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The purpose of this study is to examine the conditions surrounding information use in the backcountry and technologies that enable it. First, the existing literature will be reviewed to determine the climate for the adoption of information enabling technologies in the backcountry. Specifically considered will be the users of information and the nature of information needs, which may vary from user to user. Then current technologies and their impact on information use will be examined. A formula was created to assess the extent to which these technologies fulfill information needs and how likely they are to be used. Limitations of current technologies as pertains to their use in backcountry settings will be discussed. Finally, conclusions about information enabling devices will be drawn.

Headings:

IT in the environment
Remote wilderness study/experience
Information use
Technology adoption conflicts
User study
Product survey

INFORMATION AND THE BACKCOUNTRY: A SURVEY OF THE TECHNOLOGIES AVAILABLE FOR LEVERAGING INFORMATION THROUGHOUT A REMOTE WILDERNESS EXPERIENCE

by
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TABLE OF CONTENTS

List of Tables and Figures

Page

Introduction

Over the course of history, there have been many people who have walked into the remote Alaskan backcountry never to return. One man caused quite a stir by doing so in 1992. His name was Christopher J. McCandless, and after graduating from Emory University in 1990, he embarked on an adventure through the Last Frontier, as Alaska is sometimes called (Alaska Office of Economic Development, 2007). In April of 1992, McCandless was dropped off at the trailhead of the Stampede Trail with very minimal supplies to face the wild. By August, he had died (Krakauer, 1996.) John Krakauer wrote an account of McCandless' life in *Outside* magazine in 1993. In this article, which later became a book, and then a movie, Krakauer reveals a small but crucial piece of information that, had McCandless known, he might still be alive.

McCandless had crossed the Teklanika River in April to reach the site where he established camp for the next four months. By the time he was ready to rejoin civilization, the river was running far too high for him to cross because of snow melt. When he was unable to ford the river, he returned to camp where starvation overtook him. Krakauer points out that only a quarter of a mile downstream there was a cable tram that crossed the river, installed there for just such high water crossings. Had McCandless known this information he could have crossed the river and returned home (Krakauer, 1996). This lack of information in the backcountry cost McCandless his life.

This may be a particularly extreme example and perhaps one that is not fair; however, it does illustrate the consequences of insufficient information in the backcountry. Information technologies can help people avoid a similar fate, but only if they are willing to use these technologies. From reading Krakauer's account of McCandless' adventure, which was based in large part on a journal kept by McCandless, it became apparent that McCandless rejected information or technologies that would help him access information. In fact, he shunned both. But information and the technologies that enable people to leverage information–whether it be maps, cell phones, computers, or the next thing not yet invented–are here to stay (or will be soon). Therefore, use of these information enabling technologies in the backcountry to help keep people safe should be encouraged.

A contrast to the story of McCandless, for example, is the case of Jason Tavaria. In March of 2009, Tavaria was snowboarding in the Swiss Alps when inclement weather overtook his group. Tavaria was separated from the group and lost his way. Using Twitter and his iPhone's global positioning system (GPS) functionality Tavaria was able to guide rescuers to his location who then safely assisted him out of the wilderness (Malvern, 2009).

These two stories demonstrate that information can play an important role in various aspects of any given backcountry setting. Had McCandless taken a map–or even looked at one when planning his journey–he might have known that there was a tram to help him cross the river. Had Tavaria not been willing to take his phone with him on his outing, had he not been able to find his location from the GPS built into his phone and then use its communication abilities to share this information, Tavaria might not have survived. The lack of information cost McCandless his life, while information technologies saved the life of Tavaria.

Problem Overview

To date, no extensive studies have been done regarding how information is created, stored, shared, or used in the backcountry. There is a lack of discourse concerning what technologies exist to facilitate these information actions. There is also little discussion of who might use information in the backcountry or what their information needs may be. This situation needs to be remedied, as there are a variety of new and emerging information technologies that could be adopted by people in the backcountry to protect themselves, and possibly save their lives.

In order to understand the complexities of this situation, there are questions that need to be asked: What is the backcountry? Who can be found in the backcountry? What information do these people need to accommodate their backcountry experience? Why do these people need information? What do they do with information? What form will their information come in? What encourages some people to use information tools but not others? What limitations are there on information in the backcountry? Furthermore, does anyone care? Is this actually important? Do people even want or need information in the backcountry?

By attempting to answer these questions, it should become evident that this is an interesting realm to examine, as very little research has been done, and the complex nature of the setting makes for some intricate yet exciting possibilities. This paper will suggest a synergy of extant information technologies that could entirely improve the backcountry experience, despite claims these technologies and the outdoors do not mix.

A few of the questions posed above should be addressed before delving into the literature. First, what exactly is the backcountry? Backcountry, as defined by the Oxford

English Dictionary, is "the country lying towards or in the rear of a settled district." Merriam-Webster defines it as "a remote undeveloped rural area." These meanings give some indication of the meaning of backcountry; however, about.com's site on camping provides a better definition: "remote uninhabited areas of public lands, national parks, and forests. . . is accessible to hikers, backpackers, and horse riders". However, this definition could be amended to include activities such as rock climbing, mountaineering, mountain biking, kayaking, skiing, or snowshoeing. Terrain varies from one backcountry setting to the next: canyons in Utah, forests in Maine, and alpine peaks of Colorado are all backcountry settings. This paper uses the following definition for backcountry: remote uninhabited areas, recognized or not, where people can go for any recreational activity.

Information Users

Then there is the issue of who can be found in the backcountry. It is a select group: people who enjoy the outdoors and the challenges that venturing into a remote wilderness location provides. These are all people who may have information needs, and therefore may benefit from access to information. The people in question could be called backcountry information users. How they access information, utilize information, and the kinds of information they need differentiates them. For this study, there are three primary categories and one secondary category of backcountry information users. The types of information and the means of access to information will vary based on the user in question. The three primary categories are adventurers, administrators, and responders. An adventurer is anyone who uses the backcountry to undertake some sort of recreational activity. People utilizing the backcountry for hiking, backpacking, kayaking, or climbing would all fall into the category of adventurer. Park rangers are the primary example of administrators, although anyone tasked with monitoring, patrolling, conserving, or otherwise overseeing an area of the backcountry could also be included in this category. The last primary category is the people involved in search and rescue, the responders. Finally, the secondary category includes everyone involved in the lives of those in the backcountry. This means family, friends, and co-workers or bosses who need to know information about their outdoor loving acquaintances.

Information Uses

In order to help information users fulfill their information needs, they must have avenues to interact with information. Because information use has been well studied in the past, I will only briefly mention it here. Choo (1996) writes about "the knowing organization" and how organizations use information, and applying some of his theories to the individual backcountry user can provide some insight. To modify Choo's ideals on the creation and use of information for the individual, we would have three distinct areas. First, information is searched for and evaluated in order to make decisions. A key component of this area is that the choice should be made rationally, but in practice the decision making is usually complicated by any number of external factors. In the case of the backcountry user, the lack of information is foremost among them. Second, the individual must make sense of changes and developments in its external environment (as well as his internal environment.) I liken this idea to situational awareness, as so much of the backcountry experience is responding to the changes in conditions around the backcountry user. Finally, individuals "create, organize, and process information in order to generate new knowledge" (Choo, 1996). By fully understanding what kinds of things people can do with information, it becomes easier to see how information technologies can be applied to information needs.

Information Needs

The final theoretical piece is the actual information need. Various researchers have described an information need as a gap in knowledge. Belkin (1980) describes an "anomalous state of knowledge", whereby the individual realizes that their current mental model of their situation has some deficiency and that information is necessary to rectify this problem. Dervin (1986) labels her model 'Situation-Gap-Use'. Similar to Belkin, Dervin's model is based on sense-making. Information needs occur when an individual's internal sense runs out, and they must create new sense. "The sense-maker is stopped in a situation. Movement is prevented by some kind of gap. This sense-maker is seen as potentially making some kind of use of whatever bridge is built across the 'gap' the user faces" (Dervin, 1986). Figure 1, from Wilson (1994), illustrates the theoretical interrelatedness of information users, information needs, and information uses.

