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THE IMPACT OF ATTENTIONAL INTERRUPTIONS ON CREATIVE PROBLEM SOLVING

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF PSYCHOLOGY

BY THE COMMITTEE CONSISTING OF

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Abstract

Some scholars have found that a broad breadth of attention facilitates creative performance, whereas other researchers have found that it is best to have flexible attention based on the situation at hand and stage of the creative process one is in. These research discrepancies ultimately point to the inconclusiveness of findings within this scholarly literature. Moreover, many of the studies are fraught with methodological limitations, including unrealistic creativity tasks and constrained operationalizations of creative performance. The purpose of the present study was to address these issues by examining how different aspects of attentional interruptions impact creative problem-solving performance. Using a 2 × 2 × 2 between-subjects design with an additional control group, 216 undergraduate participants completed a creative problem-solving marketing task. Participants were asked to assume the role of a new marketing consultant at a failing soda company. Three email interruption manipulations (i.e., interruption timing, interruption amount, and interruption relevance) were embedded into the task and creative performance was measured by the quality, originality, and elegance of final marketing plans. Although none of the hypotheses were supported, exploratory findings point to the benefits of receiving a low number (e.g., two) of interruptions for creative problem-solving performance. The findings are discussed in terms of the need for future research that examines the interplay between attentional interruptions, cognitive load, and creative performance.

Keywords: creativity, innovation, attention, interruptions, marketing

The Impact of Attentional Interruptions on Creative Problem Solving

Creative problem solving is a critical activity for organizations that look to develop, grow, and innovate. Some scholars even make the argument that creative employees represent an organization's most important asset and are necessary for overall success (Florida & Goodnight, 2005). Creative problem solving is, however, quite complex and involves the production of original and useful solutions (Runco & Jaeger, 2012) to problems that are novel, complex, and ill-defined (Besemer & O'Quin, 1999; Lubart, 2001). Although conceptualizations somewhat differ, many creativity scholars agree that creative problem solving can be seen as a complex process, where ideas are generated and later refined in a cycle that can repeat based on various situational elements and contingencies (Mumford, Mobley, Reiter-Palmon, Uhlman, & Doares, 1991; Sternberg & O'Hara, 1999; Ward, Smith, & Fink, 1999).

From a cognitive perspective, the creative problem-solving process is intricate and involves many different activities including (a) problem definition, (b) information gathering, (c) concept selection, (d) conceptual combination, (e) idea generation, (f) idea evaluation, (g) implementation, and (h) monitoring (Mumford et al., 1991). The initial generation of ideas represents early cycle creative processes, and the evaluation and monitoring of those ideas represents late cycle creative processes (Mumford et al., 1991). Figure 1 presents a graphic depiction of the elements and cycles comprising the creative process.

Clearly, creative problem solving is a complex and cognitively demanding activity (Mumford, Watts, & Partlow, 2015), that requires active cognitive processing (Fink et al., 2009) and cognitive persistence (Teubner-Rhodes et al., 2017). The modern world is full of interruptions and stimuli that individuals must filter, sift through, and balance. Life in organizations is no different as there are important business emails, phone calls, and reminders

trickling in throughout the day that one must deal with on top of their most pressing work tasks. One report found that in 2019 the average employee sent/received over 126 business emails per day (Radicati Group, 2019). The same report indicated that even when factoring out spam emails, the average employee still sent/received 107 legitimate emails per day. Given the cognitively complex nature of creative problem solving and the idea that humans have a limited capacity to process information (Chun, Golomb, & Turk-Browne, 2011), an important issue arises. That is, whether ubiquitous attentional interruptions are detrimental for creative problem-solving performance, or whether there are instances in which they can be beneficial.

