The Impact of Affective Mood States on Multitasking Performance

by

Angela Arlene Beiler

A thesis submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Master of Science

Auburn, Alabama
August 3, 2013

Keywords: Affect, organizational performance, multitasking, productivity

Approved by

Malissa Clark, Assistant Professor of Psychology
Daniel Svyantek, Department Chair, Department of Psychology
Ana Franco-Watkins, Associate Professor of Psychology

Abstract

Multitasking is a task performance phenomenon that has become extremely common among organizational employees (Gonzalez & Mark, 2004; 2005). Multitasking requires that individuals focus cognitive resources on different tasks simultaneously, which may be done by switching attention rapidly between tasks (Pashler, 1994). Research suggests that an individual's affective state may increase an individual's cognitive attention (Derryberry 1993; Isen 2008a; 2008b), which could improve performance in a multitasking scenario. Watson and Cropanzano's (1996) *affective events theory* posits that minor everyday can influence an individual's affective state, which can in turn influence their performance in the work domain. The current study examined the impact that affective states have on multitasking ability, utilizing the dimensions of hedonic tone and arousal in line with Russell's (1980) *circumplex model of emotion.* One hundred and twenty four undergraduate students took part in a mood induction study and multitasking simulation. Results indicate that there is an interaction between hedonic tone and activation on complex task performance, although no significant main effects were found. Implications for the impact of both hedonic tone and activation levels on task performance are discussed.

Acknowledgments

First and foremost, I would like to thank God for the abilities and opportunities He has given me. Next, I would like to thank my parents, Gary and Ginger, as well as my sister Kristen for their love and support through the rollercoaster of events that have defined these past two years. I do not know where I would be without their daily encouragement. I would also like to thank Malissa Clark for all the guidance she has provided me with throughout this experience. Lastly, I would like to thank my committee members Ana Franco-Watkins and Dan Svyantek for their much-appreciated feedback and support, and Eric Dooley for his technological expertise in helping me develop the Instant Messaging program used in my study.

I would like to dedicate this paper to Luca Bernardo Maurizio Amadeo Garovi (1985-2013) for teaching me to both live passionately and love deeply, and that there is no greater crime in this life than a missed opportunity.

Table of Contents

List of Tables

List of Figures

Introduction

In the contemporary workforce, the ability to perform dual tasks—or multitasking—is a crucial component to most job positions. As more companies incorporate real-time technologies such as instant messaging, it becomes the responsibility of the employee to take on the added task of maintaining communications with colleagues and employers while managing their primary job tasks. Additionally, a number of current studies have shown support that moods, particularly those of a positive nature, play a role in an individual's task performance (Derryberry, 1993; Isen, 2008a; Isen & Means, 1983). Since jobs typically require multiple tasks to be performed concurrently, and performance may be impacted by mood, it is important to consider the impact that this mood-task relationship could have on an individual's multitasking responsibilities. Contemporary research is conflicted as to whether it is the mood type (positive or negative) or activation level (activated or unactivated) that impacts an individual (Albarracin, 2011; Raghunathan & Pham, 1999). In the current study, both positive and negative affect and varying levels of activation were examined while individuals performed a multitasking exercise to examine the impact that Russell's (1980) *circumplex model of emotions* has on multitasking abilities in a setting that imitates a work environment.

Although contemporary researchers have examined the concepts of multitasking, task performance, and affect, the literature on these topics is rarely integrated. For example, some studies have focused on multitasking and the impact on decision making tasks without including affect (Gonzalez, 2003; Neider, 2011; Strayer, 2011), while others have focused on decision making tasks and affect without any multitasking component (Albarracin, 2011; Estrada, 1997; Isen & Means, 1983; Sinclair, 2010). The current study will add to contemporary research by integrating these three concepts in order to examine the possible interaction between affect, multitasking, and decision making task performance. Additionally, contemporary research tends to focus on only the hedonic tone of affective states, which is the facet that represents the pleasantness or unpleasantness of the state (Estrada, 1997; Fredrickson, 2005; Isen & Means, 1983). The current study will build upon research examining affect via the *circumplex model*, including both activated and unactivated states in addition to hedonic tone, in order to more fully understand the impact of mood on multitasking abilities. Lastly, many multitasking studies use tasks that are not directly relevant to a work environment, such as basic mathematical or word association tasks to examine multitasking (Bühner, König, Pick, & Krumm, 2006; Pashler, 1994). The current study will use measurements that more closely mimic workplace multitasking demands, including both a dynamic decision-making task and an instant messaging simulation in order to gain a better understanding of how multitasking impacts work environments.

In order to accomplish this task, the concept of multitasking will first be introduced. This includes the impact that multitasking has on the current work environment. Next, an overview of current cognitive literature regarding attention and decision making will be provided. This will include possible theoretical explanations for an individual's ability to multi-task, and how these mechanisms can cause performance to decline when taking part in more than one task concurrently. Following the cognitive constructs behind multitasking, the phenomenon of instant messaging– a contemporary method of multitasking– will be examined, including both positive and negative implications for workplace productivity. Next, an overview of contemporary affect research, including explanations of the various forms of affect, will be provided. This section will include definitions, support for relevant theories, and contemporary affect research. Lastly, the current study will be presented. This final section includes the rationale and hypotheses of the current study, procedures and measures, data analysis methods, results, and a discussion of current results and possible future directions for research in this field.

Multitasking

Within the context of the modern workplace, the phenomenon of multitasking has become increasingly common. Multitasking has been loosely defined as an individual processing two or more tasks simultaneously (Appelbaum, Marchionni, & Fernandez, 2008; Salvucci & Taatgen, 2008). Gonzalez and Mark (2005) explain that groups of work tasks can be divided into goals, or *work spheres.* Employees are required to function within a number of work spheres at any given time, and must switch between tasks to accomplish daily goals. In order to gain a better perspective of how individuals take on tasks while working, Gonzalez and Mark (2005) closely observed and interviewed participants within their normal job routines. Their research found that participants took part in an average of 12.22 working spheres per day, switching between spheres approximately every 10.5 minutes. In a previous study, Gonzalez and Mark (2004) found that the majority of an office work day is comprised of desk work (38 percent), followed by unscheduled meetings (18.9 percent) and other activities (15.1 percent). With such a large portion of the day divided between multiple activities, it is important to examine the implications of multitasking.

Additional studies have focused on factors that influence an individual's multitasking use and performance. König, Bühner, and Mürling (2005) examined individuals' performance while multitasking, finding that working memory, attention, and fluid intelligence were significant predictors. Interestingly, polychronicity (defined by König and colleagues as a preference for multitasking and a belief that multitasking is the most effective strategy) did not predict performance, although it was shown to predict the use of multitasking strategies in later studies (König, Oberacher, & Kleinmenn, 2010). König, Oberacher, and Kleinmenn (2010) examined both individual and situational characteristics that influence employees' use of multitasking at work. This study found that work demands, impulsivity, and polychronicity all significantly predicted the use of multi-tasking in the work environment.

Unfortunately, studies examining multitasking have found that attempting to take on multiple tasks at once can result in a number of negative outcomes. Paridon and Kaufmann (2010) simulated both a driving and office environment, and compared multitasking and single task conditions. The study found that drivers who were also taking part in secondary tasks were more likely to deviate from their lane, and reported significantly higher levels of stress. During the office simulation, participants had to identify the number of spelling errors in words. In the multitasking condition, participants also had to listen to a text being read, under the impression that they would need to recall the information later. Participants in the multitasking condition reported significanly higher amounts of strain while completing the tasks. Kalsbeek and Sykes (1967) found that when an individual is performing more than one task at once, their performance on both tasks decreases. In a more recent study, Strayer, Watson, and Drews (2011) found that participants in a simulated automobile were unable to break as quickly or maintain appropriate driving speeds while talking on either a hand-held or hands-free cell phone. These results support earlier findings by Mark, Gudithe, and Klocke (2008), who induced a multitasking state by having participants respond to e-mails on various topics while communicating with a supervisor. They found that these task interruptions resulted in increased job stress, frustration, and effort on the part of participants.

With so many consequences to taking part in multitasking, it is important to look at the impact that this activity has on workers' abilities to make decisions.

Cognitive Factors Impacting Multitasking

Within contemporary cognitive literature, the process of multitasking incorporates a number of individual constructs. Two specific constructs that may influence an individual's ability to multitask include working memory and attention.

Working Memory. Working memory is a system of specific memory components that are activated at a given point in time (Cowan, 1995; Oberauer & Hein, 2012). A widely accepted model of working memory was developed by Baddeley and Hitch (1974), and later updated by Baddeley in 2000 (see Figure 2). Baddeley and Hitch's (1974) original model of working memory consisted of three components. The first component is the central executive, which acts as a control system for the entire construct. The next two components are the phonological loop and visuospatial sketchpad. The phonological loop processes auditory information, while the visuospatial sketchpad processes visual and spatial information. A fourth component, the episodic buffer, was added to the model by Baddeley in 2000. The episodic buffer is responsible for the integration of information from the different systems, as well as information in the long-term memory.

Studies have shown that working memory is strongly related to multitasking use and performance. König and colleagues (2005) examined a number of individual difference variables including working memory, fluid intelligence, attention, polychronicity and extraversion. They found that working memory was the strongest predictor of multitasking performance, accounting for the highest amount of variability in task performance. Attention and fluid intelligence were also significant predictors of multitasking performance, while extraversion and polychronicity had no effect. Bühner et al. (2006) expanded on these findings by parsing working memory into three separate dimensions following the framework of Oberauer, Süß, Wilhelm, and Wittmann (2003). Oberauer et. al. (2003) divided working memory into the three separate roles of task storage, task coordination, and task supervision. Task storage is the role of working memory in which new information is rehearsed and retained. Task coordination acts as an integration system, allowing various pieces of information to be comprehended. Lastly, task supervision reflects the role of the central executive in directing cognitive resources to specific tasks. Bühner et al. (2006) found that the three components of this multidimensional working memory framework had differing impacts on multitasking performance. Specifically, storage was able to predict the number of errors made in multitasking, but not the speed at which an individual worked. Coordination, on the other hand, predicted speed but not the number of errors. The third component, supervision, predicted both speed and number of errors while multitasking. These studies show support for the multifaceted role of working memory within multitasking performance.

