tropsha. *Journal of Computational Biology (JCB)*, vol. 12, no. 6, pp. 657-671, 2005.

6. Guest editors' introduction: special issue on mining biological data, by **Wei Wang** and Jiong Yang, *IEEE Transactions on Knowledge and Data Engineering (TKDE)*, vol. 17, no. 8, pp. 1019-1020, 2005.

7. An improved biclustering method for analyzing gene expression profiles, by Jiong Yang, Haixun Wang, **Wei Wang**, and Philip Yu, *International Journal on Artificial Intelligence Tools (IJAIT)*, vol. 14, no. 5, pp. 771-789, 2005.

8. Mining surprising periodic patterns, by Jiong Yang, **Wei Wang**, and Philip Yu. *Data Mining and Knowledge Discovery (DMKD)*, vol. 9, no. 2, pp. 189-216, 2004.

9. Discovering high order periodic patterns, by Jiong Yang, **Wei Wang**, and Philip Yu. *Knowledge and Information Systems Journal (KAIS)*, vol. 6, no. 3, pp. 243-268, 2004.

10. WAR: weighted association rules for item intensities, by **Wei Wang**, Jiong Yang, and Philip Yu. *Knowledge and Information Systems Journal (KAIS)*, vol. 6, no. 2, pp. 203-229, 2004.

11. Recent progress on selected topics in database research: a report from nine young Chinese researchers working in the United States (invited paper), by Zhiyuan Chen, Chen Li, Jian Pei, Yufei Tao, Haixun Wang, **Wei Wang**, Jiong Yang, Jun Yang, and Donghui Zhang. *Journal of Computer Science and Technology*, vol. 18, no. 5, pp. 538 – 552, 2003.

12. Mining asynchronous periodic patterns in time series data, by Jiong Yang, **Wei Wang**, and Philip Yu, *IEEE Transactions on Knowledge and Data Engineering (TKDE)*, vol. 15, no. 3, pp. 613-628, 2003.

BOOK CHAPTERS

1. Protein local structure comparison: methods and future directions, by Jun Huan, **Wei Wang**, and Jan Prins, *Advances in Computers* by Chau-Wen Tseng (eds.), Elsevier, 2006.

2. Models for sequential pattern mining, by Hye-Chung Kum, Susan Paulsen, and **Wei Wang**, *A Book on FDM --- Lecture Notes in Computer Science*, Springer-Verlag, 2006.

3. Discovering evolutionary classifier over high speed non-static stream, by Jiong Yang, Xifeng Yan, Jiawei Han, and **Wei Wang**, *Advanced Methods for Knowledge Discovery from Complex Data*, pp. 337-364, 2005.

4. Mining high dimensional data, by **Wei Wang** and Jiong Yang, *Data Mining and Knowledge Discovery Handbook: A Complete Guide for Practitioners and Researchers*, Kluwer Academic Publishers, 2005.

BOOKS

1. *Mining Sequential Patterns from Large Data Sets*, by **Wei Wang** and Jiong Yang, in *Series of Advances in Database Systems*, edited by Ahmed Elmagarmid, Kluwer, 2005.
2. *Advances in Web-Age Information Management --- Lecture Notes in Computer Science No. 2762*, edited by Guozhu Dong, Changjie Tang, and **Wei Wang**, Springer-Verlag, 2003.

SOFTWARES

1. Fast Algorithm for Imputing Missing Genotypes in SNPs (NPUTE)
2. MotifSpace Client for Discovering Spatial Motifs from the Protein Structure Space
3. An ActiveX Control for Visualizing Proteins and Motifs (RasCtrl)
4. Fast Frequent Subgraph Mining (FFSM)
5. Pyramid-K Tree (PK-Tree)

Wei Wang

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

N/A

c. Course development work undertaken (2-3 sentences per item)

I developed the data mining class (Comp 790-90) and co-developed the bioalgorithms class (Comp 590-90) with Leonard McMillan.

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

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PERSONAL

Born 6 March 1944, Berkeley, California
U.S. Citizen
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EDUCATION

B.S. 1966   Carnegie Institute of Technology (now Carnegie Mellon University),
Mathematics

M.S. 1969   Cornell University, Computer Science

Ph.D. 1970   Cornell University, Computer Science

EMPLOYMENT (non-teaching)

Computation Center, Carnegie Mellon University,
    Computer Operator, part-time 1964-65
    Programmer, part-time 1965-66,
    User Consultant, part-time 1965-66

Warner & Swasey, Cleveland, Programmer, summers 1965-66

Cleveland Illuminating Company, Programmer, summer 1967

ACADEMIC EXPERIENCE

Cornell University, Computer Science, Teaching Assistant, 1966-67

University of Cambridge, The Computer Laboratory, Cambridge England, Visiting Senior
Scholar, 1979

University of North Carolina at Chapel Hill, Department of Computer Science,
    Assistant Professor, 1970-75

Associate Professor, 1975-84
Professor, 1984-89
Professor and Chairman, 1989-2004
Associate Dean for First Year Seminars and Undergraduate Experiences, 2005-2007

Department Service

Chairman, 1989-2004

Departmental committees

Teaching Tune-Up Committee
Undergraduate Curriculum Planning Committee, 1999-
Sitterson Addition Building Committee, chair 2004-2008

University Service

Committee on Women in Science, 2003

Science Complex Space Committee, 1998-

University Manager's Association 1989-

Executive Committee of the Faculty Council (elected position) 1997-2003

Conference of Department Chairs (1989-2004)

Committee on Student Conduct (appointed by Chair of faculty) 1991-2003

University Personnel Advisory Panel, 1982-

University Hearings Board, 1983-

Search Committee for Dean of the School of Information and Library Science, 1998
    Reappointment review committee (chair) 2003

Faculty Mentor for Carolina Teaching Fellows Program 1990-

UNC Academy of Distinguished Teaching Scholars, 1999-
    Board of Directors (elected position) 2003-

College of Arts and Sciences, Chairs Advisory Committee (elected position), 2000-2004

PROFESSIONAL SOCIETIES

Association for Computing Machinery
    Special Interest Group on Information Retrieval
    Special Interest Group on Computers and Society
    Special Interest Group on Computer Science Education
    Special Interest Group on Personal Computing

OTHER PROFESSIONAL ACTIVITIES

Consultant and expert witness for Cole, Scott & Kissane, 2004

Consultant and expert witness for Cravath, Swaine and Moore, 1993-1994, 1999

Consultant and expert witness for Akin, Gump, Strauss, Hauer & Feld, 1997-1998

Consultant and expert witness for Jones, Day, Revis & Pogue, 2000, 2002

Motion picture extra in Universal's "Patch Adams", 1998

Grader for the College Board AP Computer Science Exam, June 2007

Referee for:

    ACM Special Interest Group in Computer Science Education (SIGCSE)

    Journal of the American Society for Information Science and Technology

    IBM Journal of Research and Development

    Carolina Planning

    The North Carolina Board of Science and Technology

    The National Science Foundation; member of technical review panel

    IEEE Computer

    Nebraska Research Initiation Program

Textbook reviewer for:

Academic Press

Brady Publishing Company

Benjamin/Cummings Publishing Company

Hamilton Publishing Company

Harper & Row, Publishers

Houghton Miffin Company

John Wiley & Sons, Company

McGraw Hill

Oxford University Press

Prentice Hall Publishing Company

PWS Publishers

Random House

West Publishing Company

Special Master for the U.S. District Court, Greensboro, NC

Co-author of section on Computers in Encyclopedia Britannica

HONORS

2007 Hometown Hero Award

2007 Thomas Jefferson Award, awarded to one faculty member each year who "through personal influence and performance of duty in teaching, writing, and scholarship and has best exemplified the ideals and objectives of Thomas Jefferson."