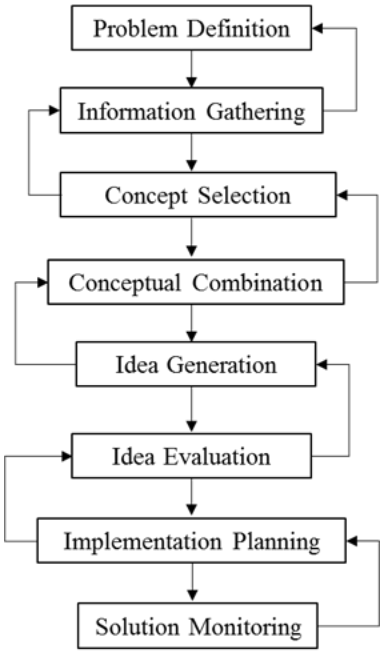

Figure 1. Model of Creative Problem-Solving Processes.

The following study aimed to examine the helpfulness/hurtfulness of email attentional interruptions throughout the creative problem-solving process. Generally speaking, I predicted that if participants received interruptions that broaden attentional focus (i.e., received a greater

number of emails, received emails irrelevant to the task at hand) during early cycle creative problem solving, then it would result in better creative problem-solving performance. Conversely, I predicted that when participants received interruptions that broaden attentional focus during late cycle creative problem solving, then it would result in worse creative problem-solving performance.

Defining Attention

Psychological research has long held the importance of attention in predicting behavior (Nideffer, 1976). Sustained attention involves an individual's ability to focus on a set of stimuli for a prolonged period of time (Sarter, Givens, & Bruno, 2001). Humans have a limited capacity to process information, therefore attentional mechanisms are involved in selecting, modulating, and sustaining focus on relevant information (Chun et al., 2011). These attentional mechanisms, or competencies, should alter adaptively in response to situational demands (Nideffer, 1976).

Although conceptualizations somewhat differ, researchers have broken down attention into two main dimensions, breadth of focus and direction of focus (Nideffer, 1976). The number and range of a stimuli an individual attends to represent breadth of attention. A narrow, or focused breadth of attention represents an individual attending to only a relatively small range of stimuli at any given time (Kasof, 1997; Nideffer, 1976). In other words, individuals are filtering out a great deal of information (Kasof, 1997; Nideffer, 1976). Conversely, a broad breadth of attention involves focusing on a large range of stimuli at any given time (Kasof, 1997; Nideffer, 1976). Here, the individual is more aware of extraneous information (Kasof, 1997; Nideffer, 1976).

With respect to the direction of attention, researchers have broken this dimension down into two categories: external and internal (Nideffer, 1976). External attentional processing

involves environmental stimuli (Nideffer, 1976), which includes sensory inputs, such as noise, objects in an environment, and spatial locations (Chun et al., 2011). External attentional stimuli lead to perceptual analysis (Corbetta & Shulman, 2002; Johnson, 1983; Nideffer, 1976; Pashler, Johnston, & Ruthruff, 2001) and automated reactions (Nideffer, 1976). With external direction of focus, individuals are preoccupied with environmental stimuli, and at an extreme level there is nearly a complete external locus of control (Nideffer, 1976).

Conversely, internal attentional processing represents higher-order internally generated information, such as thoughts and feelings and involves tuning out environmental stimuli (Nideffer, 1976). Internal attentional stimuli are selected based on relevant goals (Bacon & Egeth, 1994; Corbetta & Shulman, 2002) and involves cognitive processes such as understanding task rules, planning, working memory, long-term memory, decision making, and responding (Chun et al., 2011). Internal attentional focus is related to other similar constructs such as self-regulation, which involves behaviors such as planning, directing and maintaining attention, as well as behavioral correction (Diehl, Semegon, & Schwarzer, 2006). Similarly, internal attentional focus is related to attentional control. Attentional control represents an individual's ability to focus their attention on a given task and to control external, as well as internal distractions in order to accomplish a task (Diehl, et al., 2006). Most people maintain a balance between internal and external directions of attention, shifting between the two as necessary (Nideffer, 1976). Moreover, both external and internal attention involve cognitive processing in distinct areas of the brain (Corbetta & Shulman, 2002).

