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Naturalistic Allocation: Working Memory and Cued-Attention Effects on Resource Allocation

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Naturalistic Allocation: Working Memory and Cued-Attention Effects on

Resource Allocation

A Dissertation

Presented in

Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

By

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Biography

The author was born in St. Thomas, Jamaica on November 15th, 1983. She

graduated from the Queen's School in 2002, received her Bachelor of Science

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Abstract

The allocation of resources is a ubiquitous decision making task. In the workplace, resource allocation, in the context of multiple task and/or work demands, is significantly related to task performance as the commitment of more resources generally results in better performance on a given task. I apply both resource and naturalistic decision making theories to better understand resource allocation behavior and related performance. Resource theories suggest that individuals have limited cognitive capacity: limited capacity may limit performance in dynamic situations such as situations that involve the allocation of attentional resources. Additionally, the naturalistic decision making framework highlights the role of context cues as key aids to effective decision making. Therefore, I proposed an interactive relationship between working memory, a cognitive resource, and allocation cue, a contextual variable. Specifically, I conducted an experimental study in which I manipulated allocation cue type and examined the individual difference of working memory on allocation behavior and task performance. I hypothesized a moderated-mediated effect including cue type, working memory, and proportion of time on task on task performance (i.e., accuracy and efficiency). The effect of cue type on both the proportion of time spent on task and task performance was expected to be contingent on working memory capacity. As working memory increased, both time on task and performance were expected to increase for participants exposed to either goal- or both task- and goal-related cues, as opposed to task cues. Conversely, as working memory decreased both time on task and performance were expected to increase

for participants exposed to task cues in comparison to those exposed to either

goal- or both task- and goal-related cues. Additionally, as proportion of time on

task increased, performance was expected to improve. Results from this study did

not find support for the hypothesized moderated-mediated effect. However,

results indicated an effect of task cue on task efficiency. Specifically, individuals

cued to allocate their attention based stimulus-related features (i.e., task cue)

completed the task more quickly. Theoretical and practical implications as well as

study limitations are discussed in detail.

PART I

Introduction

Modern-day organizations are plagued with distractions. Consider the following example:

> It is 8:00 am on a Monday. Beth has just arrived at her office, and she is looking forward to finishing a paper she has been putting off for weeks. The paper is a "revise and resubmit", and the deadline for the revision is approaching. Her plan is to prioritize this task; she has given a great deal of thought to her approach for the edits, and she is ready to begin working. She turns her computer on and opens the file to begin writing. However, as is typical of Monday mornings, within 30 minutes, her e-mail notifications begin flooding in. Will she continue to focus on her writing, or will she stop and respond to the e-mails? Additionally, how might her allocation decision influence her writing performance?

> A recent study by Samsung and the University of Leeds suggested that employee distraction is widespread. Employees surveyed spent an average of only 22 minutes completing uninterrupted work each day, which is estimated to cost UK companies £250 million each year (Press Association, 2015).

> In modern organizations, employees frequently experience autonomy and are networked to other employees. Such conditions require employees to make decisions about how to manage their tasks. Decision making is influenced by prior choices and incorporates other external factors (Atkinson & Birch, 1978), such as organizational politics and task interdependence. Additionally, in many

cases, employees' personal interpretations of their roles may introduce idiosyncratic views about how work should be performed and prioritized (Sanchez & Levine, 2009). Resource allocation behavior, or how individuals partition their cognitive energy or attention among tasks, ultimately influences the effectiveness of job performance (Minbashian & Luppino, 2014).

Performance is generally higher on tasks that receive more attention (Minbashian & Luppino, 2014). Therefore, it is necessary to ensure that employees allocate their attention to the highest priority tasks that are aligned with organizational goals. Allocation decisions differ among individuals, and researchers have used a number of theories to explain resource allocation.

From the self-regulation perspective, it is suggested that resources are often allocated to whichever goal or task shows the least progress or most discrepancy between current and desired states (Carver & Scheier, 1990; Latham & Locke, 1991; Schmidt & DeShon, 2007). Individuals are likely to focus on completing tasks that are in need of the most attention to catch up on their progress. In contrast, expectancy theory has suggested that some individuals are more likely to commit their efforts to tasks or goals with a smaller discrepancy between the current and desired completion states (Kernan & Lord, 1990; Schmidt & Dolis, 2009). This theory thus suggests that some employees may prioritize tasks that are closer to completion. More recently, it has been suggested that the decision regarding which task to prioritize is influenced by environmental volatility—or, the unpredictable nature of the task environment (Schmidt, Dolis, & Tolli, 2009). Specifically, when environmental volatility is low (i.e., task

progress is largely influenced by the individual), individuals allocate more

resources to the task that is closer to completion before they focus on the task

further from completion; however, when environmental volatility is high (i.e.,

task progress is largely influenced by external factors), individuals allocate more

resources to the task furthest from completion before they focus on the task

closest to completion (Schmidt et al., 2009).

This finding by Schmidt et al. (2009) raised an important concern about

the allocation of attention in the dynamic or rapidly changing situations that exist

in highly volatile organizational environments. Specifically, if the task most

valued by the organization is the one furthest from completion, employees may

erroneously allocate attention to alternative tasks. For example, an employee may

decide to focus on a task closer to completion or one easier to complete, such as

responding to e-mails. Therefore, to enhance job performance, it is important to

identify interventions to support the proper allocation of attention. There is still

much to be discovered about the following areas: a) how employees make

allocation decisions, b) the potential predictors of allocation behavior, and c) the

performance effects of differing allocation patterns. The judgment and decision

making literature embedded within the meta-perspective of the person–situation

perspective has provided some insight into potential strategies.

As a meta-theory, the person-by-situation interaction suggests that

behavior is a function of both environmental factors and individual differences

(Endler & Magnusson, 1976; Lewin, 1939). Within the domain of environmental

factors or context effects, the current study focuses on context cues with direct

reference to the judgment and decision making literature. Specifically, naturalistic decision making focuses on describing how decisions are made in dynamic and often high-stakes situations (Klein, 1998; Lipshitz, Klein, Orasanu, & Salas, 2001). The naturalistic approach to decision making departs from the traditional models of decision making, which suggests that decision-makers generate and compare alternatives, by focusing on how decisions are made under difficult conditions (Klein, 2008). Using naturalistic decision making perspective, I explore how a contextual element (i.e., cues) influences performance in the context of resource allocation. I propose that the judgment and decision making literature has provided relevant lens for an examination of resource allocation, because the shifting of attention from one task to the next is, in effect, a judgment and decision making process. This perspective is aligned with that of other researchers who have also promoted a decision making approach to resource allocation (e.g., Ball, Langholtz, Auble, & Sopchak, 1998; Langholtz, Ball, Sopchak, & Auble, 1997; Langholtz, Gettys, & Foote, 1994). I further suggest, in conjunction with the role played by context cues, an interaction between these environmental factors and a salient individual difference variable—working memory capacity.

The resource allocation literature has suggested that individual differences, such as cognitive abilities, influence the allocation process by determining the amount of available resources an individual has to assign among tasks and other work demands (Kanfer & Ackerman, 1989). Elsewhere in the literature, the suggestion has been made to begin exploring more specific

cognitive predictors of job performance (e.g., Wee, Newman, & Joseph, 2014).

Working memory is one important individual difference within the job

performance literature.

Working memory, a source of intelligence, is an important predictor of

work performance (Krumm, Schmidt-Atzert, & Lipnevich, 2013) and is related to

the regulation of attention (Kane & Engle, 2003). Specifically, higher working

memory capacity is associated with more sustained focus on goal-directed

activities (Lavie, Hirst, de Fockert, & Vinding, 2004; Redick & Engle, 2006).

Implied by this is the possibility that the efficacy of working memory capacity as

a predictor of performance may depend on the presence of goal-directed factors

within the environment. This research is a further attempt to gain a better

understanding of the resource allocation domain.

Several researchers have acknowledged the value of resource allocation

research and have called for future research on the process (e.g., Ball et al., 1998;

Gonzalez, Langholtz, & Sopchak, 2002; Langholtz et al, 1997; Langholtz et al.,

1994; Minbashian & Luppino, 2014; Randall, Oswald, & Beier, 2014; Schmidt &

DeShon, 2007; Schmidt & Dolis, 2009). This research responds to that call by

expanding on what is currently known about resource allocation behavior.

Specifically, this research is an exploration of the extent to which cues helps

individuals effectively allocate attention; and the extent to which this relationship

is a function of the type of working memory.

In the following sections, I review the literature on resource allocation, as

well as the individual differences and situational factors that influence the

process. I also introduce naturalistic decision making and discuss its proposed application to resource allocation. Specifically, first, I provide a general review of resource theories, followed by an introduction to resource allocation as an important performance criterion. Second, I discuss the theoretical underpinnings of resource allocation. In reviewing these theories, I provide the foundation for the predictions that follow. Third, I provide an overview of attention, the resource in question, as well as a review of the processes regulating selective attention. Fourth, I discuss working memory as a cognition-related individual difference and demonstrate how situational stressors work in tandem with this individual difference. Finally, I discuss the applicability of naturalistic decision making and highlight its underlying mechanism (i.e., its reliance on cues).

Resource Theories

Resource theories (e.g., Hobfoll, 1987; Norman & Bobrow, 1975) are a means to explain the limits of human capacity on performance, and they provide a general framework to explore the allocation of resources. These theories provide a structure for explaining the effects of task characteristics and individual differences on the cognitive resource and performance relationship. There are two critical propositions of resource theories. The first is that cognitive or attentional resources are limited (Kahneman, 1973). The second is that the performance–resource allocation relationship is influenced by ability level and the nature of the task; specifically, low ability reduces the amount of resources available for allocation (Kanfer & Ackerman, 1989).

Generally, cognitive ability is the primary resource in resource theories (Kanfer & Ackerman, 1989). When people work on multiple tasks that require the same psychological resources, their performance on one task may interfere with their performance on another task, given the limits of cognitive resources (Norman & Bobrow, 1975). At the same time, certain boundary conditions have been identified that regulate the cognitive ability-performance effect. For example, task difficulty moderates the cognitive ability and performance relationship such that high cognitive ability enhances performance on difficult tasks (Kanfer & Ackerman, 1989). Such finding demonstrates that when using the resource theory paradigm, the consideration of situational or task-related factors is useful for exploring the effects of attentional resources on performance, and how resources are allocated to tasks.

Resource theories often explain the relationship between cognitive ability and task performance, while resource allocation theories go a step further by specifically explaining how resources are allocated to tasks (Randall et al., 2014). The self-regulation literature is typically applied to resource allocation. Specifically, effective self-regulation is associated with enhanced task performance: people who are able to self-regulate effectively are able to direct attentional efforts to areas where resources are needed to meet task goals (Carver & Scheier, 1990; Erez, 1977). Therefore, in situations where resources are not being assigned as needed to complete a task, performance may suffer (Randall et al., 2014). This is particularly relevant to performance in situations where there are multiple priorities or tasks. Employees having to allocate their time between

multiple projects need to be able to monitor and adjust (i.e., self-regulate) their

attentional resources efficiently in order to meet the goals of multiple

assignments.

Resource theories can be explained using the dual-process approach to

cognitive processes. The dual-process model includes two primary processing:

automatic and controlled processes (Schiffrin & Schneider, 1977). Automatic

processing involves low effort and rapid or holistic thinking, while controlled

processes include high effort and slow or analytic thinking (Evans, 2008). This

distinction between controlled and automatic processes helps to determine the

amount of cognitive resources necessary for task performance, depending on the

nature of the task. For example, a task requiring controlled mental processes may

require more cognitive resources than one that involves more automatic mental

processes. Within the domain of resource theories, the dual-process model

provides a base for explaining the effects of task characteristics on performance

(Kanfer & Ackerman, 1989; Norman & Bobrow, 1975).

In other words, the nature of a task determines the extent to which

resource limitations influence task performance. Specifically, resource-limited

tasks are those for which performance is primarily *dependent* on attentional

resources, while data-limited tasks are those where the impact of attentional

resources on performance is only negligible (i.e., performance is *independent* of

resource processing; Norman & Bobrow, 1975). For example, a very simple task

may be said to be data-limited, as performance changes would occur due to ease

of performing the task rather than the amount of effort committed to completing

the task. Resource theories have aided the development of resource allocation theories.

Resource Allocation

Making decisions about the allocation of resources is a universal practice. People make these decisions in their personal lives to determine how they assign their leisure time, money, and other useful resources. At work, this practice is equally prevalent because in many cases employees must make decisions about how they assign their time and effort among multiple tasks and other work-related demands. Despite this reality, very little research attention has been directed to understanding performance progress under conditions of multiple or competing priorities (Schmidt, Dolis, & Tolli, 2009) or to how effective people are at making allocation decisions (Ball et al., 1998; Riekamp, Busemeyer, & Laine, 2003). Yet, is has been established that the allocation of resources influences the variability in job performance such that performance is higher on tasks with more cognitive resources assigned (Minbashian & Luppino, 2014).

The commitment of cognitive and other resources may help to explain resource allocation as a performance outcome of interest in the workplace. That is to say, we may be able to extend the extant literature regarding predictors of job performance to explain some of the variation in resource allocation performance. Predictors such as general mental ability, conscientiousness, goal orientation, and self-efficacy (Barrick & Mount, 1991; Schmidt & Hunter, 1998; Sitzmann & Ely, 2011; Vandewalle, 1997) which are strong predictors of job performance in the general domain may contribute somewhat to resource allocation performance.

However, to help to better understand the specific context of resource allocation, it is important to consider domain-specific predictors that may provide more precise predictions of performance in situations where attention is being regulated.

In situations involving multiple attentional demands, an employee may be required to determine how best to allocate his/her psychological resources (e.g., attention, commitment, mental energy, or effort) between equally important tasks. In such cases, performance levels should be maintained for each task in a manner that avoids one or more tasks being neglected at the expense of another. Identifying how employees strategize the commitment of their effort or time when working on multiple tasks is critical, as this helps to determine the direct contribution of attention on performance within the context of multiple or competing priorities.

However, the resource allocation problem is often a difficult one to intuitively resolve as choice options generally differ in interrelated ways (Ball et al., 1998). For example, consider Nick, a marketing representative determining how to allocate his time between Products A and B. Prioritizing product A may require less in terms of creative energy but may hurt the department's overall performance if product B has a larger income potential. If creativity and income are the only valued resources being considered, then this allocation problem may be less difficult to resolve. To be exact, if one simply considers which of the two outcomes—creativity or income—is more valuable, then selecting between product A and B could be directed by whichever option helps to secure the more

valued outcome. In reality, however, Nick's resource allocation decision may be far more complex. Choices may be influenced by multiple contextual factors, including environmental and task conditions, risk, uncertainty, power, and politics (Langholtz, et al., 1997; Langholtz, et al., 1994; Langholtz, Gettys, & Foote, 1993; Pfeffer, 1992). For example, Nick's decision may be influenced by his perceived difficulty of the two tasks, directions from a superior, or work norms and patterns within his department, such as a tendency toward planning or interruptions from peers seeking assistance. Therefore, several factors may influence Nick's allocation decision, making the identification of ideal allocation a challenging one.

Within the literature on cognitive psychology, mathematical models have been applied to identify optimal resource allocation under different circumstances (e.g., Langholtz et al., 1997; Langholtz et al., 1994). These attempts have largely focused on identifying and testing ideal allocation algorithms. Mathematical modeling, and specifically, Linear Programming (LP; Dantzig, 1963), is a method frequently applied in the operations research and management science literature. LP provides a formula for calculating ideal allocation strategies based on knowledge of the amount of resources available and how these resources combine to produce a return. While such resource allocations may be useful for some tasks, it may be unrealistic for employees to use them as decision aids as they encounter typical and daily resource allocation problems such as how to spend their time during the day. More likely, people rely on natural cognitive processes when making these decisions—processes that are influenced by individual differences

and situational factors. Differences between individuals have been observed based on situational factors such as levels of uncertainty or risk.

Prior research on resource allocation decisions (i.e., for resources including time and fuel, for example) and the influence of contextual factors has focused on assessing performance under conditions of high and low risk and uncertainty. This includes circumstances where resources are limited and the potential for loss is high. For example, using a Coast Guard scheduling task, 30 participants were challenged with scheduling two boats to maximize operating hours while ensuring minimum patrol hours. Participants were warned about the history of unforeseen incidences resulting in losses and had a fixed amount of fuel and personnel hours for completing the task (see Langholtz et al., 1994). Participants were assigned to either a low, moderate, or high difficulty condition with difficulty intensifying as the amount of time required to operate the boats increased. Results demonstrated that participants' overall performance approached optimal levels. Participants were better able to complete the task when task difficulty was low. Under conditions of high difficulty, success was most likely for those who appropriately allocated resources based on the optimal allocation determined by an LP model (Langholtz et al., 1994).

Furthermore, while those under conditions of certainty and risk self-corrected to avoid missed opportunities for allocation, those under conditions of uncertainty were significantly less likely to do so. Evidence also suggests that participants were able to learn more efficient resource allocation strategies (Langholtz et al., 1993). Collectively, these results suggest that research attention

to the process of resource allocation is promising. Specifically, given the association between effective resource allocation and performance, and evidence that situational factors and learning may enhance performance, researchers and practitioners may benefit from having a better understanding of how resource allocation decisions occur.

The Allocation of Attention

Employees are faced with multiple task demands, such as writing reports, attending meetings, meeting deadlines, and attending to e-mails (many times non-critical e-mails). These tasks represent constant streams of information that require attention. Attention is "the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought… [I]t implies withdrawal from some things in order to deal effectively with others" (James, 1883, p. 381–382). Attention may be studied from either a divided or selective paradigm. In both cases, the assumption is that attentional resources are limited (Kahneman, 1973).

To effectively manage their time, employees must selectively process relevant aspects of work-related demands while ignoring irrelevant portions as called for by the situation. This is known as selective attention, which is the "differential processing of simultaneous sources of information" (Johnston & Dark, 1986, p. 44). While specific to auditory stimuli, the cocktail party problem (Cherry, 1953) is a good illustration of selective attention. The cocktail party effect occurs when an individual is presented with a variety of stimuli, similar to those presented while at a cocktail party, including multiple and simultaneous

conversations in the background. However, it may be possible to selectively focus on one dominant conversation despite the distractions. Similarly, an employee may be bombarded with a litany of responsibilities but can consciously focus (i.e., selectively attend) on completing one task at a given time.

Several models have been used to explain selective attention. The Broadbent Filter Model (Broadbent, 1958) explains how information becomes ignored during the selection process. This model suggests that individuals focus on the physical features of information (e.g., color or visual information, pitch of auditory stimuli) very early in the selection process. Therefore, unattended cues are filtered out on the basis of physical features and not transferred to short-term memory. The second model of selective attention, Treisman's Attenuation Model (Treisman, 1960), further builds on the Filter Model to explain how and why individuals are able to switch their attention suddenly from focusing on writing a report to responding to a critical e-mail. This theory suggests that rather than being completely blocked out, critical but unattended information (such as a secondary task), is attenuated and transferred to short-term memory. Further, late selection models have suggested that even unattended information is processed and that relevant information receives conscious awareness (Deutsch & Deutsch, 1963). The major distinction between early (i.e., the Filter Model) and late selection models is whether the selection of what to attend to occurs before or after processing.

Still, one may respond to an instant task request, such as an urgent e-mail, while focusing on a different task (i.e., by divided attention). Divided attention,

or processing multiple sources of information at the same time (Johnston & Dark,

1986) may impair performance, as this requires performing multiple processes

simultaneously as in multi-tasking situations. From the perspective of capacity

theory, being selective is necessary, as attentional resources are limited

(Kahneman, 1973). Therefore, based on this assumption, employees would need

to attend to their e-mail *or* complete a report, rather than attempting to do both

simultaneously. At the same time, assuming that all tasks competing for attention

are relevant to the greater goal of the organization, the management of attention is

more dynamic a process than simply selecting a single task to prioritize. In other

words, effective performance may depend on making changes to the allocation of

attention, effort, or time as called for by the situation.

Flexibility of attention is required to cognitively manage multiple

processes (Kahneman, 1973). What an individual attends to is determined by

goals, and attention helps to create a balance between the need for focus and

flexibility (Dijksterhuis & Aarts, 2010). Therefore, in the management of multiple

priorities or tasks, an employee will be required to effectively balance the need to

focus on certain priorities with the ability to be flexible enough to switch between

tasks, as required. This process of attention regulation is governed by

performance goals which enable self-regulation (Locke & Latham, 2002). Further,

human behavior is influenced by the interaction between goals and their

associated stimuli (Pashler, Johnston, & Ruthruff, 2001). For example, an

individual may determine which task to focus their attention on based on

departmental goal (i.e., to complete report by the end of the month) or based a

feature of the task itself (e.g., task progress or difficulty). This determination is

based on the dominant mode of processing being employed—top-down or

bottom-up.

Top-down regulation of attention.

Top-down regulation, or endogenous control (Posner, 1980), refers to

attentional regulation that is cognitively derived or goal-driven (Pashler et al,

2001). This system of control functions to activate related cognitive structures and

inhibits competing processes to prevent interruptions (Lord & Levy, 1994). To

illustrate, this would equate to prioritizing tasks based on their relationship to an

overarching goal. As a result, thinking back to the context in the opening

example, if one's principal goal is to enhance teaching, and not to enhance

research productivity, then tasks related to teaching would be prioritized before

those related to other activities. Goal setting may facilitate more effective

teaching; for example, a goal to increase teaching evaluation scores and the

monitoring of that goal based on feedback can help to regulate attention and effort

in light of that goal. The goal setting and feedback processes function in support

of top-down regulation of attention.

Top-down regulation is also a feature of deliberate task preparation

(Ruthruff, Remington, & Johnston 2001), which can provide some advantages to

task performance and mirrors the literature on goal-setting and planning. Top-

down regulation may involve setting goals and calculating goal progress. Goals

are critical for directing attention and effort, energizing, driving persistence, and

stimulating task-relevant knowledge (Locke & Latham, 2002). Additionally,

given that resource allocation represents a dynamic decision making process accounting for evolving situational demands (Atkinson & Birch, 1978), the use of a top-down strategy may be critical for success. That is to say, the development of a specific plan before implementation may help reduce any ambiguity inherent in allocation tasks. Drawing on the literature on planning, creating a strategy prior to beginning a task is associated with several benefits. Planning facilitates goal development (i.e., intellectual benefit) and helps to stimulate confidence and persistence (i.e., volitional benefit) toward a task (Gollwitzer, 1996). As is established in the literature, goal-setting is associated with enhanced performance (Locke & Latham, 2002). Therefore, the implicit parallel between planning and the top-down regulation strategy suggests that approach may provide a performance advantage.

