MORE TASKS, MORE IDEAS:
THE ENERGY SPILLOVER OF MULTITASKING ON SUBSEQUENT CREATIVITY

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ABSTRACT

Chaitali Kapadia: MORE TASKS, MORE IDEAS: THE ENERGY SPILLOVER OF MULTITASKING ON SUBSEQUENT CREATIVITY
(Under the direction of Shimul Melwani)

In this dissertation, I propose that multitasking behavior has a beneficial influence on subsequent creativity. By drawing on theories of energy, I propose that multitasking behavior induces a higher level of activation, which in turn, positively influences downstream creative performance. I empirically examine this model in three studies: two laboratory experiments and a field study with restaurant servers; the studies yield convergent findings across different measures of multitasking and creativity. Results from the first laboratory experiment provide support for a positive relationship between multitasking and subsequent creative performance and demonstrate that this effect is specific to creative performance and not task performance. Results from the second laboratory experiment provide support for multitasking indirectly increasing creative performance through higher activation on two of three creativity measures. Results from the field study suggest that multitasking improves creative performance indirectly through activation, and that a person's dispositional preference for multitasking, polychronicity, moderates this relationship such that the effect of multitasking on activation is stronger for someone who prefers not to multitask. Together this work yields important theoretical and practical implications about managing creativity in the fast-paced contemporary workplace.

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CHAPTER 1: MULTITASKING AND CREATIVITY

Introduction

To one who lives with "time famine" (Perlow, 1999), a chronic shortage of sufficient hours in the day, multitasking seems to hold out a brilliant solution. By performing two tasks concurrently or rapidly switching between two tasks, the thinking goes, an individual can maximize the finite hours that make up a life. In many workplaces, multitasking is considered an essential job demand (Fleishman, Costanza & Marshall-Mies, 1999), and 41% percent of employees state that they engage in multitasking "all the time" at work (Barba, 2014). Notwithstanding the skill's apparent usefulness, psychologists regard multitasking behavior as singularly detrimental. Extensive research across myriad psychological domains shows outcomes ranging from poorer health and workplace safety, reduced task performance, worse negotiation outcomes, as well as increased stress and work-family conflict (e.g., Laxmisan, et al., 2007; Monsell, 2003; Paridon & Kaufmann, 2010; Voydanoff, 2005). While this literature has unequivocally established that multitasking is harmful to the quality of the tasks being performed, researchers have not yet considered how multitasking behavior may affect performance on future tasks, and little consideration has been given to its potential positive effects. In particular, we do not know what downstream benefits multitasking may have for another crucial indicator of performance—creativity.

At first glance, it would appear that multitasking behavior is at odds with the factors that enable people to harness their creativity, such as low time pressure (Amabile, 1996), enhanced time for incubation (Dodds, Ward, & Smith, 2003), a flow state (Csikszentmihályi, 1991), short

breaks (Segal, 2004) and a relaxed focus (Isakson, 1983). Yet the existing literature does hint at a potential connection between multitasking and subsequent creativity. As creative performance is often described as a process of accessing and recombining distinct and disparate knowledge (Guilford, 1956; Mednick, 1962) because the multitasking individual holds two or more cognitions in his or her mind at once, attending to these two (or more) tasks or cognitions stimulates broader associative thinking that then engenders higher creativity on subsequent tasks. Indeed, several recent studies spanning topics from bicultural identity or multiple social identities (Tadmor, Galinsky, & Maddux, 2012; Gaither, Remedios, Sanchez, & Sommers, 2015) to emotional ambivalence (Fong, 2006) have demonstrated how attending to multiple cognitions leads to subsequent higher creativity. Even though multitasking—the concurrent performance of two different tasks—may reduce one's access to cognitive resources and worsen cognitive operations (Kahneman, 1973), these separate tasks also activate dissimilar ideas and cognitions and foster divergent thinking, the cognitive activity that generates creative ideas. My prediction is supported by recent work on task switching, which finds that task switching among creative tasks reduces cognitive fixation and, in turn, leads to higher creative performance on both convergent and divergent thinking tasks (Lu, Akinola, & Mason, 2017). Prior research on task rotation (Madjar & Oldham, 2006; Madjar & Shalley, 2008) also provides support for the idea that juggling multiple tasks increases downstream creativity, Together, this body of evidence suggests that multitasking will lead to enhanced divergent thinking, and thus creative performance on subsequent tasks.

In order to elucidate the theoretical mechanism that explains how multitasking positively influences creativity on a subsequent task, I propose a mediating framework in which multitasking increases divergent thinking through a specific physiological response: increased

activation. Because multitasking behavior involves working on and thinking about more than one task at a time, it is an effortful experience demanding cognitive resources; as such, it compels multitasking individuals to draw upon and respond with higher levels of activation (Yeykelis, Cummings, & Reeves, 2014; Wetherell & Carter, 2013).

What happens to this activated energy when the demands of multitasking behavior ease, either through shifting to a single task or through practiced habituation (Schumacher, et al., 2001; Hazeltine, Teague, & Ivry, 2002; Schneider & Detweiler, 1988)? The activated energy generated from multitasking does not immediately decay, but rather persists and spills over onto the following task (Zillmann, 1971; Zillmann, Katcher, & Milavsky, 1972), providing the cognitive and motivational stimulation that then enables creativity to proliferate on a set of future tasks (Andrews & Farris, 1972). Although no work has directly examined the influence of activation on creativity, it is known that *activated* positive and negative moods have a positive relationship to creativity, especially divergent thinking. Activation facilitates cognitive flexibility and cognitive restructuring and also intensifies persistence (De Dreu, Baas, & Nijstad, 2008). Importantly, given the increased level of activation generated during multitasking behavior, one could argue that creativity should also increase during multitasking behavior. I argue that this effect emerges only in subsequent tasks because the energy generated to perform multitasking behavior is met by the demands required of multitasking behavior. However, once the behavior ceases, the physiological energy decays slowly, thus awarding the subsequent task with extra energy and resources that fuels creativity. In my proposed mediating framework, multitasking increases subsequent creativity through the spillover of this increased activation.

Of importance to my theoretical framework is the qualitative experience of multitasking, as not all individuals respond to multitasking in quite the same way. Performing two tasks

concurrently is described, alternately, as exciting and exhilarating or arduous and frustrating (Salvucci & Taatgen, 2010). Whether described as a positive or negative experience, the emotions that result as a consequence of multitasking involve increased activation. However, individuals who have higher levels of polychronicity, defined as an individual's preference for multitasking (Kaufman, Lane, & Lindquist, 1991), may engage in multitasking with greater ease because highly polychronous individuals have personal preferences that fit with the multitasking requirements of their job (temporal symmetry); as such, these individuals will not be compelled to draw upon as many resources as they cope with the multitasking task requirements. By contrast, less polychronous individuals, or those who prefer to work on a single task at a time (Kaufman, et al., 1991), are likely to require additional energy resources to cope with the multitasking requirements as the behavior requires them to overcome both the demands and the temporal asymmetry they experience in performing multitasking behavior. In short, not all multitasking activity can be expected to yield the same effects. Therefore, in addition to exploring the mechanism of activation that underlies the multitasking–creativity link, I also address the question *for whom* multitasking will most enhance creativity. I do so by testing an interactionist model of creativity (Zhou & Hoever, 2014) that explores whether the multitasker's level of polychronicity facilitates or inhibits activation and thus creativity.

By integrating perspectives from the creativity and energy domains with prior research on multitasking, I thus aim to uncover a benefit for this common, yet much-maligned, human behavior. I do so while recognizing that the level of energy required to multitask will vary among individuals, and this variation will likely affect their creative performance, such that individuals with lower levels of polychronicity are paradoxically more likely to benefit from multitasking. I tested my theoretical model, presented in Figure 1, across three studies, using

multiple methodologies. In my first study, a laboratory experiment, I tested the direct effect of multitasking (at Time 1) on divergent thinking (at Time 2). In my second study, another laboratory experiment, I find support for multitasking indirectly increasing creative performance through higher activation on two of three creativity measures. Finally, in my third study, I tested the complete moderated mediation model in a field experiment involving 109 restaurant servers across 20 restaurants. Across these three studies, I provide support for my theoretical model (see Figure 1.).

Multitasking: Conceptual and Definitional Issues

Multitasking has been studied across many different fields of work, including cognitive psychology, human factors, information science, and communication studies. In this dissertation, I focus on a definition specific to the workplace context, and define multitasking as **performing two (or more) tasks within a concurrent timeframe** (e.g., Carlson & Sohn, 2000; Monsell, 2003; Salvucci, Kushleyeva, & Lee, 2004).

The definition highlights two main components, each of which is important for narrowing the focus of my research. The first key facet entails understanding the definition of a "task". Given that multitasking in a modern work environment involves employees switching between several demanding and ongoing tasks, I define a task as "a distinct activity carried out for a distinct purpose" (Cascio, 1978: 133). This specific focus differentiates my definition from past multitasking research in two ways. First, because I describe multitasking as being engaged in two or more *tasks*, I do not include non-task behaviors such as listening to music while working (Lesiuk, 2005), or doodling while on the phone with a client (Andrade, 2010). Non-task behaviors that do not have a specific goal or outcomes vary in comparison to task behaviors, which involve distinct goals, endpoints and objectives and thus remain at the forefront of the

mind as long as they remain incomplete (Leroy, 2009; Zeigarnik, 1927). Therefore, because simultaneously engaging in two or more tasks is likely to implicate different affective, motivational and cognitive processes and outcomes than engaging in non-tasks, I believe it is important to restrict our definition to one that is specific to tasks only. Second, I focus on tasks that require primarily mental effort, with few physical aspects. This separates my definition from past work that has sometimes focused on individuals engaged in multiple household activities like cooking while taking care of children (Kalenkoski & Foster, 2010) or exercising while working (Knight & Baer, 2014).

Second, the definition specifies that these tasks must be conducted within a concurrent time frame, suggesting that multitasking behavior is not binary but rather a position along a continuum (Salvucci, Taatgen, & Borst, 2009). Research has yet to clarify how individuals concurrently work on multiple tasks. Some scholars argue that humans are limited in their capacity to perform concurrent mental operations by a central mechanism (Schweickert & Boggs, 1984) so that when people believe they are performing two tasks simultaneously, they are really switching back and forth between those tasks (Rubinstein, Meyer, & Evans, 2001) demonstrated by the delay in task performance caused by the central bottleneck (Pashler, 1994; Welford, 1952). Indeed, related cognitive research on dual-task performance finds that people struggle with performing two tasks concurrently (Pashler, 1994) and that they do so because they experience a psychological refractory period effect, which refers to the period of time a second stimulus is significantly slowed because a first stimulus is still being processed (e.g., Pashler, 1994; Welford, 1952). However, research has also found that people can sometimes be trained to perform two tasks simultaneously without any refractory period as though there were no bottleneck (Schumacher, et al., 2001; Hazeltine, Teague, & Ivry, 2002), implying that the content

and difficulty of multitasking behavior is a factor in its performance decrement. Regardless of the theoretical differences, research into how humans perform complex operations in multidimensional environments such as air traffic control (Lee & Anderson, 2001) or driving while operating a cellular telephone (Salvucci, Boer, & Liu, 2001) shows that performing multiple tasks simultaneously requires complex cognitive modeling (Salvucci, et al., 2004) and that people experience themselves as engaging in multitasking behavior in these situations. Based on this research, I argue that the qualitative experience of multitasking is a key aspect of the definition, and that multitasking behavior is the extent to which people are multitasking in a particular moment.

Related Areas of Research

In addition to research on multitasking and task switching, research in several related areas may also be relevant to the study of multitasking. Below, I outline how this research fits in with the model of multitasking I propose.

Cognitive Busyness. Cognitive busyness is a mental state, which is caused by high cognitive load (Gilbert, Pelham, & Krull, 1988). Thus, while some forms of multitasking may cause cognitive busyness, there may be others that do not. For example, bartenders may clean and organize the bar area while taking orders from customers. This is unlikely to strain their cognitive resources, if they are practiced in their job. Although empirical studies in this field assess cognitive busyness through laboratory measures that are designed similarly to task switching and multitasking tasks, the scholars in this field have also found that it hurts individual outcomes, specifically by amplifying biases in person perception. For example, cognitively busy people make more fundamental attribution errors while perceiving others. Even after correcting their initial impressions, people's original impressions bias their perceptions (Gilbert & Osborne,

1989). Scholars in this field have not yet researched cognitive busyness's relationship to creativity.

