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The Effects of Mood as a Mediator of Media Multitasking on Cognitive Performance

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by

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Abstract

The Effects of Mood as a Mediator of Media Multitasking on Cognitive Performance

By Nicole Zamanzadeh

The current study investigated the indirect effect of media multitasking on cognitive performance in subsequent single tasking mediated through mood. A post-test between-subjects experiment was conducted to investigate the effects of nonsocial and social media multitasking on mood (i.e., valence and arousal), attention filtering (i.e., ability to selectively pay attention to some information), and inhibitory capacity (i.e., ability to control behavior) as compared to single tasking. The results demonstrate that media multitasking with both nonsocial and social tasks decrease mood valence but increase arousal. Additionally, there is evidence that nonsocial media multitasking may improve behavioral inhibition by increasing arousal. Future research should continue to examine different combinations of tasks that make up media multitasking's task demand and the possible benefits of its effect on mood as well as cognitive performance.

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The Effects of Mood as a Mediator of Media Multitasking and Cognitive Performance

Introduction

The purpose of this study was to investigate media multitasking's benefit to a person's mood (valence and arousal), and to then examine mood as a mediator of media multitasking's effect on subsequent performance on a set of cognitive tasks. The study also explores two forms of media multitasking, "nonsocial" and "social" multitasking.

Media multitasking in this study is defined as the allocation of attention and cognitive effort to two or more tasks, when one task or more includes media. People media multitask with a variety of task combinations. Despite being a relatively complex phenomenon, in its basic form media multitasking requires people to split their attention between tasks rather than engage in a single task or wholly expend attention and effort toward one task. The bulk of research on media multitasking has focused on people's ability to successfully complete multiple tasks while splitting their attention or the potential detrimental effects of chronically dividing one's attention.

Past studies have suffered from several problems. They often have inconsistencies in the way multitasking is defined. They have often ignored the potential consequences of the diversity of tasks that can be involved in multitasking. They have sometimes used potentially unreliable self-reports of time spent concurrently with two or more media. While this past work represents a crucial first step, inconsistencies in the findings suggest that a new methodological and theoretical approach may be necessary. The current study investigates media multitasking's potential effect on mood as well as cognition in a laboratory experiment wherein tasks are systematically manipulated to investigate their unique contributions.

Theoretically, the current study builds a model of media multitasking based on past research that has found that people often media multitask in short spans during the day. They then spend longer periods of time single-tasking or monotasking, that is working on one task without interruption (Yeykelis et al., 2014). This pattern suggests that there may be a short-term benefit to bursts of media multitasking that encourages more chronic media multitasking behavior. The proposition tested in this study is that this benefit is mood improvement.

Decades of media effects research have demonstrated that exposure to various forms of media benefits affective states by providing stimulating content, meaning and enjoyment. It follows intuitively then that media multitasking, which allows a person to incorporate media into other daily tasks, can be used for mood regulation, more technically, for regulation of arousal levels and the valence of affective states. Further, media multitasking may indirectly benefit cognitive performance when people return to single tasking by increasing arousal states and by providing pleasant affective states. The current experiment was designed to evaluate a simple theoretical model in which mood (defined as both arousal and valence) mediates the relationship between media multitasking and cognitive performance tasks such as attentional filtering and behavioral inhibition when people return to single tasking.

Review of the Literature: Media Multitasking

There is great concern among parents and policymakers about young adults and adolescents' constant use of digital devices and the fact that they appear to simultaneously try to complete tasks while viewing media or communicating with others. Yet, much of the research on media multitasking and its effects is inconsistent (Lang & Chrzan, 2015; Van der

Schurr et al., 2015 Wang et al., 2015). Van der Schurr and his colleagues (2015) reviewed investigations of the relationship between media multitasking and cognitive control, socioemotional wellbeing and academic performance measured by GPA, homework performance, and attitudes and beliefs toward school-work. They reported that the effects of multitasking, if they exist at all, are often small to moderate and not consistently replicated. Further, often the relationships reported by researchers are correlational rather than casual (Alzahabi & Becker, 2013; Minear et al., 2013). These problems may be a function of the lack of clear conceptualization and incomplete theorizing. What follows is a review of the ways multitasking has been conceptualized and the primary theoretical perspectives taken by media multitasking researchers.

Defining Media Multitasking

Originally, multitasking research was undertaken by computer scientists. The term "multitasking" was used to describe a computer's capacity to concurrently complete two or more tasks. Although the term multitasking may meaningfully apply to the simultaneous processing of tasks for computers, the term does not so clearly apply to human processing capacity and behavior. People may intend to simultaneously engage in more than one goal and task at a time but the majority of past work shows that humans have certain limitations that prevent them from multitasking like computers. Below contemporary definitions of media multitasking are described, then theoretical perspectives on media multitasking and cognition are discussed.

Media multitasking has been defined as an involvement in two or more tasks, at least one of which involves media (Xu, Wang & David, 2016). However, recent literature reviews by Lang and Chrzan (2015), van der Schurr et al. (2015) and Wang, Cooper, Irwin and

Srivastava (2015) suggest that investigations of media multitasking suffer from certain ambiguities in this definition. Many of these ambiguities involve the tasks undertaken and the mental processes involved in multitasking.

The lack of consistency in defining media multitasking and the multitude of contexts in which it occurs in, together, pose as a challenge to understanding its impact. One vexing question is: When people do attempt to concomitantly engage in two or more tasks is dual tasking successful, does it represent a special type of cognitive capacity, or is this engagement an artifact of the technological devices that are used to facilitate it? For instance, smart phones and laptops provide the capacity to open more than one window at once and access a variety of content on the same screen. This affords the opportunity to participate in several tasks, including more than one form of media at once or consuming media while completing work-related tasks.

Some scholars discuss media multitasking as concurrently engaging with, or engaging in dual tasking using only two media tasks (e.g. texting and television). Others think of media multitasking as involving one form of media such as television and some nonmedia related activity such as doing homework. Finally, scholars do not often address much less agree as to what it means to concurrently work on two tasks. For instance, researchers have not specified what time interval between tasks might be classified as "concurrent" as opposed to rapid task switching.

Definitions of media multitasking also include a variety of behaviors. Multitasking may occur both within and between devices, between media or between media and non-media (e.g., checking Facebook during face-to-face communication). It may be a function of external triggers (e.g., notifications on a device) or internal motivations or self-interruptions

(Adler & Benbunan-Fich, 2013). It may be conscious or top-down process of allocating attention or an unconscious bottom-up phenomenon.

Colloquially put, the cognitive load or distraction due to media multitasking during an academic lecture may not be the same as switching to email someone in the middle of dinner with a romantic partner, nor is it the same as texting while watching television or receiving a call while working on homework. Each of these activities undertaken in a variety of contexts, with a variety of devices and media, may require different cognitive processes.

Defining Nonsocial vs. Social Media Multitasking. A further definitional refinement involves the difference between nonsocial and social multitasking. The social aspects of media tasks may be a meaningful dimension for distinguishing forms of media multitasking. "Nonsocial" media multitasking refers to media multitasking in which the media tasks undertaken do not involve an interaction with a person. "Social" media multitasking, on the other hand refers to media multitasking with media tasks that include interacting with other people synchronously or asynchronously.

Earlier work by others has not directly tested the effects of various types of tasks involved in media multitasking, but there is some suggestion from previous research that media multitasking with social media differs from nonsocial media multitasking. Media multitasking with the social media platform Facebook is associated with less focused engagement with tasks compared to media multitasking in the absence of a social platform such as Facebook (Judd, 2014). Karpinski et al. (2013) also found that participants who reported routinely media multitasking with social media also had lower grades in school. Finally, Rosen, Whaling, Rab, Carrier, and Cheever (2013) found that media multitasking with social media in particular was associated with clinical symptoms of depression, mania, narcissism, antisocial disorder, compulsive disorder and paranoid disorders. This suggests that social media multitasking may be a unique form of media multitasking and comparing it with nonsocial media multitasking may yield useful information.

Information Processing Approaches

The term multitasking applied to human behavior originates in information processing perspectives. Information processing approaches to multitasking focus on the "limited capacity" to cognitively process complex information and on so called "bottlenecking" of cognitive functioning that place constraints on peoples' capacity to multitask. These approaches differ slightly in how they conceive of "dual tasking"--a process many scholars believe to be the central feature of media multitasking. Both of these models are discussed immediately below. The application of these theories has primarily focused on the possibility that people can be successful at media multitasking (Chrzan & Lang, 2015).

Limited capacity models. Those researchers who embrace a limited capacity model assert that a finite set of cognitive resources such as working memory become strained when engaging in multiple tasks (Lang, 2009). Investigations have since identified the costs of multitasking or allocating cognitive resources either simultaneously known as "dual tasking" or in serial switches known as "task switching." According to this approach multitasking increases reaction times and therefore efficiency while completing certain tasks due to the strains associated with divided attention and working memory. The model predicts that multitasking leads to cognitive overload by placing excess demands on limited resources. From a limited capacity perspective, it may be possible to dual task, but there are costs to task performance due to this cognitive strain.

Cognitive bottlenecking models. The cognitive bottlenecking model suggests that higher order cognitive functions such as decision-making or goal development require people to serially processing information. This serial process fundamentally limits people's ability to attend to two tasks simultaneously (Salvucci & Bogunovich, 2010). From the cognitive bottlenecking perspective, people are not actually capable of dual tasking. They are limited by higher-order functions. Cognitive bottlenecking models conceive of people serially switching cognitive effort between tasks in order to complete more than one task in less time. Scholars using this approach believe people can only task "switch" they cannot dual task.

Multitasking, whatever the cognitive processes involved differ depending on what tasks one is asked to undertake. The following section discusses information processing approaches that have also considered the characteristics of the tasks themselves to make predictions about the effects of media multitasking.