Elsewhere in the literature, top-down processing resembles the 'search and schedule' strategy (SAS), which is a resource allocation strategy involving detailed search and scheduling of resources prior to approaching tasks (Ball et al., 1998). The SAS strategy involves an overall assessment of the allocation problem and calculations to arrive at the optimal solution prior to beginning a task. This strategy represents a "less sophisticated" version of the LP solution and is similar to strategies from the problem-solving literature, including means-end analysis and hill-climbing (Ball et al., 1998, p. 73). Consistent with the dual-process approach to thinking and reasoning, one could suspect that the processes involved in this approach would therefore be somewhat consistent with more controlled and analytical cognitive processing (Evans, 2008; Schiffrin & Schneider, 1977).

While it has been established that goal-driven processes such as attending to goal-setting (e.g., Locke & Latham, 2002) and planning (e.g., Gollwitzer, 1996) are advantageous to task performance, there are situations in which these benefits are limited. For example, when individuals are given a goal during training, performance tends to be lower compared to those given no goal, especially for individuals with low cognitive ability (Kanfer & Ackerman, 1989). This effect, explained by the limited capacity perspective (Kahneman, 1973), is likely to be seen because the self-regulation process demands attentional resources, which further stresses the limited capacity of those with low cognitive ability. As a result, these individuals are unable to focus as much on learning, as their attentional resources are also being devoted to self-regulating their goal progress. While performance may increase over time for these individuals, their performance may continue to lag behind both their high cognitive ability counterparts and those with low cognitive ability who are not assigned a goal (Kanfer & Ackerman, 1989). This effect is seen during the initial phase of skill acquisition, or when a task is novel or complex—during which time, the demand for cognitive resources is highest (Kanfer & Ackerman, 1989).

Research from the neuroscience literature also supports the negative effect of goals on performance in some situations. In a study looking at dynamic decision making, participants were asked to either predict or control the health of an infant. During the learning phase of the task, participants were given outcome feedback based on their performance. Unexpectedly, this feedback was found to impair learning and transfer (Osman, 2012). The author suggested that the

negative effect of feedback was a result of the nature of the task presented; a caution regarding the value of feedback that has been supported by others (e.g., Harvey, 2011; Kluger & DeNisi, 1996). Specifically, for complex judgment and decision making tasks, such as dynamic decision making, decision-makers engage in constant learning, as decisions are impacted by previous decisions and other factors within the task environment. More specifically, in dynamic decision making tasks (such as resource allocation), decision-makers will be required to constantly use the feedback provided to develop new knowledge—a process called exploration—and use their existing knowledge to make the decisions required of the task being completed—a process called exploitation (Harvey, 2011). For example, while managing time between a main goal (e.g., improving teaching performance), and other priorities, receiving weekly feedback on goal progress throughout the quarter will be cognitively expensive. In other words, reassessing and redistributing effort based on ongoing feedback increases the cognitive load associated with these tasks which may ultimately impair performance. This is especially likely if an individual's cognitive resources are limited (Kanfer & Ackerman, 1989).

Given that top-down processing is associated with goal-driven cognitive processes, this may include the regulation of goal-related information such as feedback on goal progress. As such, rather than relying on top-down attentional regulation exclusively, there may be some benefit to exploring an alternative strategy for effective resource allocation for certain individuals.

Bottom-up regulation of attention.

Bottom-up regulation, or exogenous control (Posner, 1980), is driven by features related to the stimulus in question (Pashler et al., 2001). Further, regulation based on this type of process often results in attention being captured by features of the stimulus that "pop out" based on their dissimilarity with the other features in the stimulus environment (Treisman & Gelade, 1980). Using visual attention to illustrate, using bottom-up regulation, an item will be more likely to command one's attention if its features or colors are distinct from that of its background. Similarly, a dominant bottom-up approach would result in task prioritization based on task-related factors including identified discrepancies between one's current and desired goal progress or time to task completion (Lord & Levy, 1994), rather than consideration of the macro-level goals. As such, an individual may decide to focus on task A over B because task A is closer to being completed (i.e., less time intensive) even if task B is more in-line with a superordinate goal. Being stimulus-driven, bottom-up attention may be involuntarily directed (Schreij, Owens, & Theeuwes, 2008). For example, an employee may commit unplanned time or attention to handling emergency situations at work. This may include completing tasks that are not directly related to meeting an established goal but require attention nonetheless.

This approach to attentional regulation resembles the 'consume and check' (CAC) strategy. The CAC strategy involves some initial planning at the beginning of tasks but follows with daily "consumption" of resources and constant checking to avoid over- or under-use of available resources as time processes (Ball et al.,

1998). The CAC strategy equates to choosing a task on the first day of the week and constantly checking progress to the resources available as the week progresses to consume the final share of resources. This implies a routine-like nature of consuming and checking resources (i.e., satisfy current needs), in comparison to the more cognitively complex process of solving and scheduling (i.e., seeking to maximize resources). In comparison to the SAS strategy, the CAC strategy may be more data-limited (i.e., performance is independent of resource processing; Norman & Bobrow, 1975). Specifically, using the CAC strategy may rely less on the cognitive resources given the routine-nature and less complex process involved. Additionally, the CAC strategy may be considered more responsive than proactive (Gonzalez et al., 2002). At the same time, the success of this strategy depends on the manner in which allocation decisions are made in the moment.

Using the CAC strategy, in comparison to the SAS strategy, individuals have demonstrated an inability to meet overall goals due to allocation errors at the end of the tasks. Specifically, using a meal-scheduling task, some participants were unable to consume the minimum daily meal required on the last day of the week as a result of over-consumption earlier in the week (Ball et al., 1998). This implies that the approach utilized during the decision making process may be a function of perception and judgment.

Comparison of top-down and bottom-up allocation.

A number of differences have been identified between behaviors associated with top-down and bottom up attention. For example, top down visual

attention is described as sustained and takes longer to deploy than its transient

bottom-up alternative (Pinto, van der Leij, Sligte, Lamme, & Scholte, 2013).

Within the domain of resource allocation specifically, findings appear to suggest

differences in allocation as influenced by attentional focus. On one hand, while

working on multiple goals, participants' goal priorities were influenced by a

discrepancy between their current and desired goal progress—a bottom-up

influence (e.g., Schmidt & DeShon, 2007). That is, participants prioritized the

task with the greater discrepancy. On the other hand, participants may also

prioritize whichever task is closer to being completed (Kernan & Lord, 1990), a

demonstration of a top-down attention. This difference was suggested as being

attributable to the nature of the tasks used by the researchers in the studies

reported (Schmidt et al., 2009). A bottom-up influence was believed to be in

response to the dynamic task used (Schmidt & DeShon, 2007) while a top-down

influence a function of the static task used (Kernan & Lord, 1990). This

difference in allocation pattern has also varied based on goal orientation. To be

exact, those with a high mastery orientation (i.e., individuals who want to increase

competence; Dweck & Leggett, 1988) generally prioritize based on large goal

discrepancy while those with a high performance avoid orientation (i.e.,

individuals who want to avoid negative judgments; Dweck & Leggett, 1988) are

more likely to allocate attention to goals close to completion (i.e., least discrepant;

Schmidt et al., 2009). These findings suggest that inter-individual factors can

influence resource allocation patterns. In addition to allocation behavior, any

associated performance differences are also of concern.

In the seminal work conducted by Ball and colleagues (1998), which aided the identification of the CAC and SAS resource allocation strategies, a few differences were observed between the verbal protocols of participants, using the CAC and SAS strategies. First, it was noticed that the majority of participants used the CAC strategy (71%). Others have also found the use of the CAC strategy more common among participants and have attributed this difference to CAC being a less cognitively complex approach (Gonzalez et al., 2002). Second, participants using the SAS strategy had better performance than those using the CAC strategy in less complex resource allocation tasks. There were no differences between strategies (i.e., on performance) when the task was more complex. However, given the sample size (i.e., 20 participants) used in the study, additional research is warranted as this absence of an effect may have been due to a lack of power.

Research has also attempted to determine whether people are capable of solving resource allocation decisions in an optimal manner (e.g., similar to the LP approach). Evidence suggests that under certain conditions (i.e., certainty, risk) individuals are able to identify optimal solutions. Of those participants who identified the optimal solution, all used the SAS strategy (Gonzalez et al., 2002). This further supports the idea that the SAS strategy may be superior to the CAC strategy. Given the limited attention to these "intuitive" (e.g., SAS and CAC)—in comparison to mathematical strategies (i.e., LP)—in resource allocation decision making (Ball et al., 1998), additional work continues to examine more intuitive allocation strategies. Specifically, as referenced above, research has begun to

explore the individual differences associated with different allocation behaviors (e.g., Schmidt et al., 2009). This proposed research continues this trend toward a focus on individual differences by examining the effect of working memory.

Working Memory Capacity

Attention directs cognitive resources to selected activities or tasks, and working memory aids this process. Working memory is a cognitively-based individual difference that actively preserves small pieces of information to be utilized during cognitive task activities (Cowan et al., 2005). Working memory biases attention to prioritized activities (Lavie et al., 2004) and is related to the ability to focus on goal-relevant information (Redick & Engle, 2006). In other words, working memory mirrors executive control (Engle, 2002). Therefore, this construct is relevant to resource allocation as it may facilitate the ability to maintain attention and ignore distractions during task performance. In fact, within the multitasking literature, the dimensions of working memory capacity predict both performance speed and error (Buhner, Konig, Pick, & Krumm, 2006). Therefore, in this study, it is expected that working memory capacity will affect both performance efficiency (i.e., time to completion) and accuracy (i.e., absence of errors). To better understand how working memory capacity plays a role in affecting these performance outcomes, it is important to understand the dimensions and structure of working memory.

Working memory includes three primary dimensions: storage in the context of processing, coordination, and supervision (Oberauer, Sub, Wilhelm, & Wittman, 2003). Storage in the context of processing is the ability to briefly retain

information even after presented. This is useful within the context of resource

allocation for the maintenance of performance over time. Namely, should a

stimulus-driven factor, such as an emergency e-mail at work, require the need to

pause from working on a goal-directed activity, the ability to retain information

from the primary task may help to preserve performance when returning to the

task. Therefore, the benefit that high working memory capacity has on multi-

tasking performance may be extended to resource allocation performance. The

second dimension of working memory is coordination, which refers to the ability

to "build relations between elements and to integrate relations into structures"

(Oberauer et al., 2003, p. 169). This dimension may also be useful if switching

between tasks to integrate activities to improve efficiency. For example, if

allocating attention between two writing projects, it would be helpful to

coordinate the writing process between these distinct projects in such a way as to

allow working on one to facilitate, rather than inhibit, working on the other.

Finally, supervision, the third dimension of working memory, is related to

monitoring activities to ensure that relevant tasks are prioritized and irrelevant

tasks do not cause a distraction.

With regards to the structure of working memory, four primary systems

have been identified: the central executive, the phonological loop, the visuospatial

sketchpad, and the episodic buffer (Baddeley, 2003). The central executive is the

most critical system and effects control via: a) patterns or schemas which are

influenced by environmental cues, and b) the supervisory activating system which

intervenes when control processes are lacking (Baddeley, 2003). Therefore, the

central executive is implicated when behavior is driven by superordinate mental

constructs such as goals—this speaks to the first role of the central executive.

However, when cognitive resources are limited, the central executive may also

function to influence behavior by supervising the actions of its supporting

systems. These supporting systems include the phonological loop and the

visuospatial sketchpad. The phonological loop is the system of sound processing

that supports the acquisition of language (Baddeley, Gathercole, & Papagno,

1998) and is responsible for temporarily storing phonological information to

memory using a rehearsal process; similarly, the visuospatial sketchpad stores and

manipulates visual and spatial information for short periods (Baddeley, 2003).

Finally, the episodic buffer, (Baddeley, 2000) facilitates integration between the

phonological loop, the visuospatial sketchpad, and long-term memory (Baddeley,

2003). See Figure 1 for a visual representation of the systems involved in working

memory.
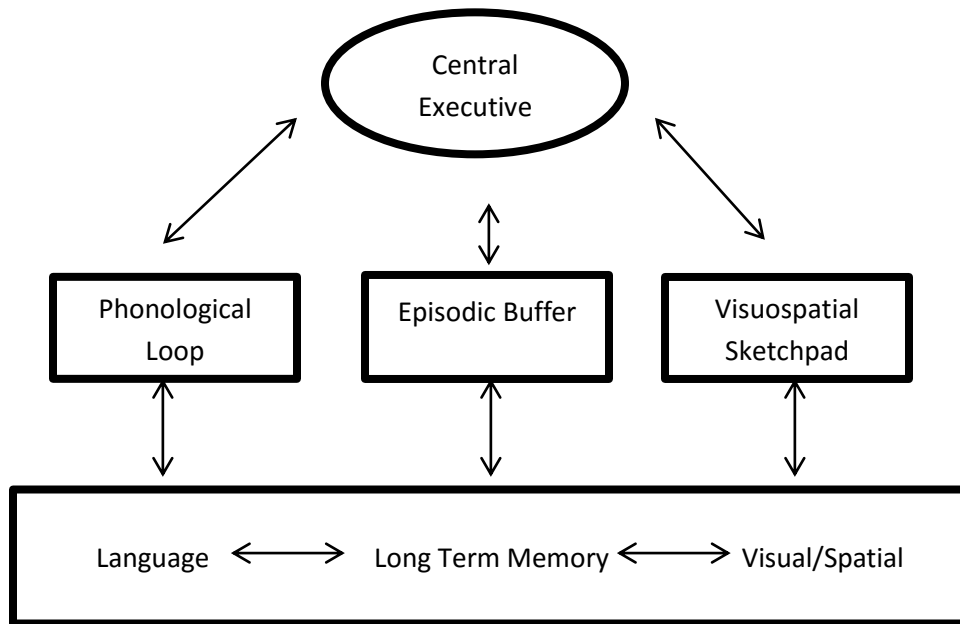
Figure 1. The multi-component model of working memory. Adapted from Baddeley (2003).

The role of working memory in the allocation of attention.

Working memory is an important predictor of performance in situations requiring multi-task performance (Hambrick, Oswald, Darowiski, Rench, & Brou, 2010; Konig, Buhner, & Murling, 2005). Additionally, working memory predicts the likelihood of exercising more cognitive control (Kane, Bleckley, Conway, & Engle, 2001), the likelihood of multi-tasking (Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013), and the ability to avoid interference (Kane & Engle, 2003). Recent meta-analytic evidence also suggests that limited working memory capacity is associated with an increased likelihood of mind wandering, which ultimately reduces performance (Randall, et al., 2014). Given that top-down processing is associated with more cognitive-based regulation (Pashler et al,

2001), it seems reasonable to expect an association between high working

memory capacity and top-down processing (Sobel, Gerrie, Poole, & Kane, 2007)

Furthermore, working memory capacity is associated with enhanced

performance on tasks related to ignoring distractions (e.g., Sobel et al., 2007). For

example, using a visual search task, search efficiency was not influenced for

subjects relying on bottom-up processes but was enhanced for those relying on

top-down processes (Sobel et al, 2007). A possible explanation for this could be

that bottom-up processes are facilitated by stimulus-related factors while top-

down processes are more heavily reliant on cognitive resources such as working

memory. As such, we may expect to find an association between top-down

attention, high working memory capacity, and performance within the context of

resource allocation.

In the preceding review, I provided an overview of the general principles

of resource theory. Additionally, I narrowed in on the regulation of attention and

highlighted the role of working memory in the process. Limits to working

memory capacity interfere with the appropriate regulation of attention, which

poses a challenge for successful task performance in work environments that

require multitasking. A reliance on working memory capacity is likely to increase

as jobs increase in complexity and workload. Therefore, identifying

environmental factors that interact with working memory capacity to affect

performance in these conditions is important. The allocation of attention is

heavily dependent on judgment and decision making processes. For example,

having identified that working on my dissertation is presently my most important

goal, directing my attention to preparing an activity for the class I am teaching for

a portion of my day today involves an active decision of not doing one thing and

doing another instead. While several decision making frameworks exist that may

provide a viable suggestion to the resource allocation dilemma, I will apply the

naturalistic decision making model.

Naturalistic Decision Making

Within the tradition of decision making research, several recent dominant

paradigms have influenced theoretical and practical applications (Highhouse,

Dalal, & Salas 2014). One is bounded rationality (Simon, 1972), which highlights

the limits of human cognition and influenced research on heuristics and biases

(i.e., Kahneman's & Tversky's work). Another is adaptive decision making,

including the Brunswick lens model (i.e., Hammond, 1955), and research from the

ABC group suggesting that the "fast and frugal" nature of heuristics can enhance

decision making (e.g., Gigerenzer & Goldstein, 1996). A third approach focuses

on real-life decision making, influenced by more dynamic realities. One example

of this approach is naturalistic decision making (Lipshitz et al., 2001).

Naturalistic decision making seeks to "understand how people make

decisions in real-world contexts that are meaningful and familiar to them"

(Lipshitz et al., 2001, p. 332). This approach to decision making responds to the

shortcomings of traditional decision making approaches that are incompatible

with the uncertainty associated with organizational life (Grossman et al., 2014).

This supports the applicability of a naturalistic decision making model to the

problem of resource allocation. To be precise, typical work situations are believed

to include some uncertainty and be dynamic in nature—thereby complicating the decisions about where and how attention should be allocated. For example, going back to the opening example - consider that Beth has prioritized the goal of completing the edits needed for the revise and resubmit. This task may support the goal she has of increasing her research productivity.

However, applying a traditional decision making framework—prospect theory which models real-life choices, for example—a question exists of how she would determine the value of the potential gain to be achieved from completing this task when there is no guarantee that completing the edits will result in her paper being accepted for publication. Additionally, further uncertainty relates to how she would quickly and accurately weight the value of revising one paper versus another to decide which to prioritize. Therefore, while more recent models of decision making deviated from the classical or rational choice model of decision making where decision-makers were assumed to be rational thinkers, an understanding of decision making in more dynamic contexts is still warranted (Lipshitz et al., 2001). The limitation of applying traditional decision making theories to explain how we allocate attention is therefore challenging given the dynamic nature of resource allocation.

Consequently, naturalistic decision making might be a good fit for explaining and enhancing allocation decisions. Eight distinguishing features are typical of naturalistic decision making contexts. These include: ill-structured problems, uncertain and dynamic environments, shifting and ill-defined or competing goals, action/feedback loops, time constraints, high stakes, multiple

players, and organizational goals and norms (Orassanu & Connolly, 1993).

Applying naturalistic decision making to a situation requires that some—not

necessarily all—of these contextual features are present (Grossman et al., 2014).

Additionally, naturalistic decision making relies heavily on experience. That is,

decision-makers are required to have some amount of knowledge of the decision

domain (Lipshitz et al., 2001). This facilitates a critical component as decision-

makers engage in a matching process between cues within their existing and

previous decision environments (Grossman et al., 2014). As this relates to

resource allocation, I suggest that this reliance on cues further supports the

relevance of naturalistic decision making to resource allocation decisions as it

provides the possibility of enhancing allocation decision through the practice of

training.

　　There are four essential characteristics of naturalistic decision making that

distinguishes it from other decision making frameworks. The first is that

naturalistic decision making is process-oriented (Lipshitz et al., 2001). This

means that rather than proposing the appropriate alternative in a choice situation,

the naturalistic model describes the decision *process*. Therefore, applying

naturalistic decision making to resource allocation would focus on identifying the

type of information focused on to arrive at decisions about what to prioritize. By

knowing this, attempts can be made to provide this information in order to prime

more appropriate allocation decisions. The second characteristic is the use of

situation-action matching decision rules (e.g., "Do A because it is appropriate for

situation S"; Lipshitz et al., 2001; p. 334). This has an important implication to

resource allocation decisions. Explicitly, if we are able to identify appropriate matching rules for ideal allocations, this can help to facilitate superior performance and help to avoid erroneous allocations. Given that the resource allocation process is fundamentally dynamic (Atkinson & Birch, 1978), naturalistic decision making may help to guide appropriate task switching as called for by the work situation. Third, naturalistic decision making is context-bound which further supports the value of domain-specific experience (Lipshitz et al., 2001). The final characteristic is that naturalistic decision making facilitates empirically-based prescriptions (Lipshitz et al., 2001). This means that optimal allocation decisions would be based on evidence of previously successful allocations. The third and fourth characteristics reinforce the value of expertise or prior experience within the decision-domain. This leads to the question of what underlining features of experience support naturalistic decision making.

Cues aiding naturalistic decision making.

To better appreciate the underlining factors of influence during naturalistic decision making, it is helpful to understand a specific type of naturalistic decision making model—recognition-primed decision making (RPD; Klein, 1998). RPD involves categorizing a situation as similar to other situations in the past and finding a course of action by predicting the outcome. RPD includes three variations of "if: then" reactions (Klein, 1998). The first variation occurs when the situation is clear and the decision-maker has a fair understanding of both the stimulus and the outcome. The second and third variations occur when the decision maker is uncertain about either the stimulus situation or outcome. In

order to decide under uncertain conditions, expert decision-makers often rely on

cues (Klein, 1998). The reliance on cues in decision making represents a

simplification method used by decision makings in complex situations (Lant &

Hewlin, 2002).

The use of cues to facilitate decision making has been shown to be an

effective strategy. Based on schema theory, people develop cognitive

representations of the information they process, which helps provide rules to

direct behavior (Kiesler & Sproull, 1982). Cues may therefore help to increase

efficiency in complex allocation situations, as they can provide guidelines based

on previous experience. Further, the use of cues also helps enhance situational

awareness (Grossman et al., 2014). Situational awareness is knowledge of one's

environment; including an understanding of the meaning and status that each

element presents (Endsley & Garland, 2000). This has some implication to

resource allocation in situations where multiple elements are competing for one's

attention. That is to say, by having adequate awareness of one's situation, a better

determination can be made about the meaning and relevance of any "distractors"

presented. Therefore, less time should be lost on tasks that detract from the

accomplishment of one's main goal, as with better situational awareness only

critical off-tasks will be attended to.

Related to the discussion of working memory above, working memory is

responsible for cue-based processing, coordination, and control (Baddeley, 2003;

Oberauer et al., 2003). Further, working memory capacity also predicts how

individuals attend to information. Specifically, those with low working memory

capacity are more likely to attend to off-task activities (Kane & Engle, 2003).

Consequently, relying on working memory to facilitate this cue-based processing

may only further reduce working memory capacity. Therefore, before

implementing resource allocation cues in an attempt to support better allocation

decisions, it may be useful to first explore the effectiveness of different types of

cues in light of differences in working memory capacity. Explicitly, might those

with low working memory capacity benefit more from a certain type of cue? I

propose that cues presented from the bottom-up (i.e., task or stimulus level)

require less cognitive effort for those with low working memory capacity,

considering that they have less top-down cognitive control than people with high

working memory capacity (Redick & Engle, 2006).