Goal Prioritization. Goal prioritization research investigates how people allocate their time and effort among multiple tasks at a given point in time when those tasks require use of the same limited resources (Schmidt & DeShon, 2007). Therefore, multitasking may be considered a form of goal prioritization in which people switch back and forth among specific tasks. However, this research has focused on understanding why people choose one task over another when these tasks use competing resources. Although scholars of goal prioritization research also conduct their studies using similar research tasks and measures as task switching and dual task performance studies, their focus has remained on understanding how people decide to allocate their time and effort switching among multiple tasks (Northcraft, Schmidt, & Ashford, 2011).

CHAPTER 2: THEORY AND HYPOTHESES

Researchers across varied literatures have drawn a singular conclusion: multitasking has a negative effect on performance. Extant theoretical explanations for why multitasking has primarily deleterious effects are grounded in the notion that the different tasks involved in multitasking cognitively hinder each other. For example, theories of resource allocation argue that because a person's attentional resources are distributed across the different tasks during multitasking, they then interfere with each other (e.g., Kahneman, 1973). This interference, in turn, reduces task performance. Similarly, bottleneck theorists (e.g., Logan, 2004) argue that people's mental operations cannot be easily divided, resulting in a bottleneck that allows only one task to pass through at a time. Accordingly, when people try to do two (or more) tasks at once, this blockage hurts those task outcomes. Furthermore, organizational research that has investigated topics closely related to multitasking such as interruptions (Leroy, 2009) and distractions (Czerwinski, Horvitz, & Whilhite, 2004) also finds that people struggle to maintain their attention and resources on the task at hand when faced with these situations and that they experience these decrements because thinking about or focusing on incomplete prior tasks continue to draw on their cognitive resources (Ziegarnik, 1927) leading their task performance to suffer. In turn, multitasking hurts task outcomes like accuracy, efficiency, and quality of work performance (e.g., Laxmisan, et al., 2007; Rubinstein, Meyer, & Evans, 2001) as well as health and relational outcomes, including stress and work-family conflict (e.g., Glavin & Schieman, 2011; Voydanoff, 2005), with long-term multitasking leading to burnout and exhaustion (e.g., Howard, 2013; Steege, Drake, Olivas, & Mazza, 2015). In contrast, I argue that despite the

negative repercussions of multitasking on most individual and organizational outcomes, multitasking may have a potential positive benefit for another crucial indicator of organizational performance: creativity.

Multitasking and Subsequent Creativity

Past work on creativity highlights that triggering two independent thoughts, cognitions, or emotions in the mind may increase the mind's ability to make unusual associations, leading to higher creativity (Mednick, 1962). Disparate research supports this notion: emotional ambivalence, or the experience of two conflicting emotions at the same time (Fong, 2006), bicultural identity, which involves an activation of two cultural identities (Tadmor, et al., 2012), paradoxical framing, mental templates for embracing seemingly contradictory statements or dimensions of a task (Miron-Spektor, Gino, & Argote, 2011), dishonesty, that involves activating both a lie and a truth at the same time (Gino & Wiltermuth, 2014), are all phenomena that increase subsequent creativity. The inherent similarities among the independent variables in these studies suggest that there may be more underlying this phenomenon than previously considered. Specifically, each of these antecedents to creativity involves the activation of two opposing or, independent cognitions, attitudes or emotions. Taken together, this body of work highlights that activating two (or more) cognitions at the same time, allows people to make unusual associations more easily; this then results in the emergence of new ideas. These unusual associations may form the basis for creative performance.

Multitasking, conceptualized as performing two or more tasks concurrently or rapidly switching among two or more tasks, will act in a similar manner. Working on two concurrent tasks often results in the multitasker holding two or more cognitions in his or her mind at once because as long as the first task remains unfinished, it will occupy cognitive resources due to

lack of closure (Bushman & Baumeister, 2008; Ziegarnik, 1927). In turn, attending to these two (or more) tasks or cognitions will have potentially stimulating effects and lead to the emergence of new ideas through the unconscious integration of this disparate information (Nijstad & Stroebe, 2006; Wallas, 1926), by sparking a different idea from the individual's less accessible areas of knowledge (Rietzschel, Nijstad & Stroebe, 2006), or by reducing cognitive fixation (Lu, et al., 2017).

These theoretical explanations are supported by recent research that uses functional magnetic resonance imaging techniques. Specifically, this research suggests that when people are multitasking, unique parts of the brain are being activated in ways that do not occur during other types of cognitive behavior (Koechlin, Basso, Pietrini, Panzer & Grafman, 1999). As such, parts of the pre-frontal cortex activated during multitasking (Koechlin, et al., 1999) that are not active during other similarly cognitively taxing activities (e.g., Sigman & Dehaene, 2008; Szameitat, Schubert, Müller, & Von Cramon, 2002; Burgess, 2000) are also linked with abstract thinking, a correlate of creativity (Christoff, Keramatian, Gordon, Smith, & Mädler, 2009) and the ability to engage in integration and recombination of ideas and cognitions (Koechlin & Hyafil, 2007). Together, this body of evidence suggests that multitasking will lead to enhanced creative performance. Hence, I propose:

Hypothesis 1: Multitasking increases creative performance on subsequent tasks.

Activation as a Mediator of the Multitasking-Creativity Relationship

To understand why multitasking may lead to creativity, I draw on prior research that links multitasking to activation, as well as the research that has linked activation with creativity (e.g., De Dreu, et al., 2008; Martindale, 1981). Based on prior research on cognitions, emotions and

neuroscience, I argue that multitasking—and working on two tasks at the same time—leads to enhanced levels of activation through cognitive and affective pathways.

First, from a cognitive standpoint, research highlights that to be able to cope with these cognitive demands, these effortful experiences then necessitate energy and accordingly trigger feelings of activation (Elkin & Leippe, 1986; Reimer, Mehler, Coughlin, Godfrey, & Tan, 2009). This is supported by multitasking research in every domain that demonstrates that performing two or more tasks simultaneously is cognitively taxing and stressful: task switching requires more cognitive resources when switching between different task sets than between similar task sets (e.g., Monsell, 2003), performing two tasks concurrently is described as arduous and exhilarating (Poposki & Oswald, 2010; Salvucci & Taatgen, 2010) and long-term multitasking leads to burnout and exhaustion, a signal of enduring energy use (e.g., Howard, 2013; Steege, et al., 2015). In order to manage simultaneous multiple tasks, people respond by drawing upon and directing their energy towards these cognitive demands.

Second, from an emotional perspective, multitasking will increase activated emotions. The extant literature suggests that that multitasking is either stressful and frustrating, or exciting and exhilarating (Poposki & Oswald, 2010; Salvucci & Taatgen, 2010). Whether described as a positive or negative experience, the emotions that result as a consequence of multitasking involve increased activation. The experience of multitasking that involves holding two or more cognitions at the same time, also causes dissonance (Bushman & Baumeister, 2008), an aversive affective state that generates physiological activation (Croyle & Cooper, 1983). Third, from a neurocognitive perspective, multitasking has also been demonstrated to affect physiological changes associated with activation. In this research, when people are asked to multitask, the demand for resources increases physiological activation by producing the catecholamines (Koob,

1999), dopamine and norepinephrine (Arnsten, 1998; Finlay, Zigmond, & Abercrombie, 1995), to stimulate the areas of the brain needed for performing multiple tasks: the dorso-lateral pre-frontal cortex (Burgess, Veitch, de Lacy Costello, & Shallice, 2000) and the central executive component of working memory (Bunge, Klingberg, Jacobsen, & Gabrieli, 2000). Norepinephrine also initiates the flight-or-fight response, which primes the body (Chatterton, Vogelsong, Lu, Ellman, & Hudgens, 1996) to perform multiple tasks simultaneously.

Though levels of arousal increase rapidly, these elevated levels have also been shown to decay slowly and often "spill over" onto subsequent activities (Zillmann, 1971; Zillmann, et al., 1972). Excitation transfer research demonstrates that physical exercise leads to subsequent aggressive behavior due to the slow decay of physiological activation and the misattribution of this activation to subsequent activities (e.g., Zillmann, et al., 1972). I argue that while multitasking behavior elicits greater physiological activation while performing the behavior; in a subsequent activity, these higher levels of activation are no longer needed to perform the behavior and, therefore, act as additional cognitive resources for creative generation while they slowly decay.

In understanding the link between activation and creativity, work in the creativity domain has highlighted that activation leads to higher creativity (e.g., Isen, 2000; Martindale, 1981; Martindale & Greenough, 1973). This work shows that *activated* positive and negative moods have a positive relationship to creativity (De Dreu, et al., 2008; George & Zhou, 2007). Specifically, activation heightens creativity by enhancing the cognitive capacity to engender creativity by both facilitating cognitive flexibility and cognitive restructuring but also intensifying persistence (De Dreu, et al., 2008). In related research, physiological activation has been shown to be associated with the release of dopamine and noradrenalin (Flaherty, 2005;

Usher, Cohen, Servan Schrieber, Rajkowski, & Ashton Jones, 1999), neurotransmitters that enhance working memory capacity (Floresco & Phillips, 2001; Usher, et al, 1999), which improves cognitive flexibility and associative thinking (Baddeley, 2000; Dietrich, 2004). A recent study incorporating both physiological activation and creative performance found that teams with higher levels of activation had greater idea elaboration and higher team performance (Knight & Baer, 2014). Thus, based on prior theoretical and empirical research, I propose that multitasking stimulates physiological, cognitive, and emotional mechanisms associated with activation. Taken together, my arguments suggest a mediating framework in which multitasking increases creativity through this increased activation. Hence, I propose:

Hypothesis 2: Multitasking increases creative performance on subsequent tasks through an increase in activation.

Polychronicity as a Moderator of the Multitasking-Activation Relationship

While I have thus far argued that multitasking enhances activation, this association may vary based on individuals' time use preferences, or their levels of polychronicity. People who prefer to complete their work by switching back and forth among tasks are higher on polychronicity, while others who prefer to complete tasks serially by working on one task and then moving on to the next task are termed monochronic, or have lower preferences for polychronicity. These preferences also include people's trait reactions to interruptions and distractions; highly polychronic individuals view interruptions as a natural part of their work process whereas individuals with lower polychronicity preferences prioritize their scheduled work activities over interruptions or spontaneous activities (Bluedorn, Kaufman, & Lane, 1992). From this description of polychronicity, it is clear that it is prominently associated with multitasking, although its precise relationship with multitasking remains murky. Even though polychronic individuals report preferences for multitasking and may choose to work on tasks

concurrently (Bluedorn, Kalliath, Strube, & Martin, 1999; Conte & Jacobs, 2003), their preferences are not reflected in how well they perform while multitasking (Ishizaka, Marshall, & Conte, 2001; Konig, Buhner & Murling, 2005). Indeed, it appears that polychronic individuals enjoy the constant fluctuations of work involved in multitasking, and may therefore be more comfortable in multitasking environments in comparison to those who have fewer preferences for multitasking.

This notion that individuals who are higher on a polychronicity continuum are likely to respond better to work, like multitasking, in which they meet their needs for polychronicity, is consistent with past research that highlights that individuals can experience ‘‘temporal symmetry” (Kaufman, et al., 1991: 91) if the rhythm of their work fits with the pace they prefer. This idea of matching the individual’s time use preferences to their task environment is also reflected in research on polychronicity that finds that individuals low in polychronicity find polychronic environments difficult to manage (Hall, 1983) and find it frustrating to work with highly polychronic individuals (Schein, 1985). Together, this body of evidence suggests that because individuals have different preferences for structuring their time, they have different reactions to the way their tasks are then structured (Bluedorn, 2002).

These arguments suggest that polychronicity moderates the way that energetic responses to multitasking are shaped by a person’s preferences. Specifically, I propose that the effect of multitasking on activation will be weaker when people who have a strong preference for multitasking are performing the behavior and stronger when people who prefer to complete their tasks sequentially are performing the behavior. I base my argument for this interaction on the research that shows that congruence between an individual’s polychronicity and his or her job increases job satisfaction, organizational commitment and self-efficacy (Francis-Smythe &

Robertson, 2003; Hecht & Allen, 2005). In contrast, a lack of congruence increases role overload, absence, lateness and poorer supervisory ratings (Conte & Jacobs, 2003; Kaufman, et al., 1991). Building on this work, I suggest that levels of polychronicity will interact with multitasking to predict the generation or conservation of energy. Specifically, in the case of low levels of polychronicity, individuals will experience dissonance between their desire to stay scheduled and orderly and the need to engage in multitasking behavior. To cope with the taxing and arduous demands of the multitasking environment, individuals who are unused to, and incongruent with, this multitasking environment will elicit more energetic resources to be able to manage their tasks. Ironically, this suggests that those individuals with the least preference for multitasking behavior may be able to gain the greatest benefit from the increased activation caused by multitasking on subsequent creative performance.