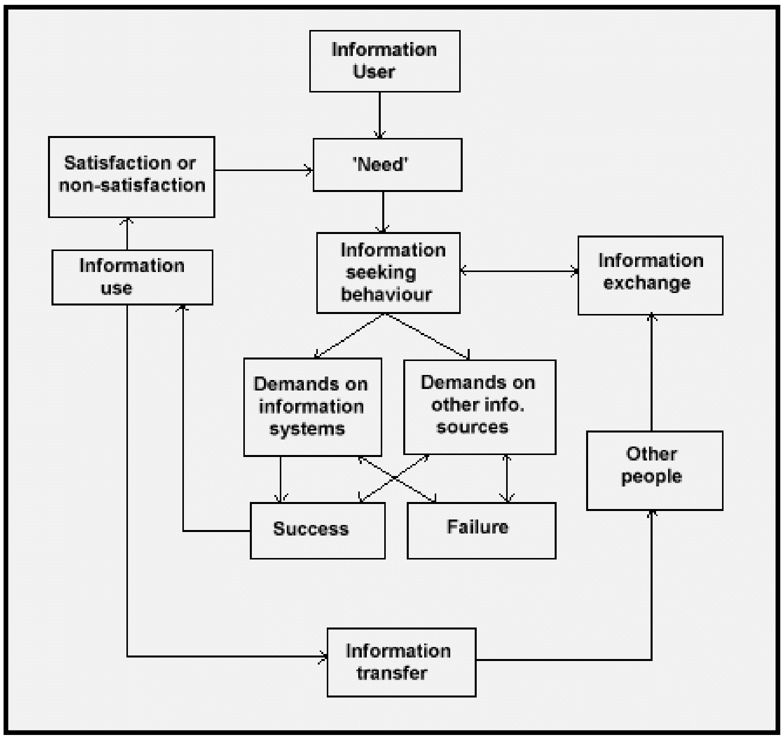

Figure 1: A model of information behavior from Watson, *Information Needs and Uses: Fifty Years of Progress?*

Now, let us put the theories to practice, keeping in mind that part of the allure of the backcountry is the fact that access to the outside world is less possible there. This fact greatly impacts the information needs of all users.

For example, the mothers and fathers of adventurers have an information need, the need to know that their offspring are well. Since those in the backcountry tend to be outside of cell phone reception, parents or loved ones can never be too sure of the condition of their children. This secondary group, however, is just a small segment of those affected. The problems caused for the primary groups are much more intricate. Just by considering the roles of adventurers, administrators, and responders, it should be clear that all will have different information needs, and likely different means to achieve their information needs.

First, consider the adventurer. For the purposes of this paper, the information needs of the adventurer start when they decide to visit the backcountry. In Clawson's (1963) model, this reflects the anticipation stage. Copious amounts of research have been done on information use at home for various non-work related tasks (Savolainen, 1995), but I uncovered none relating to the particular task of preparing for a backcountry excursion. For someone less interested in the actual backcountry experience, I would suggest that studying the information seeking behaviors of people in the anticipation state of outdoor recreation activities (of which backcountry outings are a part) could prove an interesting endeavor. However, an in-depth analysis of this process is beyond the scope of this paper. Since there are information actions involved that may shape the actual backcountry experience, I will mention it here in passing.

In order to plan his backcountry experience, an adventurer decides to do some research. He first picks a backcountry area he is interested in. Then he emails his friend who was there just last year to ask for any advice on sights to see or places he must visit. Next he cruises the web - finding driving directions, purchasing a guide book from a bookstore, checking the weather online. These are all information needs of the adventurer that are easily met prior to leaving his home. They are not so different from the non-work, citizen needs discussed by Savolainen. But once the adventurer is out in the backcountry, these needs change. The information that is important in the field are things such as the current location, the surrounding terrain, or getting updated weather forecasts. Checking in with a loved one back home could be important for some adventurers. He may also be interested in the history of the area he is visiting, human or natural.

Unlike everyday life information needs, the adventurer may have needs that could drastically change instantaneously, and the consequences for those needs not being met could be dire. Should his situation become life-threatening, due to injury, weather, or any other factor, his information needs may become immediate. With some urgency, he may need to find the nearest ranger station, or water source. He may simply lose his way and need access to information such as where the trail is, or where the nearest road is. He may need to transmit information, such as his current location for rescue. Certainly, a map can provide some information about the location of amenities or terrain features, but the user needs to both possess a map and know how to use it, as well as knowing where he is on the map. Maps are a technology that most backcountry goers utilize and consider essential for any wilderness foray, even if not into the depths of the backcountry.

Even better, a GPS unit could provide mapping information and also provide a tool to help the user orient himself properly. A compass could do so as well, but there is a perception that a GPS has a gentler learning curve than a compass, and short of running out of power, it is hard to use a GPS unit improperly.

Inevitably, the adventurer is out there by himself, or in a small group. His information needs are generally regarding himself, and are of no concern to other parties. Nor is he concerned by the whereabouts or statuses of other parties. For the purposes of this paper, the use of information related to the backcountry experience does not end when the adventurer returns from the backcountry to his car, however. There is another component to the information cycle that adventurers exhibit, and that is sharing. Returning to Clawson's (1963) model for outdoor recreation experiences, this step is a part of recollection. This information action, whether sharing the location of a campsite with a friend, posting pictures on the internet, or filling out a comment card and submitting it to the park service, is critical as it is how the adventurer completes the information interaction of that particular backcountry experience.

The needs of adventurers vary greatly from the needs of administrators such as a ranger who is tasked with monitoring or responding to events in a given backcountry setting. To a ranger, the pieces of information that may be important are things such as who is available locally, when the next scheduled resupply is, or how many people have applied for permits. Rangers are also concerned with threats to the land they help maintain, and information about threats could come from various sources and forms. For example, trail conditions may come to the attention of rangers through word of mouth. Imagine a hiker who experiences undesirable trail conditions in the backcountry. This hiker returns home, sharing this information with only a friend who will be visiting the same area the next weekend. Upon his arrival, the friend asks a ranger about the trail he was warned about. Since the ranger did not know of this condition, the friend tells the ranger what he knows. Now the ranger is obtaining new information, but it is very imprecise. Is there substantial downed timber that needs to be removed after the last storm? Is there trail erosion that is having an impact on the land? This example simply highlights the complexities that rangers face regarding the information that is available to them. In general, the information that rangers work with consists of a much greater number of people and places, and may require some coordination–with headquarters, with visitors, or with other rangers. There is an underlying assumption here that rangers have fewer information needs outside of the backcountry experience, since they generally work in the backcountry and are already acquainted with the area. However, backcountry administrators could benefit from access to accurate, up-to-date information.

Emergency responders have information needs similar to those of administrators, although much more specific. Massive coordination efforts are needed on the part of search and rescue operations, and information sharing becomes critical. Ela (2004) writes that "search and rescues are a particularly important subset of wilderness problems to investigate because these incidents expose rescuers to potentially dangerous conditions." This notion highlights the difference between the first two groups and the responders. Unlike the adventurer, who has planned their excursion, or the administrator, who works in the backcountry environment daily, responders are called into the backcountry irregularly and at a moment's notice. They may need to be brought up to speed on the current situation quickly, as every moment lost could be critical. In the case of a person lost in the woods, situational awareness information such as where other responders are is important to prevent areas from going unsearched, while ensuring that the maximum area is searched by minimizing overlap, in order to find the person as quickly as possible.

With a more clear understanding of what the backcountry is, who can be found there, and what their information needs are, a review of the literature makes it easy to see that little research has been done about what information technologies are best suited to help fulfill those needs.

Review of Literature

Research in the realm of information and the backcountry is severely limited. There is, however, considerable research into related areas from which we can borrow in order to gain some insights. One such area is adventure recreation. There is a close link between adventure recreation and backcountry endeavors, as most of the activities undertaken in the backcountry fall under the umbrella of adventure recreation. From examining the list of activities that are considered adventure recreation in Appendix C, it should become clear that backcountry outings are but a subset of adventure recreation. I am not attempting to equate adventure recreation and a backcountry experience, but merely to examine whatever literature is out there which could be applied to the backcountry experience. With that in mind, Ewert (2000) writes the following about adventure recreation:

> "Moreover, it should be noted that Adventure Recreation as an academic line of inquiry is a relatively recent entry and as such, much of the data, particularly those related to participation are (a) non-existent, (b) somewhat obscured by data from more traditional forms of outdoor recreation (such as hiking or camping), and (c) may be influenced by 'who' wanted the data collected."

Furthermore, its relative newness aside, the subject of adventure recreation is not traditionally an area where much overlap between information and activities occurs. More often than not, information technologies are not aimed at fulfilling the information needs of adventure recreationists, and researchers are not quick to look at the links between the two. Another issue is that most studies and academic work concerning adventure recreation are focused on the management of parks and meeting the demands for adventure recreation in its broadest sense.