Robert Byrd Award for support of academic integrity, 2003

Academy of Distinguished Teaching Scholars, charter member
Board of Directors (elected position) 2003-2006

BIBLIOGRAPHY

ARTICLES

"A Backtracking Problem to Solve a Nine Square Puzzle", 2003 Conference of the ACM Special Interest Group on Computer Science Education (SIGCSE), Reno Nevada, February 2003. (5 pages, 40% acceptance).

"A Patterened Injury Digital Library for Collaborative Forensic Medicine", co-authored with D. Stotts, J. Smith, P. Dewan, K. Jeffay, F.D. Smith, D. Smith, J. Coggins, W. Oliver, *Procroceedings of Digital Libraries '94,* The First Annual Conference on the Theory and Practice of Digital Libraries, College Station, TX, June 1994.

Hypertext: "Growing Up?," Panel presentation (co-authored with M. Frisse, M. Agosti, M. F. Bruandet, and U. Hahn) pp. 343--348, at the 13th International Conference on Research and Development in Information Retrieval, Brussels, Belgium, September 5-7, 1990.

"An Overview of Hypertext", co-authored with J. B. Smith, *Communications of the ACM*, Vol 13, No. 7, July 1988. Also co-editor of the Special Issue on Hypertext in that same issue.

"A Hypertext Writing Environment and its Cognitive Basis", co-authored with J. B. Smith and G. J. Ferguson, Hypertext '87 Workshop, Chapel Hill, NC, November 1987.

"MICROARRAS: An Overview", co-authored with J.B. Smith and G. J. Ferguson, accepted for publication in Information Processing & Management, 1987.

"WE: A Writing Environment for Professionals", co-authored with J. B. Smith, G. J. Ferguson, J. D. Bolter, Marcy Lansman, David V. Beard, 1987 National Computer Conference, Chicago, Illinois.

"MICROARRAS: An Advanced Full-Text Retrieval and Analysis System", co-authored with J. B. Smith, and G. J. Ferguson. 1987 International Conference on Research and Development in Information Retrieval, New Orleans, LA, 1987.

"Formatting Texts Accessed Randomly", co-authored with J. B. Smith, *Software Practice & Experience*, Vol. 17, No. 1, pp 5-16, 1987.

"Tree Structures for High Dimensionality Nearest Neighbor Searching", co-authored with Caroline M. Eastman. *Information Systems*, Vol. 7, No. 2, pp. 115-122, 1982.

"A Tree Based Algorithm for Nearest Neighbor Searching", presented at the British Computer Society Information Retrieval Group Research Colloquium, Birmingham, England, April 1979. *Journal of Informatics*, Vol. 3, No. 1, pp. 41-44, April 1981.

"A Pumping Theorem for Regular Languages", co-authored with D. F. Stanat, *SIGACT NEWS*, Vol. 14, No. 1, pp. 36-37, Winter 1982.

"A Word Based Compression Technique for Text Files", co-authored with R. L. Vernor, III. J. of *Library Automation*, Vol. 11, No. 2, pp. 97-105, June, 1978.

"A Tree Algorithm for Nearest Neighbor Searching in Document Retrieval Systems", (co-authored with Eastman, C. M.), *Proceedings of the International Conference on Information Storage and Retrieval*, SIGIR, Rochester, New York, pp. 131-149, 1978.

"Algebraic Parsing of Context-free Languages", co-authored with D. F. Stanat, *American Journal of Computational Linguistics*, Vol. 13, No. 7, pp. 38-60, Microfiche 55, 1976.

"Word Segmentation by Letter Successor Varieties", co-authored with M. A. Hafer, *Information Storage and Retrieval*, Vol. 10, No. 11/12, pp. 371-385, November-December 1974.

"Learning to Disambiguate", *Information Storage and Retrieval*, Vol. 9, No. 1, pp. 33-41, January, 1973.

"Algebraic Parsing Techniques for Context-free Grammars", (co-authored with Mago, G. A., and Stanat, D. F.), *Proceedings of a Symposium on the Theory of Automata, Languages and Programming*, pp. 493-498, Institut de Recherche d'Informatique et d'Automatique, Rocquencourt, France, July 3-7, 1972.

REPORTS

"MICROARRAS: An Overview", co-authored with J. B. Smith, and G. J. Ferguson, Department of Computer Science, University of North Carolina, Technical Report number 86-017, 1986.

"WE: A Writing Environment for Professionals", co-authored with J. B. Smith, G. J. Ferguson, J. D. Bolter, Marcy Lansman, David V. Beard, Department of Computer Science, University of North Carolina, Technical Report number 86-025, 1986.

"Formatting Texts Accessed Randomly", co-authored with J. B. Smith, Department of Computer Science, University of North Carolina, Technical Report number 85-031, 1981.

"Automatic Morpheme Identification in Phonetic Text", co-authored with R. Dattola, Department of Computer Science, University of North Carolina, Technical Report number TR-81-007, 1981.

"Implementations of Ordered Tree Searching", co-authored with G. A. Frank, Department of Computer Science, University of North Carolina, Technical Report number TR-78-007, 1978.

"Content Analysis in Information Retrieval", Chapter I, Information Storage and Retrieval Scientific Report No. ISR-18 to the National Science Foundation and to the National Library of Medicine, Department of Computer Science, Cornell University, Ithaca, New York, October 1970.

"Automatic Resolution of Ambiguities from Natural Language Text", Chapter IV. Information Storage and Retrieval Scientific Report No. ISR-18 to the National Science Foundation and to the National Library of Medicine, Department of Computer Science, Cornell University, Ithaca, New York, October 1970.

"Template Analysis in a Conversational System", Chapter XV. Information Storage and Retrieval Scientific Report No. ISR-18 to the National Science Foundation and to the National Library of Medicine, Department of Computer Science, Cornell University, Ithaca, New York, October 1970.

"Syntax in Text Analysis", Chapter V, Information Storage and Retrieval Scientific Report No. ISR-16 to the National Science Foundation, Department of Computer Science, Cornell University, Ithaca, New York, 1969.

"Template Analysis and Its Application to Natural Language Processing", Chapter VI, Information Storage and Retrieval Scientific Report No. ISR-16 to the National Science Foundation, Department of Computer Science, Cornell University, Ithaca, New York, 1969.

FUNDED GRANTS

"MICROARRAS", October 1, 1984 - September 30, 1986, funded by the National Endowment for the Humanities

"Cognitive Strategies for Writing Using Advanced Computer Tools", January 1, 1986 - December 31, 1987, funded by the National Science Foundation

"Implementation of an Advanced Graphics-Based Structure Editor", August 19, 1985 – August 18, 1986, funded by International Business Machines, Inc.

"MICROARRAS Project Continuation", January 1, 1986 - September 20, 1986, funded by Northern Telecom, Inc.