Individuals high in polychronicity are less likely to be affected by working across both high and low multitasking environments. In high multitasking environments, these highly polychronic individuals are likely to find multitasking congruent with their preferences and tend to enjoy it. Because of their preferences for multitasking as well as their experiences with it, those who prefer to multitask may be more comfortable and familiar with the behavior thereby eliciting less activation during the process. In low multitasking environments, these individuals are likely to feel less enjoyment, but their energy stockpile will remain the same, as it will be carried over or conserved (Hobfoll, 1989) for the next task. Together these arguments produce a first-stage moderated-indirect effect model that incorporates several related predictions among multitasking, polychronicity, activation and creativity. Stated formally:

> *Hypothesis 3: The strength of the mediated relationship between multitasking and creativity (through activation) varies depending on the individuals' preference for multitasking behavior; the indirect effect is stronger when preference for multitasking is lower.*

I tested these hypotheses in three studies. In Study 1, I tested the first hypothesis in a laboratory experiment in which I manipulated multitasking behavior. In Study 2, I replicated Study 1 as well as incorporated the activation mechanism. In Study 3, a field sample of restaurant servers, I tested the full theoretical model depicted in Figure 1.

CHAPTER 3: STUDY 1

Participants and experimental design. Two hundred and forty participants from a large southeastern university in the United States participated in the experiment in exchange for course credit. The participants (43% female) aged between 19 years and 46 years (M=20.66, SD=2.04) were included in all analyses. Participants were randomly assigned to one of three conditions (multitasking, sequential task – long, sequential task - short).

Procedure. On arrival to the laboratory, participants, seated in individual cubicles equipped with personal computers, learned that they would be working on a set of tasks. They were informed that they would play the role of a student representative of their university. As part of this role, they were provided with information about the student representative's schedule and role requirements. Each participant was then required to complete two tasks: listen to a conference call on new ways to fund student organizations and respond with their own ideas at the end of the call, as well as reply to three email messages concerning their work schedule. The order of these tasks, either simultaneous (in the multitasking condition) or sequential (in the sequential task conditions) comprised the manipulation and participants were randomly assigned to one of these three conditions. I chose this specific manipulation to mimic a real-life organizational situation, as research indicates that while at work, people tend to multi-task while on conference calls and over 60% do so by writing and responding to emails (Gavett, 2014). In the case of the multitasking condition, the participants in the multitasking condition worked for a total of four minutes, as both tasks were four minutes apiece. In the first sequential condition (sequential task – long), the participants did the two tasks in consecutive order (conference call

followed by email task), working for eight minutes total. In the second sequential condition (sequential task – short), the participants did shortened versions of the two tasks for a total of four minutes. The first control condition ensured that the tasks were exactly the same and the second control condition addressed the issue of task length to ensure that the effect was due to multitasking behavior and not an increased sense of time pressure. To ensure that participants in each condition spent the precise amount of time working on each of the tasks, the screen automatically advanced when the requisite time had passed.

On completing the tasks, participants were asked to complete two additional tasks (which were counterbalanced). The task used for assessing subsequent creative performance was an idea generation task (Guilford, 1967), generating creative uses for a brick (e.g., Goncalo, Flynn, & Kim, 2010). These ideas were then coded to provide behavioral assessments of creativity: originality, flexibility and fluency. Counterbalanced with this task was an analytical task that I included to assess whether the effect of multitasking behavior affected all task performance, or was specific to creative performance.

Measures

Unless otherwise indicated, all items used a 7-point Likert-type scale anchored at 1 = strongly disagree and 7= strongly agree. All measures are included in Appendix A.

Manipulation Check: Experienced Multitasking. After completing the tasks, participants reported the extent to which they felt like they were multitasking in both conditions using a three-item scale, with the items, "I felt like I was multitasking.", "I felt like I was performing two tasks at the same time." and "I felt like I was working on two tasks simultaneously." (α=0.94). In addition, while not a direct manipulation check, I also explored whether participants performed worse on the tasks in the multitasking condition as a replication

of prior work. I did so by examining the length and quality of their responses to the emails and conference calls across the three conditions.

Dependent Variable*: *Creativity. Participants were presented with a photo of a brick and asked to generate as many creative uses as they could (Goncalo, et al., 2010). Each idea was coded for fluency, flexibility (Guilford, 1967; Torrance, 1966), and originality (Roskes, De Dreu, & Nijstad, 2012). The number of unique ideas each participant generated measured *fluency*. *Flexibility* was measured by determining the number of distinct categories each participant referenced with their ideas. The more categories a participant referenced, the more flexible s/he was. All of the ideas were content coded by a rater who assigned one or more categories to each idea. Twenty categories emerged from this process. A second rater coded the ideas using the categories developed by the first rater. The inter-rater reliability (κ) was 0.90, which is considered substantial (Landis & Koch, 1977). Both raters were blind to the conditions. *Originality* was measured by determining an originality score for each participant. First, the percentage of participants who generated the same idea was calculated for each idea. For example, the idea "use the brick as a doorstop" was generated by 41.88% of participants and received the originality score of 0.58, and the idea "use the brick as chalk" was generated by 6.88% of participants and received the originality score of 0.93. The scale ranged from 0 (low originality) to 1 (high originality). The average originality score was used as an indicator of creativity (see De Dreu, Nijstad, & Baas, 2011; Roskes, et al., 2012).

Dependent Variable: Analytical Task. Participants were presented with 12 logical reasoning problems and asked to complete as many as they could in three minutes. The logical reasoning problems were based on GRE-style analytical reasoning problems and consisted of patterns of letters and numbers with one blank space. Each problem had 4 multiple choice

options and the participant could choose one answer for each problem. For example, one problem was "SCD, TEF, UGH, ___, WKL" and the multiple-choice options were "CMN; UJI; VIJ; IJT". The correct answer in this problem is "VIJ". Logical reasoning problems have been used in prior research as a measure of intellectual performance (e.g., Schmeichel, Vohs, & Baumeister, 2003).

STUDY 1: RESULTS

I began by checking the effectiveness of the manipulation in two ways. First, by examining self-reports of the extent to which participants felt like they were multitasking, our analyses showed that participants in the multitasking condition ($M = 5.30$, $SD = 1.71$; F [1, 158] $= 49.73$, $p < 0.001$) felt like they were multitasking significantly more than participants in the sequential task - long condition ($M = 3.44$, $SD = 1.64$).[1] In addition, I assessed whether individuals in the multitasking condition were more likely to experience worse task outcomes by looking at the quality of participants' responses to the conference call and the email tasks. By exploring differences in the length of participants' responses to the conference call, I found that, as expected, participants in the multitasking condition wrote significantly fewer words in response to the conference call and email tasks ($M = 78.8$, $SD = 41.58$; F [2, 237] $= 21.71$, $p < 0.001$) than participants in the sequential task - long condition ($M = 107.36$, $SD = 37.21$) or the sequential task – short condition ($M = 60.99$, $SD = 46.93$).

Table 1 provides the means and standard deviations for the variables. I used one-way analyses of variance to test Hypothesis 1 that proposes that multitasking increases creative performance. The ANOVA results indicated that the participants in the multitasking condition

[1] I collected this data in two waves with a similar set of participants. In the second round of data collection, due to limited time, I did not assess self-reports of multitasking behavior.

generated significantly more ideas (*Fluency*; $M = 7.29$, $SD = 4.71$; F [2, 237] = 14.49, $p < 0.001$) than participants in the sequential task – long condition ($M = 5.95$, $SD = 3.19$) or participants in the sequential task – short condition ($M = 4.33$, $SD = 2.02$). The participants in the multitasking condition also generated ideas in more categories (*Flexibility*; $M = 5.49$, $SD = 2.49$; F [2, 237] = 15.66, $p < 0.001$) than participants in the sequential task - long condition ($M = 4.70$, $SD = 2.22$) or participants in the sequential task – short condition ($M = 3.58$, $SD = 1.75$). However, while participants in the multitasking condition had more fluent and flexible ideas, they did not generate significantly more original ideas (*Originality*; $M = 0.79$, $SD = 0.08$; F [2, 237] = 0.347, *ns*) than participants in the sequential task - long condition ($M = 0.80$, $SD = 0.09$) or participants in the sequential task – short condition ($M = 0.80$, $SD = 0.09$). Thus, Hypothesis 1 was supported for two of three creativity measures. In contrast, as predicted, the ANOVA results indicated that the effect of multitasking behavior on the analytical task performance was not significantly different across the multitasking ($M = 6.28$, $SD = 2.57$; F [2, 237] = 1.523, *ns*) and sequential task - long condition ($M = 6.76$, $SD = 2.42$) and the sequential task – short condition (($M = 6.54$, $SD = 2.37$). Results suggest that the positive effect of multitasking behavior on creative performance does not include analytical performance. These results provide support for Hypothesis 1 that engaging in multitasking positively influences creative performance on subsequent tasks.

The results of my analyses show that multitasking at Time 1 lead to creativity (but not analytical performance) at Time 2 in a laboratory experiment. Thus, I conducted a second laboratory experiment with self-report measures of the mediating mechanism and some additional creativity outcome measures in order to replicate and extend my findings from the first study.

CHAPTER 4: STUDY 2

Overview

In order to replicate the multitasking – creativity link and to test for mediation, I conducted a second laboratory experiment. I maintained a similar protocol; specifically, participants again listened to a conference call and responded to emails. However, in this study, participants were randomly assigned to only two conditions, multitasking versus sequential tasking, as the effect of time was demonstrated to be independent of the multitasking behavior in the first study. I also added several important control measures: creative self-efficacy, in order to control for their confidence in their creative performance; and positive and negative affect, in order to determine the effect of activation independent of affective valence. Again, in the multitasking condition, participants were required to simultaneously listen to a conference call on new ways to fund student organizations while responding to three email messages concerning their schedule. In the sequential condition, they performed the same tasks sequentially. Subsequently, they completed several measures of creative performance, the Remote Associates Task, an idea generation task, and a test of interpersonal/creative perspective taking. Once again, I predicted that participants who multitasked would perform better on subsequent creative tasks than the participants who performed the tasks sequentially.

Method

Participants and experimental design. One hundred and five participants from a large southeastern university in the United States participated in the experiment in exchange for $6 or course credit. Five of these participants (3 female, 2 male) had technical problems with the

conference call component of the task and were thus removed from further analysis. The remaining hundred participants (47% female) aged between 18 years and 70 years (M=23.44, SD=7.78) were included in all analyses. Participants were randomly assigned to one of two conditions (order of tasks: multitasking versus sequential tasks). The study was conducted online using Qualtrics and took 30 minutes to complete.

Procedure. As in Study 1, participants were informed that they would play the role of a student representative of their university. As part of this role, they were provided with information about the student representative's schedule and role requirements and completed the same two tasks: listening to a conference call and responding with their own ideas, as well as replying to three email messages concerning their schedule. Again, each of the tasks was four minutes long, and thus, the participants in the multitasking condition worked for a total of four minutes, while the participants in the sequential condition who did the two tasks in consecutive order (conference call followed by email task) worked for eight minutes; the screen automatically advanced when the requisite time had passed.

On completing the tasks, participants then completed a short survey that assessed their experiences and emotions. They were then asked to complete three additional tasks, which I used for assessing subsequent creative performance: the remote associates task (Mednick, 1962), an idea generation task (adapted from Goncalo & Duguid, 2012), and an interpersonal creativity/perspective-taking task (Galinsky & Mussweiler, 2001). These were then coded to provide behavioral assessments of creativity.

Measures

Unless otherwise indicated, all items used a 7-point Likert-type scale anchored at 1 = strongly disagree and 7= strongly agree. All measures are included in Appendix B.

Manipulation Check: Experienced Multitasking. After completing the tasks, participants reported the extent to which they felt like they were multitasking in both conditions using a three-item scale, with the items, "I felt like I was multitasking.", "I felt like I was performing two tasks at the same time." and "I felt like I was working on two tasks simultaneously." (α=0.91). As in Study 1, I corroborated that participants performed worse on the tasks in the multitasking condition as a replication of prior work and did so by looking at their responses to the emails and conference calls across the two conditions.

Mediator: Activation. Participants self-reported their level of activation during the task using two 7-point semantic differential items: Relaxed-Stimulated and Excited-Calm (α=0.84) (Feldman Barrett & Russell, 1998).