Extensions of information processing theories to media multitasking. Two sets of researchers, Lang and Chrzan (2015) and Wang, Cooper, Irwin and Srivastava (2015) have considered the combination of both task characteristics and cognitive load, and have used the combination of the two to predict the likelihood of successful media multitasking.

Lang and Chrzan's (2016) approach is the simpler of the two. They argue that not all media multitasking is equally harmful to task performance. Rather, the type of task combinations undertaken will determine media multitasking's success. They expect that tasks' difficulty (e.g., novelty and interactivity) and overlap with required information-processing resources (e.g., vision or linguistic processing) predict the success of media multitasking. These researchers urge scholars to consider the possibility that, depending on the combinations of tasks at hand, there may be benefits to media multitasking. They specifically single out the socioemotional benefits. Similarly, Wang et al. (2014) found that college students report that they are aware they are less efficient and effective when they media multitask, but are willing to accept that cost for the emotional benefits.

Wang et al. (2015) have developed a more complex model. They identify 11 dimensions that may contribute to the cognitive load of media multitasking and thus the effectiveness of task performance. These dimensions include: task hierarchy, task switch, task relevance, shared modality, task contiguity, information modality, information flow, emotional content, behavioral responses, time pressure and user differences. Wang et al. (2015) also theoretically combine both the limited capacity models and cognitive bottlenecking into one function and call it the "law of less work." They predict that people are motivated to reserve as many cognitive resources as possible. Wang and her colleagues (2015) found support for their ideas in a study wherein participants reported more instances of media multitasking when the tasks they performed did not include the same modalities (i.e. visual, auditory or kinesthetic modalities).

Taken together, these two perspectives suggest that the effects of media multitasking depend on the tasks people are asked or choose to undertake. Media multitasking becomes more cognitively demanding when tasks require overlapping cognitive resources and when tasks are more difficult (e.g. involve more novelty or demand higher interactivity). The current study will examine media multitasking with academic tasks. This study investigates the combination of an academic task with either nonsocial media tasks or social media tasks (compared to single tasking) using a single device. This study is designed to determine if tasks' differences in cognitive demands have an effect on affective states (moods) and later indirectly benefit attentional filtering and behavioral control capacities.

Media Multitasking and Mood Regulation

Media and mood. A considerable amount of research has found that people take advantage of media's mood altering capacities (Knobloch, 2003). They find media consumption can be used strategically for mood management, mood adjustment, and mood repair. This section will briefly review theoretical and empirical support for media's effect on mood.

Moods may be characterized in several ways but generally a distinction is made with regard to two continua: valence (pleasantness) and intensity (arousal). Mood management theory originally proposed that people choose to consume media based upon the valence of the emotions it will evoke. Zillmann (1988) labeled this tendency the "hedonic principle"-- people choose to engage in entertainment media viewing because it is enjoyable. However, this idea is challenged by the fact that people use media as a means of experiencing negative emotions such as sadness or fright. Scholars have since labeled some media experiences as producing eudemonic pleasure wherein media experiences are pleasurable because they are meaningful. The current thinking is that media can be pleasurable regardless of the positive or negative valence of its content.

Others have advanced the notion of mood management and suggested that arousal plays a significant part in people's media choices. Mood Adjustment Theory, Self-regulation Theory, LC4MP, Flow Theory and the Activation Model of Information Exposure all make the argument that people seek optimal levels of stimulation or arousal and regulate this arousal through media content and task demand (Adler & Benbunan-Fich; Csikzentmihalyi, 1990 ;Donohew, Palmgreen, & Duncan, 1980; Knobloch, 2003; Lang, 2009). For instance, Bowman and Tamborini (2013) note that boredom and stress, two noxious moods, only differ in their arousal potential (stress is over-stimulating, boredom under-stimulating). People make different media choices that regulate this arousal. Stressed participants chose moderate-demand tasks while bored participants preferred high-demand tasks. In summary, then, research has shown that media choices reflect both mood valence and arousal.

Valence versus arousal. In the present study it is speculated that the valence or pleasantness of a person's mood might differ depending upon the content of tasks chosen during media multitasking (e.g., work is not pleasant while a clip of a person's favorite comedian may well be pleasant). However, the implications of arousal for multitasking are less immediately apparent. Recent research on the intersection of arousal and task demand may have important implications for understanding the effects of media multitasking. Multitasking clearly increases task demand by increasing the number of tasks being processed, which may have arousing properties regardless of the valence of the particular content. The various media tasks that might be included in media multitasking might also differ in task demands and thus have different arousal regulating properties regardless of valence. Specifically, the current study is interested in nonsocial and social media multitasking's' differences in task demand.

Indeed, past research on media multitasking suggests that it can be used to increase arousal and mood valence, and to achieve desired arousal levels. Yeylekis et al. (2014) content analyzed 12 students' laptop usage and found that task-switching between work and media could be predicted by measuring spikes of arousal that indicated "sensation-seeking." They found that while engaging in work-related tasks, involvement often becomes low or interest drops, and a boost of arousal occurs in anticipation immediately before switching to new or entertaining content found through media multitasking. Adler and Benbunan-Fich

(2013) conducted an experiment in which participants were given multiple tasks to complete within a limited time period. They later asked participants what led them to multitask. Participants reported often switching tasks because they experienced a negative emotion such as boredom or frustration with a task. These findings are supported in a study by Wang et al. (2014), which found that college students prefer media multitasking despite its negative consequences for effectiveness and efficiency because it benefited their emotional state. In sum, these findings suggest mood regulation is not only a benefit of media multitasking, but also that people consciously pursue these benefits. This line of research then leads to the first hypothesis to be tested in this study.

H1: Engaging in media multitasking will increase pleasant mood valence and arousal more than single tasking. E

Media Multitasking and Cognitive Performance

The bulk of literature on media multitasking has been concerned with its deleterious consequences for productivity and cognitive control (Van de Schurr et al., 2015). These concerns have largely been aimed at college-age and high-school students who media multitask while completing academic tasks. The current study examines media multitasking's effect on cognitive performance when media multitasking with an academic task.

The results of studies examining the effects of chronic media multitasking on cognitive capacity are mixed. Some have found negative effects, while others have not. One of the most undesirable effects of multitasking is a diminished capacity for focus or an increased distractibility. Laboratory research on multitasking has revealed a tendency for high media multitaskers to have difficulty filtering out irrelevant information, (attention filtering) and difficulty suppressing the activation of another task, (behavioral inhibition) (Ophir, Nass, & Wagner, 2009). Ophir et al. (2009) found that media multitaskers performed worse on a task that included distracting information and required them to filter their attention known as the AX-CPT. The AX-CPT is an attention-filtering task that requires participants to identify “AX” combinations in a string of letters. Ophir et al. (2009) found that heavy media multitaskers made more when there were distractor letters between “A” and “X” such that they incorrectly detect “AX” combinations when they had not occurred, known as false alarms. Heavy media multitaskers also had slower reaction times to correct “AX” combinations. Other studies have demonstrated that high multitaskers tend to tax their attentional limits, ultimately performing less well on work related tasks and often taking longer to complete tasks (Pashler, Kang, & Ip, 2013; Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013).

Outside the laboratory, Ralph, Thomson, Cheyne, and Smilek (2013) used a series of self-report measures to investigate how the habitual division of attention influenced daily life. They found an association between media multitasking and attentional failures in addition to a propensity for mind wandering or engrossment in “off-task” thoughts. Participants in this study also reported more attention-related errors in their daily lives such as “snacking without being aware that I’m eating” or “I have gone to the fridge to get one thing and got something else.” This is not uncommon. In many studies, participants report that media multitasking is related to less effective and efficient work as well as express experiencing constant distractions (Wang, Tchernev & Solloway, 2012; Zhang & Zhang, 2012).

In addition to attentional deficits and issues with behavioral inhibition, multitasking and media multitasking have been associated with other cognitive control issues including a number of forms of memory and working-memory impairments. In a study on task performance and multitasking, Srivastava (2013) found participants who were multitasking made more errors in both recall and recognition. Another study found that while completing tasks, even a simple addition of background noise led participants to encode and retain less information (Lee, Lin, & Robertson, 2011).

Yet, other studies have not found negative relationships between multitasking and attentional deficits or behavioral inhibition. For instance, Baumgartner, Weeda, and Van der Heijdan (2014) conducted an experiment to examine how using media with non-media activities affects executive functions – specifically working memory, inhibition, and attention shifting in adolescents. Although they found that media multitasking was associated with self-reports of problems with working memory, inhibition of thoughts and attention shifting, multitasking was not predictive of actual task performance for working memory and attention shifting. Rather, media multitasking was weakly associated with *improved* behavioral inhibition.

Other scholars have also failed to find a negative relationship between multitasking and cognitive performance. Minear et al. (2014) for example failed to replicate Ophir et al.'s (2009) initial finding that media multitasking was related to deficits in filtering out distractions. In fact, Alzahabi and Becker (2013) found that heavy media multitaskers often have an increased capacity to shift attention. This suggests at least the possibility that not all media multitasking is destructive to cognitive performance. Cordoso-Leite, Green, and Bavelier (2014) even contend that by playing video games people can be trained to overcome the costs of media multitasking to attention and working memory and benefit from it. These contradictory findings suggest that the relationship between media multitasking and cognitive performance may be mediated or moderated by other unspecified variables. It is proposed here that one such variable is mood (valence and arousal). This is discussed in the next section.