"An Experimental Study of Writers' Cognitive Strategies using Advanced Computer Tools", May 1, 1986 - April 30, 1989, funded by the Army Research Institute

"CISE Institutional Infrastructure Program for Prototyping Complete Digital Systems", July 1, 1988 - December 31, 1993, funded by National Science Foundation

"Infrastructure for Research in Collaboration Systems, July 1, 1996 - June 30, 2001, funded by the National Science Foundation

Steve Weiss

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

Chair of the College Taskforce on Undergraduate Advising (2007-present)

c. Course development work undertaken (2-3 sentences per item)

Javascript version of COMP 110 (not yet offered)

d. If you feel your work has had special impact (e.g. someone is using your software, research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

N/A

Gregory Francis Welch
Curriculum Vitae for 2003–2008
October 8, 2008

Contact Information

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Internet:	welch@cs.unc.edu
	http://www.cs.unc.edu/~welch

Education

Dec 1996	**Ph.D., Computer Science**
	University *of* North Carolina *at* Chapel Hill, Chapel Hill, NC
	Under the direction of Gary Bishop
May 1995	**M.S., Computer Science**
	University *of* North Carolina *at* Chapel Hill, Chapel Hill, NC
May 1986	**B.S. with *Highest Distinction*, Electrical Technology**
	Purdue University, West Lafayette, IN

Professional Experience (Summary)

	Renaissance Sciences Corporation
2007–present	Principal Investigator II
	University *of* North Carolina *at* Chapel Hill
2001–present	Research Associate Professor, Computer Science
2005–present	Adjunct Associate Professor, Applied & Materials Sciences
2000–2003	Adjunct Assistant Professor, Applied & Materials Sciences
1996–2001	Research Assistant Professor, Computer Science
1990–1992	**Northrop Defense Systems Division**
	Senior Engineer, Airborne Electronic Countermeasures, Digital Systems Group
1987–1990	**NASA Jet Propulsion Laboratory (California Institute of Technology)**
	Member Technical Staff, Voyager Spacecraft Project, Flight Command and Data Management Section, May 29, 2008.

Activities and Honors

- Keynote speaker, D2D: Digital City workshop, Shenzhen, China, October 25, 2008
- Keynote speaker, 14th Eurographics Symposium on Virtual Environments (EGVE 2008), Eindhoven, The Netherlands, May 29, 2008
- *Excellence in Teaching* award, UNC-Chapel Hill, Computer Science Student Association, for 3D Computer Modeling and Animation, Spring 2007
- Boards and Committees

  - UNC-Chapel Hill Committee on Student Conduct (COSC)
  - UNC-Chapel Hill Computer Science Committee on Undergraduate Service Courses
  - Board of Directors, HiBall Tracker, Inc. (`http://www.3rdTech.com`)

- Professional Societies

  - Association for Computing Machinery (ACM)
  - Institute of Electrical and Electronics Engineers (IEEE) Computer Society
  - Society for Simulation in Healthcare (SSIH)
  - International Association of Geodesy working group on Indoor and Pedestrian Navigation

- Reviewer, Committee, and Editorial Activity

  - Presence: Teleoperators and Virtual Environments (Associate Editor)
  - International Journal of Virtual Reality (Editorial Board)
  - International Symposium on 3D Data Processing, Visualization, and Transmission (3DPVT)
  - ACM: International Conference on Graphics and Interactive Techniques (SIGGRAPH); Symposium on Virtual Reality Software and Technology (VRST); Symposium on Interactive 3D Graphics; Multimedia; User Interface Software and Technology (UIST); Transactions on Mathematical Software;
  - IEEE: Computer Graphics and Applications (CG&A); Visualization (VIS); Virtual Reality (VR); Transactions on Vizualization and Computer Graphics; Transactions on Aerospace and Electronic Systems; Conference on Computer Vision and Pattern Recognition (CVPR)
  - IEEE/ACM International Symposium on Mixed and Augmented Reality; International Symposium on Wearable Computers
  - EURASIP Journal of Applied Signal Processing; Transactions on Automatic Control
  - Journal of Optimal Control Applications and Methods
  - Eurographics Workshop on Virtual Environments

ACTIVITIES AND HONORS (CONTINUED)

- Event Organization Activity
  - Dagstuhl Seminar on "Virtual Realities" (Seminar 08231), co-organized with Guido Brunnett (TU Chemnitz, Germany) and Sabine Coquillart (INRIA Rhône-Alpes, France), June 1–6, 2008, The International Conference and Research Center for Computer Science, Dagstuhl, Germany.
  - VR 2007 Local Arrangements Co-Chair, IEEE Virtual Reality 2007 (Charlotte, NC, USA)
  - ISMAR 2006 Workshops/Tutorials Chair, 5th IEEE and ACM International Symposium on Mixed and Augmented Reality (Santa Barbara, CA, USA)
  - ProCams 2006 Co-Chair, IEEE CVPR 2006 International Workshop on Projector-Camera Systems, (New York, NY, USA), with Chris Jaynes (University of Kentucky)
  - 3DPVT 2006 Organizing Committee, Third International Symposium on 3D Data Processing, Visualization and Transmission (Chapel Hill, NC, USA)
  - EDT 2006 Co-chair, IEEE Virtual Reality 2006 International Workshop on Emerging Display Technologies (Alexandria, VA, USA), with Mark Bolas (USC and Fakespace Labs) and Andreas Simon (FH-Aargau)
  - ICAT 2005 Program Co-Chair, 15th International Conference on Artificial Reality and Telexistence (Christchurch, New Zealand), with Sang Chul Ahn (KIST, Korea), and Haruo Noma (ATR, Japan).
  - ProCams 2005 Posters Chair, IEEE CVPR 2005 International Workshop on Projector-Camera Systems (San Diego, CA, USA)
  - EDT 2005 Co-chair, IEEE Virtual Reality 2005 International Workshop on Emerging Display Technologies (Bonn, Germany), with Mark Bolas (USC and Fakespace Labs) and Andreas Simon (Fraunhofer IMK)

STUDENT ADVISEES

Adrian Ilie (current); Hua Yang (current); Danette Allen (2007, Ph.D., NASA LaRC); Vincent Noel (2006, M.S., Google); Michael Noland (2006, M.S., Emergent); Aditi Majumder (2003, Ph.D., UC–Irvine); and Ruigang Yang (2003, Ph.D., Univ. of Kentucky).

STUDENT COMMITTEES

Tyler Johnson (current); David Gallup (current); Drexel Hallaway (current, Columbia University); Seon Joo Kim (2008, Ph.D., UNC-Chapel Hil); Patrick Quirk (2006, M.S.); Kok-Lim Low (2005, Ph.D., National University of Singapore), and Michael Rosenthal (2005, Ph.D., attending medical school).

TEACHING EXPERIENCE

- *3D Computer Modeling and Animation*, First Year Seminar, UNC-CH, 2003–2007. Conceived of and created the course, which was chosen by UNC from among competing First Year Seminar proposals. Awarded Computer Science Student Association *Excellence in Teaching* award, Spring 2007.
- *Introduction to Programming (Java)*, UNC-CH, 2002–2003.

Books Chapters/Sections

- Greg Welch and Larry Davis. Tracking for Training in Virtual Environments: Estimating the Pose of People and Devices for Simulation and Assessment. In J. Cohn, D. Nicholson, and D. Schmorrow, editors, *The PSI Handbook of Virtual Environments for Training and Education: Developments for the Military and Beyond*, chapter 30. Praeger Security International, 2008.
- Greg Welch, Ruigang Yang, Bruce Cairns, Herman Towles, Andrei State, Adrian Ilie, Sasch Becker, Dan Russo, Jesse Funaro, Diane Sonnenwald, Ketan Mayer-Patel, Bonnie Danette Allen, Hua Yang, Eugene Freid, Andries van Dam, and Henry Fuchs. 3D Telepresence for Off-Line Surgical Training and On-Line Remote Consultation. In S. Tachi, editor, *Telecommunication, Teleimmersion and Telexistence II*, pages 113–152. IOS Press (English) and Ohmsha (Japanese), 2005.

Short Courses and Panels

- Henry Fuchs, Bernd Fröhlich, and Greg Welch. "Display Technology," 14th Eurographics Symposium on Virtual Environments (EGVE 2008), Eindhoven, The Netherlands, May 30, 2008.
- Barbara Hayes-Roth, Austin Henderson, Ramesh Jain, Lev Manovich, Greg Welch, and Gopal Pingali. "Experiential Telepresence: How Can Telepresence Research be Guided Towards Better End User Experience?" ACM SIGMM 2003 Workshop on Experiential Telepresence 2003 (ETP 2003) panel, November 7, 2003, Berkeley, CA USA.