However, this is not to say that information technology and the backcountry are never linked in the literature. If they are to be discussed together, the reason is usually (1) the historical connections between the two, (2) the prediction of future trends, or (3) the controversy surrounding the balance of technology and wilderness. I have chosen this last phrase carefully–the balance of technology and wilderness–because these works only discuss information technology as a subset of the broader meaning of technology and the backcountry as a subset of all wild lands, usually those managed by the National Park Service. For example, according to Ewert and Shultis (1999), a sampling of the recent technological developments in backcountry recreation would include things such as automatic descending devices, avalanche beacons, cell phones, collapsible chairs, hand-held GPS units, Kevlar, filters, plastic climbing boots, personal locator beacons, snowboards, technical socks, website information sources, and wind-resistant fleece. The complete table appears in Appendix A. This sampling, however, should indicate clearly that information technology is simply one faucet of technology as a whole and not necessarily at the forefront of the concerns of the average recreation or backcountry researcher as pertains to technological innovation. Also note that a common theme running throughout the discussions on the past and present is that there is a double-edged nature to the interplay of technology and wilderness, while predictions for the future all seem to include some kind of warning. But before we discuss predictions, we should first examine the history of technology and the backcountry.

History

Consider that perhaps without technology, the national parks may not have developed as they have. Borrie (1998), Ewert & Shultis (1999), and Shultis (2001) all mention that the sense of the need for wilderness was enabled in part by the growth of technology. For example, the beginnings of the national parks can be traced back to the Industrial Revolution. Without the invention of the railroad (Shultis, 2001; Ewert & Shultis 1999) there might not have been a push to protect wild, free lands. The iron horse enabled easy transportation for the wealthy to elite natural resorts. These destinations were established in the areas that would later become the national parks (Bella, 1987; Runte, 1987).

Later on in history, they cite the automobile as a technology that increased public support for and visitation to the national parks. John Muir, famous explorer and activist, ardent supporter of wilderness and the preservation of the natural lands, agreed, albeit grudgingly, that automobiles should be allowed into the parks because cars would lead to an increase in public use, and in turn funding for such places (Shultis, 2001). Muir was right, increased public support for the parks because of the larger number of visitors was advantageous for the parks, but the authors of today are able to point out the downside, in addition to the benefit provided. Along with the increase in visitors, there was an increase in congestion and pollution, as well as other undesirable effects.

While the railroad and the automobile are examples of the broader meaning of technology, the literature makes clear that without technology, we would not have developed the sense of wilderness that we have today. Perhaps this is an indication that technology, with regards to the backcountry, is not pure evil as many consider it to be.

Trends

The second topic found in the literature is predictions and trends. The literature predicts that visitation to national parks will continue to increase (Eagles, 2004; Ewert, 2000). Eagles also suggests that there will be an increasing demand for sophisticated management and services, such as online registration for backcountry campsites in the event that registration is required. It is also suggested that users of the backcountry have access to an unprecedented amount of information, which makes them more aware of opportunities in the backcountry, as well as management policies for such areas. These increased levels of awareness by users of the backcountry will be the cause of some additional stress for management as the resultant scrutiny of each management decision is increased (Eagles, 2004; Ewert, 2000; Stankey, 2000). While information technology has already clearly changed the level of awareness of backcountry users, the notion that it could be stress inducing should be more fully investigated, although this falls firmly outside the means of this study. Next, consider that Eagles (2004), Ewert (2000), Shultis (2001), and Stankey (2000) all suggest that the availability of information technology will influence visitation in a positive direction. Finally, it has been reported that in the current economic downturn, more and more people will be turning to the outdoors for recreation (Sutter, 2009). The situation presents a perfect opportunity to advance the cause of adopting technology wholeheartedly in the backcountry.

Strangely enough, one prediction made has already come true. Eagles' work was prophetic, as he accurately predicted a device that will be discussed later on in this paper. Correct predictions such as Eagles', however, are not normal. For the most part, we do not possess an ability to correctly predict innovations or their impacts (Shultis, 2001; Stankey, 2000). Stankey (2000) writes of innovation in general: "Our capacity to anticipate the future accurately has yet to be demonstrated…Bill Gates' apocryphal quote '640K ought to be enough for anybody" is a perfect example.

Controversy

However, when it comes to information technology and the backcountry, the topic that receives the most attention is the interplay between the two. Some claim that there can be no balance: that the two ideas are set firmly against each other. Others advocate for seeking a middle ground, although grudgingly. Again, I must stress that most of these authors refer to technology in the larger sense, but their arguments easily apply to more specific instances of information technologies, which they view as a subset of technology.

There are a few ideas that serve as the foundations for the controversy surrounding technology and the backcountry. Borrie (1998) points out that technology changes our expectations and experiences in the backcountry, and more importantly, technology changes us. His is a more blatant statement than the views expressed by and Ewert & Shultis (1999) and Shultis (2001) that the relationship between humans and technology is far deeper and more complex than most people would like to think. There is also a discussion of the idea that backcountry settings are landscapes entirely unscathed by human actions, and that the use, or even appearance, of technologies on these sacred lands is despicable. This is a misconception, yet it persists (Ewert & Shultis, 1999; Shultis 2001). Borrie (1998) relates a similar notion.

So why would anyone want information technologies in the backcountry? Stankey (2000) states "there is a conventional sense that wilderness is where technology is not." Borrie (1998) claims that technology runs counter to every wilderness ideal. Ewert (1999) asks "if the wilderness becomes increasingly cluttered by technology, where is there left to escape to?" Isn't the point of the wilderness to get away from it all? To pit yourself against nature?

The short answer is that the use of information technologies can save lives in the backcountry. This is especially relevant now. Given the trends presented in the literature and current events, it seems likely that backcountry destinations will be in demand more now than ever. Consider too that a good number of those undertaking backcountry activities will have little to no experience operating in remote wilderness environtments. While opponents of technology in the backcountry, in its broadest sense, have always claimed that technologies enable those who might not otherwise be equipped to go places they should not go (Borrie, 1998), one might posit that if the inexperienced are going to go, they might as well leverage all the tools available to them.

In the past, other technologies have been introduced that totally altered the way things were done, and we did not hesitate to adopt them. Stankey (2000) describes a scene using some of today's technologies such as high tech synthetic fabrics and ultra-lightweight gear. He supposes that some people would find the scene repugnant, but suggests that many people would not object to a scene with horses hauling gear, canvas materials, and cast iron equipment. His point was that in either scene what people were doing was traveling in the backcountry. The technology they were using, be it canvas sacks and cast iron equipment or the latest and greatest, was contemporary, and it facilitated their use of the backcountry. Eventually, the technologies are adopted and no one will think twice about it. Weil and Rosen (1997) coined the term 'technoStress' to classify the general disconnect between individual and societal costs of acceptance of the implications of technology. It seems as if much of the literature we have is an attempt to understand the technoStress we are experiencing.

Other theories have been developed that can be applied to the situation. One that comes to mind is Tenner's (1996) "revenge theory." This is the notion that innovations in the realm of technology have consequences which are unintended that could not be predicted but have important ramifications. The aforementioned development of the national parks due to the expansion of the railroads, as well as the increase in park visitors because of the invention of the automobile would be prime examples of the revenge theory.

Wiley (2005) brings up another theory that may be applicable to the discussion. It is possible that he does the best job of explaining the tensions felt today by the encroachment of technology into the backcountry. He frames his research through the lens of Heidegger's 1977 essay, "The Question Concerning Technology" and enframing, a concept contained within the essay. While much of his discussion is in line with all that has been done previously–trying to find the balance between the backcountry and technology–he weighs the benefits that technology can provide versus some of the more traditional benefits of backcountry travel. He also is much more specific about which kinds of devices he is discussing. Information is not at the heart of this paper, but it is further removed from the adventure recreation standpoint that all of the other works cited are based on. Wiley breaks the tensions down into four distinct areas: risk versus security, solitude versus connectivity, mediation versus direct experience, and knowledge versus the unknown. These are specific factors that balance against each other, areas where we must seek the middle ground.

Impacts

For now, however, let us set the dispute aside. No matter which side of the argument one accepts, it is easy enough to look at the impacts technology has had on the backcountry. Ewert and Shultis (1999) categorize technological impacts on outdoor recreation into five categories. Their categories are based on an earlier work by Clawson (1963), which described a five-stage model for the outdoor recreation experience. The stages of this model are: anticipation, transportation to the site, on-site activities, transportation from the site, and recollection. The categories for Ewert and Shultis' impacts are access and transportation, comfort, safety, communication, and information.

While somewhat dated, the general direction Ewert and Shultis provide can be insightful. In their scheme, only communication and information really relate to information technologies, and they only examine these issues through the lens of park management.