Therefore, I predict that working memory capacity will influence

sensitivity to the source of cues. To be exact, those with high working memory

capacity will effectively allocate resources when provided with cues at the level

of the goal (e.g., feedback on goal progress facilitating self-regulation) or, at the

level of the goal along with cues on the task (e.g., information on priority of off-

tasks), because they possess the cognitive resources needed to both self-regulate

and maintain cognitive control (Kanfer & Ackerman, 1989). Conversely, those

with low working memory capacity will demonstrate more effective performance

in situations of competing attentional demands when provided with cues at the

level of the task as the instantaneous nature of these cues will command more

attention when working memory capacity is low (Kane & Engle, 2003). Further,

when individuals with low working memory capacity are given both task- and

goal-focused cues, the presence of both cues will impair performance as

processing information from both cues will command more cognitive resources

which low working memory individuals lack (Kanfer & Ackerman, 1989). In this

study, task-related cues should reduce the cognitive demands on low working

memory individuals by reducing the need to consciously make judgments about

whether they should switch their attention to the off-task activity. Allocation

cueing that encourages attending to whether an off-task activity is critical should

provide help (in comparison to cueing a goal monitoring focus), rather than hurt

low working memory individuals. Therefore, providing salient or clear

information on whether a secondary or off-task demand requires attention may

help those with low working memory capacity allocate their attention

appropriately. In sum, it is expected that cueing those with high working memory

at the goal and goal and task levels will result in a) more time on a goal-related

task and, b) better performance on a goal-related task. Conversely, cueing

individuals with low working memory capacity at the task level will result in a)

more time on a goal-related task and b) better performance on a goal-related task.

See Figure 2 for the full conceptual model of the proposed relationships.
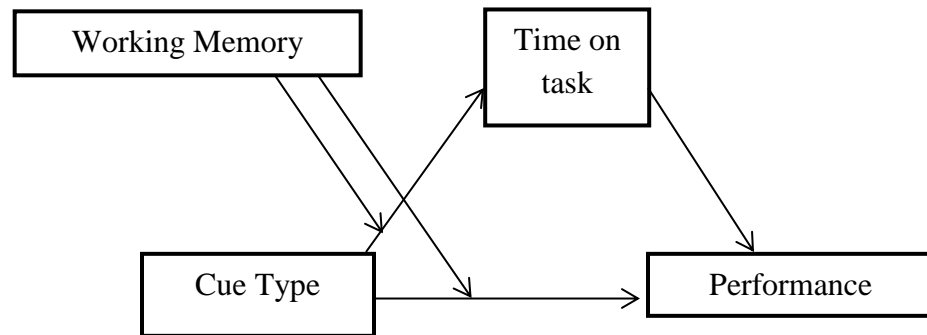
Figure 2. Conceptual Model Depicting the Proposed Moderated-Mediated

Relationship between Cue Type, Working Memory, Time on Task, and

Performance.

Rationale

The proposed study contributes to the understanding of resource allocation

performance from a decision making perspective. Naturalistic decision making,

while mostly applied to emergency contexts (e.g., Carvalho, dos Santos, & Vidal,

2005), has some promise for more typical decision making contexts (Grossman et

al., 2014). The resource allocation context is believed to be one such context

given its dynamism (Atkinson & Birch, 1978). The proposed research applies the

principles of naturalistic decision making and seeks to determine if working

memory capacity moderates the relationship between allocation cues and

performance in the resource allocation context.

The results from this study have two primary implications. First, this study

applies naturalistic decision making to a prototypical work context. While

naturalistic decision making is believed to be valuable outside of contexts related

to firefighting, the military, aviation, and medical decision making (Grossman et

al., 2014), very little research has applied naturalistic decision making to prototypical working settings such as office environments. Factors such as greater autonomy, technological advancements, and increases in the distributed nature of work (Goodwin, Burke, Wildman, & Salas, 2009; Wood, 2011) present a very complex environment for resource allocation and, as such, naturalistic decision making may provide some value in understanding allocation decisions. This value can be enhanced through proper task-related training directed at managing multiple demands which leads to the second major contribution of this research.

Second, by identifying the differential effects of resource allocation cues on resource allocation, targeted work design or training can be implemented to take advantage of these effects. That is, if those with low working memory capacity show more effective performance when given allocation cues at the task level, work or training design could provide targeted interventions to help individuals with low working memory to perform in resource allocation contexts. For example, this research may suggest that cueing low working memory capacity employees to attend to task features may be more effective than a focus on goals in situations where task distractions are highly likely. As another practical application, training based on the principles of naturalistic decision making can take several approaches. One promising training format which facilitates cue recognition is situation awareness training (Grossman et al., 2014). Situational awareness refers to the ability to perceive features of the environment and to comprehend the meaning of these features (Endsley, 1995). This research will help to provide support regarding the types of cues best capable to facilitate this

awareness based on working memory differences. In addition to cue recognition or situational awareness training, another practical implication that this research may provide concerns the provision of resource allocation cues in the work environment. If the hypothesis that task-level cues are more effective than goal-level cues for individuals with low working memory, then attempts to make task-level cues more salient or clear may also provide some advantages. The hypotheses are summarized below.

Statement of Hypotheses

Hypothesis I: There will be a positive relationship between working memory capacity and time spent on task such that, participants with higher working memory capacity will spend more time on the task (i.e., be less distracted by the e-mails).

Hypothesis II: There will be a positive relationship between time spent on task and performance in terms of (a) accuracy and (b) efficiency such that, participants with higher working memory capacity will be more accurate and more efficient.

Hypothesis III: The relationship between cue type and performance (a) accuracy and (b) efficiency will be partially mediated by time on primary task.

Hypothesis IV: Working memory will moderate the effect of cue type on time spent on the primary task. Specifically,

    (a) As working memory increases, individuals who are exposed to the goal-focused cue or both goal- and task-focused cues will spend more time on the task than individuals exposed to the task-focused cue.

(b) As working memory decreases, individuals exposed to task cues will

spend more time on the task than individuals exposed to the goal-focused

cue or both goal- and task-focused cues.

Hypothesis V: Working memory will moderate the effect of cue type on

performance in terms of (a) accuracy and (b) efficiency. Specifically,

(a) As working memory increases, individuals who are exposed to the goal-

focused cue or both goal- and task-focused cues will demonstrate higher

performance in terms of (a) accuracy and (b) efficiency on the task than

individuals exposed to the task-focused cue.

(b) As working memory decreases, individuals exposed to task cues will

demonstrate higher performance in terms of (a) accuracy and (b)

efficiency on the task than individuals exposed to the goal-focused cue or

both goal- and task-focused cues.

PART II

Method

Overview

A one-way independent samples experimental design with four conditions was used to examine the hypotheses. Specifically, the independent variable, cue type, was manipulated to include four levels: task level cue, goal level cue, both task and goal level cues, and no cue. Working memory was measured as an individual difference moderator variable. Attention was operationalized as the proportion of time spent on the primary task, and was examined as a potential mediator of the working memory and cue type effect on performance. The dependent variable was performance, which was operationalized in two ways: a) accuracy (correct responses) and b) efficiency (time to completion). General mental ability, task-specific self-efficacy, goal orientation, conscientiousness, experience with the task software (Excel), and baseline performance were examined as covariates.

Participants

Participants were undergraduates enrolled in Introduction to Psychology (PSY 105 & 106) at a large, private Midwestern University. Participants received 2.5 credits for their participation (.5 for an online pre-measure and 2.0 for the experiment). Participants from all demographic background (e.g., gender, race) were allowed to participate; however, all participants were at least 18 years old. In total, 484 participants completed the pre-measure (part 1); of that number, 235 also completed the experiment (part 2). Given that participants were required to

complete both parts 1 and 2, 235 was the qualified sample size for hypothesis

testing. After data preparation and screening, the total sample included in study

analyses was reduced to 166 participants; this is further discussed in the section

describing the data screening process. Of the participants who were included in

the analyses, 79.5% self-identified as female and 19.9% as male. The average age

of participants was 19.72 ($SD = 2.48$). Regarding racial background, 58.4% of the

participants reported being Caucasian/White, 19.9% as Hispanic or of Spanish

origin, 13.9% as Asian/Pacific Islander, 6.6% as Black/African American, and

.6% as American Indian or Alaska native. In terms of employment status, 53.6%

of participants reported being not employed, while 41.6% were employed part-

time, and 4.2% had fulltime employment. Finally, regarding years of work

experience, 25.3% of the sample had 5-10 years of work experience.

Task Description

The experimental task was a procedural knowledge Excel task previously

used to assess trainer effects (e.g., Towler et al., 2008; see Appendix A). The task

involved using Microsoft Excel to conduct calculations, formatting, filtering, and

creating charts using a dataset on the lifestyle choices of college students. The

task included seven questions that participants were asked to complete.

Participants were given 15 minutes to complete the task. The primary task was

scored out of a total of 36 points based on the number of correct responses.

The lab task also included a distractor activity (see Appendix B), which

was attending to e-mails. During the task, participants received a series of e-mails

intended to simulate a work environment whereby a secondary activity competed

for the allocation of attention from a primary task. Participants received a total of 8 e-mails. The e-mails served no task-related purpose and were solely intended to distract participants from the experimental task (example e-mail titles included: "Discover the meaning and history behind your last name" and "Sign up for additional Experiments on Sona Systems". Participants were told that they were free to attend to these e-mails if they wished to do so. The e-mails were selected to be attractive enough in nature so as to elicit the attention of participants away from the main task. As participants worked on completing the task, e-mails were received via a dedicated Microsoft Outlook e-mail account whereby on receipt of an e-mail, a visual notification to the lower right hand corner as well as an auditory notification by headphone was received. Participants were instructed to wear headphones during the task; this was done to increase the likelihood of participants noticing the e-mails.

Study Manipulation

Independent variable: Cue type was manipulated to include goal, task, task and goal, or no cue. The cues were intended to prime participants to engage in either top-down (i.e., goal-focused), bottom- up (i.e., task-focused), or both types of attention allocation strategies. In other words, participants in the goal cue condition were primed to attend the experimental activities based on their goal (e.g., goal progress); conversely, participants in the task cue condition were primed to attend to activities based on features at the task level (e.g., criticality), and finally, participants receiving both task and goal cues were primed to engage in both types of allocation strategies. In total, 39 participants were included in

goal cue condition, 44 were in the task cue condition, 41 were in the goal and task

cue condition, and 42 participants were in the control group.

Participants in the goal cue condition (i.e., top-down attention) were given

a paragraph describing the importance of top-down thinking. The paragraph (see

Appendix C) provided an explanation of what top-down processing means, a

description the value of processing from the top down (i.e., maintaining a focus

on a goal) and two recommendations for using this strategy when deciding how to

allocate attention while completing the task (e.g., considering how close one is to

a goal). Essentially, participants were primed to focus on allocating their attention

based on an overarching goal. Participants in this condition were also asked to set

a goal for themselves after reading the instructions. The purpose of setting this

goal was to give participants a frame of reference for regulating their attention as

they worked on completing the task.

Likewise, participants in the task cue condition (i.e., bottom–up attention)

were given a paragraph describing bottom-up thinking (see Appendix C). The

paragraph provided an explanation of bottom-up processing, a description of its

benefit (i.e., attending to critical or urgent information) and two recommendations

for using this strategy when deciding how to allocate attention while completing

the task (e.g., quickly scan e-mail title to determine relevance). Participants were

primed to allocate their attention based on the nature of the e-mails received.

Participants in the both task and goal cue condition received both paragraphs in

their instructions.

Manipulation check. Each manipulation was followed by a series of

questions assessing participants' understanding of the description of the strategies

and a question about a self-set goal for participants in the goal-focused condition.

These questions served as the manipulation check (see Appendix C). Twelve

participants failed the manipulation check by failing to provide the correct

responses. These participants were excluded from the analyses.

Procedure

Participants completed a two-step process as part of their participation in

the study. First, using Sona System, participants sign up to participate in the

study. They were given a description of the research and the requirements for the

two-part nature of the study. Participants then had the option to complete the first

online portion (after reviewing the informed consent; Appendix D) which

included the pre-test measures of: a) conscientiousness, b) goal orientation, c)

experience with Microsoft Office platforms (i.e., Word, PowerPoint) within

which was embedded a measure of experience with Excel, and d) the

demographic measure (Appendix E). Participants received half a credit (.5) for

completing these measures. In order to create a unique identifier to link data from

the online pre-test to the second portion (i.e., lab data), participants were

instructed to create a unique password that they were required to take with them

to the lab if they so desired to participate in the second portion of the study.

Participants then had the option of signing up for the lab session—participation in

the lab session was not required, therefore, there was some attrition between the

first and second components of the study.

Prior to the participants' arrival to the lab for the second portion of the study a random condition assignment software was used to create a series of participant ID numbers based on the four experimental conditions. Numbers were then assigned to participants chronologically (e.g., 0001A, 0002C, 0003A, 0004D, 0004B). On their arrival to the lab, participants were asked to review an informed consent document (Appendix F). To ensure that participants had a clear understanding of the general purpose of the study, and the benefits and risks associated with participation, participants were asked three general questions based on information presented on the informed consent. Participants who failed to respond correctly were redirected to the informed consent before signing. Once signed, participants were then directed to the Qualtrics survey which housed the measures to be completed during the lab session. This survey had links to the working memory and general mental ability measures. Before accessing the survey, participants were required to submit the password that they created at the end of the pre-lab measures. Next, participants were given their unique participant ID number to enter at the beginning of the working memory and general mental ability measures. They were also required to enter this number at the end of the Qualtrics survey. Therefore, all measures could be linked using this participant ID that also allowed easy tracking of condition assignment.

In the lab, participants first completed a) an online working memory test, and b) a timed general mental ability test. Following this, participants completed a 15-minute training to become acquainted with the Excel task (Towler et al., 2008). The training was facilitated by a pedagogical agent-led video created for

the task. After watching the video, participants completed a brief recall measure

to assess their understanding of the training material; this measure served as a

measure of baseline performance (see Appendix G). Next, participants read the

instructions for the tasks. Instructions varied based on the study manipulation and

was followed by the manipulation check (see Appendix C). Next, participants

completed a task-specific self-efficacy measure (see Appendix H). Finally, they

began the performance task (Towler et al.).

Participants were given 15 minutes to complete the task. This is less than

the 25 minutes typically given to complete this task in prior studies (e.g., Mann,

Mitchell, Brown, & Towler, 2013; Mitchell, Brown, Mann, & Towler, 2014).

Participants were given this reduced time limit to make the task more challenging.

During the task, eight e-mails were sent to participants from a dedicated Gmail

account. E-mails were sent by the research assistant every 1.5 minute starting 1

minute into the task. The e-mails were sent to all participants in the same order.

Participants received these e-mails to a Microsoft Outlook account configured to

the machine they were working on. Microsoft Outlook allowed e-mails to "pop

up" at the lower right hand corner of the screen providing both a visual and

auditory notification. While working on the computer and switching between the

task and e-mails, the time tracking software, ManicTime, ran in the background to

track participants' attention between the Microsoft Excel and Outlook

applications. The program tracked time based on application opened, mouse

clicks, and keyboard use.

Participants were told when they had 5 minutes remaining on the task and

were instructed to stop after 15 minutes. For participants who completed the task

before 15 minutes, the time taken to complete the task was recorded. Once

completed, participants were instructed to save their working file and directed to

the Qualtrics to read the study debrief (see Appendix I).

Measures

Moderator: Working memory was measured using the Operational span

(O-Span) task developed by Bryan Edwards and Ana Franco-Watkins. This task is

similar to the one developed by the Engle laboratory for use with the E-prime

software (Unsworth, Heitz, Schrock, & Engle, 2005). O-span is a test of working

memory capacity that assesses the associated processing and storage of

information (Engle, Tuholski, Laughlin, & Conway, 1999; Turner & Engle,

1989). The O-span correlates with other measures of working memory capacity

(Conway, Cowan, Bunting, Therriault, & Minkoff, 2002). This measure was

convenient as it facilitated accessible online testing via a URL through the

Franco-Watkins lab. This test consisted of sets of mathematical problems (e.g.,

8/4 + 3 =7?) coupled with letter strings. First, participants practiced each task, and

then they practiced solving the mathematical problems while storing the letters to

memory. In total, there are 75 math/letter pairs; 12 sets were used in this task. A

working memory score was determined based on the total number of correctly

recalled letters in the correct position while maintaining accuracy (85% or

greater) on the mathematical problems. The O-span adapted to each participant's

time to solve the mathematical problems presented. This measure lasted for

approximately 10-15 minutes (self-paced). Appendix J contains screenshots of the

working memory test. Participants could receive scores ranging from 0-50 points

on the working memory measure. On average, participants had a working

memory score of 34.97 ($SD = 9.17$).

Control variables. To help to control the influence of individual

differences known to have an effect of performance, data was collected on general

mental ability (GMA), conscientiousness, goal orientation, task self-efficacy, and

prior experience with Microsoft Excel. To assess GMA, participants completed

the Wonderlic Personnel Test (WPT-R) in which they completed as many of 50

items possible in 8 minutes. Past research has found test-retest reliability of .82-

.94 and alternate-forms reliability coefficients of .73-.95 (Geisinger, 2001). In

relation to validity, the test demonstrated predictive validation across jobs with

values of .22-.67 and correlates with the WAIS Full Scale IQ and the General

Aptitude Test Battery's "Aptitude G" ($r = .70$-$.92$; Geisinger, 2001). On average,

participants had a general mental ability score of 23.55 ($SD = 3.28$), out of a

potential range of 0-50.

Within the domain of personality, conscientiousness has generally shown

the most promise as a predictor of job performance ($r = .25$, Barrick & Mount,

1991; $r = .31$, Schmidt & Hunter, 1998). Conscientiousness was measured using

the conscientiousness sub-scale from the International Personality Item Pool

(IPIP; Goldberg et al., 2006; Appendix K). The IPIP's conscientious subscale

reports coefficient alphas ranging from .71-.85. The scale also correlates with the

NEO Personality Inventory ($r = .60 - .76$; Goldberg et al., 2006). In this study,

data collected with the IPIP conscientiousness scale had a coefficient alpha of .86.

      Data were also collected on goal orientation given its observed effect in

previous resource allocation research (Schmidt et al., 2009). Goal orientation was

measured using a 13-item instrument on a 7-point Likert-type scale ranging from

1 (strongly disagree) to 7 (strongly agree) (VandeWalle, Cron, & Slocum, 2001;

Appendix L). The instrument also showed high internal consistency in this study

with acceptable coefficient alphas for learning (.77), avoid (.76), and prove goal

orientation (.76), respectively. Task-specific self-efficacy, which has a moderate

to strong relationship with self-regulated learning, was also measured as a control

variable (Sitzmann & Ely, 2011). Task-specific self-efficacy was measured using

an adapted scale from prior research which contains 4 items assessing confidence

in the ability to complete the task (De Guinea & Webster, 2011; Appendix H).

Sample item includes: "I feel confident that I can carry out the Excel task". The

measure shows good reliability ($\alpha = .90$; De Guinea & Webster, 2011). Scale

items were assessed using a 1-100 response scale (0 = no confidence; 100 =

completely confident) to be consistent with recommendations from Bandura

(2006). In the current study, the scale demonstrated very high internal consistency

($\alpha = .98$).

      Baseline performance was assessed using a 13-item recall test often used

with the task in previous research. The test was given after the 15-minute training

video was viewed by the participants and was objectively scored based on an

answer sheet. On average, participants had a pretest score of 8.04 (*SD* = 2.28).

The recall test can be found in Appendix G.

Experience with Excel was also accessed by asking participants how

frequently they use Microsoft Excel (Towler et al., 2008). This measure was

included in the pre-test survey with questions about the frequency of use of other

Microsoft products so as to reduce the likelihood of participants predicting the

task for the study before coming to the lab (Appendix M). Thirty-two percent of

the participants reported having no experience using Microsoft Excel.

Mediator: Proportion of time spent on task was used as a proxy for

attention. Time was recorded in seconds using the ManicTime software. This

software automatically monitors and records computer usage by tracking time

spent, in seconds, using different applications, working on documents, and

visiting various websites. The data is date- and time-stamped and stored to the

local machine (not cloud-based) which facilitates offline tracking (see Appendix

N for a screen shot of the data logged using ManicTime). This program was

selected instead of a keyboard logger—which tracks key presses or mouse

movement—as it is assumed that participants may be attending to the Excel file or

e-mails by looking at the screen without interacting with the keyboard for a

duration of seconds. At the same time, ManicTime does not distinguish between

cases in which participants simply have a file or e-mail open but are not actively

attending to the information (e.g., not looking at the screen, reading). As such,

research assistants were instructed to monitor participants to make a note of

participants who appear inattentive to the task. No participant was reported as

displaying behavior indicating disengagement during the task (e.g., staring off into space for a significant period of time).

Given the preciseness (i.e., time in seconds) of the time measurement and the presence of minor variations in task length, attention was operationalized as the proportion of time spent on task. Proportion was calculated as time on task divided by total time (time on task plus e-mail). See Table 1 for means and standard deviations for proportion of time spent on task by study condition.

Dependent variable: Performance outcome was determined in two ways: a) accuracy and b) efficiency. Accuracy was calculated based on correct responses to each item. The correct responses were indicated on an answer sheet prepared for the task (Towler et al., 2008). Accuracy was calculated as an aggregate of scores from the primary task (36 points).

Efficiency was determined based on the amount of time taken to complete the task. Participants who completed the task, before the allotted 15 minutes, received efficiency points based on the number of seconds they had remaining at the time of task completion. For example, a participant who completed the task in 10 minutes received 300 efficiency points while a participant who completed the task in 14 minutes received 60 points for efficiency. That is, participants completing the task in 10 minutes had 5 minutes remaining (i.e., 300 seconds) and a participant completing the task in 14 minutes had 1 minute remaining (i.e., 60 seconds). Participants who failed to complete the task received an efficiency score of 0. See Table 1 for means and standard deviation of efficiency and accuracy by study condition.

Table 1

Means and Standard Deviations for Outcome Variables by Study Condition

	Goal	**Task**	**Both**	**Control**	**Total**
N	39	44	41	42	166
Proportion of time on task	0.84 (.36)	0.95 (.20)	0.85 (.35)	0.90 (.29)	0.89 (.30)
Accuracy	11.26 (6.00)	12.82 (9.19)	12.46 (9.79)	10.50 (8.92)	11.78 (8.78)
Efficiency	3.41 (13.88)	17.10 (50.62)	12.15 (42.98)	20.57 (59.66)	13.54 (45.67)

Note: Values in the cells are presented as means followed by the standard deviation in parentheses.

PART III

Results & Analyses

Before hypothesis testing, data were screened for violations of statistical

assumptions. The data preparation and screening process is detailed below.