Mood and Cognitive Performance

Previous research has shown that mood regulation influences cognitive performance, but the findings of these studies are mixed. Mood-state may affect motivation, physiological responses and regulation processes related to cognitive load (Choi et al., 2013; Morris, Leclerc, & Kensinger, 2013; Ortner, Zelazo, & Anderson, 2013). Noxious moods such as sadness have been shown to have a negative impact on attention, inhibition, and attention shifting. Chepenik, Cornew, and Farah (2007) suggested that sad moods bias memory and attention, as well as diminish working-memory and inhibition performance. However, anxiety, which can be conceptualized as high arousal, negatively valenced state, differs from sadness in that there are instances in which anxiety has been beneficial for cognitive performance (Eysenck, Derakshan, Santos, & Calvo, 2014). This suggests that higher arousal levels can benefit cognitive performance regardless of mood valence, but that positive mood valence generally provides the optimal state for cognitive performance. For instance, Yang and Yang (2014) demonstrated that positive affect improved executive functioning such as attentional control. Positive affect may increase cognitive flexibility in attention and reduce the costs of shifting attention. Research on mood and cognitive performance suggests that increases in mood valence and arousal levels would benefit attentional mechanisms and behavioral inhibition.

The present study investigates mood as a mediator of media multitasking and as it effects on attention-filtering and behavioral inhibition. It is predicted that because media multitasking increases task demand and has mood regulating properties, it improves affective states both in terms of valence and arousal. This may create a favorable condition for cognitive performance. (Recall, cognitive performance is reflected by fewer mistakes or more correct responses and quicker reaction times on correct responses.)

Therefore, it is predicted that mood will mediate the relationship between media multitasking (both social and nonsocial) and cognitive performance. Specifically, media multitasking will increase pleasant mood valence and arousal, and this improved mood will benefit cognitive performance. It is predicted that both nonsocial and social forms of media multitasking will improve mood since multitasking of any sort appears to increase task demand and can be pleasant.

This mediated relationship is displayed in Figure 1. It is predicted that nonsocial media multitasking and social media multitasking will improve mood as compared to single tasking and that this improvement is expected to have an indirect effect on cognitive performance.

H2: Nonsocial media multitasking will have an indirect effect on cognitive performance on the attention-filtering (i.e. AX-CPT) task, mediated by mood valence and arousal state such that it will:

a) decrease the number of false alarms,

b) increase the number of correct probe-cue detections, and

c) decrease reaction times.

H3: Nonsocial media multitasking will have an indirect effect on cognitive performance on the behavioral inhibition (i.e. go-no-go) task, mediated by mood such that it will:

a) decrease the number of incorrect "go"s,

b) decrease the number of incorrect "no-go"s, and

c) decrease reaction times.

H4: Social media multitasking will have an indirect effect on cognitive performance on the attention-filtering (i.e. AX-CPT) task, mediated by mood valence and arousal state such that it will:

a) decrease the number of false alarms,

b) increase the number of correct probe-cue detections, and

c) decrease reaction times.

H5: Social media multitasking will have an indirect effect on cognitive performance on the behavioral inhibition (i.e. go-no-go) task, mediated by mood such that it will:

a) decrease the number of incorrect "go"s,

b) decrease the number of incorrect "no-go"s, and

c) decrease reaction times.

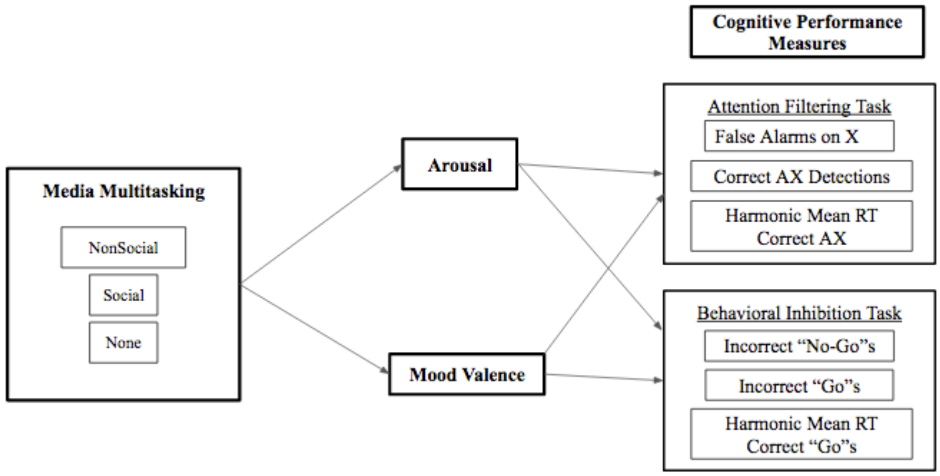

Figure 1. Theoretical model of media multitasking's indirect effect on cognitive performance, mediated by mood valence and arousal.

Nonsocial vs. Social Media Multitasking

Finally, nonsocial and social media tasks differ in task demand, rewards and cognitive load required for media multitasking. Lang and Chrzan (2016) and Wang et al. (2015) have suggested that media multitasking with social media may generally place the least strain on cognitive resources. Further, social forms of media often provide the most amount of control. For instance, they generally allow for asynchronous communication in which one has control over the pace of conversations and length of responses, which determines the task demand. Nonsocial media multitasking often involves less interactive media and thus demands fewer behavioral responses. Yet, nonsocial media multitasking often requires overlapping cognitive and information processing resources (linguistic and visual processing) and is generally intended for consumption within one sitting and lasts for longer periods of time than text-based social media tasks. Nonsocial media consumers often have less control over the pace of the information they receive and process. The content of nonsocial media tasks, however, may be less personally relevant and thus less emotionally influential than the information that is received in social media multitasking. Social media multitasking allows for more self-expression and direct influence over the information. This makes it difficult to predict exactly how social and nonsocial media multitasking may differ from one another. However, it is important to distinguish between the effects of various tasks involved in media multitasking. Therefore, it is important to ask the following question:

> RQ1: Will nonsocial media multitasking or social media multitasking have a greater direct effect on mood valence and arousal and therefore a larger indirect effect on cognitive performance?

Method

Design

A post-test between-subjects experiment was conducted to investigate the effects of media multitasking (with nonsocial media tasks or with social media tasks) on affect, attention filtering, and inhibitory capacity as compared to single tasking. In order to investigate the hypothesized affective and cognitive benefits of media multitasking, participants engage in (1) single tasking, (2) media multitasking with nonsocial media tasks or (3) media multitasking with social media tasks, and then report their mood by assessing the valence or pleasantness and intensity or arousal states. Participants then completed two cognitive performance measures: attention-filtering and behavioral inhibition.

Sample

Participants (*N*=204) were recruited from the Communication Department's research pool of lower division students at the University of California, Santa Barbara (UCSB). Students were compensated with a nominal amount of course credit for their participation in the experiment.

Materials

Academic task. In all conditions, participants were given 10 fill-in-the blank questions from the verbal portion of a practice Graduate Record Examination (GRE) exam. These questions were taken from Kaplan tests. GRE questions were chosen because they are academic in nature.

Nonsocial media tasks. The nonsocial media tasks were traditional entertainment media that were not interactive. They were chosen to be mildly pleasant.

There were two nonsocial media tasks. One task was an audio task. This task was an educational TED talk in which the speaker discusses his scientific research. The other task was a visual plus audio task. This visual plus audio media task was a five-minute clip from *Ocean Voyager,* a documentary on the life and migrations of white whales from Natural Planet. Both were used in the nonsocial media multitasking and single tasking condition.

Social media tasks. There were two text-based social media tasks included in the social media multitasking condition. The first task required participants to engage in an asynchronous form of computer-mediated communication. Participants were assigned the task of reading a Twitter feed for #AppleMusic and asked to respond with their own tweet. This task is asynchronous because there was no real time interaction with another person.

The second task was a synchronous task. It required participants to engage in a conversation with a confederate. This conversation was about increases in university tuition costs. These topics were chosen to be relevant to student participants but not overly emotionally stimulating.

Measures

Affect. Participants' affective state was measured by an adapted version of the Russell, Weiss, and Mendelsohn (1989) affect grid. This measurement instrument requires subjects to represent their emotional state on a 10 x 10 grid. The grid is arranged from unpleasant to pleasant affect on the x-axis and high to low arousal on the y-axis. The center of the grid represents a neutral feeling (Knobloch & Zillman, 2002).

Attention filtering AX-CPT. Ophir and colleagues' (2009) filtering AX-CPT was used to measure selective attention and filtering of information from working memory. The original AX-CPT was modified to include three distractor letters between the cue letter, "A" and the probe letter, "X". This required participants to keep in mind the cue letter when they saw the probe "X." Additionally, not all trials included the probe "X," in some trials the probe was either a "Y" or a "K." These additional letters were included as distractors. In trials using "Y" or "K" as probes participants were required to identify incorrect combinations regardless of the cue letter. The participant indicated "Yes," when the correct combination of cue and probe appeared, or "No," for any incorrect combination. All letters were presented for 1000 milliseconds and participants were given 1000 milliseconds to respond at the end of each cue-probe pair. This resulted in at least 4900 milliseconds between the cue and probe letter. This filtering AX-CPT consisted of 150 trials. Seventy-percent of these trials were correct cue-probe combinations. The task was developed using Direct RT software.

False alarms on X. False alarms on X measured participants' incorrect detections of "AX" combinations in instances when the target probe letter "X" was present without the probe letter, "A."

***Correct probe-cue detections*.** Correct probe-cue detections refers to participants correctly detecting or correctly pressing “Yes” on true “AX” combinations.

Harmonic mean reaction times on correct detections. Harmonic mean reaction times on correct detection measured participants’ average reaction time on correct probe-cue detections. Calculation of a harmonic means accounts for outliers within an individual’s performance (Ratcliff, 1993).