As examples of communications technologies, they mention cell phones, GPS, and "Palm" computers, among others, that will allow people to feel that they can stay connected while out in the backcountry. Their major topic for discussion, however, is that these technologies will provide more demand for search and rescue because, in the words of Borrie (1998), "... the predominance of cellular or mobile telephones raises the expectation that emergency assistance is only a phone call away." Wiley (2005) provides a counterpoint, stating that "...no reliable research exists to support the argument that the availability of mobile technologies increases risk-taking." As such, it would seem that the effect of mobile technologies on risk-taking is a topic for further study.

The information examples listed by Ewert and Shultis are television and the internet. The focus is on an increased awareness of public lands, where information may be provided by third parties that managers will have to respond to. Neither of these observations proves too useful to the discussion of information technologies in the backcountry.

Despite the lack of material specifically concerning information and the backcountry in the literature, the literature review sets the stage for this research. It is apparent that no one is willing to officially, with any depth, recognize the role that information plays in the backcountry. Perhaps this is because no information scientist has seen fit to examine this situation previously.

Methods

This paper surveys the current state of information technologies that are applicable to the backcountry setting. After reviewing existing literature to determine the climate for such a survey, it has been discovered that there is no previous work upon which to base such a survey. Therefore, this paper is exploratory in nature, designed to establish a baseline for the potential uses of existing information technologies. It is predictive and prescriptive, although as Stankey (2000) has said, it is difficult to predict where technologies will take us. Regardless, if we are willing, these technologies can enable us to take better care of ourselves in the backcountry.

Having discussed the users of information in the backcountry, and the types of information they may need, in addition to the ways in which they may use this information, this study will now systematically review five devices that have demonstrated potential for enabling information use in the backcountry. A systematic review of the devices will be conducted to determine the feasibility of carrying said device into the backcountry and what functionality it will provide in that setting. Manufacturer's specifications will be used to report physical dimensions and properties of the devices. Some of the factors mentioned by Gerling (2004) will be included: portability, size, weight, and battery life. Additionally, I will consider any requirements of the device, and extra features provided. The approached used is similar to the usability evaluations of products found in magazines such as *PC*, *PC World*, *Outside*, or *National Geographic Adventure*. The review will incorporate both an objective formula based on measurement of qualities and a more subjective discussion of the perceived ease of use and perceived usefulness of the devices. Legris (2003) has defined these factors as crucial to explaining the acceptance of technologies.

Concepts and Measures

I have created a formula to score the usefulness of information enabling devices for use in the backcountry. The formulas are based on a point system: devices will gain points by exhibiting certain features, or based on where some measurable property of the device falls on a scoring chart. Higher scores are better. The formula is as follows:

Total Score = information abilities + tangible qualities + intangible qualities

Each of these score components can be broken down further. In order to determine the individual scores, the following considerations shall be given.

Information abilities = infrastructure x *(communications + access + sharing)*

Tangible qualities = volume + weight + battery

Intangible qualities = durability + cost + subscription

The battery score can be expanded to this form:

Battery = (mode multiplier x (use hours + standby hours)) + type

Scoring will be computed according to the following possible values for the variables in the aforementioned equations:

Table 1: Description of point system						
Information Abilities						
Communication			Access		Sharing	
	Local	Global	Location	3	Global	2
1 way	1	2	Weather	2	Local	1
2 way	2	4	Internet	1		
Tangible Qualities						
Infrastructure			Volume		Weight	
Satellite	5		≤ 13 in^3	2	≤ 5.3oz	3
Cell phone	2		13-25 in^3	1	5.4–10.6 oz	2
Radio	2		≥ 26 in^3	0	10.7–16 oz	1
None	1				16+ oz	0
Tangible Qualities - Battery						
Battery Life–Standby			Battery Life - Use		Battery Modes	
≥ 336 hours	3		≥24 hrs	4	One	1
169 - 335 hours	2		16 -23 hrs	3	Both	0.75
≤ 168 hours	1		9 - 15 hrs	2		
			≤ 8 hrs	1	User-replaceable	1
Intangible Qualities						
Cost			Subscription	-2		
≤ $200	2					
$201-$499	1		Waterproof	3		
≥ $500	0					

Now, allow me to explain the rationale behind point distribution. The first consideration is of communication abilities. Underlying the table of scores above is a matrix: 1 point for local or one-way features, 2 points for two-way or global features. Ideally, a device that enables two way communications between two or more parties located any distance from each other is optimal. Thus, global two way communications are awarded four points (2 points for two-way communication x 2 points for global communication.) One way global communication is equally as valuable as communicating bi-directionally within a limited distance. From the perspective of benefit to the user: the ability to transmit a message to anyone, anywhere, at least provides them with some kind of information–an all clear message or a distress signal upon which they can act. The drawback to this is that information cannot be returned, or the person contacted may be too far removed to help. Regarding local communication, the ability to have a conversation is valuable, provided there is someone available to respond. Without a response the value provided by two-way communication is negated. The formula reflects this, showing that one way global communication earns 2 points (1 point for one-way x 2 points for global) as does two-way local communication (2 points for two-way x 1 point for local). Finally, one way local communication merits one point, as it is better than nothing (1 point for one-way x 1 point for local).

The communication score is added to the access score, which is very straight-forward. If the device enables access to current location, three points are awarded. If the device enables access to weather information, two points shall be given. For access to the internet, a device earns one point. A score of 6 is possible, if a device is able to provide access to all three criteria. Other combinations are possible. The final component of the base information score, before the infrastructure multiplier, is sharing ability. If the device is able to share information globally, two points are the reward. For local information sharing, one point is added. Communication and sharing are calculated as two different scores for the reason that communication is considered in the sense of voice information and sharing in the sense of data. A hand-held radio, for example, will enable communication, but the device itself does not necessarily share information. A user could certainly relay information he generates about his location, but the device does not have the ability to report that information on its own. Other devices, such as personal locator beacons, do not enable communication. Rather, when these devices are activated, they broadcast only the current location. No message is communicated. This distinction may seem to be splitting hairs, however, I believe that it is necessary in order to fully differentiate the features of some devices from others.

Finally, the complete information abilities score is determined by taking the sum of the communications, access, and sharing scores then multiplying the result by the infrastructure multiplier. The multiplier is determined based on the type of infrastructure the device requires to communicate, access, or share information. Satellite infrastructure is worth five points, because this type of infrastructure is accessible from nearly anywhere in the backcountry. Cellular radio and radio-to-radio based infrastructures come in next, earning two points. The final possible multiplier value is one point for no functionality enabling the communication, access, or sharing of information. This multiplier is included so that the value of older, analog devices could be scored in addition to newer technologies. This component was formulated by considering that a device is only as good as the network it operates on. The reason for the drastic gap in points is to acknowledge that satellite technology is far more versatile, able to reach into nooks and crannies of the backcountry that other signals simply do not reach. Devices that operate over local radio frequencies are limited by the strength of the transmitter, and also require a unit operating on the same frequency for them to be useful. The mobile nature of local radio infrastructure is worth noting.

The tangible qualities score is based on physical qualities of the device. Because users of the backcountry are limited in what they are able to carry with them, space and weight become important factors when considering what goes in the pack and what stays home. Devices are rewarded for being smaller and lighter, and lasting longer on a single battery charge. In order to establish a baseline for these scores, I have used commonly understood comparison items. As a reference for volume, devices will be compared to a deck of playing cards. A deck is approximately 2.6 inches by 3.6 inches by 0.7 inches. The total volume of a deck of cards is 6.55 cubic inches. Most backcountry users do not object to carrying something the size of a deck of cards if it provides value. For simple entertainment, most are willing to carry a deck of cards for long days in a tent. I have doubled this size to determine the largest point total awarded. Two points for being equal to or less than the space taken up by two decks of cards. One point is given if the device occupies a volume between thirteen and twenty-six cubic inches, or up to the space needed for four decks of playing cards. No points will be given for devices larger than this. Again, I am not attempting to say that functionally, a deck of cards is the equivalent of any device. Certainly, a deck of cards is useful. Its dimensions are discussed here merely as a point of reference to which people can relate.

Similarly, I have provided a point of reference for the weight scoring. One liter of water weighs 2.205 pounds. In the world of backcountry users, who often count ounces, this is quite hefty. Therefore, as a point of reference, the equivalent weight of approximately one half liter of water (roughly one pound) will be used. A device weighing in at less than one third of a pound (5.3 ounces) represents the maximum points (3 points) given for the weight score. Two points are given for weighing between one third and two thirds of a pound (10.6 ounces), and one point is given for being between two thirds and one pound (16 ounces). Zero points are awarded for devices over 16 ounces.