Data Preparation and Screening

In total, data were collected from 235 participants; however, only 166

participants were included in the analyses. Twelve participants failed the

manipulation check and were removed from the final sample and 2 participants

were removed due to missing records on the experimental log (e.g., time on task

vs. email, engagement). Data from 55 participants were excluded from the

analyses as a result of a failure to match the unique password supplied for both

the pre-lab and lab portions of the study. Specifically, some participants either

provided the same password as another participant (e.g., non-unique password

such as 'password123') making it difficult to identify to whom data belonged, or

they did not provide a password that could be found in the pre-lab dataset. This

resulted in missing data on all covariates. A series of independent samples t-tests

was performed comparing the mean scores of the included and excluded

participants on the key study variables. There were no significant differences for

the scores on working memory (t [219] = .25, ns), accuracy (t [219] = .73, ns), nor

efficiency (t [219] = .17, ns) between participants included and excluded from the

analyses. However, there was a significant difference for proportion of time on

task between the included (M = .88, SD = .30) and excluded participants (M = .99,

SD =0.02; *t* [219] = -2.64, *p* < .01). Participants excluded from the sample spent a

greater proportion of time on the task than those included in the sample. However,

the decision to exclude participants without scores on all covariates was

maintained. This decision was made because the covariates were significant

predictors in the regression models and because the sample size without the 55

cases with missing data was adequate for detecting a medium-sized effect.

A post-hoc power analysis was conducted using G*Power version 3.0.10.

Power was calculated for the regression analysis with the largest number of

predictors (14, including control variables); the results indicated that there was

sufficient power (i.e., .88) to detect a medium-sized effect (.15) at α =.05 with the

sample size of 161[1] (Cohen, 1992; Faul, Erdfelder, Lang, & Buchner, 2007).

Normality assumptions. To examine normality assumptions, preliminary

analyses were conducted to assess skewness and kurtosis. All main study

variables, including working memory capacity, proportion of time on task, task

efficiency, and accuracy, were examined. To assess normality, skewness and

kurtosis values were divided by their standard errors. Resulting values above 1.96

indicated the presence of skewness and kurtosis within the data (Tabachnick &

Fidell, 2007). Using this metric, it was discovered that both outcomes, the

mediating, and moderating variables were non-normal in distribution. As a result,

these variables were transformed prior to hypotheses testing.

Specifically, the proposed mediating variable, proportion of time on task,

was significantly left-skewed and was raised to the power of 4 to reduce skewness

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[1] Some cases were deleted during the analyses due to missing data on one covariate (e.g., GMA, conscientiousness).

and kurtosis. The transformation reduced the skewness of the distribution but the

variable remained non-normally distributed, most likely because there was a

highly restricted range. Working memory was also transformed by raising the

variable to the power of 2; this transformation successfully normalized the

distribution of working memory. Additionally, both dependent variables

(accuracy and efficiency) were also transformed. Accuracy was slightly right-

skewed and was converted using a square root transformation. This

transformation successfully normalized the distribution of accuracy. Efficiency

was re-expressed using the reciprocal root of the original values. Before

conducting this transformation, a value of 1 was added to all variables as

participants who did not complete the task had an efficiency score of 0. This

transformation reduced the skewness and kurtosis of this variable but did not

result in a normal distribution as efficiency was also highly restricted in range. All

regression analyses were conducted using the transformed values. Table 2 reports

the mean and standard deviations for all study variables including transformed

variables.

Regression assumptions. To ensure that assumptions of regression were

met, multicollinearity, heteroscedasticity, and influential observations were

examined using the transformed variables. To assess multicollinearity two

preliminary linear regression models were run predicting each outcome variable

(i.e., accuracy and efficiency). Tolerance and Index of Variance Inflation (VIF)

values were examined to assess the presence of multicollinearity. However, all

values were within normal range (O'Brien, 2007).

To assess heteroscedasticity, residuals were plotted against predicted scores and plots were visually inspected to confirm homogeneity of variance. The regression model including task accuracy as the outcome demonstrated no cause for concern regarding homogeneity of variance. However, the linear model predicting task efficiency suggested a violation of the assumption of homoscedasticity. As a result, a formal test of heteroscedasticity was conducted. The Breusch-Pagan test, which examines whether variance in the residuals is predicted by the independent variables, was conducted (Breusch & Pagan, 1979; Hayes & Cai, 2007). This test confirmed homogeneity of variance.

Finally, the Cook's distance was used to identify influential observations. All values were examined to identify any Cook's distance scores greater that $4/(n-k-1)$ (Chatterjee & Hadi, 1988). To account for any differences in the analyses resulting from these influential observations, analyses were conducted both with and without these observations. Where influential observations were identified, this will be reported for the relevant analysis in the result section.

Analytical Approach

Hypotheses for this study were tested using regression analyses. When applicable, moderated-mediation analysis was used to test specific hypotheses (Hayes, 2013a). In the case of this study, time spent on the primary task was expected to mediate or explain the effect of cue type on performance. Working memory was also expected to moderate the direct effect of cue type on performance as well as the effect of cue type on time spent on task. This effect was tested using the PROCESS macro developed by Hayes' (2013b), specifically

using Hayes's (2013b) Model 8. The approach uses an ordinary least square path analytic approach with bootstrap and Monte Carlo confidence intervals. This approach is considered superior to the combination of Baron and Kenny's (1986) step approach to mediational analyses with the Sobel test (Hayes, 2015; Preacher & Hayes, 2004). Using this PROCESS model, mediation is determined and communicated using the indirect effects rather than the *a* and *b* coefficients as is traditionally done with the Baron and Kenny method (Preacher & Kelley, 2011).

While moderated mediation analysis is widely used in the social sciences, it is typically used to examine continuous independent variables. In this study, the independent variable (cue type) was categorical and had 4 levels (task cue, goal cue, both task and goal cues, and no cue); the additional predictors were continuous. Recently, a treatment for categorical independent variables has been proposed using the PROCESS macro for testing mediation analyses (Hayes & Preacher, 2014). This approach is thought to be superior to other approaches which require the researcher to dichotomize independent variables with more than two levels, collapse groups, or use continuous manipulations checks as substitutes for independent variables (e.g., Forgas, 2011; Ronay, Greenaway, Anicich, & Galinsky, 2012).

This approach involves dummy coding the categorical independent variables and repeating the analyses for each dummy coded variable; in the case of this study, 2 analyses were conducted. When the independent variable is categorical, parameter estimates are needed to represent the indirect effect at each level of the independent variable. These estimates represent relative effects

(Hayes & Preacher, 2014). In other words, the effects reported for each level of the categorical independent variable should be interpreted as relative to referent dummy-coded group.

To test the overall model in this study, the four cue conditions were represented using 3 dummy-coded variables. The task cue group was used as the referent group and participants in this condition were coded as 0 for all three dummy variables. D_1 represented the goal cue/not goal cue distinction. D_2 represented the goal and task cue/not goal and task cue distinction, and D_3 represented the control/not control distinction. The PROCESS macro was executed 2 times for each outcome variable to determine the indirect effects and conditional effects of working memory for each level of cue type. With each test, the dummy code with the distinction of interest (e.g., goal cue versus non goal cue distinction) was entered as the predictor; however, so that the comparison was the referent group (i.e., task cue), the other dummy codes were included as covariates in the same model. For example, when testing the effect of goal cue as the independent variable, the dummy codes for both task and goal cues and the control group were entered in the model as covariates. In the tables displaying results, the cue types are indicated as D_1, D_2, and D_3, as described above.

Table 2

Descriptive Statistics and Zero-Order Correlations of Study Variables

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Conscientiousness	3.69	0.46	(.86)									
2. GO Learning	5.09	1.10	.23**	(.77)								
3. GO Prove	4.20	1.33	.18*	.07	(.76)							
4. GO Avoid	4.71	1.09	-.07	-.39**	.31**	(.76)						
5. Task Efficacy	58.76	25.22	.10	.16*	.09	-.14	(.98)					
6. GMA	23.55	3.28	-.07	.09	-.04	.01	.18*	--				
7. Excel Frequency	2.82	1.60	.05	.11	-.06	-.11	.25**	.05	--			
8. Working Memory Score	34.97	9.17	-.15	.02	.06	.03	.21**	.41**	.11	--		
9. Working Memory Score^T	1306	591	-.14	.05	.05	.01	.23**	.42**	.13	.98**	--	
10. Pretest	8.04	2.28	-.07	.12	-.12	-.21**	.39**	.37**	.21**	.28**	.27**	--
11. Task Time	891	182	.10	.13	-.08	-.05	.02	-.10	-.04	-.16*	-.13	-.10
12. E-mail Time	9.44	18.89	-.01	.03	.17*	-.07	.07	-.04	.09	-.09	-.10	-.04
13. Task Time(Proportion)	0.88	0.30	-.01	.00	-.05	-.01	-.10	.04	-.03	.01	.03	.08
14. Task Time(Proportion)^T	0.96	0.08	.01	-.03	-.17*	.06	-.07	.03	-.09	.09	.10	.04
15. Task Efficiency	13.54	45.67	.09	-.01	.07	.07	.21**	.21**	.20*	.07	.06	.13
16. Task Efficiency^T	2.12	3.18	.12	-.01	.09	.09	.20**	.20**	.20*	.06	.05	.13
17. Task Accuracy	11.78	8.78	.21**	.20*	-.13	-.26**	.22**	.34**	.13	.10	.13	.28**
18. Task Accuracy^T	3.32	1.32	.22**	.19*	-.12	-.25**	.24**	.33**	.15	.07	.10	.29**

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). GO = goal orientation. Propor = proportion. ^{T} = transformed variable. Time is reported in seconds. $N = 166$ for all study variables with the exception of GMA ($N = 163$), conscientiousness, learning, prove and avoid goal orientation, task efficacy and Excel frequency ($N = 165$).

Table 2

Descriptive Statistics and Zero-Order Correlations of Study Variables, continued

	11	12	13	14	15	16	17	18
11. Task Time	--							
12. E-mail Time	-0.14	--						
13. Task Time(Proportion)	0.1	-0.15	--					
14. Task Time(Proportion)^T	.16*	-.99**	.16*	--				
15. Task Efficiency	-.26**	0.01	-.18*	-0.01	--			
16. Task Efficiency^T	-.26**	0.02	-0.15	-0.03	.96**	--		
17. Task Accuracy	0.04	0.06	-0.1	-0.05	0.12	0.07	--	
18. Task Accuracy^T	0.06	0.05	-0.08	-0.04	0.13	0.1	.98**	--

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). GO = goal orientation. Propor = proportion.
^{T} = transformed variable. Time is reported in seconds. $N = 166$ for all study variables with the exception of GMA ($N = 163$), conscientiousness, learning, prove and avoid goal orientation, task efficacy and Excel frequency ($N = 165$).

Hypothesis I

The first hypothesis predicted that there would be a positive relationship between working memory and time spent on task such that participants with higher working memory capacity would spend more time on the task (i.e., be less distracted by the e-mails). To test this hypothesis, a hierarchical regression model was run with transformed proportion of time on task as the dependent variable, a control variable related to transformed proportion of time on task (i.e., GO prove) entered as a first step, and transformed working memory capacity entered in the second step. The overall model was significant (F [2, 162] = 3.34, p = .04), but results indicated no support for Hypothesis I. Specifically, the relationship between transformed working memory capacity and transformed proportion of time on task was nonsignificant (β = .10, p = .19, 95% CI [.00, .00]).

An examination of regression assumptions indicated the presence of 10 influential observations for this analysis. The analysis was conducted a second time without the influential observations. While the magnitude of the effect of the control variable (i.e., GO prove) was reduced in the analysis without influential observations, the effect of working memory did not change substantially. Table 3 presents the results of the regression analyses with and without influential observations.

Table 3

Summary of Hierarchical Regression Analysis of Working Memory as a Predictor of Proportion of Time on Task

(Hypothesis I)

With Influential Observations

Step	Step 1						Step 2					
	b	*SE*	*β*	*t*	R^2	*F*	*b*	*SE*	*β*	*t*	R^2	*F*
Step 1: Control Variable					.03	4.95[*]					.04	3.34[*]
Intercept	1.00	.02		50.92[*]								
GO Prove	-.01	.00	-.17	-2.23[*]			-.10	.00	-.18	-2.30[*]		
Step 2: Predictor												
Intercept							.99	.02		42.78[*]		
Working Memory[T]							1.32	.00	.10	1.31		

Without Influential Observations

Step	Step 1						Step 2					
	b	*SE*	*β*	*t*	R^2	*F*	*b*	*SE*	*β*	*t*	R^2	*F*
Step 1: Control Variable					.03	5.08[*]					.04	3.38[*]
Intercept	1.01	.02		47.89[*]								
GO Prove	-.01	.01	-.18	-2.25[*]			-.01	.01	-.18	-2.32[*]		
Step 2: Predictor												
Intercept							.99	.02		40.32[*]		
Working Memory[T]							1.38	.00	.10	1.29		

[**]Significant at the 0.01 level. [*]Significant at the 0.05 level. [T] = transformed variable. $N = 165$ with influential observations. $N = 155$ without influential observations.

Hypothesis II

Hypothesis II predicted a positive relationship between time spent on task and performance in terms of (a) accuracy and (b) efficiency. That is, participants who spent more time on the task, relative to time on e-mails, would more accurately and quickly complete the task. Hypothesis IIa was tested with a hierarchical regression model in which transformed accuracy was the dependent variable. Step 1 included covariates related to the outcome (i.e., conscientiousness, learning and avoid goal orientation, task efficacy, and GMA), and step 2 included transformed proportion of time on task. The overall model was significant, (F [6, 154] = 7.53, $p < .0.01$), but results indicated no support for Hypothesis IIa. Specifically, the relationship between transformed proportion of time on task and transformed accuracy was nonsignificant ($\beta = -.04$, $p = .61$, 95% CI [-3.00, 1.74]).

An examination of regression assumptions indicated the presence of 6 influential observations for this analysis. The analysis was conducted a second time without the influential observations. The effect of proportion of time on task did not change substantially. Table 4 presents the results of the regression analyses with and without influential observations.

Table 4

Results of the Hierarchical Regression Analysis of Proportion of Time on Task as a Predictor of Task Accuracy (Hypothesis IIa)

With Influential Observations

Step	Step 1						Step 2					
	b	SE	*β*	*t*	R^2	F	*b*	SE	*β*	*t*	R^2	F
Step 1: Control Variables					.23	9.02**					.23	7.53**
Intercept	-.99	1.91		-.83								
Conscientiousness	.57	.21	.20	2.77**			.57	.21	.20	2.78**		
GO Avoid	-.26	.09	-.21	-2.75**			-.25	.09	-.21	-2.72**		
GO Learn	-.00	.09	-.00	-.02			-.00	.10	-.00	-.03		
Task Efficacy	.01	.00	.12	1.62			.01	.00	.12	1.58		
GMA	.13	.03	.32	4.45**			.13	.03	.33	4.46**		
Step 2: Predictor												
Intercept							-.41	1.63		-.25		
Proportion of Time on Task^T							-.62	1.20	-.04	-.52		

Without Influential Observations

Step	Step 1						Step 2					
	b	SE	*β*	*t*	R^2	F	*b*	SE	*β*	*t*	R^2	F
Step 1: Control Variables					.22	8.19**					.23	7.00**
Intercept	-1.64	1.17		-1.40								
Conscientiousness	.60	.21	.22	2.81**			.62	.22	.22	2.86**		
GO Avoid	-.24	.10	-.19	-2.40**			-.23	.10	-.19	-2.39*		
GO Learn	-.00	.10	-.00	-.04			-.01	.10	-.01	-.06		
Task Efficacy	.01	.00	.13	1.66			.01	.00	.12	1.63		
GMA	.13	.03	.32	4.30**			.14	.03	.33	4.35**		
Step 2: Predictor												
Intercept							-.91	1.65		-.55		
Proportion of Time on Task^T							-1.34	1.32	-.07	-1.01		

**Significant at the 0.01 level. *Significant at the 0.05 level. ^{T} = transformed variable. $N = 161$ with influential observations. $N = 155$ without influential observations.

Hypothesis IIb predicted a positive relationship between proportion of time on task and task efficiency. Hypothesis IIb was tested using a linear regression model in which transformed task efficiency was the dependent variable. Step 1 included covariates related to the outcome (i.e., task efficacy, GMA, and frequency of Microsoft Excel use) and step 2 included transformed proportion of time on task. Results are reported in Table 5. The overall model was significant, (F [3, 157] = 4.14, $p < .0.01$), but results indicated no support for Hypothesis IIb. Specifically, the relationship between transformed proportion of time on task and transformed efficiency was not significant ($\beta = -.01$, $p = .90$, 95% CI [-6.67. 5.87]). There were no influential observations detected in this analysis.

Table 5

Results of the Hierarchical Regression Analysis of Proportion of Time on Task as a Predictor of Task Efficiency

(Hypothesis IIb)

Step		Step 1						Step 2				
	b	SE	β	t	R^2	F	b	SE	β	t	R^2	F
Step 1: Control Variables					.10	5.55[**]					.10	4.14[**]
Intercept	-3.84	1.82		-2.12[*]								
Task Efficacy	.02	.01	.14	1.73			.02	.01	.14	1.72		
GMA	.17	.08	.18	2.27[*]			.17	.08	.18	2.27[*]		
Excel Frequency	.32	.16	.16	2.01[*]			.32	.16	.16	1.99[*]		
Step 2: Predictor												
Intercept							-3.47	3.54		-.98		
Proportion of Time on Task[T]							-.39	3.18	-.01	-.12		

[**]Significant at the 0.01 level. [*]Significant at the 0.05 level. [T] = transformed variable. $N = 161$.

Hypotheses III, IV, and V

Hypothesis III predicted that the relationship between cue type and performance (a) accuracy and (b) efficiency would be mediated by proportion of time on task. Hypothesis IV predicted that working memory would moderate the effect of cue type on time spent on the primary task. Specifically, as working memory increases, individuals who are exposed to the goal-focused cue or the goal- and task-focused cues were expected to spend more time on the task than individuals exposed to the task-focused cue. As working memory decreases, individuals exposed to task cues were expected to spend more time on the task than individuals exposed to the goal- and task-focused cues.

Finally, Hypothesis V predicted that working memory would moderate the effect of cue type on performance in terms of (a) accuracy and (b) efficiency (i.e., direct/path c' effect). Explicitly, as working memory increases, individuals exposed to the goal-focused cue or the goal- and task-focused cues were expected to demonstrate higher performance in terms of (a) accuracy and (b) efficiency on the task than individuals exposed to the task-focused cue. As working memory decreases, individuals exposed to task cues were expected to demonstrate higher performance in terms of (a) accuracy and (b) efficiency on the task than individuals exposed to the goal- and task-focused cues. Hypotheses III-V were examined using Model 8 of the PROCESS macro (Hayes, 2013a; 2013b). First the overall model results are presented followed by the specific coefficients that examine each hypothesis. Results for task accuracy are discussed first, followed by the results for task efficiency.

Overall model results for task accuracy. The overall results of the moderated-mediated analyses, with and without 4 influential observations, for task accuracy are summarized in Table 6[2]. Covariates observed as having an effect on transformed accuracy (i.e., conscientiousness, learning and avoid goal orientation, general mental ability, pre-test, and task efficacy) were included in the model. For the analysis predicting transformed task accuracy, the overall model statistics for the path predicting transformed proportion of time on task were nonsignificant (F [13, 147] = .42, ns). However, the overall model predicting transformed accuracy was significant [F [14, 146] = 3.50, $p < .01$]

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[2] Indirect and conditional direct effects for the model tested without influential observations are not reported as these effects did not change substantially.

Table 6

Results of the Moderated-Mediated Analyses with Accuracy as the Outcome:

Model Summary and Coefficients

With Influential Observations				
Outcome: Proportion of Time on Task[T]	*b*	*SE*	*R²*	*F*
Control Variables			.04	.42
Intercept	.93*	.09		
Conscientiousness	.01	.01		
GO Learn	-.00	.01		
GO Avoid	.00	.01		
GMA	-.00	.00		
Pre-test	.00	.00		
Task Efficacy	-.00	.00		
Predictors				
D_1	.00	.02		
D_2	-.01	.02		
D_3	-.01	.02		
WM^T	.00	.00		
$D_1 * WM^T$	.00	.00		
$D_2 * WM^T$	.00	.00		
$D_3 * WM^T$	.00	.00		

Outcome: Accuracy[T]	*b*	*SE*	*R²*	*F*
Control Variables			.25	3.50**
Intercept	-.75	1.74		
Conscientiousness	.57*	.22		
GO Learn	-.01	.01		
GO Avoid	-.23*	.01		
GMA	.13	.03		
Pre-test	.07	.05		
Task Efficacy	.00	.00		
Predictors				
D_1	.07	.28		
D_2	-.19	.28		
D_3	-.22	.27		
WM^T	-.00	.00		
$D_1 * WM^T$	.00	.00		
$D_2 * WM^T$	.00	.00		
$D_3 * WM^T$	.00	.00		
Proportion of Time on Task[T]	-.81	1.23		

**Significant at the 0.01 level. *Significant at the 0.05 level. [T] = transformed variable.
WM = working memory. $N = 161$. Cue type was dummy coded in these analyses; task cue was coded as the referent group. D_1 = goal cue; D_2 = both task and goal cues; D_3 = control.
b = unstandardized regression coefficient. Boot strap sample size = 10,000.

Table 6

Results of the Moderated-Mediated Analyses with Accuracy as the Outcome:

Model Summary and Coefficients, continued

Without Influential Observations				
Outcome: Proportion of Time on Task^T	*b*	*SE*	*R^2*	*F*
Control Variables			.04	.41
Intercept	.95*	.09		
Conscientiousness	.01	.01		
GO Learn	-.00	.01		
GO Avoid	.00	.01		
GMA	-.00	.00		
Pre-test	.00	.00		
Task Efficacy	-.00	.00		
Predictors				
D$_1$	.00	.02		
D$_2$	-.01	.02		
D$_3$	-.01	.02		
WM^T	.00	.00		
D$_1$ * WM^T	.00	.00		
D$_2$ * WM^T	.00	.00		
D$_3$ * WM^T	.00	.00		

Outcome: Accuracy^T	*b*	*SE*	*R^2*	*F*
Control Variables			.26	3.61**
Intercept	-.67	1.74		
Conscientiousness	.56*	.221		
GO Learn	-.05	.10		
GO Avoid	-.22*	.10		
GMA	.13	.03		
Pre-test	.05	.05		
Task Efficacy	.01	.00		
Predictors				
D$_1$	.13	.27		
D$_2$	-.19	.27		
D$_3$	-.41	.27		
WM^T	-.00	.00		
D$_1$ * WM^T	.00	.00		
D$_2$ * WM^T	.00	.00		
D$_3$ * WM^T	-.00	.00		
Proportion of Time on Task^T	-.61	1.20		

**Significant at the 0.01 level. *Significant at the 0.05 level. ^{T} = transformed variable. WM = working memory. $N = 157$. Cue type was dummy coded in these analyses; task cue was coded as the referent group. D$_1$ = goal cue; D$_2$ = both task and goal cues; D$_3$ = control. *b* = unstandardized regression coefficient. Boot strap sample size = 10,000.