Attention and Creativity

Broad Breadth of Attention Contributing to Creativity

Researchers have traditionally argued that broad breadth of attention (i.e., attending to a large range of stimuli; Kasof, 1997; Nideffer, 1976) relates to better creative performance (Friedman, Fishbach, Forster, & Werth, 2003; Howard-Jones & Murray, 2003; Kasof, 1997; Mendelsohn, 1976; Mendelsohn & Griswold, 1964). It has been found that creative idea production lessens over a short period of time, even for problems with an infinite number of potential solutions (Howard-Jones & Murray, 2003). Researchers have therefore debated that attending to a large range of stimuli at a given time allows for a greater flow and wider variety of information to enter the mind, therefore enabling individuals to connect seemingly disparate ideas, resulting in greater levels of creativity (Friedman et al., 2003; Kasof, 1997; Mendelsohn, 1976). When attentional scope is broadened, it becomes easier for the mind to overcome fixation during idea generation tasks which allows for increased remote associations (Friedman et al., 2003; Howard-Jones & Murray, 2003; Kasof, 1997; Mendelsohn, 1976; Mendelsohn & Griswold, 1964). Limited research findings have supported this view that broad breadth of attention contributes to improved creative production (Friedman et al., 2003; Howard-Jones & Murray, 2003).

Moreover, other researchers have taken these general arguments and empirical findings one step further and have posited that beyond momentary, or state focused attention, trait broad breadth of attention contributes to creative performance (Kasof, 1997; Mendelsohn, 1976; Mendelsohn & Griswold, 1964). In other words, individuals with the stable, enduring trait of broad breadth of attention are more likely to connect distally related concepts and are therefore

more creative compared to their counterparts with trait narrow breadth of attention (Kasof, 1997).

Flexible Attention Contributing to Creativity

Contrary to the general arguments and findings suggesting state broad breadth of attention and trait broad breadth of attention contribute to creative performance, other researchers have proposed conflicting points and have argued that creative individuals may be better at adjusting their attention based on the situation at hand and stage of the creative process (Finke, Ward, & Smith, 1992; Howard-Jones & Murray, 2003; Martindale, 1999, Vartanian, Martindale, & Kwiatkowski, 2007). Here, it is critical to note that creative problem solving is often confused with divergent thinking (Kharkhurin, 2011; Mumford, 2001; Runco & Acar, 2012; Vartanian, 2009). Divergent thinking represents an individual's capability to generate a number of useful and original ideas (Merrifield, Guildford, Christensen, & Frick, 1962). Although divergent thinking has been shown to influence creative problem-solving performance (Lubart, 2001; Vincent, Decker, & Mumford, 2002), and specifically performance during early stages of the creative problem-solving process (Baughman & Mumford, 1995; Finke et al., 1992), it does not necessarily relate to the entire multifaceted creative problem-solving process (Mumford, 2001; Mumford et al, 1991). In other words, divergent thinking is not synonymous with overall creative performance (Runco & Acar, 2012) and this point is critical to keep in mind when interpreting research findings within this domain.

In their "Geneplore" model, Finke et al. (1992) proposed that creative cognition alternates between generative and exploratory phases, where concepts are either focused or expanded depending on task demands and/or situational constraints. Adding to this model, Vartanian (2009) suggests that a broadening of attentional scope may be beneficial during

generation, or early cycle creativity processes when the problem is still ill-defined and ambiguous (see Mumford et al., 1991). On the other hand, Vartanian (2009) suggests that narrowly focusing attention may be more beneficial during exploratory, or late cycle processes when the problem space is less ambiguous and more structured (see Mumford et al., 1991). After defining the problem space and generating ideas, narrowly focused attention allows the individual to concentrate on and examine the specific aspects relevant to the problem, resulting in improved creative performance (Vartanian, 2009). Limited empirical findings have supported these arguments that individuals who are more flexible in their attentional scope exhibit better creative performance (Vartanian et al., 2007; Zabelina & Robinson, 2010).