Battery score factors into the tangible score as well. The longer a device is able to last on its battery, the more points it will receive. The scoring for batteries is broken down into two categories, standby time and use time. Some devices have both a standby mode and active use mode. When this is the case, their score is multiplied by 0.75, as their reported times are exclusive and do not account for mixed usage, i.e. using the device actively part of the time and in standby mode for the remainder of the time. In this way, devices that operate in only one mode are not penalized for not having a standby mode. Battery life time score criteria were established by looking at the manufacturer specifications for devices popular today. Most devices are able to operate in standby mode for approximately two weeks, or 336 hours. 3 points are awarded for achieving this. If the device is capable of operating in standby mode for one to two weeks (168-336 hours) then 2 points are given. For any duration of time less than this, a device shall receive one point. In full power, full use mode, the ideal range is anywhere from 10 to 24 hours. The maximum points possible for use are determined in a fashion similar to the standby scoring. For use of 24 hours or more, 4 points shall be earned. 16 to 23 hours is worth 3 points, 9 to 15 hours worth 2 points, and less than 9 worth 1 point. The last factor of the battery portion of the equation is battery type. If the battery is user-replaceable, then 1 point will be added to the device's score. This is to acknowledge the benefit provided by devices that use batteries which the user could replace by carrying spares, if they so desire. While devices without removable batteries can be recharged by the use of devices such as portable solar chargers or battery packs, these devices take up additional space and weight that this equation does not account for.

The final component of the score is the intangible qualities score. Factors such as whether or not the device is waterproof, its cost, or if it requires a subscription are all factors that will add (or subtract) from the intangible score. A device that is built to withstand exposure to water earns 3 points. If a subscription is required for the device to be useful, there is a penalty of -2 points. Points for cost are awarded on a scale, with devices which cost under $200 being awarded 2 points. Devices that cost between $200 and $500 will receive 1 point, while any device that costs more than $500 will not be granted any points. This is to reward devices that are affordable.

Evaluation

Now, considering the different kinds of information needs that one might encounter in the backcountry, five of today's information devices were selected and evaluated with the aforementioned formula to determine which of them are best suited to fulfill those needs. The devices selected were chosen because of their presence in popular outdoor recreation magazines or other media. The devices are marketed as solutions to information needs identified in this paper. The devices represent five distinct approaches to the information needs: radio based coordination, cellular communication, satellite communication, personal location, and hybrid satellite communication/personal location. While collecting quantitative data about each of the devices from the manufacturer's documentation, qualitative evaluations were done to evaluate the perceived ease of use and the perceived usefulness of these products. Because ease of use and usefulness are perceived, and thus subjective, there is no score for these fields.

Results

Garmin Rino 530HCx

This GPS-enabled walkie-talkie allows users to wirelessly share data, in addition to providing access to topographical maps, barometric altimeter, NOAA weather reports, and a digital compass on screen to help users orient themselves (Garmin, 2009). Its most important feature is its ability to share data wirelessly with other similar units. This feature may not be useful for the solo adventurer out under normal circumstances, and perhaps other handheld GPS units would be more beneficial and less expensive. However, the Rino does enable the sharing of coordinates for multiple parties or routes. This device excels in search and rescue applications, and thus is included in this study. This is a GPS unit that differentiates itself

Table 2: Scorecard for Garmin Rino 530HCx

Criteria	Score	Justification
Information		
1. Infrastructure	2	Radio
2. Communication	2	2 way; local
3. Access	5	Location, weather
4. Sharing	1	Local
Tangible		
5. Volume	0	31.05 in^3
6. Weight	2	10.3 oz
7. Mode	1	One mode
8. Battery Life Use	2	14 hours
9. Battery Life Standby	0	N/A
10. Battery Type	1	User-replaceable
Intangible		
11. Durability	3	Waterproof
12. Cost	1	$499
13. Subscription	0	No
Total		
14. Total	25	

from other units by not only providing mapping information but also access to the location of other units. Coordination of dispersed group activities in the backcountry becomes much easier with a device such as the Rino.

GPS functionality is certainly no replacement for a map and map reading skills. Additionally, there is the obvious consideration that maps do not require battery power that can be exhausted. However, GPS units are definitely a tool that provides value by helping people safely find their way around the backcountry, and in the case of the Rino, by helping rescuers to conduct more efficient searches. When completing the scorecard for the Rino, it received points for operating on a radio infrastructure. Although the Rino uses GPS to acquire its location, it does not communicate over a satellite network, so thus it was scored accordingly. Also, it is worth noting that the device itself is not outlandishly large, as its score might suggest. Rather the antenna required for GPS functionality and radio based communications led to a larger than normal measurement of the device's volume. Complete device measurements may be found in appendix D. The manufacturer reports no differentiation of power settings. There are two barriers to adoption of this particular technology. The first is simply cost. The second is that multiple units are needed to make its value apparent. While the Rino can always obtain GPS information, location sharing works only with other Rino units. The radio bands the walkie-talkie operates on is standard, so the device can always talk to other hand-held walkie-talkies. The bands are Family Radio Service (FRS), an unlicensed set of frequencies that offers a range of up to five miles, and General Mobile Radio Service (GMRS), a licensed set of frequencies that can cover a range up to fourteen miles.

The perceived usefulness of this device for the solo adventurer is low. There are less expensive models with more features for the individual out there. However, for search and rescue the usefulness is high. Perceived ease of use falls somewhere in the middle: basic operation seems easy enough, although using some of the more advance features such as position reporting may not be obvious.

Apple iPhone

Before discussing the scoring or the perceptions of this device, its potential has to be acknowledged. The potential of this device is extensive, largely because of its versatility. Because it is an embodiment of most of the technologies listed above in one small package, the number of things that can be accomplished with the iPhone is impressive. While simply having an iPhone doesn't enable someone to walk into the woods and survive, the device can be leveraged by just about anyone to make his trip more enjoyable. For example, the iPhone can embed GPS coordinates in the metadata attached to photos so that the user can virtually map out their trip when they return to civilization (Apple, 2009). It has the ability to replace multiple books as well, as eBooks are available for the iPhone (Amazon, 2009). Books are both space and weight intensive, and the ability to take a few hundred books with you could be quite valuable, as you could carry field guides, first aid instruction, travel guides, and leisure reading without taking up valuable space in the pack. Through GoogleEarth and the iPhone's built-in GPS, mapping results similar to the Garmin Colorado may be achieved.

There are other applications for the iPhone too, uses which may have previously been too obscure to merit development of a specific tool. As an example, an application called Shazam (Shazam Entertainment, 2009) uses the iPhone's microphone to record audio samples of songs playing and then, after analyzing the sample and creating a unique footprint, check it against a database of known songs to identify it. On the downside, the Shazam application requires music playing through speakers somewhere to identify–not likely in the backcountry. But what someone might hear in the backcountry is birds. iBird (Waite, 2009) is an application made with its database built in. This application references photos and sound clips of the calls of all the birds in North America. By recording a bird call on the iPhone, it can then be checked against the database to identify the bird. Such technology could be used by anyone outside to identify any sound they do not know–the call of an owl, or a wolf howling at the moon.

This notion could be taken a step further: add in the geotagging abilities of the phone, and you now have a device that can record the call of an animal, identify the animal based on its unique vocal footprint, and place the animal in a given area at a given time. This information could be helpful in data collection of information on species about which little is known or that are currently under observation. This is the first device that is incredibly versatile and not built specifically for just one purpose that could be used in the backcountry. It enables a huge variety of what could be important information uses in the backcountry, if people are willing to encourage its use in the backcountry. This is a device that merits watching. As mentioned before, in 2004, Eagles suggested that such a device that combined all the features of the iPhone would come to exist in the medium term.

There are tradeoffs, however. The iPhone's camera sports only two megapixels whereas some other purpose built cameras with geotagging abilities have a thirteen megapixel sensor. As a result, image quality is severely limited. This could be the difference between spotting BigFoot and just a hairy man out for a stroll. Also, the screen is smaller and the battery life not as good as some eBook readers. Seemingly a jack of all trades, master of none, Apple has come very close to being both. The two biggest drawbacks to the iPhone are that the devices will not obtain new material or communicate without a cell phone signal and the battery is not user replaceable. A more rugged version would definitely be appreciated: clearly, users are taking their iPhone with them into the backcountry even though they weren't designed for such use.