Hypothesis IIIa predicted that the relationship between cue type and accuracy would be mediated by proportion of time on task. The first analyses examined the indirect effect of cue on transformed accuracy through proportion of time spent on task. Analyses controlled for conscientiousness, learning and avoid goal orientation, general mental ability, pre-test, and task efficacy. Table 7 displays the unstandardized regression coefficients (b), standard errors (SE), and bootstrapped results for the indirect effects. There was no significant difference between the task cue and the goal ($b = -.00$) nor between task cue and both task and goal cues ($b = .00$) conditions in predicting transformed accuracy through transformed time spent on task. Bootstrap results with a bootstrapped 95% CI around the indirect effect included zero (goal cue [.00, .00], both task and goal cues [-.00, .00]). Therefore, Hypothesis IIIa was not supported.

Table 7

Relative Indirect Effect of Task Cue Type on Task Accuracy^T through Proportion of Time^T on Task

	Goal Cue	Both Task and Goal Cues
Effect	.0000	.0000
SE (Boot)	.0000	.0001
BootLLCI	.0000	-.0002
BootULCI	.0001	.0000

Note: Cue type was dummy coded. $N = 161$. Cue type was dummy coded in these analyses; task cue was coded as the referent group. Effects are relative to the task cue. Bootstrap sample size = 10,000. CI = confidence interval; LL = lower limit; UL = upper limit. Effects are unstandardized coefficient estimates. ^{T} = transformed variable.

Hypothesis IV predicted that working memory would moderate the effect of cue type on time spent on the primary task. Specifically, as working memory increases, individuals who are exposed to the goal-focused cue or the goal- and task-focused cues were expected to spend more time on the task than individuals exposed to the task-focused cue. As working memory decreases, individuals exposed to task cues were expected to spend more time on the task than individuals exposed to the goal- and task-focused cues. Results from the overall moderated-mediated model predicting transformed task accuracy[3] (Table 6) indicated no significant moderated effect of transformed working memory on the cue type and transformed proportion of time on task relationship for neither goal cue as compared to the task cue *(b = .00)* nor both task and goal cues as compared to the task cue *(b* = .00) in the model predicting transformed task accuracy.

Results for the analyses testing whether transformed working memory moderated the relationship between cue type and transformed accuracy (Hypothesis Va) are presented in Table 8. Results indicated that the conditional direct effects of working memory were nonsignificant at 1 standard deviation below the mean on transformed working memory (goal cue, *b* = .00, *ns*; both task and goal cues, *b* = -.47, *ns*), at the mean (goal cue, *b* = .08; both task and goal cues, *b* = -.19, *ns*), and 1 standard deviation above the mean (goal cue, *b* = .15, *ns*; both task and goal cues, *b* = .09, *ns*). These results indicate that there were no differences between the conditional direct effects for participants in the task cue condition compared to those in the goal and both task and goal cues conditions at

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[3] These results are independent of type of performance and are therefore identical in both models.

different levels of working memory. Therefore, Hypothesis Va was not supported.

Given no significant effects observed for the independent, proposed moderating,

or proposed mediating variables in this analysis, this model was not explored

further.

Table 8

Conditional Direct Effect of Working Memory^T on the Effect of Cue Type on Task Accuracy^T

	Goal Cue					Both Task and Goal Cues				
WM Level	Conditional Direct Effects	SE	*t*	LLCI	ULCI	Conditional Direct Effects	SE	*t*	LLCI	ULCI
-1SD	.00	.37	.01	-.74	.74	-.47	.41	- 1.15	-1.29	.34
Mean	.08	.28	.78	-.47	.62	-.19	.28	-.69	-.74	.36
+1SD	.15	.39	.39	-.62	.92	.09	.37	.24	-.65	.83

Note: Cue type was dummy coded in these analyses; task cue was coded as the referent group. Levels for working memory are the mean and plus/minus one SD from mean. $N = 161$. Direct effects are unstandardized coefficient estimates. Bootstrap sample size = 10,000. CI = confidence interval; LL = lower limit; UL = upper limit. ^{T} = transformed variable.

Overall model results for task efficiency. The overall results of the moderated-mediated analyses, with and without 5 influential observations, for task efficiency are summarized in Table 9[4]. Covariates observed as having an effect on transformed efficiency were included in the model (i.e., frequency of Microsoft Excel use, general mental ability, and task efficacy). Overall model statistics for the path predicting transformed proportion of time on task was nonsignificant (F [10, 150] = .58, *ns*). However, the overall model for the path predicting transformed efficiency were significant (F [11, 149] = 1.99, $p < .05$).

Additionally, one noteworthy difference was observed between the analyses conducted with and without influential observations. Specifically, a significant effect of both task and goal cues was observed for the effect on transformed task efficiency (b = -.77, p = .02, 95% CI [-1.40, -.13] indicating a significant difference between both task and goal cues and the task cue conditions, excluding influential observations. Follow-up analyses will be discussed in the upcoming section on trimmed model testing.

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[4] Indirect and conditional direct effects for the model tested without influential observations are not reported as these effects did not change substantially.

Table 9

Results of the Moderated-Mediated Analyses with Efficiency as the Outcome:

Model Summary and Coefficients

With Influential Observations				
Outcome: Proportion of Time on Task^T	b	SE	R^2	F
Control Variables			.04	.58
Intercept	.98*	.05		
Excel Frequency	-.00	.00		
GMA	.00	.00		
Task Efficacy	-.00	.00		
Predictors				
D_1	-.00	.02		
D_2	-.01	.02		
D_3	-.01	.02		
WM^T	.00	.00		
$D_1 * WM^T$	.00	.00		
$D_2 * WM^T$	.00	.00		
$D_3 * WM^T$	.00	.00		
Outcome: Efficiency^T	b	SE	R^2	F
Control Variables			.13	1.99*
Intercept	-4.49	3.81		
Excel Frequency	.33*	.16		
GMA	.20*	.09		
Task Efficacy	.02	.00		
Predictors				
D_1	-.85	.71		
D_2	-.78	.72		
D_3	.09	.70		
WM^T	-.00	.00		
$D_1 * WM^T$	-.00	.00		
$D_2 * WM^T$	.00	.00		
$D_3 * WM^T$	.00	.00		
Proportion of Time on Task^T	.09	3.23		

**Significant at the 0.01 level. *Significant at the 0.05 level. ^{T} = transformed variable.
WM = working memory. $N = 161$. Cue type was dummy coded in these analyses; task cue was
coded as the referent group. D_1 = goal cue; D_2 = both task and goal cues; D_3 = control. b =
unstandardized regression coefficient. Boot strap sample size = 10,000.

Table 9

Results of the Moderated-Mediated Analyses with Efficiency as the Outcome:

Model Summary and Coefficients, continued

Without Influential Observations				
Outcome: Proportion of Time on Task^T	*b*	*SE*	R^2	*F*
Control Variables			.04	.54
Intercept	.98*	.05		
Excel Frequency	-.00	.00		
GMA	.00	.00		
Task Efficacy	-.00	.00		
Predictors				
D_1	-.00	.02		
D_2	-.01	.02		
D_3	-.01	.02		
WM^T	.00	.00		
$D_1 * WM^T$	.00	.00		
$D_2 * WM^T$	.00	.00		
$D_3 * WM^T$	.00	.00		
Outcome: Efficiency^T	*b*	*SE*	R^2	*F*
Control Variables			.08	1.00
Intercept	.11	1.79		
Excel Frequency	.08	.07		
GMA	.04	.04		
Task Efficacy	-.00	.00		
Predictors				
D_1	-.54	.32		
D_2	-.77*	.32		
D_3	.60	.33		
WM^T	-.00	.00		
$D_1 * WM^T$	-.00	.00		
$D_2 * WM^T$	-.00	.00		
$D_3 * WM^T$	.00	.00		
Proportion of Time on Task^T	.52	1.53		

**Significant at the 0.01 level. *Significant at the 0.05 level. ^{T} = transformed variable.
WM = working memory. $N = 156$. Cue type was dummy coded in these analyses; task cue was coded as the referent group. D_1 = goal cue; D_2 = both task and goal cues; D_3 = control.
b = unstandardized regression coefficient. Boot strap sample size = 10,000.

The second set of analyses examined the indirect effect of cue on transformed efficiency through time spent on task. Analyses controlled for frequency of Microsoft Excel use, general mental ability, and task efficacy as these were observed as related to transformed efficiency. Table 10 displays the unstandardized regression coefficients (b), standard errors (SE), and bootstrapped results for the indirect effects. There was no significant difference between the task cue and the goal ($b = .00$) nor between task cue and both task and goal cues ($b = .00$) in predicting transformed efficiency through transformed time spent on task. Bootstrap results with a bootstrapped 95% CI around the indirect effect included zero (goal cue [-.00, .00]; both task and goal cues [-.00, .00). Therefore, Hypothesis IIIb was not supported.

Table 10

Relative Indirect Effect of Task Cue Type on Task Efficiency^{T} through Proportion of Time^{T} on Task

	Goal	**Both Task and Goal Cues**
Effect	.0000	.0000
SE (Boot)	.0001	.0001
BootLLCI	-.0002	-.0003
BootULCI	.0002	.0003

Note: Cue type was dummy coded in these analyses; task cue was coded as the referent group. Effects are relative to the task cue. $N = 161$. Bootstrap sample size = 10,000. CI = confidence interval; LL = lower limit; UL = upper limit. Effects are unstandardized coefficient estimates. ^{T} = transformed variable.

Results for the analyses testing whether transformed working memory moderated the relationship between cue type and transformed efficiency are presented in Table 11. Results indicated that the conditional direct effects of working memory were nonsignificant at 1 standard deviation below the mean on transformed working memory (goal cue, $b = -.40$, ns; both task and goal cues, $b = -1.03$, ns), at the mean (goal cue, $b = -.85$; both task and goal cues, $b = -.79$, ns), and 1 standard deviation above the mean (goal cue, $b = -1.31$, ns; both task and goal cues, $b = -.54$, ns). These results indicate that there were no differences between the conditional direct effects for participants in the task cue condition compared to those in the goal and both task and goal cues conditions at different levels of working memory. Therefore, Hypothesis Vb was not supported.

Table 11

Conditional Direct Effect of Working Memory^T on the Effect of Cue Type on Task Efficiency^T

WM Level	Goal Cue					Both Task and Goal Cues				
	Conditional Direct Effects	SE	*t*	LLCI	ULCI	Conditional Direct Effects	SE	*t*	LLCI	ULCI
-1SD	-.40	.98	-.41	-2.33	1.53	-1.03	1.07	-.96	-3.15	1.09
Mean	-.85	.71	-1.19	-2.26	.55	-.79	.72	-1.09	-2.20	.63
+1SD	-1.31	1.00	-1.30	-3.29	.68	-.54	.97	-.55	-2.47	1.39

Note: ^{T} = transformed variable. Cue type was dummy coded in these analyses; task cue was coded as the referent group. $N = 161$. Levels for working memory are the mean and plus/minus one SD from mean. Direct effects are unstandardized coefficient estimates. Bootstrap sample size = 10,000. CI = confidence interval; LL = lower limit; UL = upper limit. ^{T} = transformed variable.

Trimmed model. A significant effect was observed for cue type on task efficiency when excluding influential observations. Given that the effects of the covariates (i.e., GMA, task efficacy, Excel frequency), the moderator (transformed working memory), and the mediator (transformed proportion of time on task) included in the model were not significant, a final trimmed model was tested to provide the most accurate test and estimates of the significant relationships. This model was tested using regression analysis in which transformed task efficiency was the dependent variable. Results are reported in Table 12. Results indicated that the overall model was significant, (F [3, 155] = 2.68, $p < .0.05$). The goal cue condition ($b = -.73$, $p < .05$, 95% CI [-1.41, -.08]) and both task and goal cues condition ($b = -.87$, $p < .05$, 95% CI [-1.56, -.22]) were significantly lower than the task cue condition on transformed efficiency. Given that higher efficiency scores indicate greater efficiency, the results suggest that in comparison to participants in the task cue condition, participants in the goal and both task and goal cues conditions were less efficient on the task.

Table 12

Results of the Regression Analysis of Cue Type as a Predictor of Task Efficiency[T]

	b	SE	β	t	R^2	F
					.05	2.68[*]
Intercept	1.97	.23		8.54[*]		
D_1	-.73	.33	-.21	-1.92[*]		
D_2	-.87	.33	-.25	-.2.17[*]		
D_3	-.63	.33	-.18	-2.62		

[**]Significant at the 0.01 level. [*]Significant at the 0.05 level. [T] = transformed variable. $N = 156$. Cue type was dummy coded in these analyses; task cue was coded as the referent group. D_1 = goal cue; D_2 = both task and goal cues; D_3 = control. This analysis excludes influential observations.

PART IV

Discussion

Using resource theories and naturalistic decision making theory, this study sought to identify appropriate allocation strategies for individuals based on working memory capacity. The extant literature consistently concludes that individuals with low working memory capacity are often more likely to be distracted by task-irrelevant information (Lavie et al., 2004; Redick & Engle, 2006) and less likely to show high performance in situations involving multiple stimuli (Buhner, et al., 2006). Essentially, individuals with low working memory capacity are more sensitive to task- or stimuli-driven information, while those with high working memory capacity better attend to goal-derived information. Given this tendency, this study proposed that cueing individuals' attention allocation at the level to which they are more sensitive would result in better allocation decisions (i.e., more time on task) and higher performance.

In the following sections, I will discuss four main observations from the current study associated with the effects observed. First, I discuss the allocation pattern that emerged during the performance of the task. I anticipated that the allocation of attention to the task would be determined by working memory capacity. However, this was not observed in the study. Possible explanations for the actual allocation patterns observed are presented. Second, I discuss the relationship observed between the allocation of attention and task performance. This study predicted that performance on the task would benefit from an increase in the attention allocated to the task. However, this effect was not observed.

Third, it was expected that time spent on the task would explain the effect of cue type on performance. Possible reasons for this nonsignificant finding are presented. Finally, I discuss the findings observed regarding the effect of cue type on efficiency—the observation of allocation cueing at the task-level being associated with greater efficiency, in comparison to goal and both goal and task cueing.

Working Memory

Working memory is associated with the ability to focus on prioritized activities as well as goal-relevant information (Lavie et al., 2004; Redick & Engle, 2006). In the present study, individuals were presented with a task, alongside distracting stimuli, and informed that their priority was performance on the task. I expected that individuals with high working memory capacity would demonstrate better attention allocation patterns by focusing more time on the task and ignoring the non-task-related stimuli presented (HI). However, working memory capacity was not associated with allocation pattern in the context presented. In this study, the majority of participants spent the entire time on the primary task and did not open the distractor e-mails received.

One possible explanation concerns the element of time pressure induced in the study design. During this study, participants were given 15 minutes to complete a task that typically requires 25 minutes for completion (Mann et al., 2013; Mitchell, et al., 2014). This was done to make the task more challenging and thereby encourage a need to focus on the task in order to be successful. However, it is possible that this element of pressure dissuaded participants from

engaging with the e-mails. For one, inducing a time pressure on individuals may place pressure on available resources (Bakker & Demerouti, 2007), resources that are already limited (Kahneman, 1973). As a result, to meet the demands of the situation, participants may have actively managed their time and attention in an effort to balance their available resources with that needed to complete the task. From a resource allocation perspective, this effect may further be explained by the ability-motivation interaction.

The ability-motivation interaction proposes that the allocation of attention is a function of both an individual's cognitive ability and motivational processes (Kanfer & Ackerman, 1989). In the present study, working memory, a cognitively-based ability, failed to demonstrate any effect on the allocation of attentional resources. Theoretically, allocation decisions may have instead been directed by the motivational states of participants—influencing their choice to engage in the task as well as guiding their self-regulatory processes (e.g., on-task vs. off-task activities) throughout the task (Kanfer & Ackerman, 1989). The situational strength hypothesis—the idea that implicit or explicit situational cues may restrict the influence of individual differences (Mischel, 1999)—may further support this explanation. Explicitly, the addition of a time pressure, or the allocation cues, may have strengthened the situation; thereby, suppressing any influence of working memory by motivating participants to primarily focus on the task.

Attention

The primary allocation of attention to the task was expected to have a

functional role. Namely, by allocating attention to the task activities and away

from the off-task activities, performance was expected to increase (HII;

Minbashian & Luppino, 2014). The absence of this effect may be related to the

nature of the experimental task. From a resource theory perspective, a task is said

to be resource-limited when variations in the amount of attention allocated to that

task influences performance. Alternatively, a task is data-limited when the amount

of attention allocated to the task has no effect on task performance (Norman &

Bobrow, 1975). It is possible that the task used was data-limited for the sample.

For example, average frequency of Excel use was 2.82, an average that

corresponds with a range between a few times per month and once per month.

Therefore, participants may have required additional experience and training

using Excel for their effort or attention on the task to result in a performance pay-

off. Additionally, proportion of time on task could have failed to have an effect as

a result of statistical limitations.

The variable representing attention—proportion of time on-task—was

nonnormally distributed. Given that the majority of participants committed all

their task-time to the task, this variable demonstrated a "ceiling effect" (Luther,

2000), whereby the majority of participants clustered around the high end of the

distribution (i.e., entire proportion of time on task; value of 1). This distribution

was both skewed and restricted in range. Consequently, the absence of an effect

of proportion of time on-task on performance (HIIa and HIIb) as well as the

absence of a mediating effect of this variable on the cue type-performance relationship (HIIIa and HIIIb) could have been a result of violating the normality assumption or the restriction in range.

Allocation Cues

The most unique contribution of this study was the introduction of allocation cues and the proposed contingent effect of working memory on both allocation decisions and performance. Specifically, I predicted that individuals with high working memory capacity would make better allocation decisions (i.e., spend more time on the task) and demonstrate higher performance when cued to allocate their attention based their overarching goal. Alternatively, I predicted that individuals with low working memory capacity would make better allocation decisions (i.e., spend more time on the task) and perform better when cued to allocate based on the features of the task. Results found no support for the proposed effects.

There were no contingent effects observed for working memory on the cue type and performance relationship. The absence of this proposed moderating effect of working memory could be associated to the absence of an effect of working memory on allocation behavior, as discussed above. To reiterate, it is likely that the allocation behaviors and related performance outcomes observed in this study were a function of situational factors such as the time pressure experienced by participants. Alternatively, to further speculate, the cues identified (i.e., task- and goal-level cues) may, in reality, function in a different manner than that proposed.

My predictions were based on the assumptions that a) low working memory is associated with poor performance under conditions of distractions, and b) cueing at the level of the task would be effective only for those with low working memory, and at the level of the goal only for high working memory individuals. In other words, predictions about the effects of the two cue types assumed that each cue would *only* be effective for a distinct group of individuals. However, the actual mechanism of each cue might be equivalent or less distinct that assumed, thereby attenuating any distinctions in the effect of working memory. That is, regardless of the level, allocation cues may simply aid allocation decision. While no interactive effect of working memory and cue type was observed, there was evidence of an effect of task cue on efficiency.

A subset of participants exposed to the task cue were more efficient (i.e., completed the task more quickly) than those exposed to the goal and both task and goal cues. This finding could be explained in a number for ways. For example, it may suggest that task-level cueing activates a sense of urgency. Or, that goal and both goal and task cueing places greater demand on cognitive resources, thereby, increasing the amount of time needed to complete a task. Task-level cues, may provide cognitive short-cuts during allocation situations, in comparison to the more cognitively demanding cueing at the level of the goal (c.f., Gonzalez et al., 2002). Specifically, allocation based on a goal, a top-down process, requires more deliberation and controlled thinking—more cognitively demanding processes (Evans, 2008; Ruthruff, et al., 2001; Schiffrin & Schneider, 1977). Therefore, the alternative of allocating based on task information, a faster bottom-up process

removes the need to engage in cognitively complex thinking and may facilitate faster allocation decisions; resulting in more time available to complete the task more quickly in comparison to the slower and analytical top-down alternative (Schreij et al., 2008). The absence of an observed effect of cue type on task accuracy highlights the importance of considering the performance measure in resource allocation contexts.

Efficiency is unique as a performance measure because it accounts for input relative to output in comparison to measures accounting for output only (e.g., effectiveness, accuracy); therefore, efficiency is more likely to capture the process benefits of an intervention (Beal, Cohen, Burke, & McLendon, 2003). Measures of efficiency often consider inputs including time or effort. Findings from the current study imply a more proximal relationship between bottom-up processing (i.e., task-level cueing only) and efficiency in comparison to cues involving top-down processing (i.e., goal-level or task and goal-level). Therefore, this reinforces the value of specifying performance dimensions for any intervention aimed at enhancing resource allocation-related performance.

Practical and Theoretical Implications

This study has several practical and theoretical implications. First, managers interested in enhancing resource allocation-related performance may consider interventions geared at bottom-up attentional regulation for tasks where efficiency is a valued outcome. A consideration of stimulus- or task-level features when allocating attention between competing demands may help to reduce the time typically needed to deliberate an allocation decision. To activate bottom-up

allocation during task performance, first, employees should be made aware of the tasks or responsibilities that are of priority to their organizations or teams. Second, when demands arise outside of prioritized activities, the nature of these demands should be made salient to employees. For example, if an urgent issue arises that is unrelated to a prioritized activity, the urgency of this issue should be clearly communicated. As an example, flagging an email as urgent (a task-level cue), will help employees to more quickly decide on how to allocate their attention; resulting in a positive spillover effect on efficiency for the main task.

In addition to making task-level stimuli more salient, managers may also consider cue recognition training to enhance situational awareness (Grossman et al., 2014). To develop this training, managers would first need to identify the organization's needs related to resource allocation, as well as the content of, and target for training (Brown, 2002). For example, this assessment would identify the primary interests of the organization that should first be prioritized and the features of secondary activities that should serve as cues indicating when these subordinate demands should be given immediate attention (e.g., an urgent email from a particular client). Following this, training can be designed to guide employees' attention to crucial task- or stimulus-level features—providing internal context to enhance allocation decisions. In addition to practical implications, this study has implications for theory.