Dependent Variable: Creativity. The dependent variable of creative performance was measured in three different ways: Divergent Creativity (Idea Generation), Convergent Creativity (Remote Associates Test), and Creative Perspective-taking.

Divergent Creativity - Idea Generation. Participants were presented with a scenario depicting a campus restaurant in the process of shutting down (Goncalo & Duguid, 2012). The scenario was presented as follows: "After years of mismanagement and poor quality food, the campus restaurant has finally gone bankrupt and is being shut down. The school administration is trying to decide what new business should go into that space." Participants were tasked with generating as many creative (novel and useful) solutions for what should take the place of that restaurant within 4 minutes. Each idea was coded for fluency, originality, and flexibility (Guilford, 1967; Torrance, 1966). The number of unique ideas each participant generated measured *fluency*. *Flexibility* was measured by determining the number of distinct categories each participant referenced with their ideas. The more categories a participant referenced, the

more flexible s/he was. All of the ideas were content coded by a rater who assigned one or more categories to each idea. Ten categories emerged from this process. A second rater coded the ideas using the categories developed by the first rater. The inter-rater reliability (κ) was 0.78, which is considered substantial (Landis & Koch, 1977). Both raters were blind to the conditions. Originality was based on the average (in) frequency of ideas. The more often an idea appeared in the pool of ideas in the sample, the lower its originality score. This variable was recoded so that higher scores indicated higher originality.

Convergent Creativity - Remote Associates Test. Participants were presented with fifteen remote associates problems and asked to solve as many as possible within four minutes. The Remote Associates Test (RAT; Mednick, 1962) presents three words and asks the participant to identify a word that associates with all three words. For example, the remote associate for *coin, quick, spoon* is *silver* (i.e., *silver coin*, *quicksilver*, *silver spoon*). The RAT is often used to assess convergent creativity because creative insight is required to converge at the correct answer (Mednick, 1962). The test problems were randomly chosen from a list of sixty-eight RAT problems of varying difficulty, and were randomly presented to each participant.

Perspective-taking. Though perspective taking is not a typical measure of creative performance, research on cognitive creative processing suggests that perspective taking may play a role in many aspects of creative performance. In particular, perspective taking has been shown to influence idea selection, a key aspect of creativity (Amabile & Mueller, 2007) as well as interpersonal creativity and problem-solving in negotiations (Galinsky, Maddux, Gilin, & White, 2008). Increased perspective taking improves individuals' ability to discover hidden agreements and arrive at creative solutions (Galinsky & Mussweiler, 2001; Galinsky, et al., 2008). In this study, participants were presented with a photograph of an angry looking woman. They were

asked to write a story in which they interact with the person in the photograph. They were asked to try to describe the person they were interacting with, what both parties were feeling, thinking, and wishing for, and what led to the situation depicted in the picture and how everything will turn out in the end. Perspective taking was measured by coding for how much they took the perspective of the woman in the photo (1-little or none, 5-a great deal). Two coders rated each story. Their inter-rater reliability was $\kappa = 0.31$, which is considered fair (Landis & Koch, 1977).

Control variables

Creative Self-Efficacy. Creative self-efficacy measured participants' comfort with creative tasks. I controlled for creative self-efficacy using the 3-item measure developed by Tierney & Farmer (2002). The participants reported their agreement with these items on a 1-7 scale, sample item, "I have confidence in my ability to solve problems creatively" (α=0.77).

Positive and Negative Affect. I controlled for state positive affect and state negative affect during the tasks using four items assessing valence because affect has been shown to affect creative performance (e.g., Davis, 2009). Additionally, controlling for positive and negative affect allowed me to assess activation independent of valence (De Dreu, et al., 2008). Items for negative affect included "I felt negative", and "I felt unpleasant" (α=0.90). Items for positive affect included "I felt positive", and "I felt pleasant" (α=0.86).

Education level. Participants reported their education level because performance on the three creativity tasks may be influenced by the level of education that participants had attained.

Demographics. Participants also reported their age and sex.

STUDY 2: RESULTS

Table 2 provides the means and standard deviations for the variables.

Manipulation Check

I checked the effectiveness of my manipulation in two ways. First, I assessed how much the participants felt like they were multitasking in both conditions using the felt multitasking scale. Participants in the multitasking condition ($M = 4.14$, $SD = 0.77$; F [1, 98] = 20.12, $p < 0.001$) felt like they were multitasking significantly more than participants in the sequential condition ($M = 3.26$, $SD = 1.16$). As in Study 1, participants in the multitasking condition wrote significantly fewer words in response to the conference call and email tasks ($M = 135.80$, $SD = 51.95$; $F[1,98] = 5.97$, $p < 0.05$) than participants in the sequential task condition ($M = 163.54$, $SD = 61.10$), suggesting that they had difficulties managing their performance on the tasks simultaneously.

Tests of Hypotheses

Table 3 provides the results of the linear regression analyses used to test my hypotheses. Hypothesis 1 proposes that multitasking increases creative performance. When I entered multitasking condition in the first step of the linear regression, it did not significantly affect cognitive flexibility ($\beta = 0.06$, *ns*), perspective taking ($\beta = 0.06$, *ns*), or performance on the remote associates test ($\beta = 0.05$, *ns*), rejecting Hypothesis 1.

Hypothesis 2 proposes that arousal mediates the relationship between multitasking and creative performance. I tested this hypothesis in two steps. In the first step, I tested whether multitasking increased participants' activation, finding that multitasking significantly affected activation ($\beta = 0.21$, $p < 0.05$) partially supporting Hypothesis 2. The ANOVA results indicated that the participants in the multitasking condition felt significantly more activated ($M = 4.72$, $SD = 1.03$; $F[1, 98] = 4.697$, $p < 0.05$) than participants in the sequential task condition ($M = 4.19$, $SD = 1.39$).

In the next step, I tested whether feelings of activation increased creative performance on three factors: cognitive flexibility, RAT, and perspective taking. In these linear regression models, I controlled for creative self-efficacy, positive and negative affect, education, and which creativity task was presented first (RAT or Idea Generation). The results demonstrated that activation increased cognitive flexibility ($\beta = 0.25$, $p < 0.05$) and perspective taking ($\beta = 0.24$, $p < 0.05$), but did not significantly improve performance on RAT problems ($\beta = 0.17$, *ns*), thus providing partial support for Hypothesis 2.

To test the significance of the indirect effect of multitasking as mediated by arousal, I used the steps outlined by MacKinnon, Fairchild, and Fritz (2007). Though the direct effect of multitasking on creativity was not significant for any of the three creativity variables, MacKinnon and colleagues argue that that the first step of the Baron and Kenny (1986) method of determining mediation is not always necessary (2007). Using the product of coefficients method, I calculated the indirect effect of multitasking on cognitive flexibility and creative perspective-taking. The results are reported in Table 4. In order to determine significance, I used the Preacher and Hayes (2008) method of bootstrapping the indirect effects. Results indicated that the indirect effect of multitasking on creativity was significant as the 95% confidence interval did not include zero for cognitive flexibility (coefficient = 0.21, 95% CI = 0.06, 0.16) and creative perspective-taking (coefficient = 0.10, 95% CI = 0.03, 0.14). Thus, Hypothesis 2 was partially supported for cognitive flexibility and creative perspective-taking.

While I was able to demonstrate the multitasking-subsequent creativity link across two laboratory experiments, my findings are subject to several important limitations. First, the experimental studies raise questions about the generalizability and external validity of my findings. Second, participants in the experiments engaged in short one-shot multitasking

episodes. However, among working employees, multitasking is often an everyday, repeated behavioral act (Konig, Oberacher, & Kleinmann, 2010) and more often than not, a relatively enduring skill utilized in the job itself (e.g., Chisholm, Collison, Nelson, Cordell, 2000; Czerwinski, et al., 2004). Thus, to test my full model and overcome some of these limitations, I conducted a quasi-experimental field study using a sample of restaurant servers, a group for which multitasking is an important aspect of the job description, but the demand for which still varies significantly based on number of customers in the restaurant at one time. In this study, I measured restaurant servers' multitasking behavior, its effect on their activation, and downstream creativity outcomes, as well as explore the role of the individual difference of polychronicity as a moderator on the multitasking-activation relationship.

CHAPTER 5: STUDY 3

This study, Study 3, was designed to extend the findings of Studies 1 and 2 by addressing the aforementioned limitations. First, to increase external validity, I collected more naturalistic data on multitasking behaviors in a sample of restaurant servers across 20 restaurants. Restaurant servers provide an optimal sample with which to test my model as they are required to multitask quickly and efficiently. Indeed, most job postings for restaurant servers highlight the importance of having good multitasking skills. Corroborating this experience, restaurant servers describe their daily experience as "in the weeds: all your tables need something and you have to determine how to get everything done" (Gatta, 2009: 114). Second, I wanted to rule out the possibility that multitasking for short periods may increase creativity but that this effect is mitigated when people multitask over longer periods of time. Restaurant servers work shifts that are often 10 to 12 hours long (Gatta, 2009) and accordingly provide a realistic sample of the effects of multitasking over longer periods. Third, this data sample also enabled me to test the model as a whole by examining mediating and moderating mechanisms by collecting data on employees' activation levels at the end of their multitasking shifts and their individual levels of polychronicity. Fourth, the students in the laboratory were forced to multitask, however at work, individuals often have the autonomy and volition to perform multiple tasks concurrently (Kessler, Shencar, & Meiran, 2009) and so I wanted to confirm that my results would stand even when individuals made the voluntary choice to multitask.

Participants and Procedure

My sample was comprised of 109 restaurant servers from 20 local restaurants. The sample of restaurant servers was 51.9% male with a mean age of 28.2 years (*SD*= 8.11 years) with an average of 6.33 years of experience working in restaurants (*SD*=6.68 years). Participants received $5 as compensation. To get varied levels of multitasking, I surveyed wait staff in restaurants on slower days such as Tuesday and Wednesday nights as well as busier days such as Friday and Saturday nights. To capture participants' self-assessments of multitasking as well as measures of creativity, the servers were given a short survey during their break or the end of their shifts. This survey included two divergent creativity tasks: the same creativity task as in Study 1, generating creative uses for a brick (Goncalo, et al., 2010), and a structured imagination task (Ward, 1994). As part of the survey, participants also reported their perceptions of multitasking for the shift, their level of activation, positive and negative affect, demographic information, and trait measures of polychronicity.

Measures

Unless otherwise indicated, all items used a 7-point Likert-type scale anchored at 1 = strongly disagree and 7= strongly agree. All measures are included in Appendix C.

Multitasking During Shift. Multitasking was assessed using the same multitasking scale used in Study 1. This three-item scale asked participants to rate the extent to which they felt they were multitasking during their shift, *M*=6.22, *SD*=1.11 (α=0.92).

Mediator: Level of Activation. Participants self-reported their level of activation during the task using four items from Feldman Barrett and Russell's, 1998, activation scale: "I feel amped up", "I am energized", "I am stirred up" and "I am relaxed" (reverse-coded), *M*=4.02,

SD=1.41 (α=0.75). This scale was assessed at the end of their shift (or during their break), but before completing the creativity tasks.

***Creative Performance*:** In this study, I measured creativity using two tasks that are designed to be measures of divergent creativity: the Alternate Uses task (Guilford, 1956) and Ward's (1994) measure of structured imagination, in which participants were asked to draw an alien. Participants were first given the Alternate Uses task, in which they were presented with a photo of a brick and asked to generate many creative uses for the brick as they could (Goncalo, et al., 2010). As in Study 1, *fluency* was calculated based on the number of unique ideas generated (*M*=7.31, *SD*=3.85). For *flexibility* (number of different categories those ideas fell into), each idea was categorized by two coders based on the 20 categories previously developed in Study 1 (Guilford, 1967; Torrance, 1966). The ratings of the two coders reached significant agreement (ICC=.96, p<.001) and their ratings were averaged together (*M*=5.12, *SD*=2.07). An originality score, or the average level of novelty across the ideas generated, was calculated as in Study 1 (Roskes, et al., 2012) (*M*=0.79, *SD*=0.16).

Next, participants completed Ward's (1994) measure of structured imagination that gauges the extent to which people can think outside of the constraints of their own experiences and knowledge to generate ideas that are divergent from their existing knowledge. In this test, participants were asked to draw a space creature based on the following instructions: "Imagine going to another galaxy in the universe and visiting a planet very different from Earth. You have one minute to draw a picture of a creature that is local to this other planet." (Ward, 1994). Following Ward's (1994) original coding scheme (and more recently used by Goncalo, et al., 2010), each alien was coded for creativity by assessing the atypicality of the space creatures' sensory organs. Two trained coders, blind to the conditions, counted the atypicality of the

creatures based on (a) lacking a major sensory organ (i.e., eyes, ears, nose), (b) an atypical number of sensory organs (e.g., one eye), (c) having an unusual configuration of senses (e.g., nose above eyes), (d) having organs with an unusual ability (e.g., eyes that shoot laser beams), or (e) having organs that serve an atypical function. The total number of atypical features was tallied for each participant. The ratings of the two coders reached significant agreement (ICC = .93, $p<.001$) and their ratings were averaged together to create an overall measure of creative performance (M=6.61, SD = 2.24).