REFEREED PUBLICATIONS

[51] G. Welch. History: The Use of the Kalman Filter for Human Motion Tracking in Virtual Reality, Presence: Teleoperators and Virtual Environments, 18(1), 2009.

[50] A. Ilie, G. Welch, and M. Macenko. A Stochastic Quality Metric for Optimal Control of Active Camera Network Configurations for 3D Computer Vision Tasks, in Proceedings of ECCV 2008 workshop on Multi-camera and Multi-modal Sensor Fusion Algorithms and Applications, Marseille, France, October 18 2008. European Conference on Computer Vision (ECCV).

[49] H. M. Söderholm, D. H. Sonnenwald, J. E. Manning, B. Cairns, G. Welch, and H. Fuchs. Exploring the Potential of Video Technologies for Collaboration in Emergency Medical Care. Part II: Task Performance, to appear in the Journal of the American Society for Information Science and Technology (JASIST), 2008.

[48] D. H. Sonnenwald, H. M. Söderholm, J. E. Manning, B. Cairns, G. Welch, and H. Fuchs. Exploring the Potential of Video Technologies for Collaboration in Emergency Medical Care. Part I: Information Sharing, to appear in the Journal of the American Society for Information Science and Technology (JASIST), 2008.

[47] Brian Clipp, Rahul Raguram, Jan-Michael Frahm, Greg Welch, and Marc Pollefeys, A Mobile 3D City Reconstruction System, IEEE Virtual Reality 2008 workshop on Cityscapes, March 9, 2008, Reno, Nevada, USA

[46] Marc Pollefeys, David Nistér, Jan-Michael Frahm, Amir Akbarzadeh, Philippos Mordohai, Brian Clipp, Chris Engels, David Gallup, Seon Joo Kim, Paul Merrell, C. Salmi, Sudipta Sinha, Brad Talton, Liang Wang, Qing-Xiong Yang, Henrik Stewénius, Ruigang Yang, Greg Welch, and Herman Towles, Detailed Real-Time Urban 3D Reconstruction From Video, International Journal of Computer Vision (IJCV), special issue on "Modeling Large-Scale 3D Scenes, 2007.

[45] Hanna M. Söderholm, Diane H. Sonnenwald, Bruce Cairns, James Manning, Greg Welch, and Henry Fuchs, The Potential Impact of 3D Telepresence Technology on Task Performance in Emergency Trauma Care, proceedings of the ACM Group 2007 Conference, November 4–7 2007.

[44] Brian Clipp, Greg Welch, Jan-Michael Frahm, and Marc Pollefeys, Structure From Motion via a Two-Stage Pipeline of Extended Kalman Filters, in Proceedings of the British Machine Vision Conference (BMVC 2007), September 10–13 2007.

[43] Hua Yang, Marc Pollefeys, Greg Welch, Jan-Michael Frahm, and Adrian Ilie, Differential Camera Tracking Through Linearizing the Local Appearance Manifold, in Proceedings of the 2007 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR' 07), 2007.

[42] Philippos Mordohai, Jan-Michael Frahm, Amir Akbarzadeh, Brian Clipp, Chris Engels, David Gallup, Paul Merrell, C. Salmi, Sudipta Sinha, Brad Talton, Liang Wang, Qing-Xiong Yang, Henrik StewŐnius, Herman Towles, Greg Welch, Ruigang Yang, Marc Pollefeys, and David Nistér, Real-time video-based reconstruction of urban environments, in Proceedings of the IS-PRS Working Group V/4 Workshop 3D-ARCH 2007: 3D Virtual Reconstruction and Visualization of Complex Architectures, (ETH Zurich, Switzerland), July 12–13 2007.

[41] Greg Welch, B. Danette Allen, Adrian Ilie, and Gary Bishop, Measurement Sample Time Optimization for Human Motion Tracking/Capture Systems, Proceedings of Trends and Issues in

Tracking for Virtual Environments, Workshop at the IEEE Virtual Reality 2007 Conference (Charlotte, NC USA) (Gabriel Zachmann, ed.), Shaker, March 11 2007.

[40] Greg Welch, Michael Noland, and Gary Bishop, Complementary Tracking and Two-Handed Interaction for Remote 3D Medical Consultation with a PDA, Proceedings of Trends and Issues in Tracking for Virtual Environments, Workshop at the IEEE Virtual Reality 2007 Conference (Charlotte, NC USA) (Gabriel Zachmann, ed.), Shaker, March 11 2007.

[39] Diane H. Sonnenwald, Hanna Maurin, Bruce Cairns, Eugene Freid, James Manning, Greg Welch, and Henry Fuchs. Experimental Comparison of the Use of 2D and 3D Telepresence Technologies in Distributed Emergency Medical Situations. In Proceedings of the American Society of Information Science and Technology (ASIS&T 2006), Austin, Texas, November 3–9, 2006.

[38] Hua Yang and Greg Welch. Illumination Insensitive Model-Based 3D Object Tracking and Texture Refinement. In Proceedings of the Third International Symposium on 3D Data Processing, Visualization and Transmission (3DPVT 2006), The University of North Carolina at Chapel Hill, Chapel Hill, NC USA, June 14-16, 2006.

[37] Ruigang Yang, Liang Wang, Greg Welch, and Marc Pollefeys. Stereovision on GPU. In Proceedings of the 2006 Workshop on Edge Computing Using New Commodity Architectures (EDGE 2006), May 23–24 (Chapel Hill, NC, USA).

[36] Greg Welch, Hua Yang, Andrei State, Vincent Noel, Adrian Ilie, Ruigang Yang, Marc Pollefeys, and Henry Fuchs. GPU-Based View Synthesis Using an Orbital Reconstruction Frustum. In Proceedings of the 2006 Workshop on Edge Computing Using New Commodity Architectures (EDGE 2006), May 23–24 (Chapel Hill, NC, USA).

[35] Greg Welch, Diane Sonnenwald, Ketan Mayer-Patel, Ruigang Yang, Andrei State, Herman Towles, Bruce Cairns, and Henry Fuchs, Remote 3D Medical Consultation. In Proceedings of *BROADNETS: 2nd IEEE/CreateNet International Conference on Broadband Networks*, (Boston, MA, USA), pp. 103-110, Omnipress, October 2005.

[34] B. Danette Allen and Greg Welch. A general method for comparing the expected performance of tracking and motion capture systems. In *VRST '05: Proceedings of the ACM symposium on Virtual reality software and technology*, (Monterey, CA, USA), pp. 201–210, ACM Press, New York, NY, USA, November 2005.

[33] Adrian Ilie and Greg Welch. Ensuring Color Consistency Across Multiple Cameras. In Proceedings of the 2005 International Conference on Computer Vision (ICCV 2005), October, 2005 (Beijing, China).

[32] Greg Welch, Ruigang Yang, Sascha Becker, Adrian Ilie, Dan Russo, Jesse Funaro, Andrei State, Kok-Lim Low, Anselmo Lastra, Herman Towles, Bruce Cairns, M.D., Henry Fuchs, and Andy van Dam. Immersive Electronic Books for Surgical Training. *IEEE Multimedia*, 12(3):22–35, July–September 2005.

[31] Ruigang Yang, Marc Pollefeys, Hua Yang, and Greg Welch. A Unified Approach to Real-Time, Multi-Resolution, Multi-Baseline 2D View Synthesis and 3D Depth Estimation Using Commodity Graphics Hardware. *International Journal of Image and Graphics (IJIG)*, 4(4):1–25, 2004.