Given the arguments and limited empirical findings discussed above, the present study seeks to examine the helpfulness/harmfulness of email attentional interruptions throughout the creative problem-solving process. Therefore, the first experimental manipulation was constructed to observe how attentional interruptions during idea generation, representing an early cycle creative problem-solving process, vs interruptions during idea evaluation, a late cycle process, impact overall creative production on a complex problem-solving task. Thus, I tested the following hypotheses (see Appendix A, Figure A1 for a graphic depiction of hypothesized pattern of means):

> *Hypothesis 1a*: Compared to a control group, participants receiving attentional interruptions during idea generation will result in better creative problem solving, as measured by the quality, originality, and elegance of final plans for a marketing scenario.

Hypothesis 1b: Compared to a control group, participants receiving attentional interruptions during idea evaluation will result in worse creative problem solving, as measured by the quality, originality, and elegance of final plans for a marketing scenario.

Methodological Limitations in the Literature

Operationalization of creative performance. Within the research domain of attention and creativity, there is a failure to acknowledge the complexities of the creative problem-solving process and consequently many researchers extrapolate that divergent thinking represents creative problem-solving more generally (e.g., Friedman et al., 2003; Howard-Jones & Murray, 2003; Mendelsohn, 1976; Mendelsohn & Griswold, 1964). However, unlike divergent thinking, creative problem solving represents the production of solutions to problems that are novel, complex, and ill-defined (Besemer & O'Quin, 1999; Lubart, 2001). Yet, for example, Howard-Jones and Murray (2003) and Friedman et al. (2003) utilized a simple divergent thinking task and made the argument that the number of ideas produced corresponds to overall creative performance. Moreover, Vartanian et al. (2007) measured creative potential by standardizing and averaging scores on two divergent thinking measures and a self-reported creative personality measure. To reiterate, many scholars argue that although divergent thinking is associated with overall creative performance, the two are not necessarily synonymous (Mumford et al., 1991; Runco & Acar, 2012; Sternberg & O'Hara, 1999; Ward et al., 1999). Furthermore, researchers often caution against the use of self-reported measures of creativity, as they are subjective and do not necessarily reflect actual levels of creativity (Baas, De Dreu, & Nijstad, 2008)

Additionally, the task used by Ward, Smith, and Finke (1999) and Kharkhurin (2011) to measure complex creative problem solving was the Invented Alien Creatures task, where

participants must imagine and draw a creature from another planet. It has been argued that creative performance is, at least in part, tied to a particular domain (Conti, Coon, & Amabile, 1996; Sternberg, 2005), where individuals are able to retrieve relevant information to the problem at hand, as compared to more universal creativity skills (Ward et al., 1999). Although tasks such as the Invented Alien Creatures activity may highlight some universal creativity skills, they fail to acknowledge the importance of domain-specific creativity skills (Conti et al., 1996). Moreover, some scholars even argue that there are no general creativity skills, but rather only task-specific creativity skills (Baer, 1991).

Therefore, the present study aims to address these methodological shortcomings and will present participants with a domain specific, complex creative problem-solving task that incorporates real-world elements. Specifically, participants were asked to develop a marketing plan for a failing soda company. For this novel, complex, and ill-defined scenario, plans were judged based on their originality, quality, and elegance.

Nature of attentional interruptions. There is a limited body of evidence investigating how attentional interruptions impact creative problem solving. Existing research findings are inconclusive as to whether attentional interruptions help/hinder creative problem solving and many of the existing studies suffer from critical methodological shortcomings. A main issue surrounding both sides of the argument has to do with the types of activities used to broaden/narrow attention. Recall that attentional stimuli can be broadly categorized as external (i.e., environmental stimuli) and internal (i.e., internally generated stimuli) (Chun et al., 2011; Corbetta & Shulman, 2002; Nideffer, 1976; Pashler, Johnston, & Ruthruff, 2001), where external attention refers to the automatic processing of sensory information in the environment (e.g., noises, objects in the environment, spatial locations) (Corbetta & Shulman, 2002; Johnson, 1983;