The effect observed of task-related cues on efficiency as a performance outcome highlights an interesting theoretical implication regarding the operationalization of task performance. The effect of task-related cues on task

efficiency, and not task accuracy, highlights the theoretical (and ultimately

practical) significance of carefully attending to the conceptualization and

measurement of performance as a criterion within the organizational psychology

literature (Austin & Villanova, 1992). Specifically, findings from the current

study support the value of using multiple criteria, rather than a composite

measure, of task performance when studying performance as an outcome,

(Schmidt & Kaplan, 1971). Both the difference in effects observed for efficiency

and accuracy as well as the lack of any correlation between the two task

performance dimensions support a multi-dimensional approach. Within the

domain of resource allocation-related performance, the current findings imply that

considerations made and interventions used during the allocation process may

have differential impact on task performance. Additional theoretical implications

also relate to the foundational theories applied to this study.

   This study tested the application of both resource and naturalistic decision

making theories to resource allocation and subsequent performance. From an

academic perspective the discoveries of this study present a number of potential

implications for both theories. Naturalistic decision making has traditionally been

applied to extreme decision making situations such as those encountered by

firefighters and medical decision-makers; however, suggestions have been made

supporting its application to more general work contexts (Grossman et al., 2014).

I expected that by theoretically matching cues to an individual difference,

allocation decisions could be primed similarly to enhancing cue recognition, as

discussed by naturalistic decision making theory (Klein, 1998; Klein, 2008).

However, failing to find support for this prediction implies that appropriate cues

may be more contextually-driven. That is, rather than expecting that individuals

would attend to cues based on their ability levels, it is possible that cues related to

motivational states or situational demands might be more appropriate for

influencing allocations decisions. The naturalistic decision making framework has

made tremendous contributions to the literature in terms of identifying the cue

recognition patterns of expert decision makers. An understanding of "cue fit"

based on context would expand the application of naturalistic decision making to

additional areas within the literature.

Further, resource allocation has often been approached from a

motivational perspective, one that has significantly contributed to understanding

allocation patterns (e.g., Kanfer & Ackerman, 1989; Schmidt et al., 2009).

However, very often, organizational psychologists fail to apply decision making

theories to topics central to the process of decision making (Dalal, Bonaccio,

Highhouse, Ilgen, Mohammed, & Slaughter, 2010). Resource allocation might be

one such example. Naturalistic decision making was applied given the dynamic

nature of the resource allocation process; results indicate some promise for its

application to the resource allocation problem. Specifically, it was observed that a

reliance on particular types of cues to aid allocation decisions may have a positive

effect on task efficiency. However, that is not to say that other decision making

theories are not applicable to the process. Therefore, future research on the

application of alternative decision making approaches such the dual process

framework (Evans, 2008), adaptive decision making (Hammond, 1955), and fast

and frugal heuristics (Gigerenzer & Goldstein, 1996) may also be viable areas to

consider for understanding resource allocation.

Future Research

There are several other rich areas for future research based on the above

findings. First, this study found support for the effect of cueing stimulus- or task-

directed attention allocation. It is reasonable to suspect that in addition to task

cues, more specific cue types might also be effective at guiding better allocation

decisions and influencing related performance outcomes. For example, resource

theories highlight the role of task features, such as difficulty, as a relevant

contextual variable to the resource allocation process (Langholtz et al., 1994).

Further, additional features of the work context such as time, social structure, and

accountability (Johns, 2006) may also impact allocation decisions. Understanding

any moderating effects of these features, as well as determining the appropriate

cueing strategies based on contextual differences and demands are promising

areas for future research.

In addition to contextual features, future research may explore the

interactive effects of working memory capacity with other individual differences

such as personality differences. While no effect of working memory was observed

in this study, the motivating effect of context was proposed as a potential

explanation for this finding (or lack thereof). Exploring motivation-related

individual differences might provide further nuanced explanations for the varying

effects of working memory. Variables such as conscientiousness and goal

orientation that positively relate to job performance (Schmidt & Hunter, 1998;

VandeWalle et. al, 2001), may supplement limits to cognitive resources such as low working memory capacity. In highly distracting situations, where adequate contextual signals (such as time pressure) are absent, a conscientious individual may possess internal cueing mechanisms to aid appropriate attentional allocation decisions and practices. Or, an individual high on mastery goal orientation may appropriately select amongst activities to accelerate goal accomplishment (Schmidt et al., 2009). In this study avoid performance goal orientation and conscientiousness were significantly related task accuracy. It could be that these variables, rather than working memory, are more important for predicting sustained accuracy in the resource allocation context. Future research exploring these effects is viable for better understanding the nature of allocation decisions.

Finally, the reliance on teams has increased significantly as organizations attempt to address more complex issues (Mathieu, Maynard, Rapp, & Gilson, 2008). Often, teams are composed of individuals with competing priorities or serving on multiple teams (O'leary, Mortensen, & Woolley, 2011). Resource allocation is a critical research domain with relevance to the organizational teams' literature. Future research exploring antecedents of effective allocation decisions is a domain worth exploring. For example, team composition and emergent states such as transactive memory might be relevant predictors of resource allocation decisions.

Limitations

This study had some methodological limitations that could have influenced the results. First, the study used an experimental design with a sample

of undergraduate students at a single time point. An experimental design was

selected to enhance the internal validity of the study's findings. However, internal

validity often comes at the expense of external validity. Therefore, before making

generalizations based on the observed findings, replication of the study's results

using an applied sample is necessary. Further, the task design accounted for a

single performance period. This may have limited the possibility of more robust

effects emerging, in comparison to a longitudinal design. In particular, given the

dynamic nature of resource allocation and observations of allocation behaviors

changing over time (Atkinson & Birch, 1978), a design accounting for temporal

effects may have provided opportunities for additional findings.

Second, an alternative operationalization of attention could have produced

different results. While the ManicTime software was extremely useful for

tracking time, as a proxy for attention, this operationalization of time/attention

might have resulted in the loss of some information. For example, when an e-mail

was received, a participant may not have clicked on the link to open it, but may

have spent several milliseconds reading the title of the e-mail. ManicTime would

not have recorded off-task time in this situation. A more precise measure of

attention such as eye-tracking could have provided a more valid measure of

attention.

Conclusion

The opening illustration describes Beth as she attempts to complete a

revision and resubmission while being distracted by e-mails. This situation, and

others of greater magnitude, is a familiar one to many employees. The above

research proposed that a solution for Beth, and others like her, could be found by considering Beth's working memory capacity. This prediction was not supported. However, a question remains as to whether the use of cues is ever effective.

With the proliferation of technological and other advancements, organizational environments have become increasingly distracting. These distractions are associated with significant productivity and financial losses. Understanding contextual and individual differences associated with effective allocation decisions is a valuable domain for research. This study found that cueing individuals to allocate their attention based on features of the task might be associated with more efficient task performance. This effect implies that interventions reinforcing or making task features more salient, may support efficiency within distracting work contexts. Therefore, while allocation cues may be effective, this effectiveness might be contingent upon the operationalization of task performance.

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Appendix A: Study Task

Instructions for Training

Before completing the experimental task, you will watch a video that will serve as a training guide to prepare you for the task. This video will last for 15 minutes and will be followed by a brief 10-minute questionnaire to assess what you have learned.

Instructions for the Task

In this task, you will complete a series of questions which require you to perform basic functions in Excel to answer the questions correctly. **Completing the questions correctly and as quickly as possible is how you gain points in this task**. Gaining as many points possible out of 36 is the goal of this task. While answering the questions, you will also receive some e-mails. These e-mails will include information that you may or may not find interesting. Attending to these e-mails is entirely up to you.

(manipulation text inserted here)

Your objective is to gain as many points as possible in the session. **The Excel task is your most important responsibility and will allow you to earn up to 36 points**. The 10 participants who have earned the most number of points will receive a $25 Starbucks gift card at the end of the quarter. The research assistant will take your name, and e-mail address, and record your total number of points on a sheet at the end of the experiment if you are interested in entering the competition for the gift card. Your name will not be linked to the other measures you completed for the study.

Please submit your responses using the Qualtrics survey page opened and minimized on your desktop. **Please do not use the split-screen option as you work on the files and remember to save your work.**

You have 15 minutes to complete this task. If you are able to complete the task in less than 15 minutes, you will receive a bonus in the number of points you achieve based on the number of minutes you have remaining. For example, a participant who completes the task in 10 minutes will receive 5 points in bonus points while a participant who completes the task in 14 minutes will receive a 1-point bonus. The researcher will let you know when you have 5 minutes remaining.

Task:

A. The researchers defined "junior" participants as being below 18 years and "senior" participants as being above 27 years. Color code each participant as being "junior" (blue), or "senior" (yellow). Save your work after color coding.

1. How many participants are categorized as "junior"? 3 (1 point)

2. How many participants are categorized as "senior"? 12 (1 point)

B. Curious about living arrangements in their sample, the researchers wanted to compare types of residences to the number of people living in these residences.

	Type of Residence
1	Dormitory
2	Apartment
3	House

1. List the names of the people who live in a dorm, and *also* have 6 or more people in residence: Albert, Joanne, George (3 points)

→ **Turn off filters and return to the original data set.**

C. According to a different survey, Americans watch an average of 15 hours of television per week.

1. How many participants in this study match exactly the national average of 15 hours per week? 15 (1 point)

	Sex
1	Female
2	Male

2. List the names of the males who watch more than 26 hours of TV per week: Bradley, Mario, Robert, Lawrence, Steven, Don, Steve, George, Paul, Albert, Louis, Frank, Carmen (13 points)

→ **Turn off filters and return to the original data set.**

D. The researchers in this study were also interested in the types of college students that credit card companies market their credit cards to. They compared the 6 summer job types to the 5 categories of cards people carry.

	Summer Job Type			Credit Card Type
1	Managerial and Professional		1	American Express
2	Sales and Office		2	Visa
3	Service		3	Master Card
4	Agricultural and Natural Resources		4	Discover
5	Production, Craft, Repair		5	Other
6	Operation, Fabrication, General Labor			

1. List the names of the students with summer jobs in the service industry who carry a card "other" than one of the major brands listed in the survey: Debbie, Sheila, Laura, Ruby, Denise (5 points)

➔ **Turn off filters and return to the original data set.**
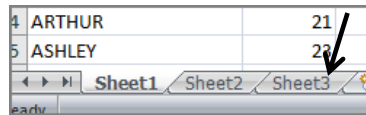
E. Politics are typically an important issue on college campuses. Color code all participants who identify as "Liberal" or "Extremely Liberal" (below 3) as blue, and all participants who identify as "Conservative" or "Extremely Conservative" (above 5) as yellow.

	In the last election…
1	Voted
2	Did not vote

	Political View
1	Extremely Liberal
2	Liberal
3	Slightly Liberal
4	Moderate
5	Slightly Conservative
6	Conservative
7	Extremely Conservative

1. Among those who voted in the last election, how many people identify themselves as liberal or extremely liberal? 35 (1 point)

2. Among those who did not vote in the last election, how many people identify themselves as conservative or extremely conservative? 20 (1 point)
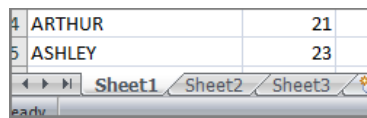
➔ **For the following task, please open Sheet 2 using the tab on the bottom and use the data set on that sheet.**

F. Please create a chart showing the commute times of individuals. Save your work after completing your chart. (5 points)

➔ **For the following task, please open Sheet 3 using the tab on the bottom and use the data set on that sheet.**

G. Please create a chart showing the individuals' hours of watching TV per week for the participants who were born in October. Save your work after completing your chart. (5 points)

Appendix B: E-mails to be Sent During the Task

E-mail 1: Ideas on how to use your Starbucks Gift Card: 21 Best Starbucks Drinks!

With so many delicious beverages, it might be hard to choose the best Starbucks drinks, but I can help! I have 21 best Starbucks drinks you'll thoroughly enjoy! Whether you like coffee or tea, iced, or hot, these beverages, will definitely quench your thirst and keep you coming back for more! I know I'm guilty of this!

http://food.allwomenstalk.com/best-starbucks-drinks-to-enjoy

E-mail 2: 4 GMAIL HACKS THAT WILL CHANGE THE WAY YOU WORK

IF OPENING YOUR INBOX GIVES YOU A PANIC ATTACK, TRY THESE SIMPLE MOVES TO MAKE GMAIL FEEL MORE MANAGEABLE.
BY MADISON FELLER, LEVO LEAGUE

I'll be honest—I've had mixed feelings about Gmail. Sometimes it's fantastic, like when my best friend and I send each other cool links all morning while simultaneously talking on Gchat. But other times, as I'm watching my inbox fill up at the speed of light, it can just be overwhelming. Gmail and I have finally come to a mutually respectful relationship (think Kanye's post-VMA apology to T-Swift), but it's been a long road. These four hacks have paved the way, and once you've got them down, I promise Gmail will feel like a whole new ball game.

1. YOU CAN FAKE THE TIMESTAMP
As a self-proclaimed night owl, I never really thought anyone noticed my late-night e-mailing, until one morning I came into the office and my supervisor (whom I'd e-mailed during a late-night catch-up binge) asked, "Were you working at 2 a.m.?" Busted. I realized that if I wanted to be taken seriously, it would be a lot better if my e-mails looked like they were being sent at 8 a.m. instead of at 3 a.m. And then I discovered Boomerang.
Boomerang is a Gmail app that allows you to schedule e-mails, set up snooze messages, and get reminders. You can easily schedule e-mails to go out at any time, so it'll look like you're sending something at 8 a.m. on Monday, even though you scheduled it at 11 p.m. the night before. You can also choose to "boomerang" e-mails, meaning you can mark an e-mail to leave your inbox and

return on a certain date. Let's say there's a reminder for a networking event next month and as much as you want the e-mail, it's cluttering your inbox. Just choose to "boomerang" the message, so that it leaves your inbox for now but returns two days before the event. You can also ask Boomerang to send you a reminder if nobody replies to an e-mail, so you'll never forget to follow up with people again. Tip: When scheduling an e-mail, I do like to BCC myself just to be absolutely, 100% sure that everything is getting sent out.

2. YOU CAN INSTANTLY PULL UP SOMEONE'S NAME, TITLE, AND MUTUAL CONNECTIONS

You know how before cold e-mailing someone important, you can spend a good 30 minutes stalking their LinkedIn profile, searching for any mutual connections, and triple-checking the spelling of their first and last name? Well, [Rapportive](#) is your new networking best friend. This Gmail extension will pull up LinkedIn profiles right inside of Gmail, so you can see someone's profile alongside your message. Whether you're sending or receiving an e-mail, Rapportive will give you the quick information you need to make sure your message is accurate and well-informed.

3. YOU CAN UNSEND A HASTILY WRITTEN MESSAGE

This new Gmail feature made headlines last week—and it's true, whether you fired off a nasty e-mail to your boss or any of these [other five mistakes](#), you can now take it back. Gmail's new undo feature will let you unsend an e-mail up to 30 seconds after you hit send. To enable the feature, just click the gear in the top right-hand corner of your Gmail window, go to Settings, scroll down to "Undo Send", make sure the button is checked, and then save your changes.
Now after you send an e-mail, a yellow bar will appear at the top of your inbox, asking if you would like to undo. I think I speak for everyone when I say this magic button makes us breathe a huge sigh of relief.

4. YOU PLOW THROUGH YOUR INBOX IN RECORD SPEED

When my friend first told me about the Gmail keyboard shortcuts, I was underwhelmed at the suggestion, even though she claimed she *loved* them. But being one who doesn't knock it till I try it, I decided to give them a whirl. And, oh my, these shortcuts are a game changer. To enable them for Gmail, go to the gear on the top right-hand corner of your main page, go to Settings, scroll down to Keyboard Shortcuts, make sure they're turned on, and then save your changes.
Now you can whiz through Gmail without (almost) ever leaving the keyboard. Need to draft a new e-mail? Just press "c." Need to mark something as important? Just press "+." Need to mark an e-mail unread? It's as easy as hitting "Shift and

u." Get ready for your coworkers to be shocked (or at least impressed) by how quickly you get through the morning e-mails.
This article originally appeared [on Levo](#) and is reprinted with permission.

E-mails 3: Discover the meaning and history behind your last name

Hi Participant,

Your last name gives you a sense of identity and helps you discover who you are and where you come from.

Some of the interesting facts you'll learn about your surname:
Meaning and History
Where your family lived in the U.S. and U.K.
Average life expectancy
When your family immigrated to the U.S.
Common occupations
Service in the civil war

Visit here:
http://www.ancestry.com/learn/facts?o_xid=65782&o_lid=65782&o_sch=External+Paid+Media

E-mail 4: New Website Reveals Personal Information Even Google Can't Find

Ever try Googling someone only to come up with basic information and maybe a link or two to an outdated social media profile? There's a new website going around that promises to reveal much more than just a simple google search can show you.

Been issued a speeding ticket? Failed to stop at a stop sign? What about your family members? And friends? If you are like most of us, the answer to at least one of those questions is "yes"—the vast majority of us have slipped up at least once or twice.

An innovative new website—[Instant Checkmate](#) is now revealing the full "scoop" on millions of Americans.

[Instant Checkmate](#) aggregates hundreds of millions of publicly available criminal, traffic, and arrest records and posts them online so they can easily be searched by anyone. Members of the site can literally begin searching within seconds, and are able to check as many records as they like (think: friends, family, neighbors, etc. etc.).

Previously, if you wanted to research someone's arrest records, you might have had to actually go in to a county court office—in the appropriate county—and formally request information on an individual. This process may have taken days or weeks, or the information might not have been available at all. With websites like Instant Checkmate, however, a background check takes just a few clicks of the mouse, and no more than a minute or two.

Want to give it a real-world test? Pull your own report. You might reveal long forgotten crimes you committed in your younger days. Even been busted for possession of a fake ID? Been caught shoplifting? Get in trouble with the cops for being rowdy at a bar? Instant Checkmate may reveal exactly when and where you were arrested.

"You might reveal long forgotten crimes you committed in your younger days." After that, search all of your family members. If your aunt gets a speeding ticket every month, you'll know. If your parents have kept arrests hidden from you, you could uncover them instantly.

One of the most interesting aspects of Instant Checkmate is that it shows not only criminal records, but also more general background information like marriage records, divorce records, various types of licenses (medical, firearm, aviation, etc.), previous addresses, phone numbers, birthdates, estimated income levels and even satellite imagery of known addresses—it's really pretty scary just how much information is in these reports.

In addition to giving information on the specific person you search for, the report also includes a scrolling list of "local sex offenders" for whatever region you've searched—along with a map plotting out the locations of those offenders. Peruse the ones that show up in your report. You might even discover someone you know on the list.

"You might even discover someone you know on the list"
Prepared to be shocked? Anyone can start running background checks on Instant Checkmate within a few seconds—just click this link to get started.

If you would like to search someone you know, click here.

E-mails 5: Google self-driving car involved in first injury accident

FILE - In this May 13, 2015, file photo, Google's self-driving Lexus car drives along street during a demonstration at Google campus in Mountain View, Calif. Google says that one of its self-driving cars has been involved in an injury accident for the first time. The tech giant disclosed Thursday, July 16, 2015, that one of its SUVs was rear-ended in its home city of Mountain View, and the three people on board complained of minor whiplash. All were released from the hospital soon after the July 1 collision. (AP Photo/Tony Avelar, File)
LOS ANGELES (AP) — Google Inc. revealed Thursday that one of its self-driving car prototypes was involved in an injury accident for the first time.

In the collision, a Lexus SUV that the tech giant outfitted with sensors and cameras was rear-ended in Google's home city of Mountain View, where more than 20 prototypes have been self-maneuvering through traffic.

The three Google employees on board complained of minor whiplash, were checked out at a hospital and cleared to go back to work following the July 1 collision, Google said. The driver of the other car also complained of neck and back pain.

In California, a person must be behind the wheel of a self-driving car being tested on public roads to take control in an emergency. Google typically sends another employee in the front passenger seat to record details of the ride on a laptop. In this case, there was also a back seat passenger.

Google has invested heavily as a pioneer of self-driving cars, technology it believes will be safer and more efficient than human drivers.

This was the 14th accident in six years and about 1.9 million miles of testing, according to the company. Google has said that its cars have not caused any of the collisions — though in 2011 an employee who took a car to run an errand rear-ended another vehicle while the Google car was out of self-driving mode.

In 11 of the 14, Google said its car was rear-ended.

In a blog posted Thursday, the head of Google's self-driving car program, Chris Urmson, wrote that his SUVs "are being hit surprisingly often" by distracted drivers, perhaps people looking at their phones.

"The clear theme is human error and inattention," Urmson wrote. "We'll take all this as a signal that we're starting to compare favorably with human drivers."

In a telephone interview, Urmson said his team was exploring whether its cars could do something to alert distracted drivers before a collision. Honking would be one possibility, but Urmson said he worried that could start to annoy residents of Mountain View.

According to an accident report that Google filed with the California Department of Motor Vehicles about the July 1 crash:

Google's SUV was going about 15 mph in self-driving mode behind two other cars as the group approached an intersection with a green light.

The first car slowed to a stop so as not to block the intersection — traffic on the far side was not moving. The Google car and the other car in front of it also stopped.

Within about a second, a fourth vehicle rear-ended the Google car at about 17 mph. On-board sensors showed the other car did not break.

The driver of that car reported "minor neck and back pain." The SUV's rear bumper was slightly damaged, while the vehicle that struck it lost its front bumper.

Mountain View police responded, but did not file an accident report.

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Contact Justin Pritchard at http://twitter.com/lalanewsman

E-mail 6: Find Out How to Win a $100 Starbucks Gift Card Instead

Hi Participant!

How would you like to win a $100 Starbucks Gift card instead of a $25 Gift Card?

Interested? Here's how you can.

To earn this gift card you will be required to recruit 10 participants to complete this study within the next 2 weeks. In order to qualify, you **MUST** send an e-mail to the researcher at shaniquebrown@outlook.com within the next 7 minutes. **E-mails sent after this time will not qualify for this opportunity.** The e-mail should include your name, e-mail address, contact number, the name and contact information of the 10 people who you believe would be interested in participating in this study. You are also required to include a 2-3 sentence summary of why you believe each person would be interested in participating.

Entering for this $100 gift card will disqualify you from earning Sona Credits for your participation today.

E-mail 7: Sign up for additional Experiments on Sona Systems

Have you signed up for enough studies on Sona for the quarter? Remember, you need to earn at least 5 credits for each Introduction to Psychology class that you are enrolled in.

For more information about the Research Participation signup system, students can consult the psychology department web page (http://psychology.depaul.edu) under "Research" or e-mail the Research Participation Coordinator (psychexperiments@depaul.edu).

E-mail 8: Need Help Using Microsoft Excel?

Here are some tips on using Microsoft Excel

Greetings! In this tutorial, you'll learn about rows, columns, cells, worksheets (spreadsheets), and workbooks. We'll discuss how to add rows and columns, and how to move around in a worksheet. We'll learn how to enter data, and protect cells and spreadsheets. We'll tell you everything you need to know to get started using Microsoft Excel.