Behavioral inhibition: Go-no-go task. The go-no-go task is a cognitive performance measure of sustained attention and response control or inhibition developed by Fillmore, Rush and Hays (2006). It includes trials with the following sequence of events: (a) presentation of a fixation point (+) for 800 milliseconds; (b) a blank white screen for 500 milliseconds; (c) a cue, displayed for one of five stimulus onset asynchronies (SOAs = 100, 200, 300, 400 and 500 milliseconds); (d) a go or no-go target, which remained visible until a response occurred or 1000 milliseconds had elapsed; and (e) an intertrial interval of 700 milliseconds.

A “go” target in this task was a green rectangle. When presented with a green rectangle, particiapnts' were required to respond by hitting the spacebar. Participants were required to repond regardless of the rectangle's orientation. Blue rectangles were “no-go” targets. Participants were required to withold response on trials with "no-go" targets. Blue and green rectangles were dispersed among white rectangles. White, blue and green rectangles each flash upon the screen for 500 miliseconds for a total of 120 trials. Eighty-percent of trials were a “go” target and the remaining 20 percent were “no-go” targets. This task took roughly 10 minutes to complete.

Incorrect "go"s. Incorrect "go"s measured the number of incorrect responses to "go" stimuli. Incorrect responses to "go" targets were defined as a lack of response to a green rectangle.

Incorrect "no-go"s. Incorrect "no-go"s measured the number of incorrect responses to "no-go" stimuli, or the number of times participants' hit the spacebar despite being presented with a blue rectangle.

Harmonic mean reaction times on correct "go"s. Harmonic mean reaction times on correct "go"s measured participants' average reaction time on correct responses to "go" targets. Harmonic means were used because they account for outliers within an individual's performance (Ratcliff, 1993).

Procedure

Participants were randomly assigned to one of three conditions: (1) single tasking with nonsocial media tasks, (2) nonsocial media multitasking, and (3) social media multitasking. Each participant completed a set of three tasks. Upon completing these tasks either by single tasking or multitasking, the participants were presented with a graph and asked to indicate their affective state.

In the final portion of the study participants were presented with behavioral cognitive measures. The order of the tasks was arbitrary. First, researchers introduced the participants to the filtering AX-CPT task. The participants were then provided time to orient to the task, ask questions and become familiar with the task before beginning. Once participants completed the filtering AX-CPT, they were introduced to the go-no-go task. Participants were also given oral instructions for the go-no-go task and provided a trial or practice period.

This was done in order to reduce possible language barriers or misunderstandings of the instructions. Once participants were comfortable, they proceeded to complete the task.

Manipulations

Single tasking. In the single tasking condition, participants completed three tasks sequentially in Media Lab. These tasks included an academic task (i.e. 10 GRE questions), and two nonsocial media tasks (the clip of *Ocean Voyager* and the TED Talk). Participants were instructed to pay attention to the information during these tasks because they would have to answer questions about the content later. The order of these tasks was randomized per participant. Each of these tasks generally required at least five minutes to complete. The single tasking condition required a total of fifteen minutes.

Nonsocial media multitasking. In the nonsocial media multitasking condition, participants completed three tasks within a limited time. These three tasks -- the GRE questions, the clip of *Ocean Voyager*, and the TED Talk podcast -- were all opened on the participant's computer monitor simultaneously. The participants were told they had 10 minutes to complete the three tasks. They were also told that these tasks usually required 15 minutes. In the instructions, it was recommended that participants' media multitask. Pariticpnats were then told that they would be asked questions about the content of the tasks later. Participants were timed for 10 minutes. Regardless of whether they completed the task, participants were asked to stop working at the end of then ten-minute period.

Social media multitasking. In the social media multitasking condition, participants were prompted to media multitask. They were given three tasks: ten GRE questions to complete, a Twitter feed with #AppleMusic to read, and the Skype account to contact the confederate. All three tasks were simultaneously opened on the participants' computer monitor. Participants were then given 10 minutes to complete all tasks. In the instructions, it was recommended that participants media multitask.

Results

Descriptives and Data Screening

Table 1 displays the means and standard deviations of all continuous variables. None of the mediators exhibited substantial non-normality or outliers. Most of the dependent variables of cognitive performance (i.e., measures of attention filtering and behavioral inhibition) did not exhibit non-normality. However, incorrect “no-go”s and incorrect “go”s both exhibited kurtosis and skewness in their distributions (refer to Table 1). A number of the cognitive performance measures also exhibited outliers, but no transformations were undertaken. Table 2 displays the correlations amongst the mediators and dependent variables

Missing data. Of the 204 participants who participated in the study, only 174 participants had at least some data on one of the two cognitive performance tasks. Because performance measures on attention-filtering and behavioral inhibition tasks were essential for the study, participants who did not have at least some data on one of these two tasks were deleted. This missing data is largely due to issues with software used to run the experiment originally, which malfunctioned. Because of these problems, use of this software was discontinued. Instead, participants were presented each of the cognitive performance tasks separately rather than through the software program, which had combined them.

Data Analysis

For the media multitasking conditions, contrast coding was employed. The base group of single tasking received a value of zero, and each other level receives one in one of the coding variables mtreat1 or mtreat 2. This coding allows for a comparison of each of the media multitasking conditions to the single tasking control condition. Table 3 displays the coding of these two variables refer to Appendix A. Using these coded variables, Hypothesis 1 was tested using an ANOVA. Both contrast-coded variables were entered as predictors of cognitive performance in the linear regression.

Hayes' PROCESS macro was used for mediation analysis for Hypotheses 2, 3, 4 and 5. For these hypotheses, PROCESS tested the indirect effect hypothesized as well as the direct effects within the model depicted in Figure 1. This model was run separately for each of the six dependent variables: three dependent variables are measures from the attention-filtering task and three dependent variables are measures from the behavioral inhibition task. Together, these six dependent variables measure cognitive performance. Therefore, the results of three models will reported for Hypotheses 2-5.

Hypothesis 1

> **H1**: Engaging in nonsocial media multitasking and social media multitasking will increase pleasant mood valence and arousal.

Results from the ANOVA indicate H1 was partially supported. In this analysis, both nonsocial and social media multitasking had a significant effect on mood valence and arousal in comparison to single tasking.

First, the effect of nonsocial and social media multitasking on mood valence was assessed. Nonsocial media multitasking had a significant effect on pleasantness of mood valence F (1,168) = 5.22, $p < .05$. Specifically, on average participants who media multitasked with nonsocial tasks (M = 0.91, SD = 0.39) reported less pleasant moods than participants who single tasked or media multitasked with social tasks (M = 1. 98, SD = 0.59). Social media multitasking had a similar significant effect on pleasantness of mood valence F

(1, 169) = 4.12, *p* < .05. Social media multitasking (*M* = 1.18, *SD* = 0.41) led to less pleasant moods than single tasking or nonsocial media multitasking (*M* = 1.84, *SD* = 0.54). Both forms of media multitasking led to less pleasant moods in comparison to single tasking.

Second, we assessed the effect of both forms of media multitasking on arousal states. Nonsocial media multitasking in comparison to single tasking had a significant effect on arousal states F(1, 168) = 9.18, *p* < .01. Nonsocial media multitasking (*M* = 1.81, *SD* = 0.69) led to higher arousal states than single tasking or social media multitasking (*M* = -0.21, *SD* = 0.57). Social media multitasking had a nearly significant effect on arousal states in comparison to single tasking, F(1, 168) = 3.70, p = .056. Social media multitasking (*M* = 0.68, *SD* = 0.64) led to a slightly higher arousal state than single tasking or nonsocial media multitasking (*M* = 0.36, *SD* = 0.48).

In summary, engaging both forms of media multitasking led to higher arousal states, but led to less pleasant mood valences than engaging in single tasking did.

Hypothesis 2

H2: Nonsocial media multitasking will have an indirect effect on cognitive performance on the attention-filtering (i.e. AX-CPT) task, mediated by mood valence and arousal such that it will:

a) decrease the number of false alarms,

b) increase the number of correct probe-cue detections, and

c) decrease reaction times.

Hypothesis 2a mood valence: Decrease the number of false alarms. Hypothesis 2a predicted that nonsocial media multitasking would have an indirect effect on the number of false alarms during the attention-filtering task that would be mediated by mood valence. This was not supported. In Step 1, the contrast between nonsocial media multitasking and the control, single tasking did not significantly predict number of false alarms, $b = .21$ $t = .80$ $p = .43$. This indicated no significant direct effect of nonsocial media multitasking on the number of false alarms as opposed to single tasking.

In Step 2, the contrast between nonsocial media multitasking and single tasking did not significantly predict mood valence, $b = -1.12$, $t\ (167) = -1.55$, $p = .12$. Also, nonsocial media multitasking and mood valence were negatively related. This is in the opposite direction of the prediction.

In Step 3, mood valence and the contrast between nonsocial media multitasking and single tasking were also not significantly related to the number of false alarms $R^2 = .09$, $F\ (2, 164) = .66$, $p = .51$. The bootstrapped confidence intervals found no evidence of mediation in the model, with an indirect effect of .02, 95% CI[-.31 .73].

Hypothesis 2a arousal: Decrease the number of false alarms. Hypothesis 2a predicted that nonsocial media multitasking would have an indirect effect on the number of false alarms during the attention-filtering task that would be mediated by arousal. This was not supported. In Step 1, the contrast between nonsocial media multitasking and the control, single tasking did not significantly predict number of false alarms, $b = .25$ $t(165) = .92$, $p = .36$. This indicated no significant direct effect of nonsocial media multitasking on the number of false alarms.

In Step 2, the contrast between nonsocial media multitasking and single tasking significantly predicted arousal, $b = 1.94$, $t\ (165) = 2.31$, $p < .05$. Thus nonsocial media multitasking significantly increased arousal in contrast to single tasking.

In Step 3, arousal and the contrast between nonsocial media multitasking and single tasking were not significantly related to the number of false alarms R^2= .07, F (2, 164)= .43, *p* = .65. The bootstrapped confidence intervals found no evidence of mediation in the model, with an indirect effect of -.01, 95% CI[-.14 .08].