Moderator: Polychronicity. Polychronicity is an individual's trait preference for multitasking. This trait was measured using the four-item Polychronic Attitude Index (PAI; Kaufman, et al., 1991), which assesses how much participants prefer to multitask their work. Sample items include: "I like to juggle several activities at the same time." and "When I work by myself, I usually work on one project at a time." (reverse-coded) (α=0.81) (M=4.47, SD=1.36).

Control variables. I controlled for individual and contextual factors that could be expected to influence both activation and creativity. As servers with more tenure may be more likely to manage multitasking environments, I controlled for server tenure (M=6.27 years, SD=6.55). To account for time spent multitasking and control for potential resource depletion effects, I calculated the amount of time between their last break and the time they took the survey in minutes (M=296.83, SD=144.75). Furthermore, I also controlled for state positive affect and state negative affect during the tasks using four items assessing valence because affect has been shown to influence creative performance (e.g., Davis, 2009). Items for negative emotions included "I felt negative", and "I felt unpleasant" (M=2.12, SD=1.27; α=.87). Items for positive emotions included "I felt positive", and "I felt pleasant" (M=5.30 SD=1.30; α=.91). Last, as individuals who spent more time working on the task were more likely to do better, I controlled

for the length of time participants spent working on the idea generation task in my analyses (*M*=2 minutes 49 seconds, *SD*=1 minute, 37 seconds).

STUDY 3: RESULTS

The descriptive statistics and correlations among the study variables are shown in Table 5. The regression analyses are shown in Table 6.

Because the study design involved restaurant servers nested within 20 different restaurants, I checked to see whether creativity was influenced by restaurant-level factors. However, one-way analyses of variance indicated that controlling for the effects of the restaurant was not necessary (idea fluency: F (19, 85)= 1.04, p =.43; idea flexibility: F (19, 85)= 1.02 , p =.44; idea originality: F (19.85)=1.14, p=.33; and, alien task creativity = F (19, 85)= 1.59, p =.08. Given this, I ran my analyses at the individual level of analysis.

Hypothesis 1 proposes that multitasking increases creative performance. When I entered multitasking condition in the first step of the linear regression, it did not significantly affect fluency (β = -0.09, *ns*), flexibility (β = -0.18, *ns*), originality (β = -0.05, *ns*), or performance on the alien task (β = 0.01, *ns*), rejecting Hypothesis 1.

Hypothesis 2 proposes that arousal mediates the relationship between multitasking and creative performance. I tested this hypothesis in two steps. In the first step, I tested whether multitasking increased participants' activation, finding that multitasking significantly affected activation ($\beta = 0.21$, $p < 0.05$) partially supporting Hypothesis 2.

In the next step, I tested whether feelings of activation increased creative performance on four factors: fluency, flexibility, originality, and creativity on the alien task. In these linear regression models, I controlled for positive and negative affect, server tenure in months, minutes working straight, and restaurant busyness. The results demonstrated that activation increased

fluency ($\beta = 0.21$, $p < 0.05$), flexibility ($\beta = 0.22$, $p < 0.05$), and creativity on the alien task ($\beta = 0.26$, $p < 0.05$), but did not significantly improve originality ($\beta = 0.10$, *ns*), thus providing partial support for Hypothesis 2.

To test the significance of the indirect effect of multitasking as mediated by arousal, I used the steps outlined by MacKinnon, Fairchild, and Fritz (2007). Though the direct effect of multitasking on creativity was not significant for any of the three creativity variables, MacKinnon and colleagues argue that that the first step of the Baron and Kenny (1986) method of determining mediation is not always necessary (2007). Using the product of coefficients method, I calculated the indirect effect of multitasking on fluency, flexibility, and creativity on the alien task. In order to determine significance, I used the Preacher and Hayes (2008) method of bootstrapping the indirect effects. Results indicated that the indirect effect of multitasking on creativity was significant as the 95% confidence interval did not include zero for fluency (coefficient = 0.14, 95% CI = 0.06, 0.16), flexibility (coefficient = 0.08, 95% CI = 0.08, 0.17), and creativity on the alien task (coefficient = 0.11, 95% CI = 0.03, 0.14). Thus, Hypothesis 2 was partially supported for fluency, flexibility, and creativity on the alien task.

I then tested my full model which predicts that polychronicity will attenuate the indirect effects of multitasking through activation on subsequent creativity, using Hayes's (2013) PROCESS procedure (model 7, default settings). As seen in Table 6, I found that the level of multitasking interacted with polychronicity to predict levels of activation ($b = -.27$ ($SE = .11$), $p < .05$). Specifically, multitasking was significantly related to activation for low levels of polychronicity ($b = .42$ (.22), [.11, .99], $p < .05$), showing that individuals with low levels of polychronicity responded with higher levels of activation while engaging in high levels of multitasking as compared to when they were engaging in low levels of multitasking. In contrast,

individuals with a higher preference for multitasking, those with higher levels of polychronicity, did not differ in terms of their levels of activation irrespective of whether they were engaging in high or low levels of multitasking (b = -.03 (.16), [-.34, .35], *ns*) (See Figure 2). Furthermore, I found that the levels of activation predicted creativity in terms of idea fluency (b = .53 (SE = .24), $p < .05$), idea flexibility (b = .28 (SE = .14), $p < .05$) and creativity in the structured imagination (or draw an alien) task (b = .40 (SE = .16), $p < .05$), but not idea originality (b = .01 (SE = .01), *ns*). Together, these results corroborate Hypothesis 3.

While I find evidence for my model, that is, the positive effect of multitasking on creativity through activation, some past research based on activation theory (e.g., Gardner, 1990) suggests that activation can increase creativity but only to a point, as too much activation can lower performance on creative tasks. According to this theory, individuals are thus at their most creative when they experience moderate levels of activation, and are thus able to optimally use their cognitive resources (Baer & Oldham, 2006; Gardner, 1986). In contrast, too little or too much activation is suggested to hinder performance on cognitively demanding tasks, like those requiring creativity. The curvilinear hypothesis predicted by this research was not borne out in that my data supported a linear rather than a curvilinear relationship between activation and creativity.

CHAPTER 6: GENERAL DISCUSSION

Drawing on a theory of activation, I proposed and found that multitasking behavior had a positive downstream impact on creative performance and this association was mediated by increased levels of activation. Furthermore, as predicted, the multitasking-energy association was strengthened for those who had low levels of polychronicity and least preferred to multitask. The first experimental laboratory study provides support for the direct multitasking-subsequent creativity link. In this study, I also show that this relationship holds for creative performance but not analytical performance. The second and third studies, a second lab experiment and a field study of restaurant servers provide empirical support for the mechanism underlying this effect, activation. Finally, the third study shows that the indirect effect is influenced by one's preference for multitasking behavior.

Contributions to Theory, Research and Practice

A critical contribution of my work is the introduction of a theoretical model that demonstrates how and under what circumstances multitasking can have a positive influence on downstream creative performance. In doing so, this research makes contributions to the existing literature on multitasking, creativity and affect. With regard to multitasking, my model differs from prior multitasking theories to consider the lasting effects behaviors can have on subsequent tasks and to my knowledge is one of the first papers to propose and find support for a beneficial outcome of multitasking behavior. A secondary contribution within this literature is that I was able to capture multitasking behavior using natural work scenarios and real work settings to demonstrate the impact of this behavior as it occurs in the workplace. Much of the prior research

done in psychology investigated multitasking in structured ways that do not map onto how people actually multitask at work; yet, their findings are presumed to generalize to the organizational setting. By focusing on this behavior at work, I consider the longer-lasting impact of this behavior on other meaningful organizational outcomes. I was also able to confirm that multitasking had a positive effect on creative performance whether it was forced (as in Studies 1 and 2), or a combination of voluntary and involuntary behavior (as in Study 3 where servers both chose to multitask but were also subject to interruptions from customer requests).

By integrating multiple creativity studies and theories, I contribute to creativity research by demonstrating that juggling multiple tasks concurrently increases subsequent creativity similarly to recent research that shows support for increased creativity after holding dual contrasting thoughts in the mind (i.e., paradoxical framing; Miron-Spektor, et al., 2011). By adding to this literature, I demonstrate that this effect could go beyond holding directly opposing thoughts to simply juggling two or more thoughts in the mind at once. It is not precisely clear how this process occurs, but theories suggest that by diluting attention from a single, focused activity, the unconscious mind may be easier to access and that this part of the mind has the tools to make more unusual associations crucial for creativity (Dijksterhuis & Nordgren, 2006).

Last, I provide further support for the link between activation and creativity and demonstrate a previously untested link between multitasking and activation. Though prior research has suggested a link between multitasking and activation (Yeykelis, et al., 2014), I confirm this link holds for several types of multitasking activities. Research on activation with regard to creativity (De Dreu, et al., 2008) demonstrates that both positive and negative activating emotions can have positive effects on creativity. My research adds to this literature by demonstrating that behaviors that stimulate activation can also influence creative performance,

even when the activation is not accompanied by positive or negative emotions, or above and beyond the effects of positive and negative valence. Prior research on the spillover effects of energy and excitement suggest that the activation response incompletely decays after the first activity and that this energy then "spills over" onto subsequent thoughts and emotions (Zillmann, 1971). My study shows that through this spillover effect, residual activation has a positive effect on creativity after people have moved on from multitasking behavior to a subsequent task. To this end, I contribute to a prior literature that addresses the spillover effects of emotions and behavior on subsequent outcomes (e.g., Zillmann, 1971; Zillmann, et al., 1972).

Accordingly, my research offers important practical implications for managers and their employees. Based on prior multitasking research, managers may seek to reduce multitasking in the workplace, but this research suggests that under certain circumstances or in certain industries, it could be helpful to allow employees to multitask on occasion. For example, those working in creative industries such as technology or advertising may derive benefits from multitasking. Likewise, managers might encourage multitasking behavior before leading brainstorming meetings to stimulate employees' creative energy.

Limitations and Future Directions

One of the strengths of my studies is that I obtain consistent results across three different studies that use experimental and field contexts and use both coded and self-reported measures. These differing research designs and methodologies serve the purpose of constructive replication (e.g., Gordon, Slade, & Schmitt, 1986) and enhance the ecological validity of the work. In addition, my samples include both students and restaurant servers thus enhancing my ability to generalize my results across different situations and populations. Despite these strengths, my work, like all studies, is subject to a number of limitations.

My lab and field studies used a commonly accepted measure of creative performance, an idea generation task based on prior creativity studies (e.g., Goncalo, et al., 2010); however, I did not find support for all three aspects of creative performance on our hypotheses. Specifically, I did not find support for the effect of multitasking on creativity for the measures of originality. This lends itself to the question; how can I claim creative performance without finding support for the originality measure? There could be both theoretical and empirical reasons for why I did not find support for originality. Theoretically, perhaps the energy generated by multitasking is enough to drive increased fluency and flexibility but not enough to produce wholly original ideas. Originality might also require other important factors such as subject matter expertise to recognize the distinction between what has been done before and what is original (Mumford, Marks, Connelly, Zaccaro, & Johnson, 1998). By asking participants to generate as many creative uses as they could, I may have inadvertently directed their energy towards a focus on number of ideas over quality of ideas. In addition, prior research has also sometimes situated cognitive flexibility as the mechanism for originality (De Dreu, et al., 2011), and thus, when fluency is taken into account, originality scores have been shown to add little variance (Hocevar, 1981; Hocevar & Michael, 1979). This suggests that these different measures may not capture independent facets of creative performance (Mumford & Gustafson, 1988; Mumford, et al., 1998).

Another major limitation is my ability to assess creative performance using measures that correspond to the work setting. In each of my three studies, I had to use established measures of creativity that did not correspond to the tasks being multitasked. Future studies could explore how multitasking at work affects the creative performance of the work produced, such as the creative output of an advertising agency or a scientific laboratory. Relatedly, my studies focused

on the idea generation phase of the creative process. Future studies could explore how multitasking behavior impacts idea selection or implementation. Multitasking behavior could positively increase subsequent creative idea selection through increased cognitive flexibility or increased energy for creative decision-making in line with my current model. Alternatively, multitasking behavior, by increasing cognitive busyness and creating high cognitive load (Gilbert, et al., 1988), which has been shown to amplify individual biases in perception, may negatively affect idea selection by predisposing people to less creative ideas which may align more easily with their stereotypes. Similarly, multitasking behavior during implementation may generate more creative iterations of the idea or divert attention and energy from potential creative improvements.