Attention. When more than one task requires simultaneous focus, the central executive component of Baddeley and Hitch's (1974) working memory model is responsible for delegating an individual's cognitive resources to the tasks at hand (Baddeley, 2002; Baddeley & Hitch, 1974). This process of allocating resources to one task or another is known as attention. When multiple tasks require high levels of cognitive processing, performance decrement, which is an inability to perform the tasks at the same level as one could sequentially, can occur (Kondo & Osaka, 2004). Even researchers who do not ascribe specifically to the central executive model have found some general factor related to performance decrement while multitasking (Bourke, Duncan, & Nimmo-Smith, 1996). This processing factor, when unable to keep up with multiple task demands, can lead to numerous consequences.

One well- supported theory of attention contradicts the common assumption of multitasking—that the tasks being completed are processed simultaneously within the brain. According to Pashler's (1994) *central bottleneck theory* of decision making, an individual is unable to simultaneously process multiple complex tasks. Therefore, the individual must switch cognitive resources quickly between the two tasks when they must be performed concurrently, lengthening the amount of time it takes to complete the tasks. This delay in cognitive processing is referred to as a cognitive bottleneck (Pashler, 1994). The bottleneck theory was empirically examined by Borst, Taatgen, and van Rijn (2010), who conducted three separate multitasking experiments and found support for a possible central bottleneck on both easy and hard subtraction and text entering tasks while simultaneously performing a listening task. Specifically, they found that an employee's responsibility to take on a number of tasks at the same time could cause interruptions between multiple tasks, delaying the individual's ability to complete each task in the amount of time it would take to complete each task on its own (see Figure 1).

Instant Messaging in the Workplace

One way that contemporary employees take part in multitasking is through the use of instant messaging systems in the workplace. According to the technology market research firm Radicati, the number of organizational instant messages per year is expected to hit 40 billion by 2015 (Radicati, 2011). Current research regarding the impact of instant messaging in the workplace is conflicted. Some studies suggest the technology may be interruptive to employees who must respond in real-time while completing job-relevant tasks, while other studies support the perspective that instant messaging increases the employee's ability to be productive by allowing communication to take place more quickly and without complete job interruption. Garrett & Danziger (2008) conducted a study of 912 computer-using workers, and found that participants who used instant messaging systems at work reported fewer disruptions during the work day (Garrett & Danziger, 2008). In contrast, Stevens (2008) found that the constant real-time responsibilities associated with instant messaging systems caused communication overload, resulting in lowered productivity. Ophir, Nass, Wagner, and Posner (2009) examined the effects of using multiple media simultaneously by dividing participants based on how many types of media they use concurrently. They found that individuals who regularly used many forms of media simultaneously performed worse on a task that required filtering out important information. Instant messaging within a work environment adds to this multiple media usage, and could leave users at a disadvantage when trying to discriminate between information received at work, leading to the consequences found by Stevens (2008). Although instant messaging could prove detrimental to employees, it is gaining prevalence within organizations. The magnitude of Instant Messaging usage combined with conflicting research within the field makes this platform ideal for further research into the contemporary work environment.

Affect

Current research strongly supports the role of affect in both organizations and decision making. Barsade and Gibson (2007) define affect as, ". . . a broad range of feelings that individuals experience, including feeling states, such as moods and discrete emotions, and traits, such as trait positive and negative affectivity." Affect is vital to organizations, since it can influence everything from employee productivity and creativity to interpersonal interactions and absenteeism (Barsade & Gibson, 2007).

Affect encompasses a number of underlying concepts. Research suggests that affect can be divided into two categories -- trait and state affect. Trait affect is a dispositional characteristic that is stable and enduring over time, whereas state affect fluctuates as a result of particular situations (Bartels, 2007; Weiss & Cropanzano, 1996). Additionally, trait affect tends to focus on individual differences, whereas state affect places emphasizes the situation over the individual (Bartels 2007; Weiss & Cropanzano, 1996). The current study will focus on state affect, rather than trait affect.

Affective events theory. One of the leading theories of state affect is *affective events theory*, proposed by Weiss and Cropanzano (1996). This theory examines the causes and effects of mood alterations throughout the workday, positing that minor, daily work events can alter an individual's mood. These mood alterations, in turn, have the ability to change the individual's behaviors, attitudes, and job performance abilities. For example, in a study conducted by Van Rooy (2006), simply altering the length or congestion level of an individual's commute significantly impacted the manner in which they evaluated job candidates. Specifically, participants with a more strenuous commute- either longer or more congested- resulted in increased negative appraisals. In addition, participants who experienced increased route length or congestion reported higher levels of negative affect during the commute. According to affective events theory, the negative mood induced by a more strenuous commute spilled over into the working environment, causing the lower appraisals of job candidates. The current study will implement this theory by incorporating affective state-altering events, which should result in varied behavior dependent on a participant's induced affective state.

Discrete Emotions. Affective states have been shown to play a large role in employee decision making (Estrada, Isen, & Young, 1997; Fredrickson & Branigan, 2005; Isen & Labroo, (2003); Isen & Means, 1983). Researchers, however, use a variety of methods to classify and study these states, which can cause some confusion within the field. One method of classifying affective states involves looking specifically at emotions. Emotions are affective responses to a specific event that an individual experiences (Frijda, 1993). The *discrete emotion theory*, or DET, posits that there are universal emotions, each with individual causes and motivations (Izard, 1977; Izard, 1992). These emotions include feelings such as interest, disgust, sadness, and anger (Izard 1992). There has been disagreement within the field as to whether it is more appropriate to use specific emotions rather than dimensions, which contain a wider array of feelings (Barrett 2010). Even so, a number of studies have utilized discrete emotions in studying decision making (Frederickson & Branigan 2005; Raghunathan & Pham, 1999). Frederickson and Branigan (2005) used various video clips to induce the discrete emotional states of amusement, serenity, anger or disgust, and anxiety or fear, as well as a neutral state. They then had participants perform a number of tasks designed to tap into globalization abilities and thought-action repertoires. The researchers found that individuals who were primed with positive emotional inductions (either amusement or serenity) were able to recognize items on a more global scale, and maintained larger thought-action repertoires. These responses indicate a higher level of cognitive flexibility associated with positive affective states. Raghunathan and Pham (1999) examined two negative discrete emotions, sadness and anxiety, to see if there were differences that could be attributed specifically to levels of emotional arousal (also known as activation). They found that individuals primed with either anxiety (activated state) or sadness (unactivated state), although both considered negative, unpleasant emotions, differed in the levels of risk and reward associated with the decisions they made. These findings indicate that it is not merely the tone of the affective state (either pleasant or unpleasant), but also the level of arousal it creates that cause the subsequent attitudes and behaviors. Lench, Flores, and Bench (2011) performed a meta-analysis examining discrete emotion induction. They found that some of the more common discrete emotion elicitation methods were able to accurately tap into either positive or negative emotions, but could not easily discriminate between specific discrete emotions within these dimensions. Some researchers, in line with Lench, Flores, and Bench's (2011) findings, utilize wider dimensional classifications instead of attempting to hone in on discrete emotions.

Mood classifications. Although often used interchangeably, moods states differ from emotional states. Frijda (1993) explains that one of the main factors differentiating moods and emotions is the presence or absence of an affective focus. Unlike emotions, moods do not contain this specific focal point. Oftentimes, the individual does not know why they are experiencing a specific mood, and are unable to explain its cause. Morris (1989) explains that moods are also more pervasive and less intense than emotions. The current study will focus on moods, rather than emotions, by inducing a less intense, more pervasive form of affect to which a direct cause cannot be attributed.

PANAS. The Positive and Negative Affect Scale, or PANAS, is one of the two major dimensional methods of classifying mood divides affective states into two separate, unipolar dimensions. The PANAS views positive affect (PA) and negative affect (NA) as two independent constructs (Watson, Clark, & Tellegen, 1988). In this model, high NA refers to negative affective states with activated states, including anxiety and anger. Low NA, on the other hand, refers to positive affective states with low levels of activation, such as serenity and peacefulness. Estrada et al. (1997) had physicians diagnose a hypothetical patient after either receiving candy (inducing a positive mood state), or receiving no candy (a control condition). In line with Watson, Clark, and Tellegen's (1988) theory, they did not discriminate between the activation levels of the mood induction, or include a negative mood component. The researchers did, however, find that positive mood contributed to faster decision making times by physicians, without lowering the accuracy of the decisions that were made. Isen and Means (1983) reported similar findings by studying participants making decisions regarding a car purchase. Like Estrada et al. (1997), they induced only a positive state by telling some participants they scored in the 97th percentile of a matching task, as well as a control group. Isen and Means (1983) found that participants were more efficient in their decision making when in a positive mood, and did not significantly differ from the control group on their final decisions, indicating that the decision making results were not impaired by a positive mood.