Table 3: Scorecard for Apple iPhone		
Criteria	Score	Justification
Information		
1. Infrastructure	2	Cellular
2. Communication	4	2 way; global
3. Access	6	All
4. Sharing	2	Global
Tangible		
5. Volume	2	5.184 in^3
6. Weight	3	4.7 oz
7. Mode	0.75	Both modes
8. Battery Life Use	1	5 hours
9. Battery Life Standby	2	300 hours
10. Battery Type	0	Built-in
Intangible		
11. Durability	0	N/A
12. Cost	2	$199
13. Subscription	-2	Yes
Total		
14. Total	31.25	

The iPhone is a departure from traditional outdoor devices. Operating it in cold weather could become problematic. Apple lists -4° F as a non-operating temperature, and using the touchscreen with thick gloves could be difficult. Perceived ease of use tends towards easy, although adapting to interacting with the device via the touchscreen, its only method of input, may take some getting used to. Usefulness may be somewhat hampered by connectivity issues, but even without a cell signal, the device is quite versatile.

Globalstar Qualcomm GSP 1600 Handheld Phone

Combining standard terrestrial cellular communications with satellite abilities produces the Globalstar Qualcomm GSP 1600 Handheld phone. This is a device that is able to use cell phone signals where available to conserve battery and switch to a satellite signal once the user travels beyond the reach of cell service (Globalstar, 2009). It is able to send text messages via the Short Message Service and to receive GPS coordinates and display them on the screen of the device, which is also able to display information about the battery. The GSP 1600 is, with the exception of the telescoping antenna necessary for satellite based communications, just a regular looking cell phone, albeit slightly larger than the phones of today. The device can provide internet connectivity to devices such as laptops or PDAs through the use of a data cable, but it is not able to connect to the internet on its own. As such, it is scored only as having access to current location. Also, the volume measure is just outside of the largest scoring

Table 4: Scorecard for Globalstar GSP 1600		
Criteria	Score	Justification
Information		
1. Infrastructure	5	Satellite
2. Communication	4	2 way; global
3. Access	3	Location
4. Sharing	0	N/A
Tangible		
5. Volume	0	29.57 in^3
6. Weight	1	13.55 oz
7. Mode	0.75	Both modes
8. Battery Life Use	1	5 hours
9. Battery Life Standby	1	300 hours
10. Battery Type	1	User-replaceable
Intangible		
11. Durability	0	N/A
12. Cost	1	$299
13. Subscription	-2	Yes
Total		
14. Total	37.5	

bracket, so the device, although receiving the same amount of points for this measure, is not nearly as big as the Garmin Rino.

The GSP seems very easy to use. Simply turn it on, extend the antenna, and dial the number you wish to call. Its usefulness is undeniable: it does not require a cell signal, simply a clear view of the sky. On the downside, service plans can be expensive if the provider is not offering any promotion pricing, and the phone is not waterproof.

McMurdo Fast Find 210

The McMurdo Fast Find 210 is a Personal Locator Beacon (PLB) with no frills. It is a worst case scenario communications device. It does not, in the strictest sense, enable the transmission of messages in any way. When the device is activated, it connects to the International Satellite System for Search and Rescue known as Cospat-Sarsat (The acronym Cospat is in Russian, "Cosmicheskaya Sistyema Poiska Avariynich Sudov" which means Space System for the Search of Vessels in Distress"; Sarsat stands for Search And Rescue Satellite Aided Tracking). Cospas-Sarsat (2009) defines their system thusly:

> Cospas-Sarsat is a satellite system designed to provide distress alert and location data to assist search and rescue (SAR) operations, using spacecraft and ground facilities to detect and locate the signals of distress beacons operating on 406 Megahertz (MHz). The position of the distress and other related information is forwarded to the appropriate Search and Rescue Point of Contact (SPOC) through the Cospas-Sarsat Mission Control Center (MCC) network. The goal of the System is to support all organizations in the world with responsibility for SAR operations, whether at sea, in the air or on land.

Since 1982, the Cospas-Sarsat system has been used to save over 24,000 lives worldwide (Cospas-Sarsat, 2009). The activation of a PLB on the Cospas-Sarsat system indicates that the user is in urgent need of assistance. As such, the Fast Find 210 facilitates a user's need to share information about his location with third parties around the globe. The Fast Find does not actually provide the user with any information. Its access score reflects this. Since the infrastructure the device requires is satellite based, it is able to effectively communicate anywhere around the world with a view of the sky. However, the Fast Find is a device that is carried and goes unused until all other avenues of self-rescue have been exhausted, and hopefully, its use is never needed. It provides no functionality other than to alert the appropriate point of contact of the user's location, and then actively advertize their location via both the primary 406 MHz signal and a secondary 121.5 MHz homing signal until its battery runs out (McMurdo, 2009).

Table 5: Scorecard for McMurdo Fast Find 210

Criteria	Score	Justification
Information		
1. Infrastructure	5	Satellite
2. Communication	1	1 way; global
3. Access	0	N/A
4. Sharing	2	Global
Tangible		
5. Volume	2	10.34 in^3
6. Weight	3	5.3 oz
7. Mode	1	One mode
8. Battery Life Use	4	24 hours
9. Battery Life Standby	0	N/A
10. Battery Type	0	Built-in
Intangible		
11. Durability	3	Waterproof
12. Cost	1	$299
13. Subscription	0	No
Total		
14. Total	33	

The perceived usefulness of the Fast Find presents a difficult situation. The odds of actually needing the device are low, and therefore it would be easy to say that the perceived usefulness of it is low, since on a day to day basis it will not be used. However, the Boy Scouts of America warn everyone to be prepared, and for that, the Fast Find is very useful. When the situation becomes dire, that battery on the Fast Find will not be dead because you called home last night to tell your mother what you ate for dinner. It is also very easy to operate. A user must simply remove the antenna cover, deploy the antenna, and press the 'On' button. Once activated, the unit will continue to operate until the battery runs out, so even if the user is not functioning, the Fast Find is.

SPOT Satellite Messenger

SPOT is a satellite based communications device. Originally the acronym stood for "Satellite Personal Tracker", where the "O" was an earth. However, due to concerns that it was actually a tracking device that could be used for nefarious purposes, it is no longer marketed as such. Now it is sold as a satellite messenger (Ritter, 2007). It is similar to a PLB. It is a simple device–it has no keypad or screen, and only four buttons: an on/off switch; a 'Help' button, used to summon help to the current GPS location from family or friends; a '911' button that alerts authorities to the current location and that the user is in distress; and an 'Ok' button that can send a message to family or friends or update GoogleMaps with the current location. This feature provides

Table 6: Scorecard for SPOT

Criteria	Score	Justification
Information		
1. Infrastructure	5	Satellite
2. Communication	2	1 way; global
3. Access	0	N/A
4. Sharing	2	Global
Tangible		
5. Volume	1	20.56 in^3
6. Weight	2	7.37 oz
7. Mode	0.75	Both modes
8. Battery Life Use	4	168 hours
9. Battery Life Standby	3	336 hours
10. Battery Type	1	User-replaceable
Intangible		
11. Durability	3	Waterproof
12. Cost	2	$169
13. Subscription	-2	Yes
Total		
14. Total	32.25	

peace of mind for every mother who worries about the safety of her child (full grown or otherwise) who has run off into the backcountry. Despite Orwellian concerns (Shultis, 2001), some people would be more than willing to use this technology.

The SPOT's capabilities make it a valuable tool for all categories of backcountry users since any SPOT device can be used to check in or request help. Since the technology is satellite based, there is no concern about cell phone signal reception, or the intrusion of antenna installations on undeveloped land. The drawback is the limited nature of the communications it enables. It only allows for one way communication. The SPOT cannot receive messages or warnings, and all of the generated outgoing messages sent are preset. For example, there is no way to differentiate between a broken leg and a heart attack, which would be useful information to responders. Management uses are minimal (outside draconian, Big Brother-type uses where all park visitors would be required to carry one so that administrators could track all movements). That being said, rangers could be outfitted with a SPOT in the event of a worst-case scenario. Both administrators and responders, though, gain access to information regarding adventurer distress signals, which greatly facilitates emergency response. This is an improvement upon systems in use today. Currently, best practice in place suggests leaving a third party as much information about your trip as possible. This third party is responsible for reporting an adventurer late if they do not check in appropriately. This system is flawed, however, because many times the third party is able to rationalize their concerns away. By the time authorities are alerted, it is often times too late. Additionally, many times, adventurers choose not to leave plans with a third party. The case of Aron Ralston is a good example of this. Had the young man shared his plans with anyone else, he might not have been forced to amputate his own arm (Brick, 2009).

For the purposes of the scoring formula, the manufacturer provided data for 911 Emergency mode was used for battery life time for use. The calculation for standby mode was based on the SPOT's tracking mode battery performance. Also, the SPOT did not receive any points for access qualities, much like the Fast Find. The SPOT has no screen or any other means of reporting this information back to the user. The perceived usefulness of the device could vary, depending on the individual needs of the user. For someone who needs to check in regularly, the usefulness is high. For those with less ties back to civilization, usefulness may be low. The perceived ease of use is easy, as there are only 4 buttons on the device, and functionality seems straightforward.