Hypothesis 2b mood valence: Increase the number of correct probe-cue detections. Hypothesis 2b, which predicted nonsocial media multitasking would have an indirect effect on the number of correct probe-cue detections during the attention-filtering task mediated by mood valence, was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict number of correct probe cue detections, *b* = -.01 *t (163)*= -.13 *p* = .89. This indicated no significant direct effect of nonsocial media multitasking on correct probe-cue detections mediated by mood valence. This relationship is in the opposite direction from the prediction.

In Step 2, the contrast between nonsocial media multitasking and the control, single tasking was not significantly related to mood valence, *b* = -.90, *t(163)*= -1.25, *p*=21. This relationship is in the opposite direction from the original prediction.

In Step 3, the logistic regression of mood valence and the contrast between nonsocial media multitasking and single tasking on the number of correct probe cue detections was not significant, R^2= .15, F (2,163)= 1.78, *p* = .17. The bootstrapped confidence intervals found no evidence of mediation in the model, with an indirect effect of -.01, 95% CI[-.05, .003].

Hypothesis 2b arousal: Increase the number of correct probe-cue detections. Hypothesis 2b, which predicted nonsocial media multitasking would have an indirect effect on the number of correct probe-cue detections during the attention-filtering task mediated by arousal, was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict number of correct probe cue detections, *b* = -.04 *t(163)*= -.31 *p* = .76. This indicated no significant direct effect of nonsocial media multitasking on correct probe-cue detections mediated by arousal. This relationship is in the opposite direction from the prediction.

In Step 2, the contrasts between nonsocial media multitasking and single tasking significantly predicted arousal state, *b* = 2.07 *t (163)*= 2.43, *p* < .05. As predicted, this designates a significant positive relationship between nonsocial media multitasking and arousal state.

In Step 3, the logistic regression of arousal and the contrast between nonsocial media multitasking and single tasking on the number of correct probe cue detections was not significant, R^2= .01, F (2,162)= 1.10 *p* = .33 The bootstrapped confidence intervals found no evidence of mediation in the model, with an indirect effect of .02, 95% CI[-.004, .07]. Though both the indirect and direct effect of nonsocial media multitasking are not statistically significant, the indirect effect is in the correct direction (i.e. positive) as opposed to the direct effect.

Hypothesis 2c mood valence: Decrease reaction times. Hypothesis 2c, which predicted nonsocial media multitasking's indirect effect on the harmonic mean reaction times on correct probe-cue detections for the attention-filtering task mediated by mood valence, was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict harmonic mean of reaction times on correct probe-cue detections *b* = 26.37, *t(157)* = 1.13, *p* = .26. This indicates nonsocial media multitasking has no significant direct effect on correct probe-cue detection reaction times.

In Step 2, the contrast between nonsocial media multitasking and single tasking is not significantly related to mood valence, b = -.95, $t(157)$= -1.28, p =.20. This contradicts the predicted positive relationship between nonsocial media multitasking and mood valence (i.e. pleasantness of mood).

In Step 3, the logistic regression of mood valence and the contrast between nonsocial media multitasking and single tasking on harmonic mean of reaction times on correct probe-cue detections was not statistically significant R^2= .01, F (2,156)= .75, p = .47. The bootstrapped confidence intervals found no evidence of mediation in the model, with an indirect effect of .85 95% CI[-2.65, 10.75].

Hypothesis 2c arousal: Decrease reaction times. Hypothesis 2c, which predicted nonsocial media multitasking's indirect effect on the harmonic mean reaction times on correct probe-cue detections for the attention-filtering task mediated by mood valence, was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict harmonic mean of reaction times on correct probe-cue detections b = 30.81, $t(157)$ = 1.31, p = .19. This indicates nonsocial media multitasking has no significant direct effect on correct probe-cue detection reaction times.

In Step 2, the contrasts between nonsocial media multitasking and single tasking significantly predicted arousal state, b = 1.89, t (157)= 2.19, $p < .05$. Nonsocial media multitasking and arousal state are significantly positively related.

In Step 3, the logistic regression of mood valence and the contrast between nonsocial media multitasking and single tasking on harmonic mean of reaction times on correct probe-cue detections was not statistically significant R^2= .01, F (2,156)= 1.08, p = .34. The bootstrapped confidence intervals found no evidence of mediation in the model, with an indirect effect of -3.68 95% CI[-16.28, 3.18].

In summary, nonsocial media multitasking has a direct effect on arousal only and does not have a direct or indirect effect on performance on the attention-filtering task.

Hypothesis 3

> H3: Nonsocial media multitasking will have an indirect effect on cognitive performance on the behavioral inhibition (i.e. go-no-go) task, mediated by mood valence and arousal such that it will:
>
> a) decrease the number of incorrect "go"s,
>
> b) decrease the number of incorrect "no-go"s, and
>
> c) decrease reaction times.

Hypothesis 3a mood valence: Decrease the number of incorrect "gos". Hypothesis 3a predicted the indirect effect of the contrast between nonsocial media multitasking and single tasking on number of incorrect "go"s on the behavioral inhibition (i.e. go-no-go) task mediated by mood valence, but was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict the number of incorrect "go"s, b = -.90, t (151) = -1.09, p = .27. This indicated there was no significant direct effect of nonsocial media multitasking on incorrect "go"s.

In Step 2, the contrast between nonsocial media multitasking and single tasking did not significantly predict mood valence, b = -1.002, $t(151)$= -1.32, p =.19. Nonsocial media multitasking not only did not predict mood valence, but the two are negatively related. This is in the opposite direction of the prediction.

In Step 3, the logistic regression of mood valence and the contrast between nonsocial media multitasking and single tasking on number of incorrect “go”s was not significant, R^2= .01, F (2,150)= .63, *p* = .53. There is no evidence of mediation in the model. Nonsocial media multitasking had an indirect effect of .03, 95% CI[-.21, .51] on incorrect “gos.”

Hypothesis 3a arousal: Decrease the number of incorrect “gos”. Hypothesis 3a predicted the indirect effect of the contrast between nonsocial media multitasking and single tasking on number of incorrect “go”s on the behavioral inhibition (i.e. go-no-go) task mediated by arousal, and was supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict the number of incorrect “go”s, *b* = -.48, *t (151)* = -1.06, *p* = .29. This indicated there was no significant direct effect of nonsocial media multitasking on incorrect “go”s.

In Step 2, the contrasts between nonsocial media multitasking and single tasking significantly predicted arousal, *b* = 2.24, *t(151)*= 2.51, *p* < .05. Because nonsocial media multitasking is positively related to arousal state, this supports the prediction.

In Step 3, the logistic regression of arousal and the contrast between nonsocial media multitasking and single tasking on number of incorrect “go”s was significant, R^2= .04, F (2,150)= 3.33 *p* <.05. In this model, the contrast between nonsocial media multitasking and single tasking did not significantly predict incorrect “gos,” *b* = -.48 *t (151)*= -.59, *p* =.56. However, arousal significantly predicted the number of incorrect “go”s, *b* = -.17, *t (151)*= -2.34, *p* < .05. This indicates that arousal state is negatively related to the number of incorrect “go”s, which is in partial support of the model. The bootstrapped confidence intervals found an indirect effect of -.38, 95% CI[-1.18, -.04], which provides minimal evidence of arousal’s mediation of the number of incorrect “go”s.

Hypothesis 3b mood valence: Decrease the number of incorrect "no-go"s. Hypothesis 3b, which predicted an indirect effect of nonsocial media multitasking on the number of incorrect "no-go"s during the behavioral inhibition (i.e. go-no-go) task mediated by mood valence, was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict the number of incorrect "No-go"s, b = -.46, $t(152)$ = -.67, p = .50. This indicated that nonsocial media multitasking does not have a significant direct effect on instances of incorrect "no-go"s.

In Step 2, the contrast between nonsocial media multitasking and single tasking did not significantly predict mood valence, b = -.88, $t(153)$= -1.16, p =.25. Nonsocial media multitasking not only did not predict mood valence, but the two are negatively related. This is in the opposite direction of the prediction.

In Step 3, the logistic regression of mood valence and the contrast between nonsocial media multitasking and single tasking on number of incorrect "no-go"s was not significant, R^2= .004, F (2,152)= .28, p = .76. There is no evidence of mediation in the model. Nonsocial media multitasking had an indirect effect of .03, 95% CI[-.03, .29] on incorrect "no-go"s.

Hypothesis 3b arousal: Decrease the number of incorrect "no-go"s. Hypothesis 3b, which predicted an indirect effect of nonsocial media multitasking on the number of incorrect "no-go"s during the behavioral inhibition (i.e. go-no-go) task mediated by arousal, was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict the number of incorrect "No-go"s, b = -.61, $t(132)$ = -.86, p = .39. This indicated that nonsocial media multitasking does not have a significant direct effect on instances of incorrect "no-go"s.

In Step 2, the contrast between nonsocial media multitasking and single tasking significantly predicted arousal, *b* = 2.20, *t(153)*= 2.49, $p<.05$. Nonsocial media multitasking is positive related to arousal, which supports the original prediction.

In Step 3, the logistic regression of arousal and the contrast between nonsocial media multitasking and single tasking on number of incorrect "no-go"s was not significant, R^2= .01, F (2,152)= .95, *p* = .39. There is no evidence of mediation in the model. Nonsocial media multitasking had an indirect effect of .17, 95% CI[-.03, .70] on incorrect "no-gos."

Hypothesis 3c mood valence: Decreases reaction times. Hypothesis 3c predicted nonsocial media multitasking's indirect effect on the harmonic mean reaction times on correct "go"s for the behavioral inhibition task was mediated by mood valence, but was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict harmonic mean reaction times on correct "go"s for the behavioral inhibition task, *b* = -1.18 *t(153)* = -.19, *p* = .85. This indicated no significant direct effect of nonsocial media multitasking on reaction times or response rates on correct "go"s.