Some results of affective studies indicate that, depending on the desired outcome, a positive mood state may not be the most beneficial. Huntsinger, Sinclair, and Clore (2009) used classical music to induce positive and negative mood states. They then had participants take part in a number of tasks designed to identify possible stereotype biases. The researchers found that individuals in negative mood states are less likely to utilize stereotype biases than those in positive mood states. Lastly, Baron (1990) examined the impact of positive mood compared to a neutral mood by using pleasant scents while having participants take part in a number of tasks. Baron (1990) found that, while performing a negotiation task, individuals in a positive mood state were more likely to make concessions. These concessions could be detrimental to an organization attempting to gain the most leverage in a negotiation. Once again, there was no negative state to compare with the positive state. Since activation was not measured in either the Huntsinger et al.'s (2009) or Baron's (1990) study it is difficult to know if the positive and negative music had similar levels of arousal for the participants, which could confound the information.

Circumplex model. Another method of classifying mood states differs from the PANAS in regards to its unipolar structure. The circumplex model of emotion, developed by Russell (1980), incorporates the pleasant or unpleasantness of an affective state (known as the hedonic tone) as two opposite ends of the same spectrum (see Figure 3). It also includes a second bipolar spectrum classifying the activation level. According to the circumplex model, activation refers to states where an individual experiences higher levels of arousal, and may describe themselves as being surprised, stimulated, or active. On the opposite end of the spectrum, an individual experiencing an unactivated state may describe themselves as being passive, tranquil, or inactive. Sinclair, Ashkanasy, and Chattopadhyay (2010) found that the level of activation, which they refer to as intensity, not the positive or negative nature of the affective state itself, can impact the decision making process. Specifically, the study found that participants relied on intuition to make decisions in both positive and negative affective states when experiencing high intensity. In an article by Sinclair and Mark (1995), the researchers explained that not controlling for activation states can cause complications while trying to interpret results. The circumplex model incorporates both activation and hedonic tone as individual components necessary for classifying the affective state, thus controlling for varying activation levels.

There has been much debate as to whether a unipolar format like the PANAS or a bipolar format like the circumplex model more accurately represents affective structure (Green & Salovey, 1999; Russell & Carroll, 1999; Tellegen, Watson, & Clark, 1999; Watson & Tellegen, 1999). Watson et al. (1988) proposed a unipolar model that views positive and negative affect independent of one another. In contrast, Russell's (1980) model views positive and negative hedonic tones as opposing ends of a singular spectrum, rather than independent constructs. A second crucial difference between the two models is the incorporation of activation level as an independent component. For the purposes of the current study, the compilation of hedonic tone and activation enable the circumplex model to act as a more versatile tool for examining all aspects of mood. The findings of studies that specifically incorporate varying activation levels of the same hedonic tone indicate that activation level plays a distinct role when researching affect (Raghunathan & Pham, 1999; Sinclair et al, 1990). In order to further research on the independent and collaborative effects of hedonic tone and activation, the current study will utilize Russell's (1980) circumplex model, rather than Watson, Clark, and Tellegen's PANAS model (1988).

There is ample support for the importance of affect in the decision-making process (Estrada et al., 1997; Isen & Means, 1983; Baron 1990). Furthermore, little research exists examining these decision making processes using the circumplex model, incorporating hedonic tone and activation level as separate dimensions. For these reasons, the current study will integrate the Russell's (1980) circumplex model with current decision making research. These will be combined in an environment that imitates the contemporary workplace, incorporating the common practice multitasking to achieve realistic, applicable results.

Affect and Attention. A few studies have shown support for a relationship between affective states and attention. Isen (2008b) argues that positive affective states may increase an individual's attentional flexibility, allowing for increased performance on tasks. Derryberry (1993) found that individuals who had just been successful at a task, inducing a positive mood state, were able to pay attention to both high-relevancy and low-relevancy targets. Individuals who had failed, however, tended to only pay attention to high-relevancy targets. Isen (2008a) achieved similar results regarding attention. She found that individuals in a negative mood state (induced by reports of failing a task) performed significantly worse when asked unexpected questions about their waiting room surroundings as opposed to those in a positive mood state (induced by reports of success). Baumann and Kuhl (2005) challenged the argument that individuals in negative affective states are able to better focus on localized information and those in positive affective states are able to better focus on global information, as was reported by Frederickson and Brannigan (2005). Baumann and Kuhl found that, when asked specific local- and global-focused questions, individuals in positive affective states were able to outperform those in negative or neutral states. These three studies suggest that individuals in positive affective states may have increased attentional flexibility, allowing them to perform better on tasks than those in negative states.

Present Study

Considering the findings that individuals take part in multiple working spheres each day (Gonzalez & Mark, 2004; Gonzalez & Mark, 2005), as well as the negative impact multitasking has on an individual's ability to perform well on decision making tasks (Gonzalez, 2005), it is important to look at these requirements in the context of daily work events. Work tasks cannot be examined apart from the contextual aspects of the workplace. Weiss and Cropanzano's (1996) *affective events theory* adds a new perspective to current multitasking and decision making literature. This was supported by the findings of Estrada et al. (1997), and by Huntsinger et al. (2009). In both cases, positive affective states resulted in better performance than either neutral or negative states. Isen and Means (1983) and Baumann and Kuhl (2005) also found that positive mood states led to better information processing and faster decisions. Previous findings of higher performance levels in positive affective states lead to the following hypothesis:

> H1) Participants in positive mood states (i.e., positive hedonic tone) will perform better at a) a decision making task and b) an instant messaging task than those in negative mood states, regardless of activation levels.

As activation increases, autonomic physiological processes like heart rate and breathing are increased. These increased responses result in higher levels of physiological feedback sent to the brain for both monitoring and processing. Mandler (1975) posited that, as states of activation become heightened, individuals must exert increased cognitive resources to attend to physiological responses. This increase in resource usage competes with other processes, acting almost as its own individual complex task, leading to performance decrement (Baddeley 2002; Bourke et al. 1996). Eysenck (1982) also theorized that heightened levels of activation may lower an individual's overall cognitive capacity, resulting in lowered performance while attempting multiple tasks simultaneously. Therefore, the second hypothesis of the current study is as follows:

> H2) Participants in unactivated mood states will perform better at a) a decision making task and b) an instant messaging task than participants in activated mood states, regardless of hedonic tone.

To date, no research has examined possible interaction effects between activation and hedonic tone. In accordance with previous research examining either hedonic tone or activation individually (Baddeley, 2002; Bourke et al., 1996; Estrada et al., 1997; Isen & Means, 1983; Mandler, 1975), activated mood states in the current study could exacerbate the negative effects of being in a negative mood state. When these activation levels are compounded with hedonic tone, specific patterns beyond those captured in the hypotheses may emerge. Therefore, in addition to hypotheses 1 and 2, the present study will examine a possible interaction between activation levels and hedonic tone.

> Hypothesis 3) Mood activation level will interact with hedonic tone to influence an individual’s performance on a) a decision making task and b) an instant messaging task.

Method

Baseline Assessment.

A baseline assessment was performed during pilot testing to evaluate participant performance on the water plant simulation and instant messaging simulation when performed separately, in order to set performance base-lines for each task. The baseline assessment consisted of 51 participants, with an average age of 20 (*SD*= 1.5). Similar to the final study, participants were mostly female (66.7%). A majority of participants were Caucasian (84.3%), followed by African-American (7.8%), Hispanic (5.9%) and “Other” (2.0%). These participants received instructions on, and then took part in one of the two study tasks, via random assignment. After this task was completed, they were presented with the alternate task without the multitasking component. Baseline assessment results indicated that participants scored an average of 77.8% on the decision making task and 80% on the Instant Messaging task when performed separately, indicating the two tasks were of similar difficulty.

Main Study.

Participants. Participants were comprised of undergraduate psychology students from a large public Southeastern university. Of the original 145 participants, 6 had to be dropped because they had participated in the original pilot study. Additionally, 9 were dropped due to guessing the study manipulation, 5 failed to complete the study, and 1 was dropped during analyses due to being a multivariate outlier. Of the 124 participants whose data could be analyzed, participants had an average age of 20 (*SD*=1.75) and were mostly female (77.4%). A vast majority of participants were Caucasian (79.8%), followed by African American (14.5%), Hispanic (3.2%) Asian American or Pacific Islander (1.6%), and “Other” (.8%).

Procedure. Participants were recruited through SONA, an online research participant registration program. Participants received extra credit for their participation, as well as a $3.00 cash incentive that they were told they received for good performance. Data collection took place over the fall 2012 academic semester.

Upon arriving to the lab, participants were told that they would be participating in two separate studies, the first of which involves an evaluation of pictures. They were then told that the first study still needed time to load, and that training for the second study would occur in the meantime. An information sheet was presented, and participants acknowledged their consent. In order to familiarize participants with the decision making task, they read through a PowerPoint presentation with basic operating instructions. They then participated in a brief training session (approximately 3.5 minutes long) to ensure their understanding of how to perform the task. Once this had finished, participants were told the first study had loaded and they could begin.

After providing consent to participate in what participants believed was the first study, they were randomly assigned to one of four mood conditions—activated positive, activated negative, unactivated positive, or unactivated negative. They then viewed a set of 18 pictures from the IAPS picture inventory corresponding to the assigned mood condition, for 6 seconds each. These images had been used in a separate pilot study in order to ensure that they reflected the appropriate hedonic tone and activation level for each condition and normed and validated by researchers at the University of Florida (Lang, Bradley, & Cuthbert, 2008). These picture sets served as the mood manipulation task. After viewing the pictures, participants completed a self-report questionnaire of their current mood state in order to gauge the effectiveness of the mood manipulation (see Appendix A). At this point in time, participants were informed that the first study had been completed, and thanked for their participation.