Limitations

The limitations of these current technologies are several, and mostly related to connectivity. For example, while the SPOT is able to connect to its service nearly all over the world wherever the user has a clear view of the sky, it is unable to send messages other than its location and an all clear or one of two requests for help. On the other hand, the iPhone is a fully-featured communications device. It is capable of phone functionality, sending emails, short message service (SMS) text messages, and high speed data transfer rates for internet access. However, unless the device is within the range of a cellular phone tower, these features are worthless. That's not to say the device is rendered useless: there is still the built in GPS functionality. But if one is carrying a GPS unit in the backcountry, it should communicate with other units regardless of cell signal, which means trading the iPhone for a Garmin Rino. If this trade is made, however, the user cannot take pictures without adding another device to their bag. Not that it matters anyhow, because if the trip is longer than a week, most of the devices' battery power will be exhausted.

Discussion

Clearly, there is not a be-all, end-all technology that will enable anyone to go out into the backcountry and be safe. If it were so, then a device that scored 76.25 (the maximum possible score) would have been considered in the survey. It would seem that until someone creates a solar powered iSatPhone with an improved integrated camera and integrated PLB with separate battery source, and then builds the infrastructure to support it (that is, a satellite network capable of handling high speed data transfer and voice), adventurers will be forced to pick and choose which technologies they carry with them into the backcountry. If they are able, that is. While all these technologies are currently available on the market, some of them can be expensive. Not everyone heading out into the backcountry can afford one or all of these devices. And then there is the discussion that we set aside earlier: that some folks might object to the very mention of such a device establishing itself as an essential for backcountry travel, much less giving it serious consideration. But set those arguments aside, and consider the following situation and attempt to see how each device fits into its resolution, and thus the value that encouraging the use of information enabling technologies provides.

Table 7: Device Score Comparison

Device	Score
1. Globalstar GSP 1600	37.5
2. McMurdo Fast Find 210	33
3. SPOT	32.25
4. Apple iPhone	31.25
5. Garmin Rino 530HCx	25

A lone backpacker, 15 miles from the trailhead, trips and falls down a steep hillside. Unbeknownst to him, he has broken a leg and ankle and is suffering from internal bleeding. The pain in his legs tells him that he is not walking anywhere. Ideally, he would like to share information about his location and medical status with potential rescuers. The adventurer needs to know his location, and needs to communicate this. The people who will eventually come looking for him also need to know his location and current medical condition.

Now, looking at the evaluation, the Globalstar GSP 1600 Handheld Phone comes out with the highest score at 37.5. Its use of the satellite technologies is what puts it out in front of the other devices. It ranks 4th out of 5 on volume and is the heaviest device included in the study, but its ability to provide its user with his location, as well as putting him in touch with anyone around the globe from just about anywhere on the globe are enough to overcome those deficits. And while it is the heaviest device compared, it still weighs less than a pound. If the fallen adventurer in the aforementioned scenario had a satellite phone such as the GSP 1600, he could call 9-1-1 and alert emergency services to his plight. He could use the phone to access his GPS coordinates so that responders could navigate to his position without having to search for him, essentially taking the search out of 'search and rescue'.

The McMurdo Fast Find comes in next with a score of 33. Satellite abilities play a factor in the success of this device, too. The fact that the device is small, gets good battery life, is waterproof, and requires no subscription all contribute to it earning second place. While it loses points for not giving the user any information access, it balances this by providing location information to a third party, which in some cases is more important. In the example, the adventurer who takes a fall could activate his PLB. While he would not know his exact location, the beacon would obtain its location from satellites and then pass that information along to the command center that monitors all distress signals on the 406 MHz frequency. Again, responders would know almost precisely where to find the adventurer as they could lock in on the 121.5 MHz beacon that the Fast Find uses after following the reported GPS data to the approximate location. Unlike the GSP 1600, the adventurer would just have to hope that the message is received–there is no confirmation–although the Cospas-Sarsat system does boast very good performance reliability numbers.

In third place, at 32.35 points, is the SPOT. The last of the satellite based devices in the roundup, the SPOT scored well due to its long battery life and satellite abilities. The subscription based nature of its service is definitely a detractor, enough to drop it behind the Fast Find. The advantage that the SPOT provides is tracking and the ability to send messages when the situation is not dire. The use of the Fast Find indicates that there is urgent need for help. The SPOT can be used just to check in. An example where this feature may be useful would be for coordinating pickup at a remote location. A third party could keep track of a SPOT user's progress and when they reach a certain location, head out to pick them up. If there is no cell phone signal at the meeting point, arranging the meeting could be difficult without SPOT. As far as the scenario goes, being equipped with the SPOT would play out in much the same fashion as it did with the Fast Find. The adventurer would have confirmation that a message was sent (via a different blink pattern on the LEDs on the device, but no other indication that the message was received).

The iPhone scored 31.25 points, placing it 4th. Despite operating on a cellular signal, it was able to score well by enabling access to just about any kind of information when it does have a signal. Hypothetically, if the iPhone were capable of operating on a satellite network while maintaining its current formfactor, it would score 67.25. It seems unlikely that it could possibly connect up with a satellite based infrastructure without becoming a little bit bulkier, but even at that, it would be head and shoulders above the other devices. The scenario laid out above could play out like the case of Tavaria–if the adventure happened to be near enough to a cell tower to get reception, he could text, call, or email his current predicament to someone, and provide them with his coordinates from the phone's GPS. If he was out of range, however, he might as well start crawling.

The last device is the Rino. It's reliance on radio to radio infrastructure, as well as its size dimensions due to the antenna and cost all hurt its performance, giving it a final score of 25. An adventurer who finds himself in the situation described above and only has a Rino on will know his location. Should he be in range of another person with a walkie-talkie tuned to the same channel, said person could send help to his location. If the person had a Rino, they could see his location on their device, which may facilitate a quicker response time. It is possible that the recipient could have only a hand-held walkie-talkie and no GPS capabilities. In this case, the recipient could take note of his location and go in search of help. However, if the adventurer is not in range of anyone else with a walkie-talkie, he again is out of luck and will have to rely on himself for extrication.

While this situation is a very limited example of information needs, it is the most likely to be encountered. There are a wide variety of other valid information needs and uses in the backcountry. However, it seems that the examples that show the highest stakes are the ones that are most often listened to. Therefore, it would be difficult for me to impress upon anyone the value of information in the backcountry by providing an example based on education. If the scenario was this: a lone hiker, 15 miles from the trailhead, encounters a flower he has never seen before. His information need is to know what it is. Would anyone give this serious consideration? Certainly, information is useful in enlightening people about their surroundings while in the backcountry, but why would you need the internet to help provide this information? Why not be prepared before entering the backcountry? But in the day and age of instant information, when people are turning to the outdoors to try something new, people who expect information on a whim, people who perhaps do not have much experience in the backcountry, why encourage the use of information tools to get this information?

Conclusion

This paper is not advocating that any sort of policy be set requiring technology to be taken into the backcountry. The argument, however, that we should ban technology from the backcountry is questionable (Shultis, 2001; Wiley, 2005). As far as this paper is concerned, the more people who responsibly visit the backcountry, the better. The more public recognition the backcountry and National Parks receive, the better. This increased awareness by the public will translate into an increased recognition by policymakers, who in turn will promote the protection of these lands. If backcountry users are carrying a GPS device, camera, phone, or iPod, so long as they leave no trace that they were there, it should not matter. While Ewert and Shultis (1999) make the claim that "in one sense, while many recreationists use technology to visit the backcountry, an increasing number of recreationists visit the backcountry to use their technology", the question I have for them is, who cares? Let them do what they want. If their use is responsible, what should it matter? It seems in the past that we have been unwilling to say that these things can be one and the same. Why can't it be said that many recreationists enjoy using technology while visiting the backcountry? Wiley (2005) asks "...can such technologies be use poietically, as part of an authentic relationship to nature?"

We have become accustomed to having information at our fingertips. We live in an information society (Stankey, 2000). These days, we have turned to devices like iPhones and BlackBerrys to have instant information, any place, so long as we have a signal. Yes, we go into the backcountry to get away from the everyday, the mundane, but we go with the intent to come back.