Last, though I was able to study multitasking in a quasi-experimental field context, it is unclear whether these findings would generalize to all types of work environments. The field study was set in a service setting in which multitasking is expected as part of the job, and it is plausible that in a different environment such as an office or a warehouse, people may respond differently when engaging in multitasking behavior.

Future research in multitasking should explore other factors that may influence how multitasking affects subsequent creativity. For example, future research could explore the effect of multitasking a work task with a non-work task, such as checking Facebook while in a meeting, or taking a personal call while working on a presentation to see if the same relationships hold. Future research could also consider multitasking activities that have a depleting effect on energy to see if multitasking alleviates the energy depletion or whether it compounds it. It would also be interesting to understand multitasking behavior in teams and the organizational outcomes of these interactions. Research on team polychronicity suggests that shared temporal cognition and

temporal transactive memory systems moderate the relationship between team polychronicity diversity and team performance (Mohammed & Nadkarni, 2014). Perhaps, by studying multitasking behavior in teams, future research can contribute to how teams develop these temporal cognitions and how they communicate and coordinate work tasks to improve performance. Additional research could also consider second stage moderators of the multitasking- activation-creative performance relationship. For example, perhaps level of task interest in the tasks being multitasked or an increased sense of goal progress could influence how the energy produced from multitasking is more or less effectively directed towards creative performance or other types of performance.

Conclusion

My research identifies a positive downstream consequence of multitasking behavior on subsequent creative performance. Those who multitask may gain the benefits of multitasking through increased activation. My findings suggest that those who least prefer to multitask may gain a greater benefit from the activity than those who do prefer to multitask. My findings may serve as a starting point for future studies on the downstream consequences of multitasking behavior.

TABLE 1

Study 1 Means and Standard Deviations

	Multitasking		Sequential tasking - Long		Sequential tasking - Short	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
1. Self-Reported Multitasking	5.30	1.71	3.44	1.64		
2. Multitasking Performance	78.80	41.58	107.36	37.21	60.99	46.93
3. Idea Generation task: Fluency	7.29	4.71	5.95	3.19	4.33	2.02
4. Idea Generation task: Flexibility	5.49	2.49	4.70	2.22	3.58	1.75
5. Idea Generation task: Originality	0.79	0.08	0.80	0.09	0.80	0.09

n = 240

TABLE 2

Study 2 Means and Standard Deviations

		Multitasking		Sequential Tasking	
		Mean	**SD**	**Mean**	**SD**
1.	Self-Reported Multitasking	4.14	0.77	3.26	1.16
2.	Activation	4.72	1.03	4.19	1.39
3.	Cognitive Flexibility	4.16	2.24	3.90	1.95
4.	Remote Associates Test	4.56	2.98	4.28	2.55
5.	Perspective-taking	2.64	1.19	2.58	1.30
6.	Creative Self-Efficacy	4.97	1.01	4.88	0.80
7.	Negative Affect	2.61	1.02	2.19	0.79
8.	Positive Affect	3.04	0.79	3.42	0.69
9.	Education	2.86	1.07	2.84	1.04
10.	Female	0.54	0.50	0.40	0.49
11.	Age	23.54	6.37	23.34	9.03

n = 100

TABLE 3

Study 2 Regression Table

Variable	IV -> Mediator	Mediator -> Cognitive Flexibility	Step 2b: Mediator -> RAT	Mediator -> Perspective Taking
IV				
Multitasking or Sequential Condition	0.214*	0.062	0.051	0.062
Controls (Step 2)				
Creative Self-Efficacy		-0.018	-0.048	-0.201
Negative Affect		-0.26*	-0.167	-0.239*
Positive Affect		-0.009	0.098	-0.045
Education		-0.132	0.234*	-0.057
RAT or Idea Generation First (2a & 2b)		-0.040	-0.003	
Mediator				
Activation		0.246*	0.168	0.243*
F - Value	4.697	2.198	1.814	3.419
Significance	p = 0.033	p = 0.050	p = 0.105	p = 0.007
Total R^2	0.05	0.124	0.105	0.154

n = 100

*** p < 0.05**

**** p < 0.01**

TABLE 4

Study 2 Indirect Effects Table

	Behavioral Outcomes	
	Cognitive Flexibility	Perspective Taking
Indirect Effect via Activation	0.207*	0.095*
(Standard Error)	(0.043)	(0.019)

*Significant at 95% Confidence Interval

TABLE 5

Study 3 Correlation Matrix

		Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1	Server Tenure	6.27	6.55										
2.	Minutes Working	296.83	144.75	0.13									
3.	Positive Emotions	5.30	1.30	-0.15	-.15								
4.	Negative Emotions	2.12	1.27	-0.03	.10	-.78 **							
5.	Multitasking	6.22	1.11	.22*	.13	-.05	.03						
6.	Energy	4.02	1.41	0.1	.07	.19 *	-.12	.21 *					
7.	Polychronicity	4.47	1.36	0.04	-.16	-.18	.16	.17	-.19				
8.	Brick Fluency	7.31	3.85	-0.02	-.09	.17	-.13	-.09	.18	-.12			
9.	Brick Flexibility	5.12	2.07	-0.11	-.01	.02	.03	-.19	.16	-.07	.63 **		
10.	Brick Originality	0.79	0.16	-0.05	-.14	-.06	.06	-.04	.04	.06	.06	.39 **	
11.	Structured Imagination Task Score	6.62	2.24	-0.02	-.02	-.10	.03	.01	.21 *	-.25 **	-.07	-.02	.04

n = 109

* **p < 0.05**

** **p < 0.01**

TABLE 6

Study 3 Regression Table

	Arousal	Idea Generation: Fluency		Idea Generation: Flexibility		Structured Imagination Task	
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Server Tenure	0.06	-0.09	-0.11	-0.17	-0.19	0.02	-0.01
Length of Shift	-0.06	-0.01	-0.01	0.04	0.06	-0.12	-0.11
Positive Emotions		0.08	0.00	0.04	-0.04	-0.29	-0.37
Negative Emotions		0.02	-0.02	0.12	0.07	-0.14	-0.18
Time Spent Working on Idea Generation Task		0.58**	0.58**	0.46**	0.46**		
Multitasking During Shift	1.14**	0.41	0.14	-0.17	-0.46	-0.13	-0.39
Polychronicity	1.31	0.80	0.50	-0.01	-0.34	-0.72	-1.01
Multitasking X Polychronicity	-1.88*	-1.01	-0.58	0.06	0.54	0.46	0.88
Activation			0.22*		0.24*		0.23*
Total R^2	0.15	0.35	0.39	0.24	0.29	0.14	0.18
Change in R^2			0.04*		0.05*		0.04*

n = 109

*** p < 0.05**

**** p < 0.01**

FIGURE 1

Full Model and Hypotheses

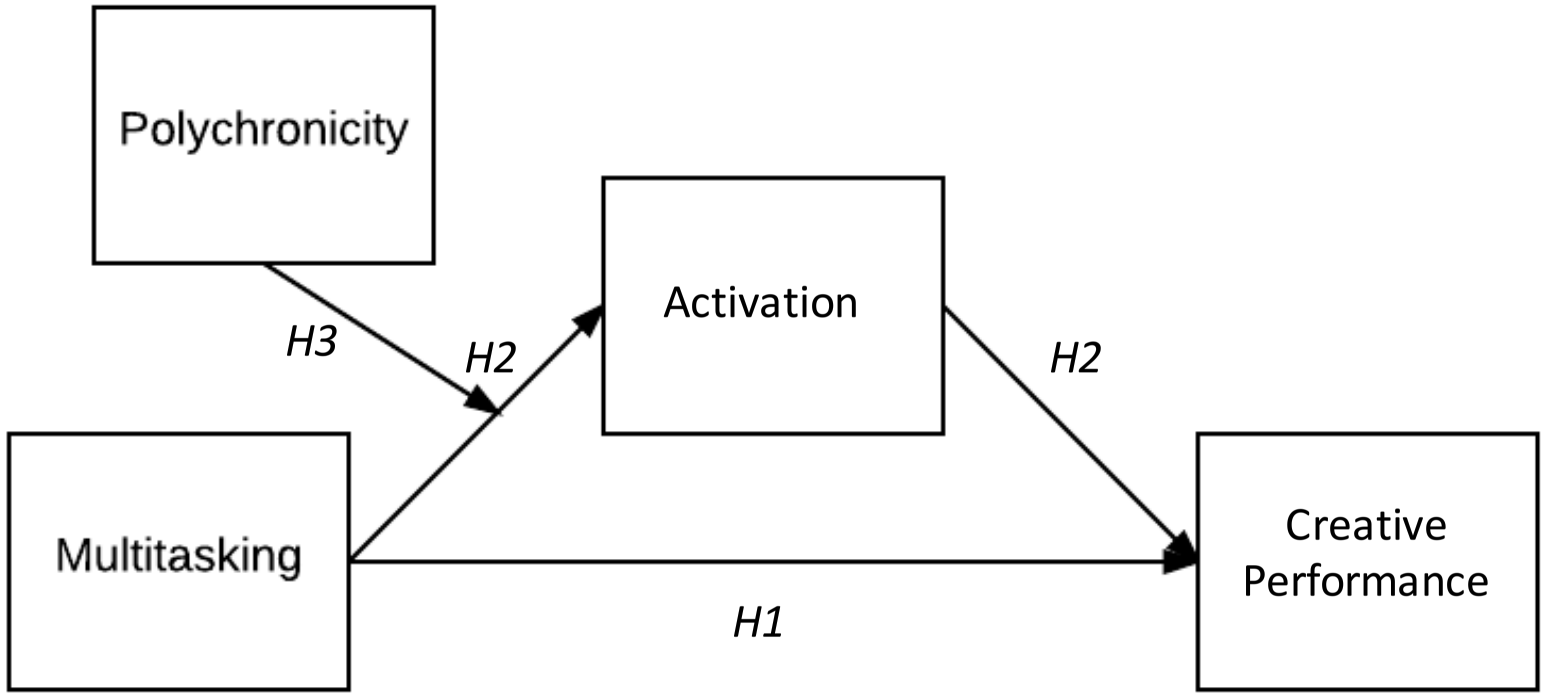
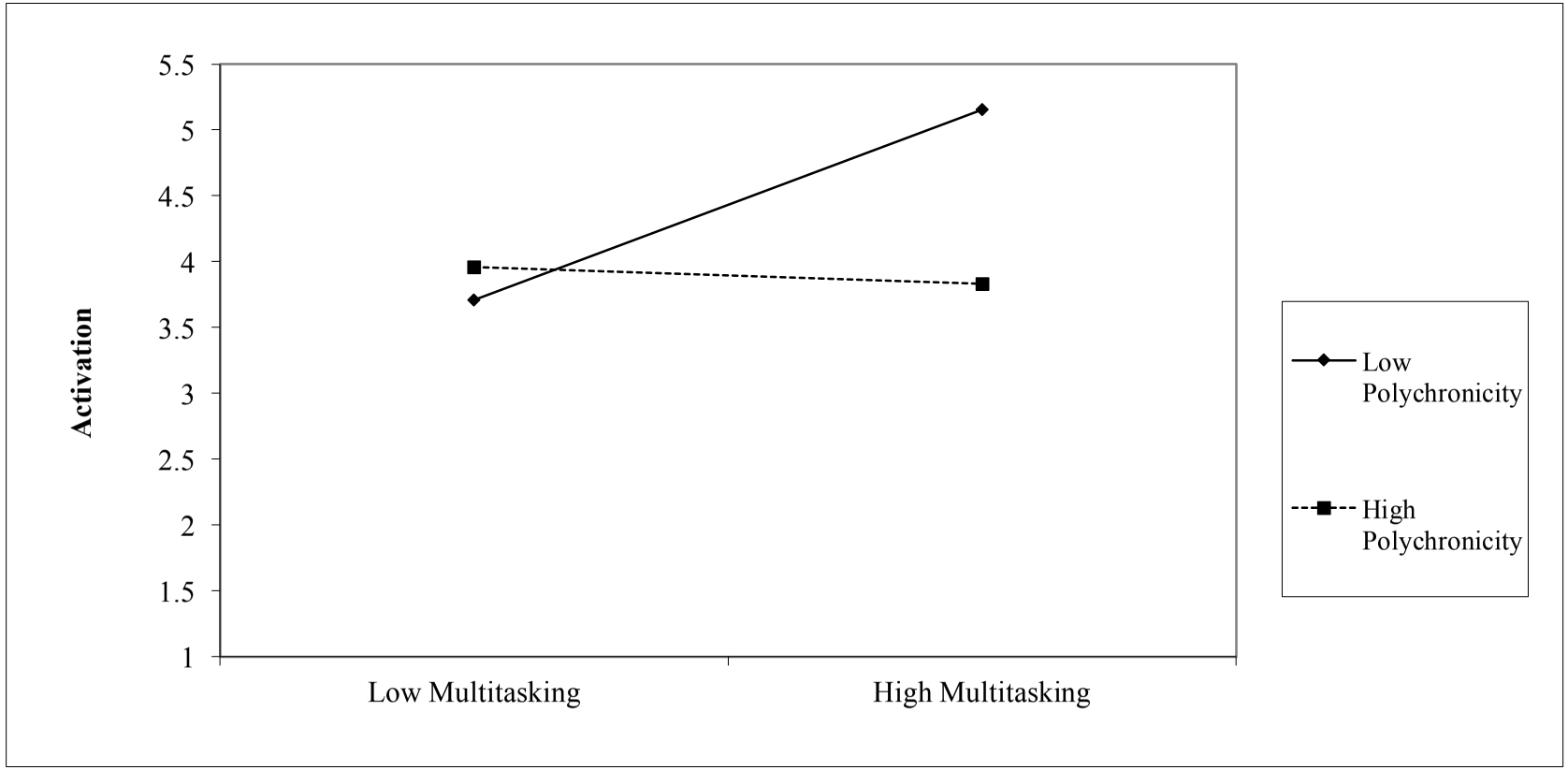