In Step 2, the contrasts between nonsocial media multitasking and single tasking was not significantly related to mood valence, *b* = -1.06, *t (153)*= -1.41, *p* =.16. This negative relationship was in the opposite direction of the original prediction and was not significant.

In Step 3, the logistic regression of arousal and the contrast between nonsocial media multitasking and single tasking on harmonic mean of reaction times on correct "go"s was not significant, R^2= .001, F (2,151)= .07, *p* = .93. The bootstrapped confidence intervals found minimal evidence of mediation in the model, with the contrast of nonsocial media multitasking and single tasking having an indirect effect of .25, 95% CI[-1.09, 2.85].

Hypothesis 3c arousal: Decreases reaction times. Hypothesis 3c predicted nonsocial media multitasking's indirect effect on the harmonic mean reaction times on correct "go"s for the behavioral inhibition task mediated by arousal, but was not supported. In Step 1, the contrast between nonsocial media multitasking and single tasking did not significantly predict harmonic mean reaction times on correct "go"s for the behavioral inhibition task, *b* = 2.28 *t(153)* =36, *p* = .72. This indicated no significant direct effect of nonsocial media multitasking on reaction times or response rates on correct "go"s.

In Step 2, the contrasts between nonsocial media multitasking and single tasking significantly predicted arousal, *b* =2.26, *t (153)*= 2.53, $p < .05$. A positive relationship between nonsocial media multitasking and arousal state provides partial support for the model.

In Step 3, the logistic regression of arousal and the contrast between nonsocial media multitasking and single tasking on harmonic mean of reaction times on correct "go"s was not significant, R^2= .02, F (2,150)= 1.57, *p* = .21. The bootstrapped confidence intervals found minimal evidence of mediation in the model, with an indirect effect of -2.27, 95% CI[-7.55, .-.01].

In summary, nonsocial media multitasking had a direct effect on arousal, which had a direct effect on number of incorrect "go"s and reaction times on correct "go"s. Nonsocial media multitasking has a small negative in indirect effect on the number of incorrect "go"s and reaction times on correct "go"s mediated by arousal state. Nonsocial media multitasking had no statistical significant direct effect on mood valence. Mood valence also did not have a direct effect on performance on the behavioral inhibition task. Nonsocial media multitasking did not have an indirect effect on incorrect "no-go"s.

Hypothesis 4

H4: Social media multitasking will have an indirect effect on cognitive performance on the attention-filtering (i.e. AX-CPT) task, mediated by mood valence and arousal such that it will:

a) decrease the number of false alarms,

b) increase the number of correct probe-cue detections, and

c) decrease reaction times.

Hypothesis 4a mood valence: Decrease the number of false alarms. Hypothesis 4a predicted the indirect effect of social media multitasking on the number of false alarms during the attention-filtering task mediated by mood valence, but was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict number of false alarms, b = -.26, $t(164)$= -1.004, p = .32.This indicated no significant direct effect of social media multitasking on the number of false alarms in the attention-filtering tasks.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related to mood valence, b = -.83, $t(164)$= - 1.19, p = .23. This indicates social media multitasking does not significantly directly affect mood valence.

In Step 3, mood valence and the contrast between social media multitasking and single tasking also did not significantly predict the number of false alarms on the attention-filtering task, R^2= .01, F (2, 164)= .85, p = .43. The bootstrapped confidence intervals found no evidence of mediation in the model, with social media multitasking having an indirect effect on number false alarms of .02, 95% CI[-.02, .14].

Hypothesis 4a arousal: Decrease the number of false alarms. Hypothesis 4a predicted the indirect effect of social media multitasking on the number of false alarms during the attention-filtering task mediated by arousal, but was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict number of false alarms, b = -.24, $t(165)$= -.92, p = .36.This indicated no significant direct effect of social media multitasking on the number of false alarms in the attention-filtering tasks.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related to arousal state, b = .49 $t(165)$= .59, p= .56. Despite not being significant, this relationship is in the predicted direction.

In Step 3, arousal and the contrast between social media multitasking and single tasking also did not significantly predict the number of false alarms on the attention-filtering task, R^2= .005, F (2, 164)= .42, p = .65. The bootstrapped confidence intervals found no evidence of mediation in the model, with social media multitasking having an indirect effect on number false alarms of -.005, 95% CI[-.06, .04].

Hypothesis 4b mood valence: Increases correct probe-cue detection. Hypothesis 4b predicted social media multitasking's indirect effect on correct probe-cue detections during the attention-filtering task was mediated by mood valence, but was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict number of correct probe-cue detections, b = -.02, $t(163)$= -.25, p = .77. This indicated no significant direct effect of social media multitasking on correct probe-cue detections during attention filtering.

In Step 2, the contrast between social media multitasking and single tasking did not significantly predict mood valence, *b* = -.96, *t(164)*= -1.38, *p*=.17. There was a negative relationship between media multitasking and mood valence, which if the opposite direction from the prediction.

In Step 3, the logistical regression of mood valence and the contrast between social media multitasking and single tasking on the number of correct probe-cue detections was not statistically significant, R^2= .02, F (2,162)= 1.80, *p* = .17. However, only mood valence approaches a statistically significant relationship with the number of correct probe-cue detections, *b* = .01, *t(164)*=1.84, *p* =.07. The bootstrapped confidence intervals found no evidence of mediation in the model, with an indirect effect of -.01, 95% CI[-.05, .002].

Hypothesis 4b arousal: Increases correct probe-cue detection. Hypothesis 4b predicted social media multitasking's indirect effect on correct probe-cue detections during the attention-filtering task was mediated by arousal, but was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict number of correct probe-cue detections, *b* = -.03, *t(163)*= .54, *p* = .59. This indicated no significant direct effect of social media multitasking on correct probe-cue detections during attention filtering.

In Step 2, the contrast between social media multitasking and single tasking did not significantly predict arousal, *b* = .45, *t(163)*= .54, *p* = .59. Though the positive relationship between social media multitasking and arousal was not significant, it was in the predicted direction.

In Step 3, the logistical regression of arousal and the contrast between social media multitasking and single tasking on the number of correct probe-cue detections was not statistically significant, R^2= .01, F (2,162)= 1.01, *p* = .35. The bootstrapped confidence intervals found no evidence of mediation in the model, with an indirect effect of .004, 95% CI[-.01, .04].

Hypothesis 4c mood valence: Decreases reaction times. Hypothesis 4c predicted social media multitasking's indirect effect on the harmonic mean reaction times on correct probe-cue detections for the attention-filtering task would be mediated by mood valence, but was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict harmonic mean of reaction times on correct probe-cue detections *b* =6.02, *t(157)* = .27, *p* = .79. This indicates social media multitasking has no significant direct effect on reaction times on correct probe-cue detections during the attention-filtering task.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related to mood valence, *b* = -.91, *t(157)*= - 1.27, *p* = .20. The negative relationship between social media multitasking and mood valence is in the opposite direction of the original prediction.

In Step 3, regressing mood valence and the contrast between social media multitasking and single tasking on harmonic mean of reaction times on correct probe-cue detections was not significant, R^2= .002, F (2,156)= .15, *p* = .86. The bootstrapped confidence intervals also found no evidence of mediation in the model. Social media multitasking had an indirect effect on reaction times of 1.01, 95% CI[-2.19, 10.91] using mood valence as a mediator.

Hypothesis 4c arousal: Decreases reaction times. Hypothesis 4c predicted social media multitasking's indirect effect on the harmonic mean reaction times on correct probe-cue detections for the attention-filtering task would be mediated by arousal, but was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict harmonic mean of reaction times on correct probe-cue detections $b = 7.50$, $t(157) = .33$, $p = .74$. This indicates social media multitasking has no significant direct effect on reaction times on correct probe-cue detections during the attention-filtering task.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related to arousal, $b = .32$, $t(157) = .38$, $p = .70$. The positive relationship between social media multitasking and arousal is not significant, but is in the predicted direction.

In Step 3, regressing arousal and the contrast between social media multitasking and single tasking on harmonic mean of reaction times on correct probe-cue detections was not significant, $R^2 = .001$, $F(2,156) = .10$, $p = .75$. The bootstrapped confidence intervals also found no evidence of mediation in the model. Social media multitasking had an indirect effect on reaction times of -.46, 95% CI[-6.16, 2.33] using arousal as a mediator.

In summary, social media multitasking has no direct effect on mood (i.e. valence or arousal), no direct effect on performance on the attention-filtering task, and no indirect effect on performance during the attention-filtering task.

Hypothesis 5

H5: Social media multitasking will have an indirect effect on cognitive performance on the behavioral inhibition (i.e. go-no-go) task, mediated by mood valence and arousal such that it will:

a) decrease the number of incorrect "go"s,

b) decrease the number of incorrect “no-go”s, and

c) decrease reaction times.

Hypothesis 5a mood valence: Decrease the number of incorrect “Go”s.

Hypothesis 5a predicted the indirect effect of the contrast between social media multitasking and single tasking on number of incorrect “go”s on the behavioral inhibition (i.e. go-no-go) task, but was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict the number of incorrect “go”s, b = .74. t *(152)* =.94, p = .35. There was no significant direct effect of social media multitasking on incorrect “go”s.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related to mood valence, b = -.82, $t(151)$= - 1.13, p =.26. This negative relationship is not significant and is in the opposite direction from the prediction.

In Step 3, together mood valence and the contrast between social media multitasking and single tasking also did not significantly predict number of incorrect “go”s, R^2= .01, F (2,150)= .47, p = .62. The bootstrapped confidence intervals found no evidence of mediation in the model, with social media multitasking having an indirect effect of .01, 95% CI[-.19, .45] with mood valence as the sole mediator.