Nideffer, 1976; Pashler et al., 2001). On the other hand, internal attention refers to the higher-order processing of internally generated information (e.g., thoughts, feelings, understanding task rules, planning, working memory, long-term memory, decision making, responding) (Chun et al., 2011; Corbetta & Shulman, 2002; Nideffer, 1976; Pashler, Johnston, & Ruthruff, 2001). Unfortunately, most research on the topic of attention and creativity fails to acknowledge this distinction and implicitly places emphasis on external mechanisms used to broaden/narrow attention (Benedek, 2018). For example, noise distractions (e.g., Kasof, 1997), Stroop-like tasks (e.g., Kharkhurin, 2011; Vartanian et al., 2007; Zabelina & Robinson, 2010), drawing completion tasks (e.g., Friedman et al., 2003), and even facial muscular movements (e.g., Friedman et al., 2003). However, creativity is a distinctly cognitive activity (Finke et al., 1992) and the underrepresentation of internal attentional stimuli presents issues for understanding the phenomena at hand (Benedek, 2018). Therefore, the present study aims to address these issues and examine the helpfulness/harmfulness of attentional interruptions on creative problem solving. Specifically, the experiment includes three manipulations embedded in email interruptions that require participants to receive, read, and respond to the message. These emails represent both an internal and external stimulus, as they interrupt the participants' sensory information (i.e., visually receiving the email and disrupting work) and also impact an individual's internal attention (i.e., participants must make a decision and respond to the message before returning to work on the task). When working in real-world situations, most people maintain a balance between internal and external directions of attention, shifting between the two as necessary (Nideffer, 1976). Therefore, the experimental task in this study attempts to mirror the attentional scope necessary for everyday tasks.

Unfortunately, gaps still exist in this domain and our literature review yielded no studies analyzing the impact of fewer vs more attentional interruptions, nor was there any evidence bearing on the impact of task-relevant vs task-irrelevant interruptions on complex creative problem solving. A majority of research analyzing attention and creativity include a single attentional manipulation activity constructed to either narrow or broaden attention. By and large these activities (e.g., Stroop-like tasks, drawing completion tasks) do not resemble real-world attentional interruptions (e.g., email interruptions, coworker disruptions), adding to issues of ecological validity. Indeed, scholars have argued that creativity experiments should use realistic and consequential tasks that mirror work done in organizational settings (Hughes, Lee, Tian, Newman, & Legood, 2018). Considering that real-world attentional interruptions will vary in quantity and relevance to a person's work, it is crucial to understand how these elements function within the creative problem-solving process.

Humans have a limited capacity to process information (Chun et al., 2011). Although no existing studies examine the extent to which the quantity of attentional interruptions impact creative problem solving, it stands to reason that with more interruptions comes diminished cognitive capacity to stay focused on the task at hand. Limited evidence indicates that broadly focused attention is better for early cycle creative problem-solving processes and narrowly focused attention is better for late cycle creative problem-solving processes (Vartanian et al., 2007; Zabelina & Robinson, 2010). Accordingly, it seems reasonable to argue that increased quantities of attentional interruptions (which are likely to broaden attention) would be more beneficial for early cycle creative problem-solving processes (e.g., idea generation), as compared to late cycle processes (e.g., idea evaluation). Therefore, the second experimental manipulation in this study will present participants with either two (low condition) or four (high condition)

email interruptions. Given the lack of research in this area, it is difficult to determine the quantity of email interruptions that should represent the low vs high condition. However, previous creative problem-solving research, which used a similar creative planning experimental task, has also utilized two vs four prompts as a low vs high condition, respectively (Scott, Lonergan, & Mumford, 2005). Thus, I tested the following hypotheses, which together reflect an interaction between the timing and amount of interruptions (see Appendix A, Figure A2 for a graphic depiction of hypothesized pattern of means):