[30] Adrian Ilie, Kok-Lim Low, Greg Welch, Anselmo Lastra, Henry Fuchs, and Bruce Cairns. Combining Head-Mounted and Projector-Based Displays for Surgical Training. *Presence: Teleoperators and Virtual Environments*, 13(2), April 2004. This is an invited (but refereed) extended version of [28].

[29] Ruigang Yang, Marc Pollefeys, and Greg Welch. Dealing With Textureless Regions and Specular Highlights—A Progressive Space Carving Scheme Using a Novel Photo-Consistency Measure. In Bill Triggs and Andrew Zisserman, editors, *Proceedings of 9th International Conference on Computer Vision*, pages 576–584, Nice, France, 2003. IEEE Computer Society.

[28] Kok-Lim Low, Adrian Ilie, Greg Welch, and Anselmo Lastra. Combining Head-Mounted and Projector-Based Displays for Surgical Training. In *Proceedings of the IEEE Virtual Reality 2003*, pages 110–117. IEEE Computer Society, 2003.

[27] Ruigang Yang and Greg Welch. Real-time consensus-based scene reconstruction using commodity graphics hardware. Computer Graphics Forum (invited submission), 22(2):207–216, 2003.

Invited Publications

[8] Amir Akbarzadeh, Jan-Michael Frahm, Philippos Mordohai, Brian Clipp, Chris Engels, David Gallup, Paul Merrell, Michael Phelps, Sudipta Sinha, Brad Talton, Liang Wang, Qing-Xiong Yang, Henrik Stewenius, Ruigang Yang, Greg Welch, Herman Towles, David Nistér, and Marc Pollefeys. Towards Urban 3D Reconstruction From Video. In Proceedings of the Third International Symposium on 3D Data Processing, Visualization and Transmission (3DPVT 2006), Chapel Hill, NC, June 2006.

[7] Andrei State, Greg Welch, and Adrian Ilie. An Interactive Camera Placement and Visibility Simulator for Image-Based VR Applications. In *Proceedings of the Engineering Reality of Virtual Reality 2006 (3D Imaging, Interaction, and Measurement; IS&T/SPIE 18th Annual Symposium on Electronic Imaging Science and Technology)*, San Jose, CA, January 2006.

[6] Greg Welch, Henry Fuchs, Bruce Cairns, Ketan Mayer-Patel, Diane H. Sonnenwald, Ruigang Yang , Andrei State, Herman Towles, Adrian Ilie, Michael Noland, Vincent Noel, and Hua Yang. Improving, Expanding and Extending 3D Telepresence. In *Proceedings of the 2005 International Workshop on Advanced Information Processing for Ubiquitous Networks*, with ICAT 2005, Christchurch, New Zealand, December 8, 2005.

[5] Hua Yang and Greg Welch. Model-Based 3D Object Tracking Using an Extended-Extended Kalman Filter and Graphics Rendered Measurements. In *Proceedings of 1st Computer Vision for Interactive and Intelligent Environments (CV4IIE) workshop*, University of Kentucky, Lexington, KY.

[4] Greg Welch, Ruigang Yang, Bruce Cairns, M.D., Herman Towles, Andrei State, Adrian Ilie, Sascha Becker, Dan Russo, Jesse Funaro, Diane Sonnenwald, Ketan Mayer-Patel,B. Danette Allen, Hua Yang, Eugene Freid, M.D., Andy van Dam, and Henry Fuchs. 3D Telepresence for Off-Line Surgical Training and On-Line Remote Consultation. Susumu Tachi, editor, *Proceedings of ICAT CREST Symposium on Telecommunication, Teleimmersion, and Telexistence*, The University of Tokyo, Tokyo, Japan, December 2004.

Poster Presentations

[7] Brian Clipp, Greg Welch, Jan-Michael Frahm, and Marc Pollefeys, Structure from motion via a two-stage pipeline of extended kalman filters," Proceedings of the British Machine Vision Conference (BMVC 2007), September 10–13 2007.

[6] Hua Yang and Greg Welch. Illumination Insensitive Model-Based 3D Object Tracking and Texture Refinement. In Proceedings of the Third International Symposium on 3D Data Processing, Visualization and Transmission (3DPVT 2006), The University of North Carolina at Chapel Hill, Chapel Hill, NC USA, June 14-16, 2006.

[5] Ruigang Yang, Liang Wang, Greg Welch, and Marc Pollefeys. Stereovision on GPU. Poster presentation at the 2006 Workshop on Edge Computing Using New Commodity Architectures (EDGE 2006), May 23–24 (Chapel Hill, NC, USA).

[4] Greg Welch, Hua Yang, Andrei State, Vincent Noel, Adrian Ilie, Ruigang Yang, Marc Pollefeys, and Henry Fuchs. GPU-Based View Synthesis Using an Orbital Reconstruction Frustum. Poster presentation at the 2006 Workshop on Edge Computing Using New Commodity Architectures (EDGE 2006), May 23–24 (Chapel Hill, NC, USA).

[3] Adrian Ilie and Greg Welch. Ensuring Color Consistency Across Multiple Cameras. International Conference on Computer Vision (ICCV), October, 2005 (Beijing, China).

[2] Bruce A. Cairns, Greg Welch, Adrian Ilie, Ruigang Yang, Kok-Lim Low, Anselmo Lastra, Henry Fuchs, and Anthony Meyer. Three Dimensional (3D) Acquisitition and Display of Reality: The Potential for a 'Holodeck' in Trauma Surgery. Presented at *The American Association for the Surgery of Trauma 2003 Annual Meeting.*

PATENTS

- U.S. #7,068,274, "System and Method for Animating Real Objects With Projected Images," with Kok-Lim Low and Ramesh Raskar.
- U.S. #6,930,681, "System and Method for Registering Multiple Images with Three-Dimensional Objects," with Ramesh Raskar and Kok-Lim Low.
- U.S. #6,677,956, "Method for Cross-Fading Intensities of Multiple Images of a Scene for Seamless Reconstruction," with Ramesh Raskar and Kok-Lim Low.
- Undergoing disclosure at Mitsubishi Electric Research Labs with Ramesh Raskar and Kok-Lim Low: "Method for Determining Image Intensities of Projected Images to Change the Appearance of Three-Dimensional Objects."

Invited Talks (Selected)

- "A Living, Breathing, Dynamic Digital City," D2D: Digital City workshop, Shenzhen, China, October 25, 2008

- "VR Research at UNC-CH: A Sampling," with Henry Fuchs, Daimler AG, Ulm, Germany, June 10, 2008

- "Immersive Display Research at UNC-CH: A Sampling," with Henry Fuchs, Max Planck Institute, Tübingen, Germany, June 9, 2008.

- "Motion Tracking as an Epic Battle Between Information and Uncertainty," Keynote address, 14th Eurographics Symposium on Virtual Environments (EGVE 2008), Eindhoven, The Netherlands, May 29, 2008.

- "Hardware Information Optimization in the Design of Systems for the Sensing of Human Motion," University of California at Riverside, Riverside, CA, USA, October 23, 2006.

- "Improving, Expanding and Extending 3D Telepresence," International Workshop on Advanced Information Processing for Ubiquitous Networks, with ICAT 2005, Christchurch, New Zealand, December 8, 2005.

- "Differential Imaging/Setups," 1st Computer Vision for Interactive and Intelligent Environments (CV4IIE) workshop, University of Kentucky, Lexington, KY, November 17–18, 2005.

- "3D Medical Consultation," Naval Postgraduate School/MOVES Institute guest lecture, Monterey, CA, November 10, 2005.