Hypothesis 5a arousal: Decrease the number of incorrect “Go”s. Hypothesis 5a predicted the indirect effect of the contrast between social media multitasking and single tasking on number of incorrect “go”s on the behavioral inhibition (i.e. go-no-go) task would be mediated by arousal, but was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict the number of incorrect “go”s, b

= .81, *t (151)* =1.06, *p* = .29. There was no significant direct effect of social media multitasking on incorrect “go”s.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related to arousal, *b* = .34, *t(151)*= .38, *p* =.70. This positive relationship is not significant but is in the predicted direction.

In Step 3, however, arousal and the contrast between social media multitasking and single tasking significantly predicted number of incorrect “go”s, R^2= .05, F (2,150)= 3.73, *p* < .05. Of the two predictors, only arousal state significantly predicted the number of incorrect “go”s, *b* = -.18, *t (151)*= -2.55, *p* < .05. The bootstrapped confidence intervals found no evidence of mediation in the model, with social media multitasking having an indirect effect of -.06, 95% CI[-.44, .25] with arousal as the sole mediator.

Hypothesis 5b mood valence: Decrease the number of incorrect “No-Go”s. Hypothesis 5b, which predicted social media multitasking’ indirect effect on the number of incorrect “no-go”s during the behavioral inhibition (i.e. go-no-go) task mediated by arousal, was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict the number of incorrect “no-go”s, *b* = .98, *t(153)* = 1.50, *p* = .13. This indicated social media multitasking had no significant direct effect on incorrect “no-go”s.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related to mood valence, *b* = -.91, *t(153)*= -1.27, *p* = .20. This negative relationship is in the opposite direction from the original prediction, but ultimately is not significant.

In Step 3, regressing mood valence and the contrast between social media multitasking and single tasking on the number of incorrect “no-go”s was not statistically significant, R^2= .01, F (2,152)= 1.18, *p*= .31. The bootstrapped confidence intervals also found no evidence of mediation in the model, with social media multitasking having an indirect effect of .01, 95% CI[-.06, .13] mood valence as the sole mediator.

Hypothesis 5b arousal: Decrease the number of incorrect “No-Go”s. Hypothesis 5b, which predicted social media multitasking’ indirect effect on the number of incorrect “no-go”s during the behavioral inhibition (i.e. go-no-go) task mediated by mood valence, was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict the number of incorrect “no-go”s, *b* = .98, *t(153)* = 1.50, *p* = .13. This indicated social media multitasking had no direct effect on incorrect “no-go”s.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related to arousal, *b* = .31, *t(153)*= .36, *p* = .72. Though this positive relationship is not significant, it is in the predicted direction.

In Step 3, regressing arousal and the contrast between social media multitasking and single tasking on the number of incorrect “no-go”s was not statistically significant, R^2= .02, F (2,152)= 1.71, *p* = .18. Neither predictor significantly predicts incorrect “no-gos.” The bootstrapped confidence intervals also found no evidence of mediation in the model, with social media multitasking having an indirect effect of .02, 95% CI[-.07, .33] arousal as the sole mediator.

Hypothesis 5c mood valence: Decreases reaction times. Hypothesis 5c, which predicted an indirect effect of social media multitasking’s on the harmonic mean reaction times on correct “go”s for the behavioral inhibition task mediated by mood valence, was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict harmonic mean reaction times on correct "go"s for the behavioral inhibition task, *b* = -3.96 *t (153)*= -.65, *p* = .51. This indicated no significant direct effect of social media multitasking on reaction times.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related mood valence, *b* = -.81, *t(152)*= - 1.12, *p* = .26. This negative relationship is in the opposite direction of the original prediction and is not significant.

Furthermore, in Step 3, the logistic regression of mood valence and the contrast between social media multitasking and single tasking harmonic mean of reaction times on correct "go"s was not significant R^2= .004, F (2,150)= .30, *p* = .74. As expected, the bootstrapped confidence intervals found no evidence of mediation in the model, with the contrast between social media multitasking and the control, single tasking having an indirect effect of .26, 95% CI[-.76, 2.88] with mood valence as a mediator.

Hypothesis 5c arousal: Decreases reaction times. Hypothesis 5c, which predicted an indirect effect of social media multitasking's on the harmonic mean reaction times on correct "go"s for the behavioral inhibition task mediated by arousal, was not supported. In Step 1, the contrast between social media multitasking and single tasking did not significantly predict harmonic mean reaction times on correct "go"s for the behavioral inhibition task, *b* = -3.34, *t (153)*= -.56, *p* = .58. This indicated no significant direct effect of social media multitasking on reaction times.

In Step 2, the contrast between social media multitasking and single tasking was not significantly related arousal, *b* = .37, *t(152)*= .42, *p* = .68. This positive relationship is in the predicted direction but is not significant.

Furthermore, in Step 3, the logistic regression of arousal and the contrast between social media multitasking and single tasking harmonic mean of reaction times on correct “go”s was not significant R^2= .02, F (2,150)= 1.66, *p* = .19. Of the two predictors, arousal’s relationship with harmonic mean of reaction times on correct “gos” nears statistical significance, b= -.95, *t(150)* = -1.71, *p* =.09. As expected, the bootstrapped confidence intervals found no evidence of mediation in the model, with the contrast between social media multitasking and the control, single tasking having an indirect effect of -.35, 95% CI[-3.05, 1.16] with arousal as the mediator.

In summary, social media multitasking had no direct or indirect effect on performance on the behavioral inhibition task. Social media multitasking did not significantly directly affect mood (i.e. valence or arousal state). Arousal state had a direct effect on the number of incorrect “Go”s and neared statistical significance in its effect on harmonic mean reaction times on correct “Go”s.

Research Question 1

RQ1: Will nonsocial media multitasking or social media multitasking have a greater direct effect on mood valence and arousal and therefore a larger indirect effect on cognitive performance?

Effects of nonsocial vs. social media multitasking. The current study was interested in exploring the difference between nonsocial and social media multitasking’s direct effects on mood valence and arousal, and indirect effects on cognitive performances in two particular areas: attention filtering and behavioral inhibition. The results of the mediation models tested in hypothesis 2-5(abc) demonstrate that nonsocial media multitasking significantly effects only arousal and indirectly effects only behavioral inhibition, but social media multitasking had no significant effects on mood valence, arousal or either cognitive performance task.

Summary

Overall, both nonsocial and social media multitasking led to higher arousal and less pleasant mood valence than single tasking. However, in the mediated models, nonsocial media multitasking only directly affected arousal. Social media multitasking did not significantly affect either mood valence or arousal. Nonsocial media multitasking also had a negative indirect effect on incorrect “go”s and reaction times on correct “go”s. Incorrect “go”s and reaction times are two measure of performance on the behavioral inhibition task. This indirect effect on incorrect “go”s and reaction times on correct “go”s was mediated by arousal. The other cognitive performance measures were unaffected by media multitasking (i.e. both social and nonsocial). Arousal state had a direct effect on incorrect “go”s in both the social and nonsocial media multitasking models. However, arousal state did not have a direct effect on the other measures of cognitive performance. Mood valence did not have a direct effect on any cognitive performance measures. In summary, media multitasking does affect mood, and only nonsocial media multitasking indirectly affects behavioral inhibition via the mediating role of arousal.

Discussion

The current study investigated the indirect effect of media multitasking on cognitive performance as mediated through mood. The study examined the effects of nonsocial and social media multitasking compared to single tasking on mood (i.e., valence and arousal) and on cognitive performance measures of behavioral inhibition and attention filtering. In all conditions, participants were asked to complete an academic task (i.e., GRE questions) and two media tasks. Participants in the single tasking control condition, sequentially completed GRE questions, watched a clip and listened to a podcast. Participants in the nonsocial media multitasking condition completed the same three tasks within a limited time and were prompted to multitask. Participants in the social media multitasking condition similarly were given a limited time and prompted to multitask, but instead completed GRE questions, responded to a Twitter feed, and held a conversation on Skype.

The results revealed that both nonsocial and social media multitasking increase arousal and decrease pleasant mood valence. However, this was only true in some analyses. In other analyses, only participants in the nonsocial media multitasking condition reported an increase in arousal. For two measures of behavioral inhibition, incorrect "go"s and reaction times on correct "go"s, nonsocial media multitasking had an indirect effect mediated by arousal. Media multitaskers' arousal had a negative effect on incorrect "go"s. This is to say, nonsocial media multitasking decreased the number of mistakes and reaction times on the behavioral inhibition task. However, media multitasking, arousal and mood valence had no significant effects on any other measures of behavioral inhibition or attention filtering. The next section will further address each of these findings.

Media Multitasking, Arousal and Mood Valence

It was expected that both nonsocial and social media multitasking would increase pleasant mood valence and arousal. However, media multitasking only led to a higher arousal states and not mood valence in comparison to single tasking. By increasing task demand, media multitasking requires more cognitive resources and leads to higher arousal. Because media multitasking's involves adding media to otherwise less pleasant academic tasks it was expected that media multitasking would lead to a more pleasant mood. Higher arousal as a function of media multitasking as expected, but mood valence was less pleasant rather than more pleasant.

These findings may indicate that the increase in task demand on cognitive resources needed in a multitasking situation serves to increase arousal. This interpretation is consistent with Yeykelis and his colleagues' (2014) findings discussed earlier. These researchers demonstrated that when working on an academic task people appear to experience a spike in physiological arousal before switching to novel content. In the current study media multitasking also left participants in higher arousal state.