If you like video-based introduction, check out Excel 2010 Tutorial for Beginners. We have this course (over 9 hours of hands-on lessons) and find it very well done. (You can watch some chapters online.)

Now - let's begin learning Microsoft Excel!

The Excel Worksheet (Spreadsheet) and Workbook

An Excel worksheet, or spreadsheet, is a two-dimensional grid with columns and rows. Look at the spreadsheet below. The column names are letters of the alphabet starting with A, and the rows are numbered chronologically starting with the number one. The cells in the first row are A1, B1, C1, and so on. And the cells in the first column are A1, A2, A3, and so on. These are called cell names or cell references.

We use cell references when creating math formulas or functions. For example, the formula to add the contents of cells B2 and B3 together is: =B2+B3. For more information, see our tutorial Excel Math Basics: Writing Formulas and Expressions.

Moving From Cell to Cell

The arrow keys can be used to move left, right, up, and down from the current cell. Press the Enter key to move to the cell immediately below the current cell, and press the Tab key to move one cell to the right.

Selecting Cells

There are a variety of ways to select cells in an Excel spreadsheet:

Excel 2010 missing manual

To select one cell, click in the cell.

To select one or more rows of cells, click on the row number(s).

To select one or more columns of cells, click on the column letter(s).

To select a group of contiguous cells, click in a corner cell and, with the left mouse button depressed, drag the cursor horizontally and/or vertically until all of the cells you want selected are outlined in black.

To select multiple cells that are not contiguous, press and hold the Ctrl key while clicking in the desired cells.

To select every cell in the worksheet, click in the upper right corner of the worksheet to the left of "A."

Entering Data into Cells

To enter data into a cell, just click in the cell and begin typing. What you type also displays in the Formula Bar. When entering dates, Excel defaults to the current year if the year portion of the date is not entered.

You may edit cell contents from the Formula bar, or from directly inside the cell. To edit from the Formula Bar, select the cell and click inside the Formula Bar. When done typing, either press the Enter key or click inside another cell. To edit directly inside a cell, either double click inside the cell, or select the cell and press the F2 key.

Each cell has a specific format. This format tells Excel how the data inside the cell should be displayed. See our separate tutorial on Formatting Cells in Microsoft Excel.

Propagating Cell Contents

There are multiple ways to propagate or fill data from one cell to adjacent cells. Let's begin with two popular keyboard shortcuts that allow us to fill down, or fill to the right:

To fill adjacent cells with the contents of the cell above, select the cell with the data and the cells to be filled and press Ctrl + D (the Ctrl key and the D key) to fill down.

To fill adjacent cells with the contents of the cell to the left, select the cell with the data and cells to be filled and press Ctrl + R (the Ctrl key and the R key) to fill to the right.

To propagate in any direction, use the Fill Handle. Click in a cell with data to be copied, hover the cursor over the cell's lower right corner until the cursor changes to a thin plus sign (+) or a dark square, and drag up, down, left, or right to fill the cells.

If the data to be copied is a date, number, time period, or a custom-made series, the data will be incremented by one instead of just copied when the Fill Handle is used. For example, to display the months of the year in column A, type January in cell A1, drag the Fill Handle down to cell A12, and the months will display, in order, in column A!

Moving and Copying Cells

To move cell contents, right-click in the selected cell and click Cut. To copy cell contents, click Copy. Then right-click in the new location and click Paste. To paste a group of cells, right-click in the cell where the top left cell of the group should be located, and click Paste. Remove the animated border around the original cell by pressing the ESC key, or start typing in a new cell.

Adding and Deleting Rows and Columns

Excel 2010 Bible

To insert a new row in a spreadsheet, right-click on a row number, and click Insert. Excel always inserts the row ABOVE the row that was clicked on. To delete a row, right-click on the row number, and click Delete.

To insert a new column, right-click on a column letter and click Insert. Excel always inserts the column to the LEFT of the column that was clicked on. To delete a column, right-click on the column letter, and click Delete.

Protecting a Worksheet (Spreadsheet) or Workbook

To protect a worksheet or workbook in Excel 2007, click the Review tab, click Protect Worksheet or Protect Workbook, and click OK (entering a password first, if desired). When a worksheet or workbook is already protected, the icons in the Review tab are Unprotect Worksheet and Unprotect Workbook.

In earlier versions of Excel, click Tools > Protection, click Protect Sheet or Protect Workbook, and click OK (entering a password first, if desired). When a worksheet or workbook is already protected, the menu items read Unprotect Sheet and Unprotect Workbook.

Don't enter a password unless absolutely necessary. If you forget the password, you won't be able to unprotect the worksheet, so you won't be able to change, delete, or format any of the Locked cells!

Working with Worksheets (Spreadsheets)

Viewing, Renaming, Inserting, and Deleting Worksheets

Worksheet tabs are found in the bottom left area of the workbook. To view a worksheet, click on its tab. If the workbook window is not wide enough to display all of the tabs, use the arrows to the left of the tabs to navigate left or right, or right-click on any of the arrows and select the tab from the list that displays.

To rename a spreadsheet, right-click on the spreadsheet tab, select Rename from the context menu, and type a new name. Or, double-click on the worksheet tab and type a new name.

To insert a worksheet, right-click on a worksheet tab and select Insert from the menu. Excel always inserts the spreadsheet to the left of the current worksheet.

To delete a worksheet, right-click on the worksheet tab and select Delete from the context menu.

Author: Keynote Support

Moving Worksheets (Spreadsheets)

Sometimes we want our spreadsheets to be arranged in a different order. To move a worksheet in the same workbook, right-click on the tab of the source worksheet and click "Move or Copy." In the Move or Copy window, click the name of the worksheet that you want the sheet to be inserted before, and click OK.

To move a spreadsheet to a new workbook, right-click on the tab of the source spreadsheet and click "Move or Copy." In the Move or Copy window, click the drop-down arrow under "To Book:" and click (new book). Excel removes the worksheet from the existing workbook and opens a new workbook containing the moved worksheet.

To move a worksheet to another existing workbook, we recommend copying the worksheet as instructed below, and then deleting the original sheet when the worksheet has been successfully pasted. Using cut and paste is an option, but if something happens to the PC before pasting occurs, a valuable worksheet could be lost.

Copying Worksheets (Spreadsheets)

Excel 2010 missing manual

Rather than start from scratch, it is often easier to copy, and then modify, an existing worksheet. To copy a worksheet in the same workbook, right-click on the tab of the source worksheet and click "Move or Copy." In the Move or Copy window, check the "create a copy" box, click the name of the spreadsheet that you want the sheet to be inserted before, and click OK.

To copy a worksheet into a new workbook, right-click on the tab of the source worksheet and click "Move or Copy." In the Move or Copy window, click the drop-down arrow under "To Book:" and click (new book). Excel opens a new workbook containing the copied spreadsheet.

To copy a worksheet from one workbook to another existing workbook, right-click the top left corner cell to select all cells and click Copy. Open the other Excel workbook, find an empty worksheet, right-click the top left corner cell to select all cells, and click Paste. Return to the first worksheet and press ESC to remove the animated border.

In Closing...

Excel error messages begin with a pound sign (#). The most common error, #####, indicates that the cell is too narrow to display all of the data. Make the column wider by placing the cursor on the right side of the column heading and dragging the column edge to the right.

We hope this article has been helpful. If you want to learn more about Excel, and you're interested in a video-based course, check out Excel 2010 Tutorial for Beginners, with over 9 hours of hands-on lessons. We've reviewed it and it's a good deal. Cheers!

Appendix C: Cue Type Manipulation and Checks

Goal-Cue and Manipulation Check

When deciding how to attend to information in our environment, we often use a top-down or goal-oriented strategy. This means that we may make decisions about what to attend to based on the goals or expectations that we have. Using this strategy allows us to be able to filter out irrelevant information that is not related to our goal. Also, attending to information in our environment in a top-down manner, or based on our goals, assists us in making better decisions about what is important for us to attend to, and allows us to persist toward meeting our goal. For example, you can set an overall goal to achieve as many points possible out of 36, which will help you to focus on activities that help you to earn points. For example, if you feel you are close to achieving your goal during the activity, you will determine that you have more time to spend reading an e-mail; however, if you feel that you are behind on achieving your goal, then you will put more effort into completing another question quickly before reading an e-mail. Another example of a goal is how you will plan you time. So, at the beginning of the task, you may decide to check e-mails at specific intervals based on how you are progressing on the task.

Please complete the following questions:

1)   Next to each question you will see the number of points that each question is worth; please set a goal for yourself (number of points you would like to make). What is the goal you have set for yourself during this activity?

_____
_____

2)   What are the names of the strategies discussed in the instructions for making decisions about attending to the e-mails?

_____
_____
_____

2)   What is one advantage of using this strategy?

_____
_____
_____

3)   What is one recommendation to determine how to attend to the e-mails based on this strategy?

_____

_____

_____

Task-Cue and Manipulation Check

When deciding how to attend to information in our environment, we often use a bottom-up or stimulus-driven strategy. This means that we may make decisions about what to attend to based on the nature of the information 'popping up' in our environment. Using this strategy allows us to be able to filter out irrelevant information based on how critical or urgent the information is. Also, attending to information in our environment in a bottom-up manner, or based on the features of the information assists us in making decisions about what we need to attend to based on how critical that information is to us. In other words, if something "pops up" that demands immediate attention, we tend to attend to that information immediately. For example, if you receive an e-mail that is far more critical to you than the task, then you may decide to attend to it immediately. One recommendation as you complete the task is to consider how meaningful the e-mails are to you as you work on the Excel task; this will help you to determine when you should reasonably attend to this information. Another recommendation is to quickly scan the title of the e-mails as they pop-up to quickly determine if you need to attend to them.

Please complete the following questions:

1) What is the name of the strategy discussed in the instructions for making decisions about attending to the e-mails?

_____

_____

2) What is one advantage of using this strategy?

_____

_____

_____

3) What is one recommendation to determine how to attend to the e-mails based on this strategy?

_____

_____

_____

Task and Goal Cues and Manipulation Check

When deciding how to attend to information in our environment, we often use one of two strategies: a top-down or goal-oriented strategy or a bottom-up or stimulus-driven strategy.

A top-down strategy means that we may make decisions about what to attend to based on the goals or expectations that we have. Using this strategy allows us to be able to filter out irrelevant information that is not related to our goal. Also, attending to information in our environment in a top-down manner, or based on our goals, assists us in making better decisions about what is important for us to attend to, and allows us to persist toward meeting our goal. For example, you can set an overall goal to achieve as many points possible out of 36, which will help you to focus on activities that help you to earn points. For example, if you feel you are close to achieving your goal during the activity, you will determine that you have more time to spend reading an e-mail; however, if you feel that you are behind on achieving your goal, then you will put more effort into completing another question quickly before reading an e-mail. Another example of a goal is how you will plan you time. So, at the beginning of the task, you may decide to check e-mails at specific intervals based on how you are progressing on the task.

A bottom-up strategy means that we may make decisions about what to attend to based on the nature of the information 'popping up' in our environment. Using this strategy allows us to be able to filter out irrelevant information based on how critical or urgent the information is. Also, attending to information in our environment in a bottom-up manner, or based on the features of the information assists us in making decisions about what we need to attend to based on how critical that information is to us. In other words, if something "pops up" that demands immediate attention, we tend to attend to that information immediately. For example, if you receive an e-mail that is far more critical to you than the task, then you may decide to attend to it immediately. One recommendation as you complete the task is to consider how meaningful the e-mails are to you as you work on the Excel task; this will help you to determine when you should reasonably attend to this information. Another recommendation is to quickly scan the title of the e-mails as they pop-up to quickly determine if you need to attend to them.

Please complete the following questions:

1)   Next to each question you will see the number of points that each question
        is worth; please set a goal for yourself (number of points you would like to
        make). What is the goal you've set for yourself during this activity?

_____

_____

2)   What are the names of the strategies discussed in the instructions for
        making decisions about attending to the e-mails?

_____

_____

3)   What is one advantage of each strategy (one per strategy)?

_____
_____

_____

4)   What is one recommendation of each strategy to determine how to attend
to the e-mails?

_____
_____

_____

No Cues (No additional instructions.)

Appendix D: Informed Consent (Online Pre-test)

ADULT CONSENT TO PARTICIPATE IN RESEARCH

How Do You Decide? A Decision making Study: Part I

Principal Investigator: Shanique Brown

Institution: DePaul University, Chicago, Illinois, USA

Department (School, College): Department of Psychology

Faculty Advisor: Suzanne Bell, Department of Psychology, College of Science and Health

What is the purpose of this research?
We are asking you to be in a research study because we are trying to learn more about decision making. This study is being conducted by Shanique Brown, a graduate student at DePaul University as a requirement to obtain her Doctoral degree. This research is being supervised by her faculty advisor, Suzanne Bell.

We hope to include about 180 people in the research.

Why are you being asked to be in the research?
You are invited to participate in this study because you are likely to engage in some decision making behaviors on a daily basis. You must be age 18 or older to be in this study. This study is not approved for the enrollment of people under the age of 18.

What is involved in being in the research study?
If you agree to be in this study, being in the research involves completing a brief online survey.

Once you have completed this portion of the study, you will be directed to schedule the in-lab portion of the study.

How much time will this take?
This portion of the study will take about 30 minutes to complete.

Are there any risks involved in participating in this study?
Being in this study does not involve any risks other than what you would encounter in daily life. You may feel uncomfortable or embarrassed about answering certain questions. You do not have to answer any question you do not want to.

Are there any benefits to participating in this study?

You will not personally benefit from being in this study.

We hope that what we learn will help other researchers and practitioners to improved resource allocation performance.

Is there any kind of payment, reimbursement or credit for being in this study?
You will be awarded .5 hour research credit for this portion of the study.

Are there any costs to me for being in the research?
There is no cost to you for being in the research.

Can you decide not to participate?
Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

Who will see my study information and how will the confidentiality of the information collected for the research be protected?
The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. However, some people might review or copy our records that may identify you in order to make sure we are following the required rules, laws, and regulations. For example, the DePaul University Institutional Review Board may review your information. If they look at our records, they will keep your information confidential.

What if new information is learned that might affect my decision to be in the study?
If we learn of new information or make changes to any portion of the study, and the new information or changes might affect your willingness to stay in this study, the new information will be provided to you. If this happens, you may be asked to provide ongoing consent (in writing or verbally).

Who should be contacted for more information about the research?
Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study or you want to get additional information or provide input about this research, you can contact the researcher, Shanique Brown at 618-560-3719 or sbrown82@depaul.edu.

This research has been reviewed and approved by the DePaul Institutional Review Board (IRB). If you have questions about your rights as a research subject you may contact Susan Loess-Perez, DePaul University's Director of Research Compliance, in the Office of Research Services at 312-362-7593 or by e-mail at sloesspe@depaul.edu.

You may also contact DePaul's Office of Research Services if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.

You will be given a copy of this information to keep for your records.

<u>Statement of Consent from the Subject:</u>

I have read the above information. I have had all my questions and concerns answered. By signing below, I indicate my consent to be in the research.

Signature: _____

Printed name: _____

Date: _____

Appendix E: Demographics Measure

Please complete the following items.

1. What is you gender?

__ Male __ Female

2. What is your race/ethnicity?

__ Caucasian/White __ Black or African American

__ Asian/Pacific Islander __ American Indian or Alaska native

__ Hispanic, Latino, or Spanish origin

4. What is your age?

Age: _____

5. What is your current employment status?

__ Full time __ Part time

__ Not currently employed

5b. If employed, how many years of work experience do you have?

___ None   ___ 6 months – 1 year

____1-2 years   ___2-5 years

____5-10 years   ___ more than 10 years

Appendix F: Informed Consent (In-lab stage)

ADULT CONSENT TO PARTICIPATE IN RESEARCH

How Do You Decide? A Decision making Study: Part II

Principal Investigator: Shanique Brown

Institution: DePaul University, Chicago, Illinois, USA

Department (School, College): Department of Psychology

Faculty Advisor: Suzanne Bell, Department of Psychology, College of Science and Health

What is the purpose of this research?
We are asking you to be in a research study because we are trying to learn more about decision making. This study is being conducted by Shanique Brown, a graduate student at DePaul University as a requirement to obtain her Doctoral degree. This research is being supervised by her faculty advisor, Suzanne Bell.

We hope to include about 180 people in the research.

Why are you being asked to be in the research?
You are invited to participate in this study because you are likely to engage in some decision making behaviors on a daily basis. You must be age 18 or older to be in this study. This study is not approved for the enrollment of people under the age of 18.

What is involved in being in the research study?
The exact procedure will involve:
- You will complete a series of pre-task measures for about 30 minutes.
- You will complete a 15-training on the use of Microsoft Excel, and a 10-minute test of your understanding of the material presented in the training
- You will complete a 15-minute task.
- Finally, you will complete a brief measure lasting about 5 minutes.

How much time will this take?
This study will take about 75 minutes to complete.

Are there any risks involved in participating in this study?
Being in this study does not involve any risks other than what you would encounter in daily life. You may feel uncomfortable or embarrassed about

answering certain questions. You do not have to answer any question you do not want to.

Are there any benefits to participating in this study?
You will not personally benefit from being in this study.

We hope that what we learn will help other researchers and practitioners to improved resource allocation performance.

Is there any kind of payment, reimbursement or credit for being in this study?
You will be given 1.5 research credits for participating in the research. You must provide your subject pool number in order to be given credit.

Are there any costs to me for being in the research?
There is no cost to you for being in the research.

Can you decide not to participate?
Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

Who will see my study information and how will the confidentiality of the information collected for the research be protected?
The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. However, some people might review or copy our records that may identify you in order to make sure we are following the required rules, laws, and regulations. For example, the DePaul University Institutional Review Board may review your information. If they look at our records, they will keep your information confidential.

What if new information is learned that might affect my decision to be in the study?
If we learn of new information or make changes to any portion of the study, and the new information or changes might affect your willingness to stay in this study, the new information will be provided to you. If this happens, you may be asked to provide ongoing consent (in writing or verbally).

Who should be contacted for more information about the research?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study or you want to get additional information or provide input about this research, you can contact the researcher, Shanique Brown at 618-560-3719 or sbrown82@depaul.edu.

This research has been reviewed and approved by the DePaul Institutional Review Board (IRB). If you have questions about your rights as a research subject you may contact Susan Loess-Perez, DePaul University's Director of Research Compliance, in the Office of Research Services at 312-362-7593 or by e-mail at sloesspe@depaul.edu.

You may also contact DePaul's Office of Research Services if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.

You will be given a copy of this information to keep for your records.

<u>Statement of Consent from the Subject:</u>

I have read the above information. I have had all my questions and concerns answered. By signing below, I indicate my consent to be in the research.

Signature: _____

Printed name: _____

Date: _____

Appendix G: Recall Test (Baseline Performance)

1. Which formula could be used to calculate the sum of cells B2, B3, and B4?

a.) =sum(B2:B4)
b.) =sum(B2-B4)
c.) =average(B2:B4)
d.) =average(B2-B4)

2. The formula **=B1+C1** is located in cell **D1**. If I dragged the curser down to cell **D4** the resulting formula would be:

	A	B	C	D
1	2	4	5	=B1+C1
2	3	3	4	7
3	3	7	8	15
4	5	2	3	????????
5	4	3	4	7

a.) =B3+A4
b.) =C2+B1
c.) =B4+C4
d.) None of the above

3. According to the training, the first steps in creating a chart are to:

a.) Highlight the data and click on the chart wizard icon
b.) Click on the chart wizard icon and enter data when prompted
c.) Use Excel's drawing function to create the chart
d.) Highlight the data and label the X and Y axes

4. In order to create a chart to show the average rainfall in each city, I would need to:

a.) Type Average Rainfall in the box labeled "Category (X) axis"
b.) Type City in the box labeled "Category (X) axis"
c.) Type City in the box labeled "Category (Y) axis"
d.) Both A & C are correct

	A	B	C
1	City	Average temperature in March	Average Rainfall in March
2	Rome	28.6	14.2
3	Seoul	17	.8
4	Singapore	12.7	3.2

5	Stockholm	39	4.5

5. (Refer to the table above) In order to create a bar chart of the average temperature in March for the Seoul, Singapore, and Stockholm, I would first need to:

a.) Click on cell A1
b.) Left click and drag the cursor across cells A3 through B5
c.) Left click and drag the cursor across cells B3 through C5
d.) Left click and drag the cursor across cells B3 through B5

	A	B	C	D
1	City	June High Temperature	July High Temperature	August High Temperature
2	Hong Kong	90	99	*102*
3	Istanbul	78	80	79
4	Kingston	90	89	*94*
5	London	73	76	79

6. Was conditional formatting and/or filtering used to select cities with an average temperature in August that is over 90 degrees:

a.) Conditional formatting
b.) Filtering
c.) Both conditional formatting and filtering were used

7. The conditional formatting option can be found in what menu at the top of the screen in Excel?

a.) Data
b.) Home
c.) Review
d.) Formulas

8. Using the Chart Wizard creates a chart using:

a.) The cell range(s) you selected
b.) All the data in the sheet
c.) The last formula you entered
d.) Data from columns A & B

9. When using conditional formatting, press the _____ key to move to the dialogue box on the right.

a.) Enter
b.) Tab
c.) Insert
d.) Ctrl

10. The filtering option can be found in what menu at the top of the screen in Excel?

a.) Insert
b.) Page Layout
c.) View
d.) Data

11. From the filtering menu, what two pieces of information do you need to provide?

a.) Comparisons (e.g., less than or greater than) and colors
b.) Colors and values (e.g., 65)
c.) Comparisons (e.g., less than or greater than) and values (e.g., 65)
d.) Comparisons (e.g., less than or greater than) and a range of cells (e.g., a4:j4)

 12. Which Excel tool reduces the data that you see on screen?

a.) Chart Wizard
b.) Conditional formatting
c.) Filtering
d.) Inserting formulas

 13. Which Excel tool highlights information by color?

a.) Chart Wizard
b.) Conditional formatting
c.) Filtering
d.) Inserting formulas

Appendix H: Task-specific Self-Efficacy Measure

Now that you have read the instructions for task, please respond to the following items indicating how confident you are in your ability to complete the upcoming task.

0   10   20   30   40   50   60   70   80   90   100

Not at all Confident   Moderately Confident
        Completely Confident

  1 – I feel confident that I can carry out the Excel task

  2 – I believe I will be good at carrying out the task

  3 – I will be able to perform this task easily

  4 – I feel confident in my capabilities to perform the Excel task successfully

Appendix I: Study Debrief

Thank you for your participation in our research study, How Do You Decide? A Decision-making Study.

I would like to discuss with you in more detail the study you just participated in and to explain exactly what we were trying to study.