- "Multi-Projector Displays," US Army sponsored workshop on "Displays for Immersive Education and Training," Institute for Creative Technologies, University of Southern California, Marina del Rey, CA, October 24–25, 2005.

- "3D Telepresence for Off-Line Surgical Training and On-Line Remote Consultation," 2nd CREST Symposium on Telecommunication, Teleimersion and Telexistence, University of Tokyo, December 9–10, 2004.

- "Immersive Telepresence for Surgical Teaching and Remote Consultation: Extending Medical Expertise Over Time and Space," University of Florida, Department of Computer and Information Science and Engineering, "Geometry, Graphics, Vision, Visualization/ Simulation (G2V2)" seminar series, October 17, 2003.

Active Funding

- IARPA A-SpaceX contract for "Mockup Future Analyst Workspace (A-Desk)," PI with Henry Fuchs. Jeff Morrison, Program Manager. $260K for April 2008–December 2008.
- ONR contract for "Behavior Analysis and Synthesis for Intelligent Training (BASE-IT)," PI with Henry Fuchs at UNC, Amela Sadagic at NPS, and Rakesh Kumar and Hui Cheng at Sarnoff. Dylan Schmorrow, Ph.D. CDR MSC USN, Program Manager. $2.2M total for February 2008–September 2010.
- ONR SBIR contract for "Deployable Intelligent Projection Systems for Training," PI with Karl Matias of Renaissance Sciences Corporation, sub-contract to UNC-Chapel Hill (Henry Fuchs, PI), $80K for Phase 1, June 2007–September 2008.
- IARPA VACE contract for "3D Content Extraction from Video Streams," Co-PI with Marc Pollefeys (PI) and Jan-Michael Frahm. Dan Aldridge, Program Manager; Dennis Moellman and Paul Matthews, Senior Technical Advisors. $660K October 2006–September 2008.
- Cisco Systems grant for "Telepresence Wall: Research Exhibit," with Henry Fuchs. $439K total for August 2007–July 2008.
- NSF CRI:IAD grant for "Integrated Projector-Camera Modules for the Capture and Creation of Wide-Area Immersive Experiences," with Co-PI with Henry Fuchs (PI), Leonard McMillan (Co-PI), Mary Whitton (Co-PI), and Svetlana Lazebnik (Co-PI). $310K total for April 2008–March 2011.

Past Funding

- ONR STTR contract for "Deployable Intelligent Projection Systems for Training: Enhanced Integrated Pose Estimation Technologies," PI with Karl Matias of Renaissance Sciences Corporation, sub-contract to UNC-Chapel Hill (Henry Fuchs, PI), $70K for Phase 1, August 2007–February 2008.
- Cisco Systems grant for "Prototype for Two-station, Four-Person, Proper Eye-Gaze Telepresence System," with Henry Fuchs. $376K total for August 2006–July 2007.
- National Library of Medicine contract for "3D Telepresence for Medical Consultation" Co-PI with Prof. Henry Fuchs (PI, UNC Computer Science), Prof. Bruce Cairns, M.D. (Co-PI, UNC), Prof. Ketan Mayer-Patel (Co-PI, UNC), and Prof. Diane Sonnenwald (Co-PI, Göteborg University and the University College of Borås). $2.5M total for October 2003–December 2007.
- ONR VIRTE contract for "Front-Projective Display For Virtual Environments: Phase 2," with Henry Fuchs and Herman Towles. Dylan Schmorrow, Ph.D. CDR MSC USN, Program Manager. $560K total for October 2004–December 2007.
- Office of Naval Research DURIP 2006 grant for "Computing for Real World Acquisition, Display and Immersive Training," with Henry Fuchs and Marc Pollefeys. $136K total.
- DARPA DSO contract for "Wide Area Visuals for a Simulator in a Box," with Henry Fuchs and Herman Towles. Ralph Chatham, DARWARS Program Manager. $1.2M total for 2003–2006.
- NSF ITR grant "Electronic Books for the Tele-Immersion Age: A New Paradigm for Teaching Surgical Procedures," Co-PI with Andy van Dam (UNC/Brown grant), $609K (UNC) for Sep 2001–Aug 2005.
- DOE contract "Front-Projection Display Wall, Group Tele-Immersion, and Tracking," with Henry Fuchs and Herman Towles, $1.8M for September 2001–August 2004.

Professional Employment Experience

Renaissance Sciences Corporation, Chandler, Arizona

Principal Investigator II, June 2007–present

- Part-time research and development efforts related to "intelligent projector units" for deployable training systems.
- Work with Jeff Clark and Karl Mathias at RSC to coordinate UNC-RSC joint efforts.

University *of* North Carolina *at* Chapel Hill, Chapel Hill, North Carolina

Research Associate Professor, Computer Science, September 2001–present

Adjunct Associate Professor, Applied & Materials Sciences, 2005–present

Adjunct Assistant Professor, Applied & Materials Sciences, 2000–2003

Research Assistant Professor, Computer Science, September 1996–August 2001

- Obtain funding, coordinate research, and advise students on projects such as the Office of the Future and Wide-Area Tracking.
- Act as academic advisor for graduate students (primary advisor or committee member).
- Periodically teach or assist with graduate seminars and primary courses.

UNC Site Coordinator, NSF Graphics and Visualization STC, September 1996–August 1998

- Coordinate and advise on research related to UNC portion of the NSF Graphics and Visualization Science and Technology Center (STC). STC members include Brown University, The California Institute of Technology, Cornell University, The University of Utah, and The University *of* North Carolina *at* Chapel Hill.

Greg Welch

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergraduate education (2-3 sentences per item)

Member of the CS Undergraduate Service Course committee and the Undergrad Capcom committee. In the latter we are working to restructure our CS curriculum to include application area-specific courses, e.g., in games and robotics, to better attract non-CS students. We are also working to streamline the curriculum for both CS and non-CS students.

c. Course development work undertaken (2-3 sentences per item)

In 2003 I developed a new First Year Seminar titled "3D Computer Modeling and Animation," and have taught the course three times since then. The course offers a hands-on exploration of computer-based three-dimensional modeling and animation. Each student plans an animated story, models the necessary objects and scenery, and then animates those models. At the end of the course each student introduces and presents their animated short movie in a public animation festival, where awards are given.

Chosen for the Computer Science Student Association's "Excellence in Teaching Award" in spring of 2007.

d. If you feel your work has had special impact (e.g. someone is using your software, your research led to commercial efforts, etc.), please supply 4-6 sentences to describe this.

Projector-based graphics work led by Fuchs, Welch, and Towles is being supported in part by an SBIR award from the US Navy, in collaboration with Renaissance Sciences Corporation. The funding is aimed at supporting eventual commercial development of "Deployable Intelligent Projection Systems for Training." The funding is aimed at developing computer algorithms and associated technologies for creating a single, seamless, panoramic image with multiple, cooperating "intelligent" projector units (IPUs). IPUs will be part of the envisioned deployable visual training system for multiple viewers.

Mary C. Whitton

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                         Chapel Hill, NC 27599-3175   fax: +1 919 962 1799

Education

M.S. Electrical and Computer Engineering (1984)
   North Carolina State University, Raleigh, NC
   Thesis Title: Special Purpose Hardware for the Display of Free-Form Surfaces

M.S. Guidance and Personnel Services (1974)
   North Carolina State University, Raleigh, NC
   Thesis Title: Same-Sex and Cross-Sex Reliability and Concurrent Validity of the
                 Strong-Campbell Interest Inventory

B. A. Religion (1970)
   Duke University, Durham, NC

Continuing Education

Managing at Sun, 1991, In-house program at Sun Microsystems, Inc.; 40 hours
Program for Technology Managers, 1985, UNC-CH Kenan-Flagler Business School ;
100 hours
Product Planning and Management, 1982, McGraw-Hill Seminar Center; 24 hours

Professional Experience

   Research Associate Professor. Department of Computer Science, University of
         North Carolina at Chapel Hill, July 2004-present.