However, as noted, media multitasking decreased the pleasantness of mood valence in the present study. This was not predicted. Previous research had shown that students experience emotional benefits to media multitasking (Wang et al., 2012). This result, although unexpected, may be consistent with limited-capacity models and cognitive bottlenecking models discussed above. These approaches assert that media multitasking is cognitively taxing. This taxing experience may be unpleasant leading to negative rather than positive moods. Another possible explanation for the negative mood valence in the current study may be that participants lacked control over the content of media multitasking. In the present laboratory experiment, participants were told to media multitask with predetermined tasks and this lack of control caused unpleasant emotions.

Similarly, we expected that social media multitasking would also lead to a more pleasant mood and higher arousal because of the personal relevance of the content and the interactivity required by social tasks. However, in follow-up analyses social media multitasking did not appear to have any significant effect on arousal or mood valence. Nonsocial media multitasking led to higher arousal only, but mood valence remained unaffected.

This finding indicates that task characteristics have important consequences for the effects of media multitasking. Chrzan and Lang's (2016) extension of limited capacity and cognitive bottlenecking models may apply here. Nonsocial media multitasking may be high on both of the maladaptive dimensions of media multitasking--overlap and difficulty. Recall that although nonsocial media multitasking tasks are less interactive, they do not afford consumers control over the pace of the information flow and have more modal overlap with one another (usually requiring visual, auditory and linguistic processing). Social media multitasking may not have as much modal overlap and often affords more control over information flow, content and amount. Thus these characteristics of nonsocial media multitasking may increase task demand and may create a higher cognitive load. This may increase arousal. This increase in task demand, however, might be maladaptive and highly taxing, and therefore may decrease pleasant mood valence.

The explanation for the lack of an effect of social media multitasking on either arousal or mood valence in the mediation models is less clear. Again, applying Lang and Chrzan’s (2016) difficulty and overlap dimensions to the present study it is possible that the increase in control over the pace of information flow, content and quantity during social media multitasking led to a far smaller increase in cognitive load and therefore did not significantly increase arousal.

The unique combination of social media and multitasking may be dependent on the connection to one’s social network as found in previous research (Karpinski et al., 2013). Without experiencing the positive emotion of interacting with one’s social network, social media multitasking may not have a significant effect on mood plesasantness. Social media multitasking may primarily influence mood by including personally relevant information.

The differences in the effects of nonsocial and social tasks on cognitive demands (i.e., difficulty through information flow, content, and quantity) and the effects of these treatments on affective states require further investigation. Further analysis of the effect of media multitasking on mood was analyzed. Change scores and unstandardized residual change scores were used in the analyses. Using change scores, it was found that nonsocial media multitasking significantly affected mood valence compared to single tasking. However, only social media multitasking significantly affected arousal when compared to single tasking. There was no effect of either form of media multitasking in comparison to single tasking in the analyses when residuals were employed. These results suggest that the effects of media multitasking on mood are complex and encourage further investigation.

Behavioral Inhibition: Indirect Effects of Nonsocial Media Multitasking

It was also expected that media multitasking would indirectly affect attention filtering and behavioral inhibition once participants returned to single tasking. Arousal and mood valence were expected to mediate this relationship. Ophir et al. (2009) and several other scholars have shown that chronic media multitasking is related to reduced executive control, less capacity for behavioral inhibition and poor attention filtering. However, it was expected that increases in arousal and pleasantness of mood valence would improve attention filtering and behavioral inhibition in the short-term as opposed to long-term such as when students return to single tasking.

The results partially supported this prediction, but only for nonsocial media multitasking's indirect effect on two measures of behavioral inhibition, incorrect "go"s and harmonic mean reaction times on correct "go"s. Behavioral inhibition may be thought of as the opposite of impulsivity. It is the cognitive capacity to inhibit or suppress a behavior. Nonsocial media multitasking's negative indirect effect on incorrect "go"s and reaction times on correct "go"s was mediated by arousal state only and not by valence. By increasing arousal state, nonsocial media multitasking improved behavioral inhibition. This was evidenced by the decreasing number of mistakes on the go-no-go task and decreased reaction times on correct "go"s. This finding may have two important implications. First, higher arousal states rather than more pleasant mood valence can enhance sustained attention and inhibition. Second, nonsocial media multitasking can indirectly benefit cognitive mechanisms involved in self-control.

To be cautious it is necessary to concede that there is a possibility that this finding is an artifact of undertaking an abundant number of statistical tests and may be the result of statistical chance. If the finding is robust, it provides preliminary evidence that the task demands of some forms of media multitasking can be adaptive for affective and cognitive states at least in the short-term.

Other Cognitive Performance Measures

Although media multitasking indirectly benefited behavioral inhibition, this was true for only two measures of performance as noted above. The other behavioral inhibition and attention-filtering dependent measures were unaffected by social and nonsocial media multitasking. Nonsocial and social media multitasking also did not have a significant direct effect on cognitive performance.

Since media multitasking between periods of single tasking seemed to make little difference for cognitive performance future research should explore media multitasking and it's indirect effects on cognitive performance by manipulating the task demand and employing alternative measures of cognitive performance.

Arousal and Cognitive Performance

The present study also provides some insight into the effects of mood on cognitive performance. In this study the arousal component of mood had a positive direct effect on incorrect “go”s in both the social and nonsocial media multitasking models. Lower arousal appeared to lead people to make more mistakes and have slower reaction times. Higher arousal improved accuracy and decreased response times. This finding suggests that arousal is important for sustaining attention and exercising cognitive control. Although arousal improved behavioral inhibition, it did not have a significant direct effect on the other measures of cognitive performance. This suggests arousal may be minimally beneficial for attention and cognitive control overall.

Mood Valence and Cognitive Performance

Previous research has suggested that negative or unpleasant moods are particularly harmful for inhibition and attention. Yet, in the present study positive moods did not affect attentional or behavioral inhibition performance. Mood valence may generally have an impact on executive control and attention, but did not significantly aid or deter participants from attention filtering or inhibiting their behaviors. The current study indicates that instead arousal state may be the mood dimension most positively related to cognitive performance. This is consistent with findings reported by Eysenck, Derakshan, Santos, and Calvo (2007) wherein higher arousal states of participants who felt anxiety were related to improved cognitive performance despite being in a noxious mood.

Limitations and Future Directions

The current study has several limitations. These limitations are largely related to the design and methodology employed in the study. First, the characteristics of the tasks may have had unique properties that affected participants' mood valence. Requiring participants to complete GRE questions might have evoked a negative affective state. The GRE questions may have increased the difficulty of both of the media multitasking conditions and contributed to media multitasking's decrease in mood valence. Future studies could vary the difficulty of the academic task and investigate the effects on mood valence and arousal.

Second, the specific nonsocial and social media tasks selected for this study may have particular characteristics that affected difficulty and overlap--the two dimensions for Lang and Chrzan (2016). Although social and nonsocial media tasks may generally differ in interactivity, information flow and information's personal relevance, it is possible that the specific tasks used in this study --a clip of an animal documentary and a podcast for nonsocial and responding to a newsfeed and chatting for social--may have had unique characteristics that affected these dimensions. The animal documentary and podcast are somewhat more educational and may be less personally relevant than the chat about increasing tuition prices for universities.

In this study interactivity and sociality are also conflated. No interactive nonsocial tasks were given. Additionally, in the social media tasks--responding to a Twitter newsfeed and chatting--participants had much more control over the pace and amount of information. Social media multitasking's lack of significant effect on mood and indirect effect on cognitive performance in this study may be a result of the user-controlled variability in the amount and pace of information within the social media multitasking condition.

Future studies should use a variety of nonsocial and social tasks that vary in levels of interactivity, pace of information, and personally relevant topics. Similarly, the incomplete factorial design, which lacked a condition in which participants' single task with social media tasks, could have resulted in confounds. The lack of difference between the social media multitasking condition and the single tasking control condition may be a result of confounding single tasking and nonsocial media tasks.

Additionally, the current study did not control the rate or amount of task switching or dual tasking that occurred in the different media multitasking conditions. This control would influence the cognitive load and task demand of these types of media multitasking. Future studies could take further precautions such as directing participants to media multitasking either by task switching or dual tasking for specified intervals of time. Because the participants' behaviors during the media multitasking portion of the current study were recorded by screen-capturing software, a follow-up study will investigate the difference between participants in the nonsocial media multitasking versus social media multitasking's number of task switches and dual tasks.

Conclusion

Media multitasking is a complex phenomenon the effects of which scholars have just begun to unravel. The current investigation examined media multitasking's direct effect on mood (i.e., valence and arousal) and evaluated media multitasking's indirect effect on attention filtering and behavioral inhibition. It also explored the distinction between media multitasking with nonsocial as opposed to social tasks. The results demonstrate that media multitasking with both nonsocial and social tasks does affect mood, but it does not directly affect cognitive performance. However, there is some evidence that nonsocial media multitasking may improve behavioral inhibition by increasing arousal. This suggests that more should be done to discover if the period of time spent media multitasking between instances of single tasking is either harmful or beneficial to students' attention filtering or behavioral inhibition while single tasking. Finally, there is some evidence that nonsocial media multitasking differs from social media multitasking's effects on mood and cognitive performance.

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Appendix A.

Table 1

Descriptive Statistics for Continuous Variables

Variable	*n*	*M*	*SD*	Skewness	Kurtosis
Mood valence	171	1.62	4.33	-0.44	-0.46
Arousal	171	0.45	5.12	-0.06	-1.10
False alarms on X	167	1.93	1.58	0.58	-0.03
Correct probe-cue detections	167	21.15	0.39	2.58	6.25
Harmonic mean RT on correct probe-cue detections	161	512.10	135.82	0.53	0.41
Number of incorrect “No-Go”s	157	1.15	5.43	8.13	67.86
Number of incorrect "Go"s	154	5.28	4.63	2.63	8.70
Harmonic mean of RT on correct "Go”s	154	335.95	35.72	0.27	-0.41