After completing the mood manipulation task, participants moved on to the multitasking portion of the study. Participants were read a script describing a scenario in which they are the head of operations at a water purification plant. They were told that their task is to manage the purification process through the computer simulation they had been trained on previously, while keeping track of incoming Instant Messages from supervisors, subordinate, and colleagues. Participants were told that they would receive a cash incentive of $3.00 if they scored within the top 75th percentile for both tasks. After asking any questions, the participants began the multitasking component of running a simulation of a water treatment plant and tracking incoming instant messages. Once the simulation was over, researchers recorded scores for the decision making task and handed participants a set of 14 questions regarding the messages they received. Once they completed the quiz, they received a demographic questionnaire which included a question assessing whether they suspected any link between the mood manipulation task and the multitasking (see Appendix B). Participants believed that the researcher was calculating their scores while they filled out the demographic information to determine whether they would receive the $3.00 incentive. Once all participants completed the demographic form, they were told they had scored within the acceptable range and handed $3.00 and a receipt. At this point in time, participants were thanked for their time and provided with a debriefing form and any necessary referrals .

Water Purification Plant Simulation

The Water Purification Plant simulation (WPP) served as a decision-making task to mimic a work scenario (Gonzalez, Lerch, & Lebiere, 2003). As recommended within validation studies (Gonzalez, Lerch, & Lebiere, 2003), this simulation lasted 8 minutes. WPP requires participants to turn a series of valves "on" or "off" to successfully move water through a water purification plant (see Appendix C). Participants have a limited number of valves that can be open at once, and must use complex decision-making skills to successfully move all of the water through the plant by the time intervals provided. The simulation gives feedback in terms of the number of gallons of water that failed to make it through the system, known as "buckets", so that participants are aware of their performance throughout the task. Baseline assessments revealed that participants missed an average of 228.5 buckets (*SD*=78.37) when performing the WPP task without a secondary task.

Instant Messaging Task

The secondary task, an instant messaging simulation, has been specifically designed and pilot tested for this study. The pilot test was used to ensure there is variability in task performance, in order to enable the examination of any group differences. The pilot test included 15 questions, and revealed that participants correctly answered an average of 12 questions (*SD*=2.20). One of the questions was removed, as its level of difficulty did not allow for any variability between individuals. The simulation consists of a blank messaging screen, on which 12 simulated work-related messages from an employer, colleague, or assistant will appear at set 25 second intervals, and remain on the screen for 15 seconds. These times enable the secondary task to continue for the entire duration of the primary task. After the time elapses, messages will disappear to ensure that participants must actively read the messages as they appear. Message appearance will be accompanied by a sound that resembles an instant message arrival in order to more accurately reflect an instant messaging system, and participants will be equipped with headphones so that more than one individual can take part in the study concurrently without distraction. Screen shots of the Instant Messaging Task, along with a list of all statements provided, are included in Appendix D.

Measures

Mood Manipulation Check. The efficacy of the mood manipulation was measured through the use of a self-report scale in accordance with Larsen and Kasimatis' (1990) Current Mood Report. The Current Mood Report scale consists of 24 items designed to assess the mood of a participant at a specific point in time. Participants are asked to describe how accurately the items reflect their current feelings using a 1-5 scale with anchors at 1 (Not at All) and 5 (Very Much). Items include emotions such as "Stimulated", "Relaxed", "Unhappy", and "Bored".

In order to calculate a mood manipulation scores, activation level and hedonic tone were scored separately, in accordance with Larsen & Kasimatis (1990). The participant ratings for the three items relating to low activation items were averaged and subtracted from the average rating for the three activated state items. Therefore, a positive score indicates activation, and a negative score indicates an unactivated state. Hedonic tone was calculated in the same manner, subtracting the average rating for negative mood items from the average rating for positive mood items. Using this formula, a positive hedonic tone score indicates a positive mood, and a negative score indicates a negative mood.

Suspicion Manipulation Check. A question was included at the end of the final questionnaire to gauge participants' possible knowledge of a link between the Mood Manipulation Task and the Multitasking Simulation. The question asks: "What do you think this study is attempting to do?" Responses were coded, and the data of participants whose responses indicated an awareness of the connection between the two studies.

Performance Measures

Water Purification Plant Task Measure. The decision making measure for this study was based on the number of buckets participants failed to empty during the WPP task. For ease of interpretation, this number was turned into a percentage score. This was done by subtracting the number of buckets missed from the total number of buckets that could be missed (1,008). This gave a number of buckets the individual had successfully passed through the task. In order to calculate a percentage, the successful number of buckets was divided by the total number of possible buckets. Therefore, a higher score indicates better performance on the task.

Instant Messaging Measure. The instant messaging measure for this study consisted of 14 questions referencing the messages participants received while working on the WPP simulation. A complete list of these questions can be found in Appendix E. The questions were designed to assess the amount of information participants were able to remember while working on the WPP task. The number of correct answers were summed and divided by the total number of questions (14), resulting in a percentage. Like the WPP measure, a higher score on the instant messaging measure reflects better performance on the task.

Results

Data Screening.

Data screening revealed one unusual multivariate outlier, which was removed from analyses. Normality plots revealed acceptable normality for all variables and conditions. Hedonic tone was skewed in all conditions, although this is expected due to the nature of the manipulation. Therefore, no transformations were performed on the data.

Manipulation Check.

In order to check the effectiveness of the mood induction technique, two separate ANOVAs were run. The first ANOVA examined overall hedonic tone, regardless of activation level (see Table 1). Results indicate that there were significant differences between the positive and negative hedonic tone groups (F (1, 122) = 88.02, $p < .001$). This difference was in the expected direction, as the average hedonic tone for the negative group (M = -.64, SD = .15) was significantly lower than that of the positive group (M = 1.40, SD = .15). The second ANOVA examined overall activation levels, regardless of hedonic tone (see Table 1). Results indicate that this manipulation was also effective, as the two groups scored significantly differently (F (1,122) = 22.88, $p < .001$). The difference for activation levels was also in the hypothesized direction, as the mean score individuals in the activated condition (M = -.44, SD = .14) was higher than the average activation level of participants in the unactivated condition (M = -1.38, SD = .14). Overall, these results indicate that the mood manipulation was successful in inducing the desired mood state for both hedonic tone and activation level.

Hypothesis Testing.

In order to examine the results of the present hypotheses and research question, a 2x2 ANOVA was performed (see Table 2). The first factor of the ANOVA was hedonic tone (pleasant or unpleasant), and the second was the activation (either activated or unactivated). Conducting an ANOVA was expected to reveal any significant main effects for the different dimensions of mood, as well as any possible interactions between hedonic tone and activation level.

No significant main effects for hedonic tone ($F(1, 120) = .40$, $p = .53$), activation level ($F(1, 120) = 2.09$, $p = .15$), or the interaction between the two ($F(1, 120) = .08$, $p = .78$) on the Instant Messaging task were found. Therefore, Hypotheses 1a, 2a, and 3a were not supported.

Results for the Water Purification Plant task indicate that, although there were no significant main effects for hedonic tone, ($F(1,120) = 1.22$, $p = .27$) or activation level ($F(1,120) = 1.84$, $p = .18$), the interaction between these two variables was significant, $F(1,120) = 5.46$, $p < .05$. See Figure 4 for a plot of this interaction. An examination of effect size indicates that the interaction between hedonic tone and activation level was able to account for 4.4% of the variance in performance on the Water Purification Plant task.

In the Negative Hedonic Tone condition, individuals in the High Activation condition performed worse than those in the Low Activation condition. The reverse was true for the Positive Hedonic Tone condition. This finding provides support for Hypothesis 3b, but no support for Hypotheses 1b or 2b.

The current results indicate that there may be disparities in performance on the two tasks. In order to examine possible disparities, an ANOVA was performed to compare performance on the tasks as performed individually compared to task performance concurrently. Pilot test results were used as indicator of consecutive task performance, and general performance during the main study (without including mood conditions) was used as as an approximate measure of concurrent performance. In the pilot study instant messaging task, question 15 was removed from the analysis since this question had not been included in the main study. A t-test was performed for each task with the condition as the independent variable (consecutive or concurrent) and performance as the dependent variable. Results of these t-tests reveal that participants did not perform significantly differently on the water purification plant task (t(173) =.6, p=.55) when it was performed consecutively (M =.77; SD=.01) or concurrently (M =.77; SD=.01) regardless of mood condition (see Table 3). They did, however, perform significantly differently on the instant messaging task (t(173) = 8.14, $p < .001$; See Table 3) when it was performed concurrently. Specifically, participants performed better when completing the instant messaging task alone (M =.84; SD=.02) than they did completing both tasks concurrently (M =.61; SD=.02). These results suggest that participants may have directed more attention to the Decision Making task when required to take part in both tasks simultaneously.

Discussion

The current study sought to integrate multitasking and performance research by examining the impact of mood on multitasking. Although previous research has explored some factors impacting the multitasking use and performance, including polychronicity, work load, and working memory (Bühner et al., 2006; König et al., 2005; König et al., 2001), affective influences have not previously been examined. Considering the influence that affect can have within organizations (Barsade, 2007) and the increasing prevalence of multitasking in organizations (Gonzalez and Mark 2004; 2005), the current study sought to examine the direct impact of affect on multitasking. Specific hypotheses were designed based on the affective events theory (Weiss and Cropanzano, 1996) and the circumplex model of affect (Russell, 1980) to examine the influence that hedonic tone, activation levels, and the interaction between the two have on multitasking performance.