FIGURE 2

Study 3 Interaction between Multitasking and Polychronicity on Activation



APPENDIX A. SURVEY FOR STUDY 1

ORDER 1 - Multitasking

Imagine that you have been appointed the student member of a small committee designed to brainstorm creative ways for funding student organizations on campus. The committee consists of: 1) the head of the Student Union, Bob Jones; 2) the undergraduate class president, Mary Smith; and 3) you, the student representative. This is your first meeting.

However, you have also received several emails pertaining to your schedule that you need to respond to while you are at the meeting.

In the following section, you will perform two tasks at the same time in 4 minutes:

(1) read a short section and respond to several emails that have come into your inbox. You may respond to the emails in any order, but you must have completed your responses within 4 minutes.

AT THE SAME TIME YOU WILL

(2) listen to the committee meeting that is 4 minutes long. You will be asked to respond with your thoughts and ideas at the end of this meeting, so please listen as carefully as you can while responding to your emails.

Please put headphones on now if you are in a public place. If you are not using headphones, please adjust the volume of your speakers to hear the audio clip. The audio clip will play automatically.

- Click here to confirm that you have read everything above and are wearing headphones or have speakers on your computer.

In addition to being the student representative at this committee, you are also involved with several organizations on and off-campus. You're the photographer for the student newspaper, a volunteer at the local elementary school helping tutor students who speak English as a second language, and you also work at Bed Bath & Beyond as an assistant manager. Next week, you're working 15 hours at your job, volunteering on Monday and Wednesday from 3:30-5:30pm, and taking photos at the women's soccer game on Tuesday at 5pm. Your job schedule for next week is: 8am-2pm Tuesday, 8am-12pm Thursday, and 10am-3pm Friday.

Email #1:

hey…so it turns out that I have a paper due next Wednesday that I forgot about. would you mind switching your volunteer hours with me so that I can work on Monday and you can take the

Tuesday 3:30-5:30pm shift? let me know when you get a chance, cause if you can't I have to find someone else to take it.

thanks!

-ed

Email #2:

Listen, I know that I already scheduled you to take photos at the soccer game, but are you available on Tuesday at 6:30pm to go to an opening at the art museum? We're doing an article on the new Andy Warhol exhibit they're featuring.

Let me know ASAP,

Taylor
Photo Editor, Student Newspaper

Email #3:

Hi,

I'm a prospective student from Midland High School. I'm interested in majoring in journalism like you, so Professor Mackworth mentioned that I should contact you to learn more about what it's like from a student's perspective.

What do you think of the journalism program? Do you find it difficult to balance your coursework with the demands of the newspaper? Would you recommend it?

Thanks for any advice that you can offer!

Christine LaPierre

Conference Call Script – 2 people in meeting, plus participant

Topic – Creative solutions for funding student organizations on campus

Directions on the screen before they start:

Imagine that you have been appointed the student member of a small committee designed to brainstorm creative ways for funding student organizations on campus. The committee consists of the head of the Student Union, Bob Jones, and the undergraduate class president, Mary Smith, and you, the student representative. This is your first meeting.

Meeting Script:

Bob: Welcome to the first meeting of the committee to creatively fund student organizations on campus. We're very excited to hear input from students about the role of student organizations and how we can find ways to fund organizations without increasing fees.

First off, let's start by discussing how student organizations impact life on campus. Why are student organizations important?

Mary: Well, as student class president, I can say that student organizations are very important. Students get to practice leadership skills that are valuable to their futures. Plus, they can learn about new cultures and get all different kinds of experiences. Lots of students come from areas where they aren't exposed to a lot of diversity, and these clubs give them the opportunity to learn about different cultures. We've got everything from cultural clubs from different countries around the world to clubs devoted to specific activities such as Chinese traditional dance or helping rural communities in Kenya. We also have clubs that let people participate in various activities such as intramural sports, clubs for advocacy for a variety of causes, ways to volunteer in the local or global community, 38 different clubs just for performing different kinds of dances or singing or music, and also clubs for staying in touch with your religious communities. You know we have 769 registered student clubs on campus right now?

Bob: Sure, we can agree that student organizations can help serve the campus community and its members, but do they have to be organized through the campus? I mean, why can't students just organize these clubs themselves?

Mary: Well, they could, but it would be hard for them to let everyone know about the club and everything that it offers. Plus, you might not know that you're interested in learning about rowing Chinese Dragon Boats until you realize that they even exist. And then it's hard to keep these organizations going after the students that founded them graduate. So, people would organize clubs for as long as they are here and then it would fall apart after they leave. And that could have negative effects especially when it comes to community service.

Bob: That's true. Plus they're all students so they're learning about organizations and how to lead and it's hard to manage these things AND take classes and do internships.

Mary: Exactly! But I think we can agree it's worth it to have these opportunities for students to learn and participate. It's a big part of being in a university. For example, I didn't think that I could be student class president, but in my first year I got really involved in the Environmental Club and I was elected president in my second year. I learned tons about leadership and how to get things accomplished. Plus, I worked on the newspaper and learned a lot about how to manage my time and get good grades and meet all my deadlines. I'm very organized now and that helped me get the job I have lined up after graduation.

Bob: Congratulations on the job!

Mary: Thanks! I'm really excited! It's with a non-profit in Washington D.C. I'll be working with small businesses to help them access free resources and help them develop sustainable ways of manufacturing goods.

Bob: Okay, back to the task at hand. Student organizations are great, but there's 769 of them! We just can't fund them all for everything they need. We can help them out with some funds, but there's just no way to do it all. And we really want to keep student fees reasonable or students won't be able to afford to come here anyway.

Mary: Well, there's got to be some creative ways for coming up with funding. What do you think we can do?

Bob: Okay, so first off, there's different kinds of clubs and they have different needs. Some of them need funds for printing flyers and getting their events promoted. Others need to sponsor trips to Africa to do relief work. There's obviously a major difference in their needs.

Mary: Yeah, but all of them could do with SOME funds. Just to organize meetings and draw in members. I was thinking that we could do some fundraising in the community in general. You know, like go to companies in the research triangle and partner with them. They might be interested in helping out some student clubs.

Bob: That's very interesting. Yes, we could see about that. The student union could reach out to different companies and see what they'd be willing to sponsor.

Hey, we haven't heard from our student representative yet. What do you think?

Bob Jones and Mary Smith are both looking at you expectantly, waiting for your response.

Type in your suggestions below:

_____

ORDER 2 – Sequential - Long

Imagine that you have been appointed the student member of a small committee designed to brainstorm creative ways for funding student organizations on campus. The committee consists of: 1) the head of the Student Union, Bob Jones; 2) the undergraduate class president, Mary Smith; and 3) you, the student representative. This is your first meeting.

You have also received several emails pertaining to your schedule that you need to respond to after the meeting.

In the following section, you will perform two tasks sequentially for 4 minutes each:

(1) listen to the committee meeting that is 4 minutes long. You will be asked to respond with your thoughts and ideas at the end of this meeting, so please listen as carefully as you can while responding to your emails.

THEN

(2) read a short section and respond to several emails that have come into your inbox. You may respond to the emails in any order, but you must have completed your responses within 4 minutes.

Please put headphones on now if you are in a public place. If you are not using headphones, please adjust the volume of your speakers to hear the audio clip. The audio clip will play automatically.

- Click here to confirm that you have read everything above and are wearing headphones or have speakers on your computer.

Bob Jones and Mary Smith are both looking at you expectantly, waiting for your response.

Type in your suggestions below:

Please read the section below and respond to several emails that have come into your inbox. You may respond to the emails in any order, but you must have completed your responses within 4 minutes.

In addition to being the student representative at this committee, you are also involved with several organizations on and off-campus. You're the photographer for the student newspaper, a volunteer at the local elementary school helping tutor students who speak English as a second language, and you also work at Bed Bath & Beyond as an assistant manager. Next week, you're working 15 hours at your job, volunteering on Monday and Wednesday from 3:30-5:30pm, and taking photos at the women's soccer game on Tuesday at 5pm. Your job schedule for next week is: 8am-2pm Tuesday, 8am-12pm Thursday, and 10am-3pm Friday.

Email #1:

hey…so it turns out that I have a paper due next Wednesday that I forgot about. would you mind switching your volunteer hours with me so that I can work on Monday and you can take the Tuesday 3:30-5:30pm shift? let me know when you get a chance, cause if you can't I have to find someone else to take it.

thanks!

-ed

Email #2:

Listen, I know that I already scheduled you to take photos at the soccer game, but are you available on Tuesday at 6:30pm to go to an opening at the art museum? We're doing an article on the new Andy Warhol exhibit they're featuring.

Let me know ASAP,

Taylor
Photo Editor, Student Newspaper

Email #3:

Hi,

I'm a prospective student from Midland High School. I'm interested in majoring in journalism like you, so Professor Mackworth mentioned that I should contact you to learn more about what it's like from a student's perspective.

What do you think of the journalism program? Do you find it difficult to balance your coursework with the demands of the newspaper? Would you recommend it?

Thanks for any advice that you can offer!

Christine LaPierre

ORDER 3 – Sequential - Short

Imagine that you have been appointed the student member of a small committee designed to brainstorm creative ways for funding student organizations on campus. The committee consists of: 1) the head of the Student Union, Bob Jones; 2) the undergraduate class president, Mary Smith; and 3) you, the student representative. This is your first meeting.

You have also received several emails pertaining to your schedule that you need to respond to after the meeting.

In the following section, you will perform two tasks sequentially for 4 minutes total:

(1) listen to the committee meeting that is 2.5 minutes long. You will be asked to respond with your thoughts and ideas at the end of this meeting, so please listen as carefully as you can while responding to your emails.

THEN

(2) read a short section and respond to several emails that have come into your inbox. You may respond to the emails in any order, but you must have completed your responses within 1.5 minutes.

Please put headphones on now if you are in a public place. If you are not using headphones, please adjust the volume of your speakers to hear the audio clip. The audio clip will play automatically.

- Click here to confirm that you have read everything above and are wearing headphones or have speakers on your computer.

Bob Jones and Mary Smith are both looking at you expectantly, waiting for your response.

Type in your suggestions below:

Please read the section below and respond to several emails that have come into your inbox. You may respond to the emails in any order, but you must have completed your responses within 4 minutes.

In addition to being the student representative at this committee, you are also involved with several organizations on and off-campus. You're the photographer for the student newspaper, a volunteer at the local elementary school helping tutor students who speak English as a second language, and you also work at Bed Bath & Beyond as an assistant manager. Next week, you're working 15 hours at your job, volunteering on Monday and Wednesday from 3:30-5:30pm, and taking photos at the women's soccer game on Tuesday at 5pm. Your job schedule for next week is: 8am-2pm Tuesday, 8am-12pm Thursday, and 10am-3pm Friday.