   Research Assistant Professor. Department of Computer Science, University of
         North Carolina at Chapel Hill, May 1995-June 2004.

   Adjunct Assistant Research Professor. School of Information and Library Science,
         University of North Carolina at Chapel Hill, December 2001-present.

   Manager of Virtual Environments Research Projects. Department of Computer
         Science, University of North Carolina at Chapel Hill, January 1995-April
         1995

   Director, Marketing, Sun Microsystems, Inc., June 1987-January 1995

Vice President and Co-Founder, Trancept Systems, Inc., January 1986-May 1987
(Trancept acquired by Sun Microsystems, May 1987)

Partner, Whitland Associates, May 1983 - December 1984 and July 1985-
December 1985

Director of Marketing, Graphics Terminals, Adage, Inc., October 1982- May
1983 and January 1985- August 1985

Vice President and Co-Founder, Ikonas Graphics Systems, Inc., July 1978-
September 1982
(Ikonas acquired by Adage, Inc., October 1982)

Middle School Mathematics Teacher, Charlotte-Mecklenburg (NC) 1973-1975,
Wake County (NC) 1975-1976.

Publications: Book Chapters

Whitton, M.C. and Brooks, F.P. (*in press-December 2008).* Evaluating VE Component Technologies. In *The PSI Handbook of Virtual Environments for Training and Education*: *Vol.2. VE Components and Training Technologies,* Schmorrow, Cohn, J., and Nicholson, D., (Series Eds), Nicholson, D., Schmorrow, D. and Cohn, J. (Vol. Eds.), (22 pp.). Westport, CN: Praeger Security International.

Whitton, M.C. and Loftin, R.B. (*in press-December 2008).* Section Perspective: VE Component Technologies. In   *The PSI Handbook of Virtual Environments for Training and Education*: *Vol.2. VE Components and Training Technologies,* Schmorrow, Cohn, J., and Nicholson, D., (Series Eds), Nicholson, D., Schmorrow, D. and Cohn, J. (Vol. Eds.), (14 pp,). Westport, CN: Praeger Security International.

Whitton, M.C. and Wendt, J., (*in press-December 2008).* Section Perspective Appendix A: Modeling and Rendering. In *The PSI Handbook of Virtual Environments for Training and Education*: *Vol.2. VE Components and Training Technologies,* Schmorrow, Cohn, J., and Nicholson, D., (Series Eds), Nicholson, D., Schmorrow, D. and Cohn, J. (Vol. Eds.), (6 pp,). Westport, CN: Praeger Security International.

Sonnenwald, D.J., Whitton, M.C., & Maglaughlin, K. (*in press--November 2008*). Evaluation of a scientific collaboratory system: Investigating a collaboratory's potential before deployment. In G. Olsen, A. Simmerson, & M. Bos (Eds.), *Scientific Collaboration on the Internet*. Boston: MIT Press. Preprint Draft.

Whitton, M.C. and Razzaque, S. (*2008*). Locomotion. In Kortum, P. (Ed.), *HCI Beyond the GUI: Design for Haptic, Speech, Olfactory and Other Nontraditional Interfaces*, pp 107-146. Burlington, MA: Morgan Kaufmann.

Publications: Journal Papers

Note: Computer Graphics has relatively few journals and, historically, the most prestigious place to publish has been in the proceedings of the annual ACM SIGGRAPH Conference. I have included SIGGRAPH papers in my list of journal papers.

Peck, Tabitha, H. Fuchs, M. Whitton (*in press*). Evaluation of Reorientation Techniques for Walking in Large Virtual Environments. *Transactions on Visualization and Computer Graphics.* Washington: IEEE Press. (Invited extended version of IEEE VR 2008 conference paper.)

Mihalik, J.P., Kohli, L., Whitton, M.C. (2008) <u>Do the Physical Characteristics of a Virtual Reality Device Contraindicate Its Use for Balance Assessment?</u> *Journal of Sport Rehabilitation,* 2008, **16**(38-49).

Burns,Eric, Sharif Razzaque, Mary C. Whitton, Frederick P. Brooks, Jr., (2007) <u>MACBETH: Management of Avatar Conflict by Employment of a Technique Hybrid.</u> *International Journal of Virtual Reality*, 6(2):11-20.

Burns, E., Razzaque, S., Panter, A. T., Whitton, M. C., McCallus, M. R., & Brooks, F. P. (2006) The Hand is Slower than the Eye: A quantitative exploration of visual dominance over proprioception, *Journal on Presence:Teleoperators and Virtual Environemnts*,**15**, 1:1-15, February 2006. (Extended version of IEEE VR 2005 paper.)

Meehan, M,. S. Razzaque, B. Insko, M. Whitton, F. Brooks, (2005) "<u>Review of Four Studies on the Use of Physiological Reaction as a Measure of Presence in Stressful Virtual Envieronments,</u>" *Applied Psychophysiology and Biofeedback*, 30 (3), 239-258.

Hudson, T., A. Helser, D. Sonnenwald, M. Whitton. (2004) "Managing Collaboration in the nanoManipulator," *Journal on Presence: Teleoperators and Virtual Environments*, 13(2), 193-210.

Sonnenwald, Diane H., K. Maglaughlin, M. Whitton. (2004) "Designing to Support Situation Awareness across Distances: An Example from a Scientific Collaboratory," *Information Processing & Management*, 40(6), 989-1011.

Publications: Reviewed Conferences

Note: Computer Graphics has several highly competitive conferences with high reviewing standards and low acceptance rates: acceptance rates run from less than 20% to about 30% and all papers are reviewed by at least four people before acceptance.

Jerald, J., Peck, T., Steinicke, F., Whitton, M. (2008). Sensitivity to Scene Motion for Phases of Head Yaws, *Proceedings of Applied Perception in Graphics and Visualization 2008* (Los Angeles, August 2008) , pp. 155-132.   New York:ACM.

Feasel, J., M.C.Whitton, J.D. Wendt, (2008). LLCM-WIP: Low-Latency, Continuous-Motion Walking-in-Place. *Proceedings of IEEE Symposium on 3D User Interfaces 2008* (Reno, NV March 2008), 97-104.

Peck, Tabitha, M. Whitton, H. Fuchs (2008). Evaluation of Reorientation Techniques for Walking in Large Virtual Environments. *Proc. of IEEE Virtual Reality 2008* (Reno, NV March 2008), 121-127.

Glencross, M., C. Jay, J. Feasel, L, Kohli, M. Whitton, R. Hubbold (2007). Effective Cooperative Haptic Interaction over the Internet, *Proceedings of IEEE Virtual Reality 2007,* (Charlotte, NC March 2007), 115-122. IEEE Computer Society.

Burns, E., Razzaque, S., Panter, A. T., Whitton, M. C., McCallus, M. R., & Brooks, F. P. (2005) "The Hand is Slower than the Eye: A quantitative exploration of visual dominance over proprioception," *Proceedings of IEEE Virtual Reality 2005*, (Bonn, Germany March 2005), 3-10, IEEE Computer Society. Honorable Mention in Best Paper Competition.

Whitton, M., Cohn, J., Feasel, J., Zimmons, P., Razzaque, S., Poulton, S., McLeod, B., Brooks, F., "Comparing VE Locomotion Interfaces," (2005) in *Proceedings of IEEE Virtual Reality 2005*, (Bonn, Germany March, 2005), 123-130, IEEE Computer Society.