Results of the current study indicate that individuals in a positive mood state did perform slightly better on the decision making task than those in a negative mood state, supporting previous research on the impact of positive affect on attentional flexibility and performance (Derryberry, 1993; Isen, 2008a; Isen, 2008b; Isen & Means, 1983), although this difference was not significant. The results did not support previous literature examining the impact of activation levels on performance (Baddeley 2002; Bourke et al. 1996; Eyesenck, 1982; Mendel, 1975), since there were no main effects found for activation level. The present results do, however, provide evidence to suggest a relationship between mood and activation level interactions on complex task performance, compatible with Russell's (1980) circumplex model of emotion. Within the context of a workplace, this study suggests that performance on complex job tasks may depend not only on an individual's mood, but also the levels of physiological activation the employee experiences. This interaction may have implications for organizations or job positions where employees regularly experience high levels of activation (i. e., high-stress, fast-paced occupations). In these high activation situations, the current research suggests that helping employees maintain a positive mood while working could minimize differences in task performance. For employees in positions that experience low levels of activation, differences in mood do not seem to have as strong of an effect, and may not need to be as highly considered by the organization. In general, organizations should consider attributes of a job that could impact the levels of activation employees experience, and utilize mood management strategies to account for any influence these activation levels may have on employee performance.

Unfortunately, the current study was unable to measure the construct of "multitasking", as performance levels differed between the two tasks. Since the WPP task started first and required constant monitoring and interaction, rather than the intermittent monitoring and rehearsal required by the IM task, participants may have given increased cognitive weight to the WPP task rather than the IM task. This tendency to focus attention on a task considered to have greater importance than the other has been shown in previous research (Konig & Klinemann, 2007). This is supported in the current study by comparisons between the pilot test and main study. Although it was expected that combining the tasks would cause performance on both tasks to decrease slightly, there was no significant decrease in WPP task performance. IM task performance, however, was significantly lower in the main study regardless of participant condition. These results align with those of Hegarty, Shah, and Miyake (2000), who found that participants may sacrifice performance on a secondary task to minimize performance on a task they perceive as more important. Due to the fact that attention was not equally divided between the two tasks in the current simulation, it is not possible to make any assertions regarding the impact of mood on multitasking performance in the current study.

This propensity to favor one task over another could, however, have major implications within contemporary organizations. The results of the current study suggest that employees will direct more of their attention on the task they deem most important, causing performance on the alternative task to greatly decrease. If an organization expects employees to multitask while on the job, supervisors should consider the requirements and attention that both tasks will require. Study instructions informed participants that they needed to reach equal performance levels on both tasks to receive a reward to stress the equal importance of the tasks, yet participants still tended to pay more attention to one of the tasks. Therefore, organizations should also consider the subjective perception that employees maintain regarding task importance. An organization's intended task priority may not coincide with employee performance, particularly if a task deemed less important requires more active participation as it did in the present simulation.

Therefore, employers may want to consider presenting the most crucial tasks to employees individually, rather than adding additional tasks, to ensure optimal levels of performance.

Limitations and Future Directions

A few limitations were present in the current study. One of these limitations was the inability to accurately replicate multitasking due to participants' focus on one of the two tasks at the expense of the other. This restricted the results to an analysis of singular task performance rather than multitasking performance. Future research could address this issue by utilizing two tasks that are equivalent in regards to their level of complexity and the amount of participant interaction required to complete them. Pilot testing should be used to ensure that performance is not significantly decreasing on one task over the other prior to including additional manipulations (such as mood manipulations).

A second limitation is the Instant Messaging system used in the current study. Due to technological limitations, this was required to be a passive rather than an active task. Without any participant interaction throughout the simulation, it may have been more difficult for participants to give adequate attention to the instant messages as they were presented. The set interval presentations may have also posed a problem, since technological limitations did not allow for randomization in the time period between messages. Participants could potentially anticipate when messages would be present, limiting the amount of attention they paid to the IM task.

Future studies should consider utilizing more advanced messaging systems that allow for active participation. This would require greater time and attention dedicated to the messaging task, potentially increasing the saliency of the secondary task. Additionally, researchers should consider presenting messages at random rather than set intervals in order to prevent participant awareness of when messages would be received. This could also increase the amount of attention participants pay to the secondary task.

A third limitation impacting the generalizability of the study was the newness of the task to participants. Within the workplace, employees are performing tasks that they have been trained on, typically over an extended period of time. They are aware of how much attention should be given to each task, and receive feedback allowing them to adjust these levels of attention over time (i. e., being reprimanded for not responding to a boss who messages them or making errors throughout the workday). As the current task was completely new to participants with very little training, it may have been difficult for them to understand how to best divide attention in order to perform optimally on both tasks. Future research could address this issue by using tasks that are already familiar to participants, as has been done in previous research (e.g., Strayer et. al.'s 2011 use of automobile and cell phone simulations). By using familiar tasks, participants are already familiar with the amount of attention they must pay to each task. Additionally, the learning of the task itself would be less likely to interfere with any other manipulations.

References

Albarracin, D. & Hart, W. (2011). Positive Mood + Action = Negative Mood + Inaction: Effects of General Action and Inaction Concepts on Decisions and Performance as a Function of Affect. *Emotion, 11*, 951-957. doi: 10.1037/a0024130.

Appelbaum, S. H., Marchionni, A., & Fernandez, A. (2008). The multitasking paradox: Perceptions, Problems, and Strategies. *Management Decision, 46*, 1313.

Baddeley, A. D. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Science, 4*, 417-423.

Baddeley, A. D. (2002). Is working memory still working?. *European Psychologist*, 7, 85-97.

Baddeley, A.D., & Hitch, G.J. (1974). Working memory. In G.H. Bower (Ed.), *The psychology of learning and motivation, Vol. 8*. New York: Academic Press, 47-89.

Baron, R. A. (1990). Environmentally induced positive affect: Its impact on self-efficacy, task performance, negotiation, and conflict. Journal of Applied Social Psychology, 20, 368–384.

Barrett, L. F. (2010). Discrete emotions or dimensions? The role of valence focus and arousal focus. *Cognition & Emotion, 12.* 579-599.

Barsade, S. G., & Gibson, D.E. (2007). Why Does Affect Matter in Organizations? *Academy of Management Perspectives*, *21*, 36-59.

Bartels, J. M. (2007). Dispositional Positive and Negative Affect and Approach-Avoidance Achievement Motivation. *Individual Differences Research, 5*, 246-259.

Baumann, N., & Kuhl, J. (2005). Positive affect and flexibility: overcoming the precedence of global over local processing of visual information.*Motivation And Emotion*, *29*, 123-134.

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review Of General Psychology*, *5*, 323-370.

Borst, J. P., Taatgen, N. A., & van Rijn, H. (2010). The problem state: A cognitive bottleneck in multitasking. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 36*, 363-382.

Bourke, P. A., Duncan, J., & Nimmo-Smith, I. (1996). A general factor involved in dual-task performance decrement. *The Quarterly Journal of Experimental Psychology, 49A,* 525-545.

Bühner, M., König, C.J., Pick, M., & Krumm, S. (2006). Working Memory Dimensions as Differential Predictors of the Speed and Error Aspect of Multitasking Performance. *Human Performance*, *19*, 253-275.

Cowan, N. (1995). *Attention and memory: An integrated framework.* Oxford, England: Oxford University Press.

Derryberry, D. (1993). Attentional consequences of outcome-related motivational states: Congruent, incongruent, and focusing effects. *Motivation And Emotion*, *17*.

Engle, R. W., Tuholski, S. W., Laughlin, J. E., & Conway, A. R. A. (1999). Working memory, short-term memory, and general fluid intelligence: A latent-variable approach. *Journal of Experimental Psychology: General, 128*, 309-331.

Estrada, C. A., Isen, A. M., & Young, M. J. (1997). Positive affect facilitates integration of information and decreases anchoring in reasoning among physicians. *Organizational Behavior and Human Decision Processes, 72*, 117-135.

Eysenck, Michael W. (1982), *Attention and Arousal,* New York: Springer-Verlag.

Fredrickson, B. L. & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition and Emotion*, *19*, 313-332.

Frijda, N. H. (1993) Moods, Emotion Episodes, and Emotions., in Lewis, M. & Haviland, J. M. (Eds), *Handbook of Emotions,* New York: The Guilford Press, 381-403.

Garrett, R. K., & Danziger, J. N. (2008). IM = Interruption Management? Instant Messaging and Disruption in the Workplace. *Journal of Computer-Mediated Communication, 13*, 23-42. doi: 10.1111/j.1083-6101.2007.00384.x

Gonzalez, C. (2005). Task workload and cognitive abilities in dynamic decision making. *Human Factors, 47*,102-120.

Gonzalez, C., Lerch, F. J., & Lebiere, C. (2003). Instance-based learning in dynamic decision making. *Cognitive Science, 27*, 591-635.

Gonzalez, V. & Mark, G. (2004). "Constant, Constant, Multi-tasking Craziness": Managing Multiple Working Spheres. *Paper presented at the 2004 Computer-Human Interaction Conference,* Vienna, Austria, 113-120.

Gonzalez, V. & Mark, G. (2005). Managing Currents of Work: Multi-tasking Among Multiple Collaborations. in Gellerson, H. et al. (eds.), *ECSCW 2005: Proceedings of the Ninth European Conference on Computer-Supported Cooperative Work,* Paris, France, 143-162.

Green, D. P. & Salovey, P. (1999). In what sense are positive and negative affect independent? A reply to Tellegen, Watson, and Clark. *Psychological Science*, *10*. 304- 306.

Hegarty, M., Shah, P., & Miyake, A. (2000). Constraints on using the dual-task methodology to specify the degree of central executive involvement in cognitive tasks. *Memory & Cognition*, *28*, 376-385. doi:10.3758/BF03198553

Huntsinger, J. R., Sinclair, S., & Clore, G. L. (2009). Affective regulation of implicitly measured stereotypes and attitudes: Automatic and controlled processes. *Journal Of Experimental Social Psychology*, *45*, 560-566. doi:10.1016/j.jesp.2009.01.007.

Isen, A. M. (2008a). Positive affect and decision processes: Some recent theoretical developments with practical implications. In C. Haugdvedt, P. M. Herr, & F. R. Kardes (Eds.), *Handbook of consumer psychology* (pp. 273–296). New York: Psychology Press.