Email #1:

hey…so it turns out that I have a paper due next Wednesday that I forgot about. would you mind switching your volunteer hours with me so that I can work on Monday and you can take the Tuesday 3:30-5:30pm shift? let me know when you get a chance, cause if you can't I have to find someone else to take it.

thanks!

-ed

Email #2:

Listen, I know that I already scheduled you to take photos at the soccer game, but are you available on Tuesday at 6:30pm to go to an opening at the art museum? We're doing an article on the new Andy Warhol exhibit they're featuring.

Let me know ASAP,

Taylor
Photo Editor, Student Newspaper

Email #3:

Hi,

I'm a prospective student from Midland High School. I'm interested in majoring in journalism like you, so Professor Mackworth mentioned that I should contact you to learn more about what it's like from a student's perspective.

What do you think of the journalism program? Do you find it difficult to balance your coursework with the demands of the newspaper? Would you recommend it?

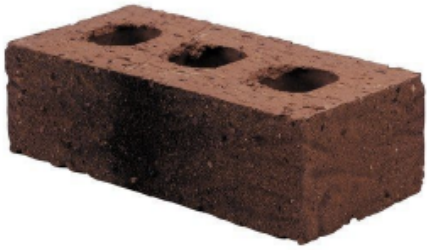
Thanks for any advice that you can offer!

Christine LaPierre

Manipulation Check

1. I felt like I was multitasking.
2. I felt like I was performing two tasks at the same time.
3. I felt like I was working on two tasks simultaneously.

Idea Generation Task



Generate as many creative, alternative uses of a brick as you can. Continue until you have finished and then click submit.

Analytical Task

On the next page, you will be looking at letter and number patterns and filling in the blank with the response that best fits the pattern.

You will have **3 minutes** to complete as many problems as you can. The screen will automatically advance after the time is up.

In these questions, you will be looking at both the letter pattern and the number pattern. Fill in the blank with the response that best fits the pattern.

1. SCD, TEF, UGH, ____, WKL (CMN, UJI, VIJ, IJT)
2. B2CD, _____, BCD4, B5CD, BC6D (B2C2D, CB3D, B2C3D, BCD7)
3. FAG, GAF, HAI, IAH, ____ (JAK, HAL, HAK, JAI)
4. ELFA, GLHA, ILJA, _____, MLNA (OLPA, KLMA, LLMA, KLLA)
5. CMM, EOO, GQQ, _____, KUU (GRR, GSS, ISS, ITT)
6. ZA5, Y4B, XC6, W3D, _____ (E7V, V2E, VE5, VE7)
7. QPO, NML, KJI, _____, EDC (HGF, CAB, JKL, GHI)
8. JAK, KBL, LCM, MDN, _____ (OEP, NEO, MEN, PFQ)
9. BCB, DED, FGF, HIH, ____ (JKJ, HJH, IJI, JHJ)
10. P5QR, P4QS, P3QT, _____, P1QV (PQW, PQV2, P2QU, PQ3U)
11. QAR, RAS, SAT, TAU, _____ (UAV, UAT, TAS, TAT)
12. DEF, DEF2, DE2F2, _____, D2E2F3 (DEF3, D3EF3, D2E3F, D2E2F2)

Demographics

1. How old are you?
2. Are you male or female? M/F
3. What is your ethnicity?
4. What is the highest level of education you have completed?
    1. Some high school
    2. High School Diploma/GED
    3. 2 year college
    4. 4 year college
    5. Masters Degree/JD/MD
    6. PhD

The study is now complete. Thank you for participating in our study.

Please see the lab manager for payment.

APPENDIX B. SURVEY FOR STUDY 2

ORDER 1 – Multitasking (Same as Study 1)

ORDER 2 – Sequential (Same as Study 1)

Mediator Scales:

Please rate how you feel right now:

Relaxed – Stimulated (1-7)
Excited – Calm (1-7)

Please rate your agreement with the following statements during the previous tasks:

Scale items: 1) Strongly Disagree, 2) Disagree, 3) Neither Agree nor Disagree, 4) Agree, 5) Strongly Agree

1. I was deeply engrossed.
2. I was absorbed intently.
3. My attention was focused.
4. I felt I could concentrate fully.
5. I felt mentally exhausted.
6. I felt drained.
7. I had to put in effort to do the tasks.
8. I worked hard to perform the tasks.
9. The tasks were difficult to perform.
10. It was tough to do the tasks.
11. I felt negative during the tasks.
12. I felt unpleasant during the tasks.
13. I felt positive during the tasks.
14. I felt pleasant during the tasks.
15. I felt like I was multitasking.
16. I felt like I was performing two tasks at the same time.
17. I felt like I was working on two tasks simultaneously.

RAT Problems

In the task below, you are given three words. Find the word that connects them.

For example, if the three words are: Falling, Actor, Dust

Then, the word that connects all three is: Star

You have 4 minutes to complete as many as possible and then the screen will automatically advance. Please do as many as you can until the screen advances.

{Randomized Order}

1. Cracker Union Rabbit
2. Widow Bite Monkey
3. Bald Screech Emblem
4. Square Telephone Club
5. Silk Cream Even
6. Sore Shoulder Sweat
7. Jump Kill Bliss
8. Lapse Vivid Elephant
9. Athletes Web Rabbit
10. Hall Car Swimming
11. Thread Pine Pain
12. Ink Herring Neck
13. Ticket Shop Broker
14. Measure Desk Scotch
15. Inch Deal Peg

Idea Generation Task

In the following task, you will be given a scenario that requires a creative solution.

You will have 4 minutes to generate as many creative solutions to the problem.

After years of mismanagement and poor quality food, the campus restaurant has finally gone bankrupt and is being shut down. The school administration is trying to decide what new business should go into that space. Come up with as many creative solutions to their problem as possible. A creative idea is one that is both novel and useful.

You have 4 minutes to generate as many creative solutions as you can and then the screen will automatically advance. Please do as many as you can until the screen advances.

Text Box:

Perspective-Taking

On the following page, we present you with a photograph of a person.

Imagine that you are interacting with this person and write an imaginative, complete story about the interaction. The story should include a beginning, middle, and end.

Try to portray who the person you are interacting with in the picture is, what both of you are feeling, thinking, and wishing for. Try to tell what led to the situation depicted in the picture and how everything will turn out in the end.

Text Box:

Creative Self-Efficacy Scale

Using the following responses, please indicate the extent to which you agree or disagree that each statement currently describes you.

Scale Items: 1) Very Strongly Disagree, 2) Strongly Disagree, 3) Disagree, 4) Neutral, 5) Agree, 6) Strongly Agree, 7) Very Strongly Agree

1. I feel I am very good at generating novel ideas.
2. I have confidence in my ability to solve problems creatively.
3. I have a knack for further developing the ideas of others.

Demographics

1. How old are you?
2. Are you male or female? M/F
3. What is your ethnicity?
4. What is the highest level of education you have completed?
    1. Some high school
    2. High School Diploma/GED
    3. 2 year college
    4. 4 year college
    5. Masters Degree/JD/MD

6. PhD

5. What was your SAT/ACT score? (If you did not take the tests, or do not remember your score, please write NA).
6. If you are a student, what is your GPA? (If you are not a student, please write NA).
7. If you are employed, how many hours do you work in a typical work week?
8. What is your job title?

The study is now complete. Thank you for participating in our study.

Please see the lab manager for payment.

APPENDIX C. SURVEY FOR STUDY 3

FIRST NAME ONLY: _____

How did you feel during **this** shift (past few hours)? Please rate your agreement with the statements below:

	Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Strongly Agree
During my shift, I felt like I was multitasking.	1	2	3	4	5	6	7
During my shift, I felt like I was performing two tasks at the same time	1	2	3	4	5	6	7
During my shift, I felt like I was working on two tasks simultaneously	1	2	3	4	5	6	7
During my shift, I felt like I was paying attention.	1	2	3	4	5	6	7
During my shift, I felt like I was bored.	1	2	3	4	5	6	7
During my shift, I felt like I was interested.	1	2	3	4	5	6	7
During my shift, I felt overwhelmed.	1	2	3	4	5	6	7

How do you feel **right now**, that is, at this very moment? Please rate your agreement with the statements below:

	Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Strongly Agree
Right now, I feel full of energy.	1	2	3	4	5	6	7
Right now, I feel stirred up.	1	2	3	4	5	6	7
Right now, I am amped up.	1	2	3	4	5	6	7
Right now, I feel jittery.	1	2	3	4	5	6	7

Right now, I feel positive.	1	2	3	4	5	6	7
Right now, I feel pleasant.	1	2	3	4	5	6	7
Right now, I feel negative.	1	2	3	4	5	6	7
Right now, I feel unpleasant.	1	2	3	4	5	6	7

On the scale below, how would describe your feeling **right now**?

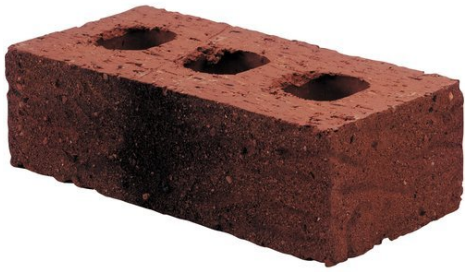
Relaxed Stimulated

1	2	3	4	5	6	7

Excited Calm

1	2	3	4	5	6	7

Your next task is to come up with as many creative (novel and useful) uses as you can for a brick. Come up with as many as you want.



What time is it right now (before you begin)? _____

What time did you finish?

_____

In the next task, imagine going to another galaxy in the universe and visiting a planet very different from Earth. You have about **1 minute** to draw a picture of a creature that is local to this other planet.

There are no further directions. Please draw an alien below.

****

Please rate your agreement with the statements below:

	Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Strongly Agree
I have confidence in my ability to solve problems creatively.	1	2	3	4	5	6	7
I feel that I am good at generating novel ideas.	1	2	3	4	5	6	7
I have a knack for further developing the ideas of others.	1	2	3	4	5	6	7
I like to juggle several activities at the same time.	1	2	3	4	5	6	7
When I work by myself, I usually work on one project at a time.	1	2	3	4	5	6	7
I like to finish one task completely before focusing on anything else.	1	2	3	4	5	6	7
I would rather switch back and forth between several projects than concentrate my efforts on just one.	1	2	3	4	5	6	7
I find my job satisfying.	1	2	3	4	5	6	7
My job gives me a sense of accomplishment.	1	2	3	4	5	6	7
I would like to continue working at my job.	1	2	3	4	5	6	7
I am committed to my job.	1	2	3	4	5	6	7
My job is an important reflection of who I am.	1	2	3	4	5	6	7
I am proud of the work that I do.	1	2	3	4	5	6	7

Date _____

Start time of today's shift _____Current time _____

How long has it been since your last break? _____

How many tables did you serve in the past hour? _____

On a scale of 1 (not at all) to 7 (very much):

How busy is this shift so far? _____

Demographics

What is your age? _____

What is your sex? Male Female

What is your race/ethnic background? _____

What is your highest level of education? _____

How long have you worked as a server (number of months or years)? _____

How long have you worked at this restaurant (number of months or years)? _____

Do you have any other job (e.g., student, actor, musician, etc.)? _____

If so, what is the other job? _____

Did you grow up in the U.S.? _____

Is English your first language?_____

Do you smoke? ___ If yes, how many cigarettes/day ___

What time did you have your last cigarette? _____

Survey for Managers

On a scale of 1 (not at all) to 7 (very much):

How busy is this shift so far? _____

How many people do you serve in an average slow shift? _____ (# of covers/# of hours)

How many people do you serve in an average busy shift? _____ (# of covers/# of hours)

What is the average bill at this restaurant? _____

Please rate each server on how much he or she was multitasking this shift:
(First Names Only)

	Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Strongly Agree
1.	1	2	3	4	5	6	7
2.	1	2	3	4	5	6	7
3.	1	2	3	4	5	6	7
4.	1	2	3	4	5	6	7
5.	1	2	3	4	5	6	7
6.	1	2	3	4	5	6	7
7.	1	2	3	4	5	6	7
8.	1	2	3	4	5	6	7
9.	1	2	3	4	5	6	7
10.	1	2	3	4	5	6	7
11.	1	2	3	4	5	6	7
12.	1	2	3	4	5	6	7
13.	1	2	3	4	5	6	7
14.	1	2	3	4	5	6	7
15.	1	2	3	4	5	6	7
16.	1	2	3	4	5	6	7
17.	1	2	3	4	5	6	7
18.	1	2	3	4	5	6	7
19.	1	2	3	4	5	6	7
20.	1	2	3	4	5	6	7

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