Publications: Other Papers and Video paper

Jerald, J, A. Fuller, A. Lastra, M. Whitton, L. Kohli, F. Brooks. (to appear). "Latency Compensation by Horizontal Scanline Selection for Head-Mounted Displays". *Proceedings of SPIE Vol 6490 Stereoscopic Displays and Virtual Reality Systems.* XX-XX (San Jose, CA, January 2007)

Muller, P., J. Cohn, D. Schmorrow, R. Stripling, K.Stanney, L., Milham, M. Whitton, J. Folkes (2006). "The Fidelity Matrix: Mapping System Fidelity to Training Outcome," *Proceedings of I/ITSEC 2006*, (Orlando, FL December 2006).

Brooks, Jr., F. P., J. Cannon-Bowers, H. Fuchs, L. McMillan, M. Whitton, "Virtual Environment Training for Dismounted Teams-Technical Challenges," Paper presented at Human Factors & Medicine Panel Workshop on Virtual Media for Military Applications, U.S. Military Academy, West Point, NY, June 13-15, 2006.

Brooks, F., Cannon-Bowers, J., Fuchs, H., McMillan, L, Whitton, M., "A New VE Challenge: Immersive Experiences for Team Training," *Proceedings of HCI International 2005*, v.9 (Las Vegas, July 2005). CD-ROM. (Invited)

Whitton, M., B. Lok, B. Insko, F. Brooks, "<u>Integrating Real and Virtual Objects in Virtual Environments</u>," *Proceedings of HCI International 2005*, v.9 (Las Vegas,July 2005). CD-ROM. (Invited)

Kohli, L., Whitton, M., "<u>The Haptic Hand: Providing User Interface Feedback with the Non-Dominant Hand in Virtual Environments</u>," *Proceedings of Graphics Interface 2005* (Victoria,BC,May 2005), 1-8.

Lok, Benjamin, Samir Naik, Mary Whitton, and Frederick Brooks (2004). "<u>Experiences in Extemporaneous Incorporation of Real Objects in Immersive Virtual Environments</u>," in Beyond Glove and Wand Based Interaction Workshop, IEEE Virtual Reality 2004, Chicago, IL.

Publications: Conference Abstracts, Posters, Panels, and Presentations

Whitton, M.C. (2008). Panelist. Getting around in VR, B. Mohler (Organizer), *IEEE Virtual Reality 2008*, (Reno, NV, March 2008). IEEE Computer Society.

Burns, E., S. Razzaque, M. Whitton, F. Brooks (*2007*), "MACBETH: The avatar which I see before me and its movement toward my hand," (Poster Abstract), *Proceedings of IEEE Virtual Reality 2007*, 295-296 (Charlotte, NC, March 2007). IEEE Computer Society.

Whitton, M.C. (2006). Panelist. How Do We Solve Human Factors for VR and AR Applications? Mark Livingston (Organizer). I*EEE Virtual Reality 2006,* (Alexandria, VA, March 2006). IEEE Computer Society.

Cohn, Joseph (LT), M. Whitton, W. Becker, F. Brooks, "Information Presentation and Control Method Impact Performance on a Complex Virtual Locomotion Task" (<u>Poster</u>), Human Factors and Ergonomics Society's 48th Annual Meeting (New Orleans, Louisiana, September 20-24, 2004).

Grants and Research Activities

Effective Virtual Environments (EVE)

Office of Naval Research—2004-2008; $680,000
    Topic: Effective Virtual Environments
    Co-PIs: Whitton, Brooks

Office of Naval Research—2000-2003; ~ $200,000/year.
　　Topic: Effective Virtual Environments
　　PI: Brooks, Co-PI: Whitton

Since 1998 the work of the EVE team, led by Brooks and Whitton and also supported in part by NIH, has focused on understanding what level of quality/performance is required of the technologies of virtual environments in order to maintain the VE illusion and have a successful application. Topics considered include locomotion technique (Usoh & UCL collaborators), field-of-view (Arthur), physiological measures, frame rate, and latency (Meehan, et al.), passive haptics (Insko), redirected walking (Razzaque), effects of lighting and lighting quality (Zimmons). Work continues in locomotion and we have begun a new thread of resesrch investigating usingdata mining and statistical methods to generate evaluation and diagnostic information from logs of behavior and state data collected during simulation-based training sessions.

In the 2008-2009 timeframe, this grant is supporting Whitton and Brooks to look out to 2015 and report what technologies will be ready for deployment in VE training systems.

Student Committees

Advisor and Ph.D. Committee Chair, Computer Science. Jeff Feasel, Chris VanderKnyff, Tabitha Peck (co-advisor with Henry Fuchs)

Member, Ph.D. Committee, Computer Science: Thomas Hudson (2004), Paul Zimmons (co-chair, 2004), Sharif Razzaque (200X), Eroc Burns (200X),Christopher Weigle (2006), Danette Allen(2007), Justin Hensley (200X), Dorian Miller, Rick Skarbez, Christopher Oates, Jeremy Wendt, Jason Jerald, Luv Kohli, and Karl Gyllstrom.

Whitton was primary advisor to Meehan, Insko, and Lok during Brooks' three sabbatical semesters in the late 1990s, and for Kohli, Wendt, Jerald, and Skarbez during his 2007-2008 stay in the UK. She was an official reader for all of the completed dissertations (i.e., have date) except Interrante and Leubke.

Departmental Service

Department Local IRB Committee Chair (2002-present)
Interior Design Committee for Brooks Building (2006-2007)
COMP101/102 Curriculum Committee (non-majors introductory course) (2006-2007)
Graphics and Image Lab Committee, Chair (1996-2006)

Professional Activities and Service

Editorial Board

2003-2006	Presence: Teleoperation and Virtual Environments

ACM

1978-present	Member
1993-1998	Member, ACM SIGBoard
1997-1998	Member, ACM SIGBoard Bylaws Revision Committee
1998-2000	Member, ACM Council

ACM SIGGRAPH

1978-present	Member
1990-1999	Member, ACM SIGGRAPH Executive Committee
1993-1995	Chair, ACM SIGGRAPH Executive Committee (Position is now cal President)
1994	Chair, *ACM SIGGRAPH in the 21st Century*, Long Range Planning Conference

ACM Symposium on Interactive 3-D Graphics

1999-2004	Symposium Steering Committee Member
2001	Symposium General Chair
1990	Program Committee

IEEE and IEEE Computer Society

1980-present	Member
2003	Virtual Reality 2004 Conference, Program Committee

ACM SIGGRAPH Conference, ACM I3D Symposium, IEEE VR and Visualization Conferences, IEEE 3D User Interface Workshop, ACM Applied Perception in Graphics and Visualization

1993-present	Reviewer
2000-present	Program Committee Member (typically for 2 conferences/year)

Other Activities

2006	Supervised Home-Schooled High School Intern
2002, 2004	Supervised High School Intern from NC School of Science and Math
1995-2007	Engineering Advisory Board, The Aurora Funds, LLC
1994-present	Graduate School Board of Advisors, N. C. State University
1994-1996	Board of Directors, North Carolina Interactive Visual Technology Center

Mary Whitton

Information concerning teaching activities over the academic years 2003-04 through 2007-08 (inclusive):

a. Supervision of postdocs – N/A

b. Active involvement in improvement of undergrad education (2-3 sentences per item)

Undergrad Service Course committee that planned new Comp 101 and 102 courses, introduction to CS for non majors – 101 with a math tag and 102 with a communication intensive tag. I will likely be the first instructor for 102, if it gets approved.

c. Course development work undertaken (2-3 sentences per item)

Comp 102 course

d. If you feel your work has had special impact (e.g. someone is using your software, your research led to commercial efforts, etc.), please supply 4-6 sentences to describe.

N/A