Isen, A. M. (2008b). Some ways in which positive affect influences decision making and problem solving. *Handbook of emotions*, 548-573.

Isen, A. M., & Labroo, A. A. (2003). Some ways in which positive affect facilitates decision making and judgement. S. L. Schneider & J. Shanteau (Eds.), *Emerging perspectives on judgement and decision research*, 365-393: New York.

Isen, A. M., & Means, B. (1983). The influence of positive affect on decision-making strategy. *Social Cognition, 2,* 18-31.

Izard, C. E. (1977). *Human emotions.* New York: Plenum.

Izard, C. E. (1992). Basic emotions, relations among emotions, and emotion-cognition relations. *Psychological Review, 99*. 561-565.

Kalsbeek, J. W. H., & Sykes, R.N. (1967). Objective Measurement of Mental Load. *Aeta Psychologica*, *27,* 253-261.

Kondo, H. & Osaka, N. (2004). Susceptibility of spacial and verbal working memory to demands of the central executive. *Japanese Psychological Research, 46*, 86-97.

König, C. J., Bühner, M., & Mürling, G. (2005). Working memory, fluid intelligence, and attention are predictors of multitasking performance, but polychronicity and extraversion are not. *Human Performance*, *18*, 243-266

König, C. J., & Kleinmann, M. (2007), Time management problems and discounted utility. *The Journal of Psychology, 141*, 321-334.

König, C. J., Oberacher, L., & Kleinmann, M. (2010). Personal and situational determinants of multitasking at work. *Journal of Personnel Psychology, 9*. 99-103.

Lang, P.J., Bradley, M.M., & Cuthbert, B.N. (2008). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8. University of Florida, Gainesville, FL.

Larsen, R. J., & Diener, E. (1992). Promises and problems with the circumplex model of emotion. In M. S. Clark (Ed.), Review of Personality and Social Psychology, Vol. 13 (pp. 25-59). Newbury Park, CA: SAGE Publications, Inc.

Larsen, R. J., & Kasimatis, M. (1990). Individual differences in entrainment of mood to the weekly calendar. *Journal of Personality and Social Psychology,58*, 164-171.

Lench, H. C., Flores, S. A., & Bench, S. W. (2011). Discrete emotions predict changes in cognition, judgment, experience, behavior, and physiology: A meta-analysis of experimental emotion elicitations. *Psychological Bulletin, 137,* 834-855.

Mandler, George (1975), *Mind and Emotion,* New York: John Wiley.

Mark, G., Gudith, D., & Klocke, U. (2008). The Cost of Interrupted Work: More Speed and Stress. *Presented in the CHI 2008 Proceedings: Don't Interrupt Me.* Florence, Italy, 107-110.

Morris, W. N. (1989). *Mood: The Frame of Mind*, New York: Springer-Verlag New York Inc.

Neider, M. B., Gaspar, J.G., McCarley, J.S., Crowell, J.A., Kaczmarski, H., & Kramer, A.F. (2011). Walking and Talking: Dual-Task Effects on Street Crossing Behavior in Older Adults. *Psychology and Aging, 26*, 260-268. doi: 10.1037/a0021566

Oberauer, K. & Hein, L. (2012). Attention to information in working memory. *Current Directions in Psychological Science, 21*, 164-169.

Oberauer, K., Süß, H. M., Wilhelm, O., & Wittmann, W. W. (2003). The multiple faces of working memory: Storage, processing, supervision, and coordination. *Intelligence*, *31*, 167–193.

Ophir, E., Nass, C., Wagner, A. D., & Posner, M. I. (2009). Cognitive control in media multitaskers. *Proceedings of the National Academy of Sciences, 106*, 15583-15587.

Paridon, H, M. & Kaufmann, K. (2010). Multitasking in work-related situations and its relevance for occupational health and safety: Effects on performance, subjective strain and physiological parameters. *Europe's Journal of Psychology, 6*.

Pashler, H. (1994). Dual-Task Inference in Simple Tasks: Data and Theory. *Psychological Bulletin, 116*, 220-244.

Radicati, Instant messaging market, 2011-2015, http://www.radicati.com/?p=7917, 2011

Raghunathan, R. & Pham, M. T. (1999). All negative moods are not equal: Motivational influences of anxiety and sadness on decision making. *Organizational Behavior and Human Decision Processes, 79*, 56-77.

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology, 39*, 1161-1178.

Russell, J. A. & Carroll, J. M. (1999). On the bipolarity of positive and negative affect. *Psychological Bulletin*, *125,. 3-30.*

Russell, J. A. & Carroll, J. M. (1999). The phoenix of bipolarity: Reply to Watson and Tellegen (1999). *Psychological Bulletin, 125*, 611-617.

Salvucci, D. D. & Taatgen, N. A. (2008). Threaded Cognition: An Integrated Theory of Concurrent Multitasking. *Psychological Review, 115*, 101-130. doi: 10.1037/0033-295X.115.1.101

Sinclair, M., Ashkanasy, N. M., & Chattopadhyay, P. (2010). Affective antecedents of intuitive decision making. *Journal of Management & Organization, 16*, 382-398.

Sinclair, R. C. & Mark, M. M. (1995). The effects of mood state on judgmental accuracy: Processing strategy as a mechanism. *Cognition & Emotion, 9,* 417-438.

Strayer, D. L., Watson, J.M., Drews, J.A. (2011). Cognitive Distraction While Multitasking in the Automobile. *The Psychology of Learning and Motivation*, *54*. doi: 10.1016/B978-0-12-385527-5.00002-4.

Tellegen, A., Watson, D. & Clark, L. A. (1999). On the dimensional and hierarchical structure of affect. *Psychological Science, 10,* 297-303.

Tellegen, A., Watson, D. & Clark, L. A. (1999). Further support for a hierarchical model of affect: Reply to Green and Salovey. *Psychological Science, 10.* 307-309.

Van Rooy, D.L. (2006). Effects of automobile commute characteristics on affect and job candidate evaluations: A field experiment. *Environment and Behavior*, *38*, 626.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063-1070.

Watson, D. & Tellegen, A. (1999). Issues in the dimensional structure of affect—Effects of descriptors, measurement error, and response formats: Comment on Russell and Carroll (1999). *Psychological Bulletin, 125,* 601-610.

Weiss, H. M. & Cropanzano, R. (1996). Affective Events Theory: A Theoretical Discussion of the Structure, Causes, and Consequences of Affective Experiences at Work. *Research in Organizational Behavior 18*, 1-74.

Table 1. *Summary of Manipulation Checks*

	df	*F*	η^2	*p*
Hedonic Tone	1	88.02	.42	.00*
Activation Level	1	22.88	.16	.00*

**p<.001*

Table 2. *The effects of hedonic tone and activation level on Decision Making and IM task performance.*

		df	*F*	η^2	*p*
Decision Task	Hedonic Tone Condition	1	1.22	.01	.27
	Activation Condition	1	1.84	.02	.18
	Hedonic Tone*Activation	1	5.46	.04	.02*
Messaging Task	Hedonic Tone Condition	1	0.40	.00	.53
	Activation Condition	1	2.09	.02	.15
	Hedonic Tone*Activation	1	0.08	.00	.78

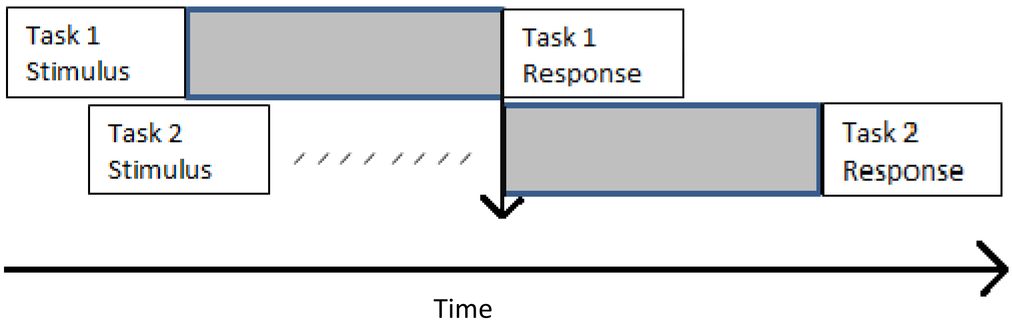
$^*p<.05$

Table 3. *Task Performance on Pilot Test versus Main Study*

	df	*t*	*Cohen's D*	η^2	*p*
Decision Task	173	0.60	0.09	0.05	0.55
Messaging Task	173	8.14	1.23	0.53	0.00*

$^{**}p<.001$

Figure 1. *A Central Bottleneck Example (Pashler, 1994)*



The shaded portion of the figure is processing time. Task 2 processing cannot start until the first task has been completed.