Before I tell you about all the goals of this study, however, I want to explain why it is necessary in some kinds of studies to not tell people all about the purpose of the study before they begin.

As you may know, scientific methods sometimes require that participants in research studies not be given complete information about the research until after the study is completed. Although we cannot always tell you everything before you begin your participation, we do want to tell you everything when the study is completed.

We don't always tell people everything at the beginning of a study because we do not want to influence your responses. If we tell people what the purpose of the study is and what we predict about how they will react, then their reactions would not be a good indication of how they would react in everyday situations.

In this study, we are trying to understand how people allocate their time while working on a task but are faced with distractions. We are trying to better understand if people who have high working memory capacity spend more or less time on their task if they are told to focus on their goal. To assess this, you were randomly assigned to either a condition where we asked you to focus on your goal, or to a condition where we asked you to focus the nature of the information related to the task. These different conditions represent either a top-down (goal-focus), or a bottom-up (task-focused) way of thinking. While you were working on the task, we monitored the time you spent on each using the software called ManicTime. This software keeps tracks of the time with spend working within a program on a computer.

Additionally, one of the emails that you received during the study asked you to provide contact information for additional participants for the study. This email, like the other emails that you received during the task was only sent as a possible distractor from the Excel task. There is no drawing for a $100 gift card. In the event that you responded to the email with contact information for others, this information will be discarded. Further, the email mentioned that entering the drawing will disqualify you from earning Sona Credits for your participation

today. This information was inaccurate—you will receive credit for your participation as stated in the informed consent.

 If other people knew the true purpose of the study, it might affect how they behave/answer questions, so we are asking you not to share the information we just discussed.
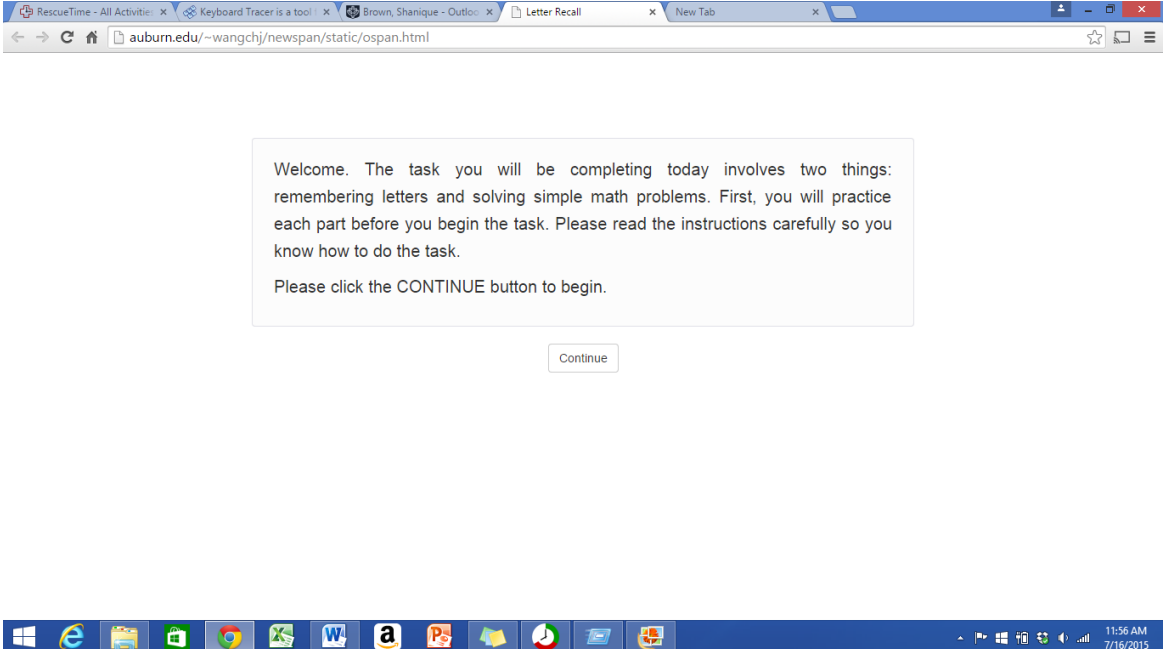
 Now that the study has been explained, if you would like for your data to be removed from the study, please inform the research assistant before leaving. If you decide to have your data removed, we will remove both your pre-lab and lab data.

 I hope you enjoyed your experience and I hope you learned some things today. If you have any questions later please feel free to Shanique Brown at sbrown82@depaul.edu or by phone at 618-560-3719.

Thank you again for your participation.

Appendix J: Screen-shots of Working Memory Test

Welcome page for Working Memory Test

Instructions for practice task (remembering letters)

Sample correct response to practice task (remembering letters)

Sample incorrect response to practice task (remembering letters)
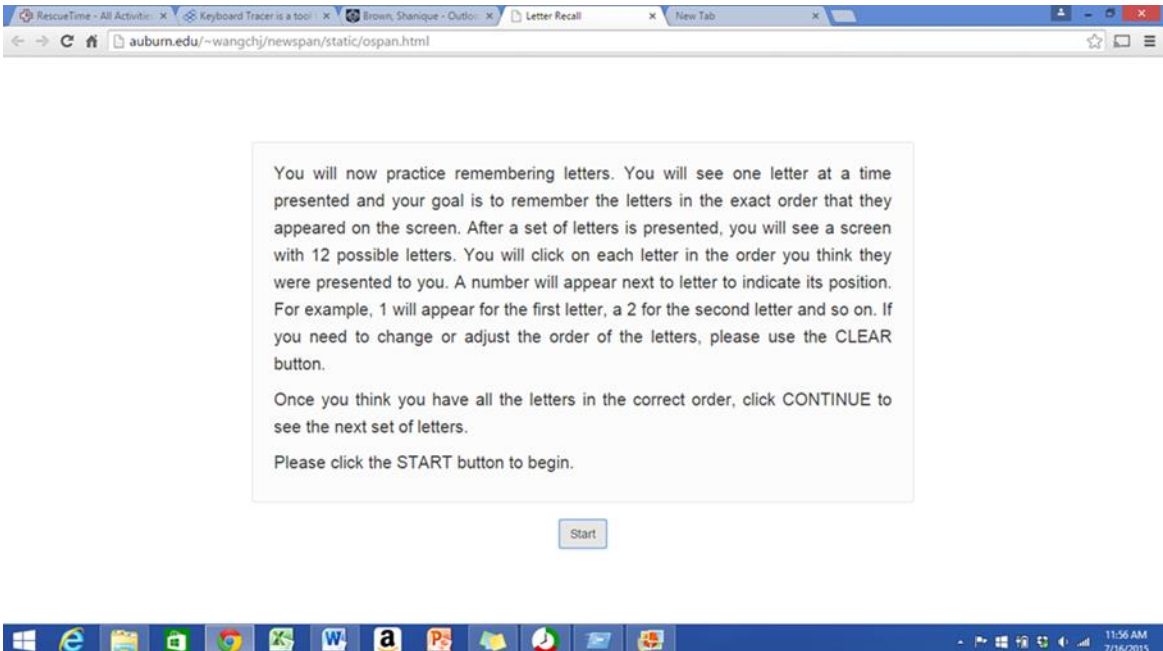
Instructions to practice task for math problems

You will now practice solving the simple math problems. You will see a math problem such as (2x2) + 3 = 5? Presented on the screen. Your goal is solve the problem and indicate whether the number after = sign is true or false. In this example, (2x2) + 3 does not equal 5, so you would click the FALSE button.
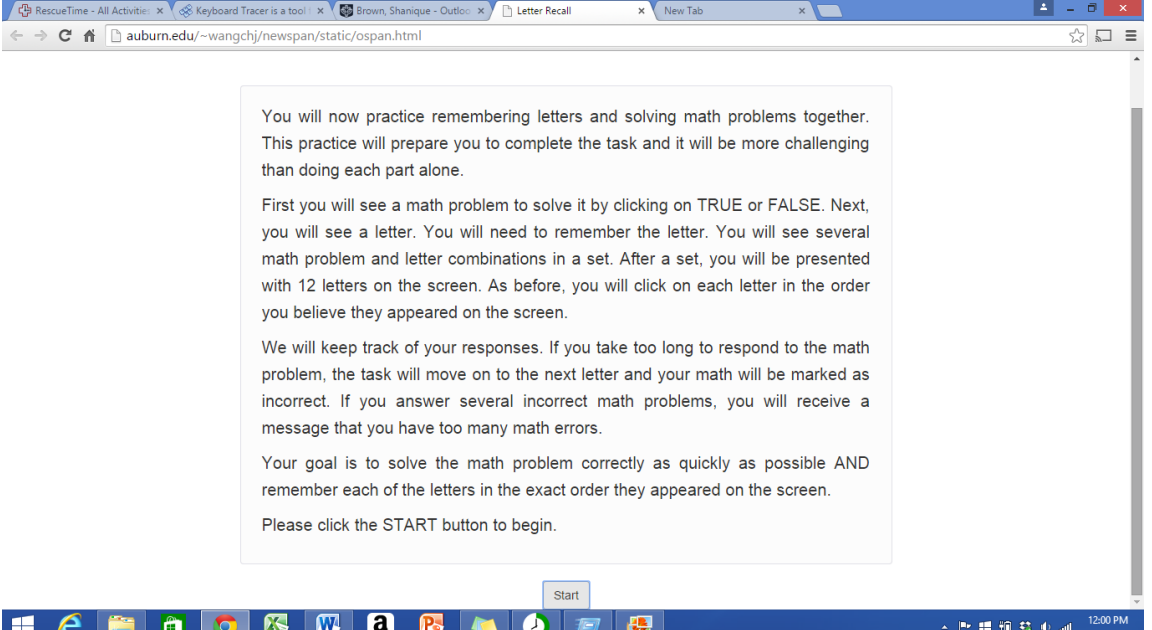
After you click on the TRUE or FALSE button, you will see whether your answer was correct or incorrect. Your goal is to solve each answer correctly as quickly as you can.

Please click the START button to begin.

Start

Instructions to practice task for remembering letters and solving math problems

You will now practice remembering letters and solving math problems together. This practice will prepare you to complete the task and it will be more challenging than doing each part alone.

First you will see a math problem to solve it by clicking on TRUE or FALSE. Next, you will see a letter. You will need to remember the letter. You will see several math problem and letter combinations in a set. After a set, you will be presented with 12 letters on the screen. As before, you will click on each letter in the order you believe they appeared on the screen.

We will keep track of your responses. If you take too long to respond to the math problem, the task will move on to the next letter and your math will be marked as incorrect. If you answer several incorrect math problems, you will receive a message that you have too many math errors.

Your goal is to solve the math problem correctly as quickly as possible AND remember each of the letters in the exact order they appeared on the screen.

Please click the START button to begin.

Start

Appendix K: Conscientiousness Measure

Indicate your level of agreement with the extent to which the following statements describe your own behavior on a scale from 1 (strongly disagree) to 5 (strongly agree).

1= Strongly Disagree

2 = Disagree

3 = Neither Agree nor Disagree

4 = Agree

5 = Strongly Agree

+ keyed

  Am always prepared.

  Pay attention to details.

  Get chores done right away.

  Carry out my plans.

  Make plans and stick to them.

  Complete tasks successfully.

  Do things according to a plan.

  Am exacting in my work.

  Finish what I start.

  Follow through with my plans.

– keyed

  Waste my time.

Find it difficult to get down to work.

Do just enough work to get by.

Don't see things through.

Shirk my duties.

Mess things up.

Leave things unfinished.

Don't put my mind on the task at hand.

Make a mess of things.

Need a push to get started.

Appendix L: Goal Orientation Measure

Indicate your level of agreement with the extent to which the following statements describe your own behavior on a scale from 1 (strongly disagree) to 7 (strongly agree).

1.   I prefer challenging and difficult classes so that I'll learn a great deal.

2.   I truly enjoy learning for the sake of learning.

3.   I like classes that really force me to think hard.

4.   I'm willing to enroll in a different course if I can learn a lot by taking it.

5.   It's important that others know that I am a good student.

6.   I think that it's important to get good grades to show how intelligent you are.

7.   It's important for me to prove that I am better than others in the class.

8.   To be honest, I really like to prove my ability to others.

9.   I would rather drop a difficult class than earn a low grade.

10.   I would rather write a report on a familiar topic so that I can avoid doing poorly.

11.   I am more concerned about avoiding a low grade than I am about learning.

12.   I prefer to avoid situations in classes where I could risk performing poorly.

13.   I enroll in courses in which I feel that I will probably do well.

Appendix M: Experience with Excel

1) How frequently do you use Microsoft Word?

   a) Multiple times per day
   b) A few times per week
   c) Once per week
   d) A few per month
   e) Once per month
   f) Never

2) How frequently do you use Microsoft PowerPoint?
   a) Multiple times per day
   b) A few times per week
   c) Once per week
   d) A few per month
   e) Once per month
   f) Never

3) How frequently do you use Microsoft Outlook?
   a) Multiple times per day
   b) A few times per week
   c) Once per week
   d) A few per month
   e) Once per month
   f) Never

4) How frequently do you use Microsoft Publisher?
   a) Multiple times per day
   b) A few times per week
   c) Once per week
   d) A few per month
   e) Once per month
   f) Never

5) How frequently do you use Microsoft OneNote?
   a) Multiple times per day
   b) A few times per week

      c) Once per week
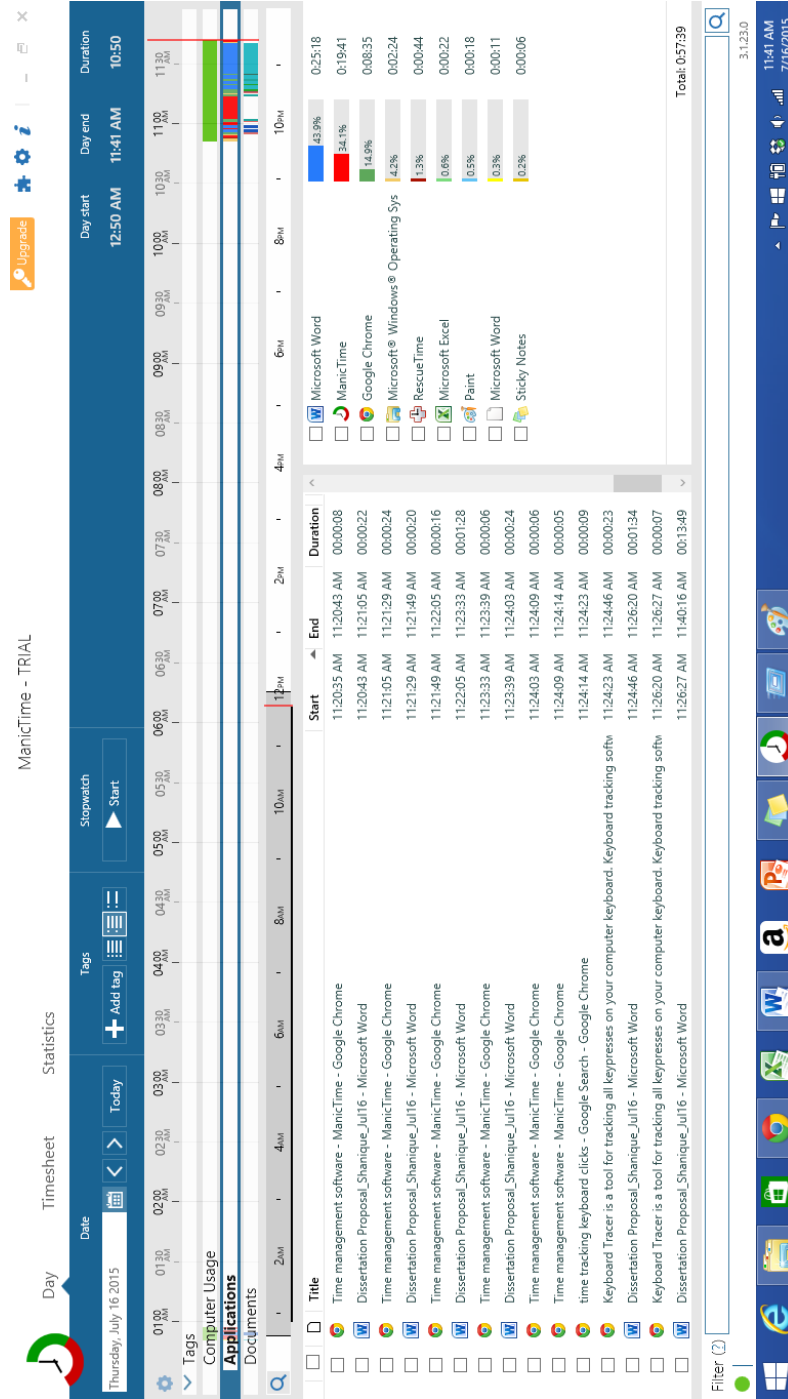   d) A few per month
      e) Once per month
      f) Never

6) How frequently do you use Microsoft Excel?
      a) Multiple times per day
      b) A few times per week
      c) Once per week
      d) A few per month
      e) Once per month
      f) Never

Appendix N: Screen-shot of Data Logged using ManicTime

Appendix O: Experimental Protocol

Instructions for Experimenters
Please follow the following protocol <u>exactly</u> when running the experiment; standardization ensures that sessions can be compared. Each participant should receive the same instructions in the same order.

Time (min)	Activity	Specific Instructions	Possible Questions and Answers

-20	Check for availability:
	- lab room
	- copies of questionnaires
	-pens /pencils
		Setup
		
		1. Log onto lab machine using your CampusConnect username and password.
		2. Put the "<u>Experiment in Progress</u>" sheet on the door.
		3. <u>Check the</u> Participation List to see:
		  a. The <u>Experiment ID of new participants</u> you are waiting for
		  b. The <u>cue conditions</u> randomly assigned to them:
		    i. 1 = Task Cue
		    ii. 2 = Goal Cue
		    iii. 3 = Both Task and Goal Cues
		    iv. 4 = No Cues
		4. <u>Check the volume</u> of the computer and increase if too low.
		5. Open the link for the cognitive ability test; minimize window.
		6. Open the link for the working memory test; minimize window.
		7. Open the ManicTime program and ensure this is running in the background.
		8. Open Qualtrics link for survey (task self efficacy and post-task survey); minimise window.
		9. Create a new copy of the Excel
			Important: Before you let the participants into the room, make sure you have a properly named Excel file for them to work on.
			
			Training video has been opened in FULL SCREEN MODE.

data sheet, and paste it to the top right corner of the Desktop. Once a copy is on the desktop, rename it. All Excel sheets should be named with the participant number.

10. Go to your Research folder and **<u>open the training video.</u> Press STOP to make sure the video starts from the beginning.**

11. Check your participant folder to ensure it includes the appropriate paperwork for each participant, in the following order.

- 1. Consent form
- 2. General Instructions
- 3. Task Instructions
- 4. Post-experiment Survey
- You can start now!

0	Participant arrives at Byrne Hall.	Participant arrives at specific lab room. If you are not ready, ask them to wait in hallway. When participant comes in, they should put their RESEARCH SYSTEM ID on the Experiment Session sheet. This is <u>not</u> their Student ID.	Q: What if the participant does now know his/her research system ID? A: If they do not know their ID number, ask them to list their first and last names so we can look up their ID later.
0	Informed consent	"**This is our standard informed consent form including some general information on the experiment. Take**	Q: Why do I have to sign this form?

	Close door and put do not disturb sign outside	**your time to read the document and feel free to ask me any questions.”** **“I will be asking you some questions to make sure you understand the consent form.”** After participants have read: **Ask** these questions for understanding: “**What is the purpose of this study? What are the benefits? What are the risks?”**	A: This form confirms that everybody has participated voluntarily in this study. You may provide a blank copy of consent if they wish to keep it.
5	Working memory test	Maximize the window for the working memory task and insert the participant ID. Inform the participant that he/she has 15 minutes to complete the test and remind him/her to pay close attention to the instructions for the test.	**Note:** Be sure to start your timer as soon as the participant begins the test.
20	Cognitive Ability Test	Maximize the window for the cognitive ability and insert the participant ID. Inform the participant that he/she has 12 minutes to complete the test and remind him/her to pay close attention to the instructions for the test.	Note: Be sure to start your timer as soon as the participant begins the test.
32	Task Instructions	Remove the instructions for the task and hand this to participant. **“These are the instructions for the task; you have 3 minutes to review the instructions. Please let me know if you have any questions.”**	
35	Excel Training	1. Tell the participant to open the Windows Media Player window file to file screen, put their	

		headphones on, and to press the Blue Circle button at the bottom of the screen. 2. When the video is over, tell participants to press the Esc key on the keyboard, and to then close the Windows Media Player window. 3. Next, have the participants complete the recall test. Inform the participant that he/she has 10 minutes to complete this test.	
55	Excel Task	1. Have the participant complete the task-specific self efficacy measure using the link provided. 2. <u>Have participant open the Task excel sheet</u> (which you prepared, renamed, and placed <u>in the top right corner of the Desktop</u> earlier), and give the participant the <u>Task questions</u> from the folder. Tell the participant that s/he has <u>15 minutes</u> to work on the task. Even if they can't finish everything, you should take the task sheet back at the end of 15 minutes duration. 3. <u>Remind the participant to save all work</u> on the desktop. 4. <u>Once the participant has completed the task, instruct the participant to complete the post-task survey.</u>	**Important!!** **Please check to make sure that the participant is not using the split screen option to work on tasks.** **Be sure to monitor the participant's engagement as he/she works on the task. Make a note in the lab log if the participant appear disengaged (i.e., The**

				person appeared off-task 1: Never, 2: For less than 2 minutes, 3: For less than 5 minutes, 4: For more than 5 minutes).
75	Wrap-up		1. Thank the participant; remind not to discuss the details of the study with others who have not completed the study. 2. Open the ManicTime software and record the participant's time spent working on the Excel sheet and on e-mail in seconds. 3. Staple all materials and place them in the folder labeled "Study Data". 4. We also have to keep record of the Excel sheets they worked on. Save the Excel file (used by participants) to our "Data" folder in the Dropbox folder labeled "Resource Allocation Data". 5. Log off. 6. Remove 'do not disturb' sign from the door. 7. Be sure to lock the lab door and scramble the code.	Important: When recording second from the ManicTime software, you will need to scroll down and add all times recorded for each as the software will show multiple entries for each program or document not a single total). WRITE NOTES ON LAB LOG about how

	the session went and about the participant's engagement (be sure to complete the 1-5 ratings provided on the log sheet about the participant's level of engagement).

Other reminders: Be friendly and welcoming. Know that participants might be out in the hallway waiting and may not knock on door.   If there are any computer issues – but sometimes just rebooting will clear things up. If there are any major issues, please contact me at 618-560-3719.