We should not be hesitant to take technology that will enable us to interact with information into the backcountry. These devices do not have to be intrusive or offensive. As this study has shown, these devices can be as small and unobtrusive as a deck of playing cards, and if used with discretion, can bother no one but the user themselves. They can provide access to nearly any level of information the user sees fit, be it simply a worst-case scenario call for help or to be able to call and check in on the family dog. If these information tools enable us to feel more comfortable, safer, to have more fun, to know more about what's going on around us, to help the people who care about us feel more at ease, then it would be absurd for us to not take these tools with us into the backcountry. That is, unless we enjoy the unknown—which many of us do.

But what is unknown anymore? Nash (1982) said "all the blank spaces are being filled in...Today, not 1890, is the real end of the American frontier." Stankey (2000) writes "the first increment in the loss of wilderness comes when the pen touches the map...in the Information Era, will wilderness be lost, not because of the increasing recreation use and impacted trails and campsites, but by the flood of information about it?"

Looking at it this way, the question then becomes a matter of will. Do you use the information available when planning your excursion? McCandless did not. He would be an exception according to Ewert and Shultis (1999), who suggest that humans have never been very good at saying no to the conveniences offered by technology. If you have decided to take any device with you, can you resist the urge to use it, unless an emergency situation arises? Should you? It is somewhat ironic that one of the zeniths of modern information technology is accessibility, and though we strive for and celebrate access to information in nearly every realm, we run from it when it comes to the backcountry. Wiley (2005) hits upon these same points:

> Even if I, as an individual, choose to enter a wilderness area without mobile communications technology, I cannot escape the knowledge that the technology is available–that, with or without a GPS or mobile phone, the wilderness I am moving through is saturated with radio signals offering me location data and communication with any other point in the network. In other words, the ability to move through the wilderness and survive in it without information and communication technologies is no longer a requirement for entering such spaces.

I do not think that the problems that are ever discussed regarding information technology in the backcountry are really about the information technology itself. Rather, we hate the fact that technology has permeated through so many aspects of our lives. So we create a dichotomy, a chasm which we cannot bridge–not until we are able to accept that information and the backcountry can co-exist. When we can do that, when we can say: 'We have no desire to be bombarded by email, we can put down the Wikipedia; we are enjoying our weekend in the wilderness…but it might be nice to have access to information on the rock formation we are standing on, and if something goes wrong, I do have my PLB' then we will have found a way to reconcile that difference. Only then will we be able to use information to create the safest, best possible backcountry experience for all.

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Appendix A: Examples of Technological Developments in Backcountry Recreation from Ewert and Shultis, *Technology and Backcountry Recreation*

"Archaeopteryk" pitons
Automatic belay devices (e.g., Grigris)
Automatic descending devices
Avalanche beacons
Bent-gate carabiners
"Camels" (back-pack water containers)
Cell phones
Ceramic water filters
Climbing protection (e.g., Friends, Camelots)
Collapsible chairs
Compact sport two-way radios
Concentrated nutrition bars
Gore-Tex, Dri-Loft fabrics
Hand-held, cordless rock drills
Hand-held GPS units
Heat packs
Inflated foam pads
International compass
Jet-skis
Kevlar
Lightweight synthetic fiber (e.g., Thermolite)
Micro-ascenders
Microbiological water filters
Modular ice-climbing tools
Modular snowshoes
Moisture transport systems in clothing
Multi-fuel stoves
Parapentes
Perabiners
Plastic climbing boots
Playboats
PLBs (Personal Locator Beacons)
Satellite patch radios
Self-bailing rafts
Self-belay systems (e.g., Soloist)
Single-wall breathable tents
"Snargs"
Snowboards
Step-in crampons
"Sticky rubber" climbing shoes
Talons (rock pitons)
Technical headlamps
Technical socks
Telemark skis and bindings
Titanium cooking gear
Water-resistent climbing ropes
Website information sources
Wind-resistant fleece
Wire carabiners
Wristwatch altimeters

Appendix B: Categories of Technological Effects and Implications for Backcountry Recreation from Ewert, *Trends in Adventure Recreation*

Category	Examples	Effects	Major Implications/Issues
Access and Transportation	Automobile, airplane, ATV, parapentes, snowmobile, RTV, mountain bike, helicopter	Increased use, willingness to participate, recreation conflicts, more human natural environment interactions (e.g., with wildlife)	Management need for more attention on carrying capacity, user conflicts, environmental impacts, infrastructure development, and a more diverse set of recreationists (e.g., experience levels)
Comfort	Synthetic fabrics, plastic, internal frame pack, light-weight tents	Longer visits, increased use, expanded use (e.g., families, less fit, elderly), increased desire for facilities	Increased attention to carrying capacity, environmental impacts, search and rescue, visitor demands for amenities (e.g., showers, etc.)
Safety	Synthetic fabrics, stronger materials, more effective means of protection (e.g., climbing aids, non-collapsible kayaks)	Longer and more remote visitation, recreation during the "shoulder periods" (e.g., winter), a general "pushing back" of the perceived margin of safety, more risk-taking activities	Search and rescue, increasing lack of congruency between the type of situation (i.e., level of danger) and the skills and experience of the individual, expectation that "experiences" will be without risk
Communication	Radio, cellular and digital phones, GPS, datalink watches	More rapid linkages to other groups, expectation that remote backcountry tripping can stay "connected" to outside world	Increased safety and planning capability, expectations that information and avility to "connect in" will be available (e.g., park radio frequencies, avalanche warnings at the site, etc.)
Information	Television, satellite TV, internet	Increased awareness, use and appreciation, more informed public, increased options and opportunities	Managers will be expected to provide more information and in a variety of formats, greater level of accuracy in expectations of the backcountry site experience

Appendix C: Partial List of Adventure Activities and Extreme Sports from Ewert, *Programs That Work*

Earth	Snow	Water	Sky	Combination
Base jumping	Bobsleigh	Bodyboards	Aerobatics	Adventure travel
BMX racing	Extreme skiing	Cliff diving	Gyros	Adventure racing
BMX stunt	Sled dog racing	Drag boats	Hang gliding	Canyoneering
Stock bike trials	Skeleton	Free-diving	Paragliding	Cave diving
Bungee Jumping	Ski joring	Powerboards	SCUBA diving	
Caving/spelunking	Snocross racing	Jetski racing	Skydiving	
Endurance running	Snowboards	Kayaking	Skysurfing	
Extreme ironing	Snow mtn biking	Kite surfing	Soaring	
Geotrekking	Telemark skiing	Inflatable kayaking		
Ice climbing	Alpine toruing	Skimboarding		
Inline skating		Surfing		
Mountaineering		Wakeboarding		
Mountain biking		Wakeskating		
Mountainboards		Water skiing		
Rock climbing		Whitewater rafting		
Skateboarding		Wind surfing		
Street luge				
Wall climbing				
Zorbing				

Appendix D: Complete Device Specifications

	Information Abilities	Tangible Qualities	Intangible Qualities
Garmin Rino 530HCx	Infrastructure: Radio Communications: 2 way, Local Access: Location, weather Sharing: Local	Volume: 2.3” x 7.5” x 1.8” (31.05 in^3) Weight: 10.3 oz Battery Life – Use: 14 hours Battery Life – Standby: N/A Battery type: User-replaceable	Durability: Waterproof Cost: $499 Subscription: No
Apple iPhone	Infrastructure: Cellular Communications: 2 way, Global Access: Location, weather, internet Sharing: Global	Volume: 4.5” x 2.4” x 0.48” (5.1 in^3) Weight: 4.7 oz Battery Life – Use: 5 hours Battery Life – Standby: 300 hours Battery type: Built-in	Durability: None Cost: $199 Subscription: Yes
Globalstar GSP 1600 Handheld Phone	Infrastructure: Satellite Communications: 2 way, Global Access: Location Sharing: No	Volume: 6.97” x 2.24” x 1.89” (29.5 in^3) Weight: 13.5 oz Battery Life – Use: 3.75 hours Battery Life – Standby: 19 hours Battery type: User-replaceable	Durability: None Cost: $299 Subscription: Yes

	Information Abilities	Tangible Qualities	Intangible Qualities
McMurdo Fast Find 210	Infrastructure: Satellite Communications: 1 way, Global Access: No Sharing: Global	Volume: 1.34” x 1.85” x 4.17” (10.34 in^3) Weight: 5.3 oz Battery Life – Use: 24 hours Battery Life – Standby: N/A Battery type: Built-in	Durability: Waterproof Cost: $299 Subscription: No
SPOT Satellite Messenger	Infrastructure: Satellite Communications: 1 way, Global Access: No Sharing: Global	Volume: 1.73” x 4.37” x 2.72” (20.56 in^3) Weight: 7.37 oz Battery Life – Use: 168 hours Battery Life – Standby: 336 hours Battery type: User-replaceable	Durability: Waterproof Cost: $169 Subscription: Yes