Figure 2. *Baddeley's (2000) Model of Working Memory*

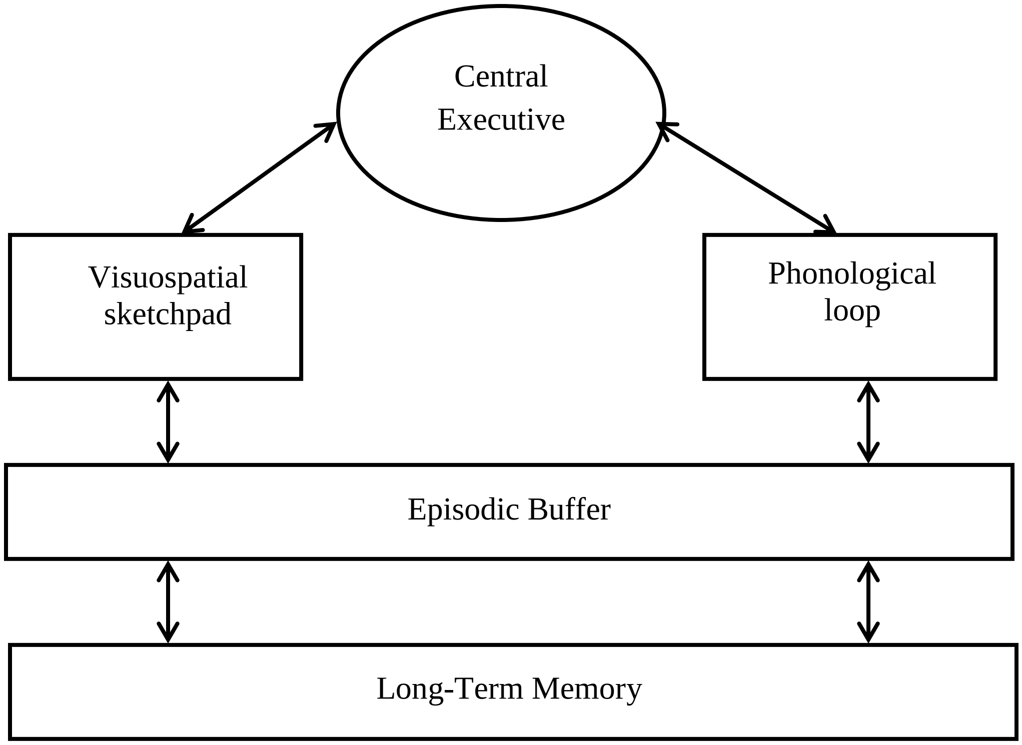
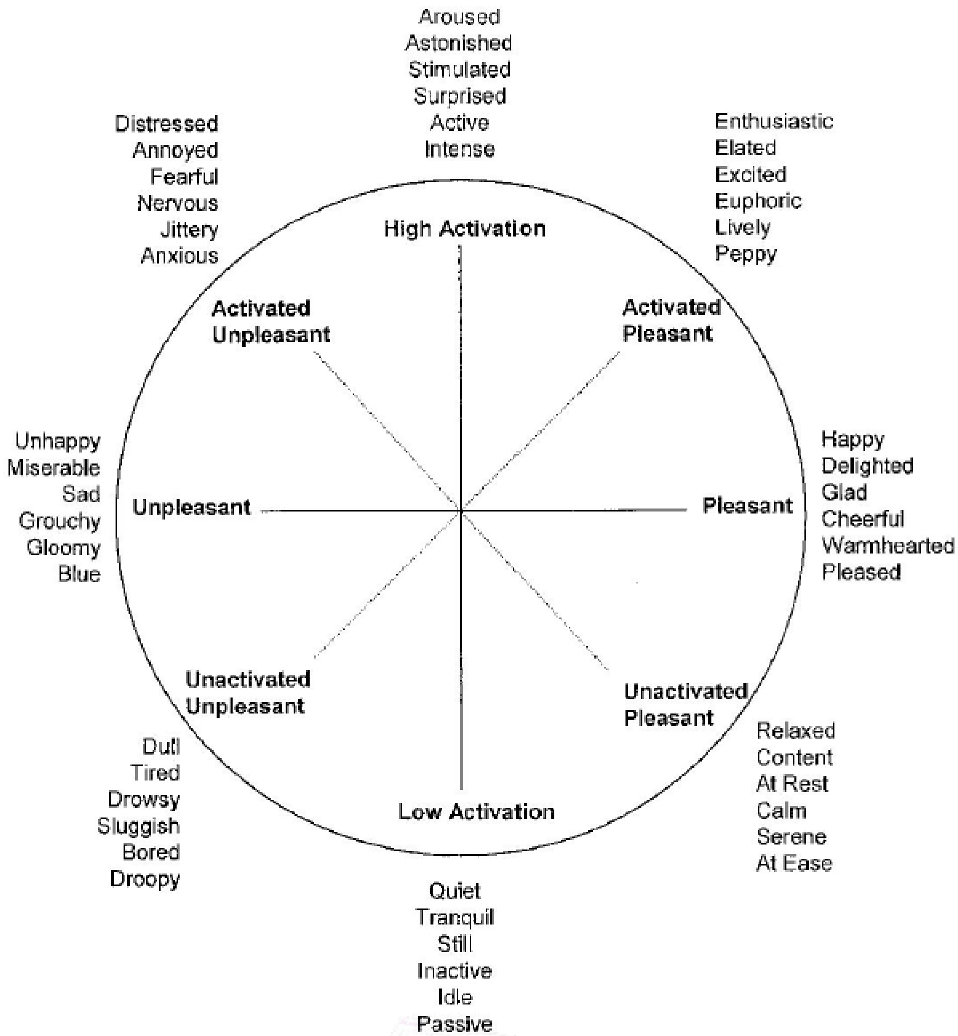
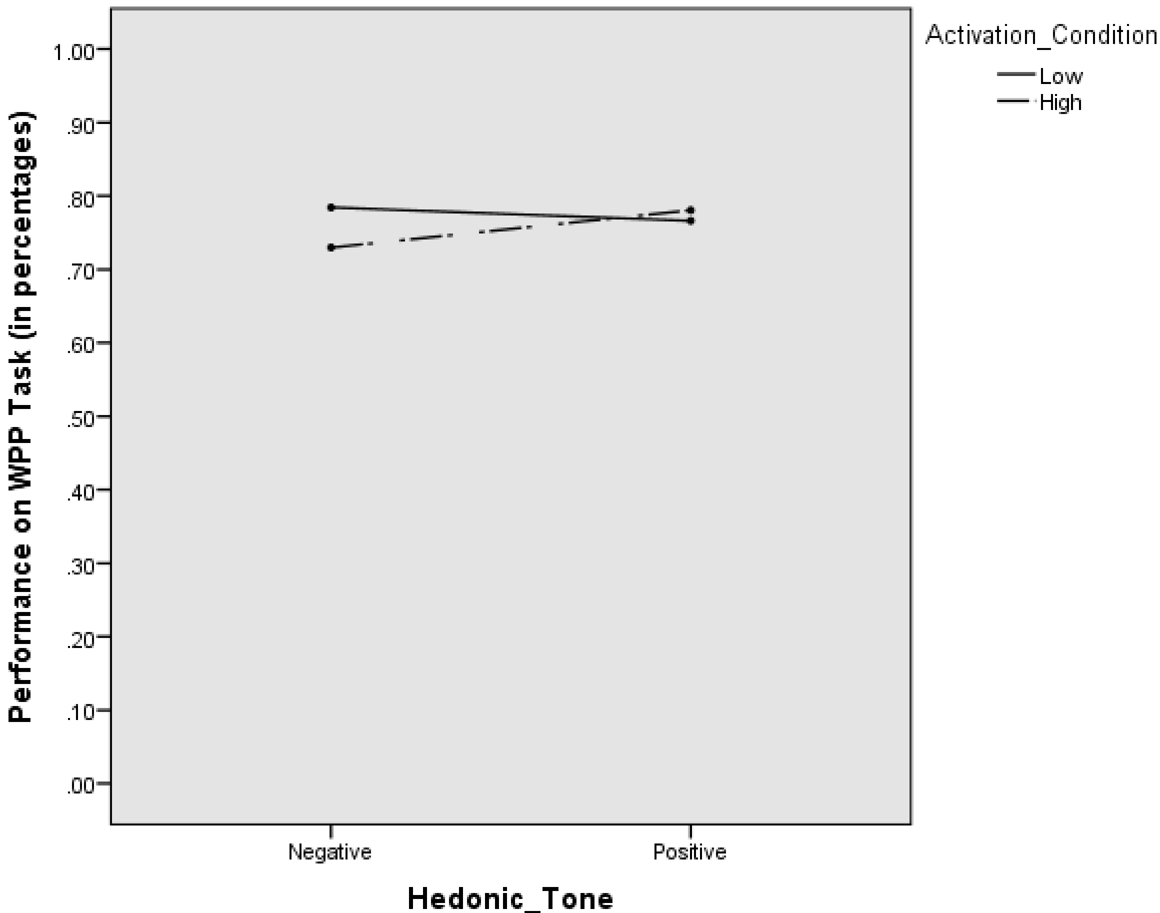


Figure 3. *The Self-Report Affect Circumplex*



Larsen & Diener (1992)

Figure 4. *Interaction between Activation level and Hedonic Tone on WPP Task Performance*



Appendix A

The Self-Report Affect Circumplex

DIRECTIONS: For the following set of items, please describe how you are feeling ***right now***, using the scale below.

Not at All				Very Much
1	2	3	4	5

1. _____Distressed
2. _____Passive
3. _____Stimulated
4. _____Elated
5. _____Enthusiastic
6. _____Annoyed
7. _____Sluggish
8. _____Unhappy
9. _____Content
10. _____Calm
11. _____Bored
12. _____Active
13. _____Aroused
14. _____Sad
15. _____Tranquil
16. _____Inactive
17. _____Tired
18. _____Cheerful
19. _____Anxious
20. _____Glad
21. _____Relaxed
22. _____Excited
23. _____Happy
24. _____Gloomy

Appendix B

Demographics

1. What is your age? ________

2. Which of the following best describes your racial background? (Circle One)
    a. African-American/Black
    b. Caucasian/White (Non-Hispanic)
    c. Hispanic
    d. Asian American/Pacific Islander
    e. Arabic
    f. Native American
    g. Other (specify) ______________________________

3. What is your gender?
    a. Male
    b. Female

4. Are you currently employed?
    a. Yes, hours per week: ________
    b. No

5. Have you ever held a full-time job (at least 40 hours a week)?
    a. Yes
    b. No

6. How many years of full-time work experience do you have? _______

7. What is your cumulative grade point average? ________

8. What is your class standing?
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. Other (specify) ______________________

9. What was your ACT Composite Score (range is from 0 to 36)?
    a. My score was ________
    b. Did not take or can't remember score

10. What was your SAT English Score (range is from 200 to 800)?

a. My score was ________
b. Did not take or can't remember score

11. What was your SAT Math Score (range is from 200 to 800)?
    a. My score was ________
    b. Did not take or can't remember score

12. Politically, I consider myself to be:
    a. Liberal
    b. Moderate
    c. Conservative
    d. Other: __________________________

13. Politically, I would label myself a:
    a. Democrat
    b. Independent
    c. Republican
    d. Libertarian
    e. Other: __________________________

14. Were you suspicious about what the study was about?
    a. Yes
    b. No

15. Did you try to guess what the study was about during the task?
    a. Yes
    b. No

16. What do you think was the purpose of this study?

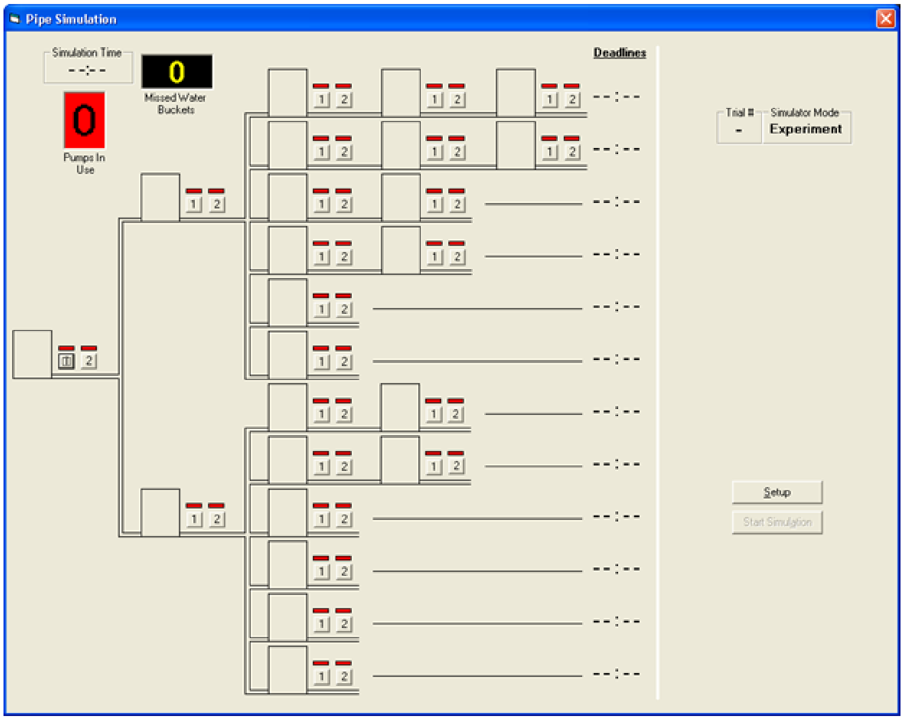
____
____
____

17. Please list your official Auburn e-mail: _______________________________

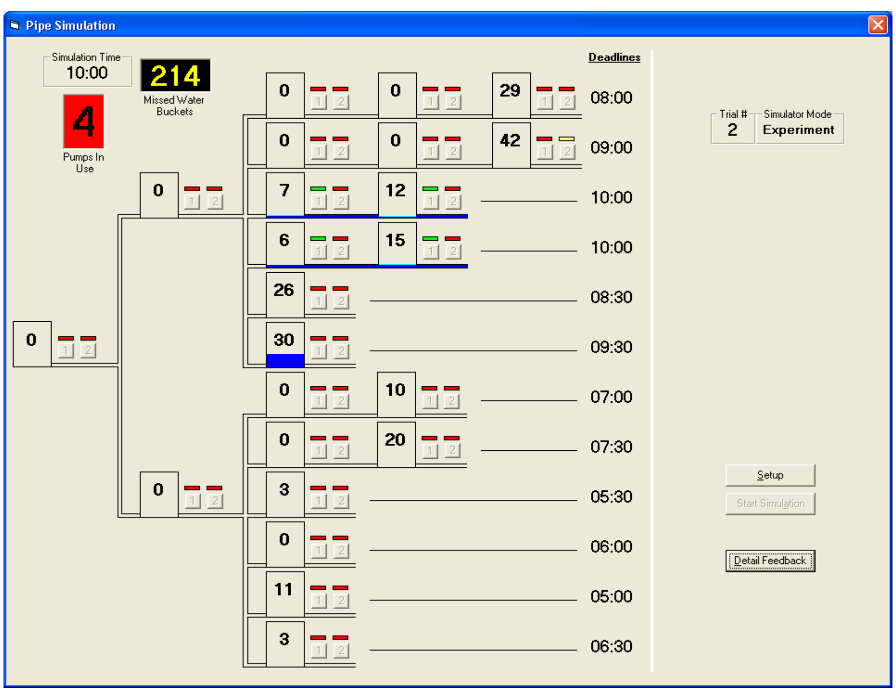
Appendix C

Water Purification Plant Simulation Images

Prior to the beginning of the simulation:



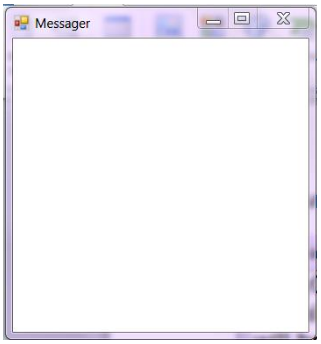
End of the simulation:

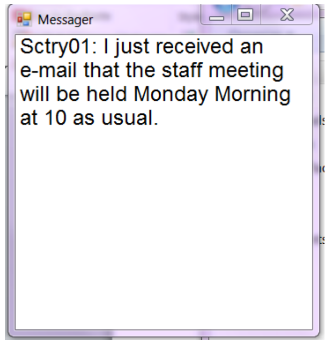


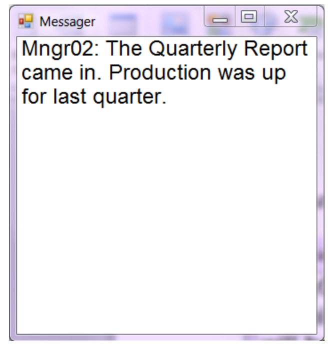
Appendix D

Instant Messaging Simulation

Screen Shots:







Messages Provided:

Secretary (Gabby)	I just received an e-mail that the staff meeting will be held Monday Morning at 10 as usual.
Co-Worker (Chase)	I was able to finish up the write-up for the PureWater project last night. Manager said that he will send it to you after it's been reviewed.
Manager (Jessie)	I am trying to put together the schedule for next month. Make sure you get your availability to me by the end of the day.
Secretary (Gabby)	I scheduled the monthly Operators Meeting for next Tuesday at 3pm in Jessie's office.
Manager (Jessie)	The Quarterly Report came in. Production was up for last quarter.
Secretary (Gabby)	I am going to grab coffee. I'll be back in a couple minutes.
Co-Worker (Chase)	There is going to be a going away party for Sherry tomorrow in the Office Lounge.
Manager (Jessie)	There will be a mandatory training session for all employees. Please schedule with Gabby to find a time that suits everyone.
Co-Worker (Chase)	Would you be able to cover my shift next Friday from 12-4? I need to pick up family at the airport.
Secretary (Gabby)	I just heard back from Chase. We're going to have to move the monthly operator's meeting from Tuesday to Wednesday, same place and time.
Co-Worker (Chase)	I have to leave early today, because my son is sick. Could you turn in my completed Bi-Weekly Production Report along with yours? I left it in my top desk drawer. Thank you so much!
Manager (Jessie)	I just sent you the PureWater write-up. The only issue is that it needs to be completed by the first week of February, not the second. Could you change this and then submit the order?

Appendix E

Instant Messaging Measure

1. Which day is your monthly Operator's Meeting?
    a. Monday
    b. Thursday
    c. Tuesday
    d. Wednesday
2. Where is Chase's Bi-Weekly report located?
    a. In your mailbox
    b. In your desk
    c. In his desk
    d. In their mailbox

3. Where will the going away party be held?
    a. Staff Lounge
    b. Conference room
    c. In the employee's office
    d. In the office cafeteria
4. Who is the going away party for?
    a. Sherry
    b. Chase
    c. Jessie
    d. Jeffery
5. What needs to be changed on the PureWater write up?
    a. The cost inventory
    b. The completion date
    c. Nothing needs to be changed
    d. The address
6. What shift are you covering for Chase?
    a. 9-12
    b. 8-3
    c. 12-4
    d. 9-5
7. What time will your staff meeting be?
    a. 8am
    b. 10am
    c. 12pm
    d. 2pm
8. What happened with production last quarter?
    a. It went up

b. It went down
c. It stayed the same
d. Production was not mentioned

9. Where did your secretary go?
    a. To the restroom
    b. On lunch break
    c. She did not leave
    d. Coffee break
10. What is the name of the new hire who will be shadowing you?
    a. Sherry
    b. Jeffrey
    c. Chase
    d. The new hire was not mentioned
11. Why did your coworker leave early today?
    a. Today is his wife's birthday
    b. To pick up family from the airport
    c. His son is sick
    d. Today is his anniversary
12. Who do you need to schedule with for the mandatory training?
    a. Sherry
    b. Gabby
    c. Chase
    d. Jessie
13. What time is the monthly operator's meeting?
    a. 6am
    b. 9am
    c. 12pm
    d. 3pm
14. Why are you covering Chase's shift?
    a. He has to go to the airport
    b. His son is sick
    c. It's his birthday
    d. It's his anniversary