> *Hypothesis 2a:* Compared to those receiving a fewer number of attentional interruptions (i.e., two emails), participants receiving a greater number of attentional interruptions (i.e., four emails) during idea generation will result in better creative problem solving, as measured by the quality, originality, and elegance of final plans for a marketing scenario.
>
> *Hypothesis 2b:* Compared to those receiving a fewer number of attentional interruptions (i.e., two emails), participants receiving a greater number of attentional interruptions (i.e., four emails) during idea evaluation will result in worse creative problem solving, as measured by the quality, originality, and elegance of final plans for a marketing scenario.

Additionally, the third manipulation was constructed to observe how task-relevant vs task-irrelevant interruptions impact creative performance. This manipulation was designed to represent how real-world interruptions may direct someone's attention either to the problem that they are tasked with solving or direct their attention away from the task at hand. Although no empirical work has been done to investigate this phenomenon, it seems reasonable to argue that these task-relevant vs task-irrelevant emails can be viewed as either narrowing (i.e., attending to a small range of relevant stimuli) or broadening (i.e., attending to a large range of extraneous

stimuli) one's focus and attention. Again, limited evidence indicates that broad breadth of attention is better for early cycle creative problem-solving processes and narrow breadth of attention is better for late cycle creative problem-solving processes (Vartanian et al., 2007; Zabelina & Robinson, 2010). Therefore, I tested an interaction between interruption relevance and interruption timing. Specifically, I hypothesized the following (see Appendix A, Figure A3 for a graphic depiction of hypothesized pattern of means):

> *Hypothesis 3a:* Compared to those receiving task-relevant attentional interruptions, participants receiving task-irrelevant email interruptions during idea generation will result in better creative problem solving, as measured by the quality, originality, and elegance of final plans for a marketing scenario.
>
> *Hypothesis 3b:* Compared to those receiving task-relevant attentional interruptions, participants receiving task-irrelevant email interruptions during idea evaluation will result in worse creative problem solving, as measured by the quality, originality, and elegance of final plans for a marketing scenario.

Finally, with respect to a three-way interaction between all manipulations, I generally predicted that those manipulations intended to broaden focus (i.e., receive a greater number of emails, receive emails irrelevant to the task at hand) will improve creative performance if they are received during idea generation, but will have an opposite effect and will hinder creative performance if they are received during idea evaluation. Therefore, I tested the following hypotheses (see Appendix A, Figure A4 for a graphic depiction of hypothesized pattern of means):

Hypothesis 4a: Compared to all other conditions, participants receiving a greater number (i.e., four emails) of task-irrelevant attentional interruptions during idea generation will result in better creative problem solving, as measured by the quality, originality, and elegance of final plans for a marketing scenario.

Hypothesis 4b: Compared to all other conditions, participants receiving a greater number (i.e., four emails) of task-irrelevant attentional interruptions during idea evaluation will result in worse creative problem solving, as measured by the quality, originality, and elegance of final plans for a marketing scenario.

Method

Sample

After receiving approval from our Institutional Review Board, I collected data from a total of 232 participants, who completed the survey in its entirety. Of those 232 participants, 216 individuals agreed for their data to be used in this study. All participants were college students at the University of Oklahoma who were enrolled in a general psychology course. Participants were recruited through an online system (i.e., SONA) listing study options that could be completed in exchange for credits to fulfill requirements in their general psychology course. Once participants self-elected to partake in this study, they were given access to the Qualtrics survey link through the online study platform. Participants were instructed to complete the entire study in a quiet, distraction free environment, within a single sitting. Upon completion, participants were granted credit through the online study system.

Experimental Task

Creative problem solving involves the creation of original and useful solutions (Runco & Jaeger, 2012) to novel, complex, and ill-defined problems (Besemer & O'Quin, 1999; Lubart, 2001). It has been argued by some researchers that creativity skills are, at least in part, domain specific (Conti et al., 1996; Sternberg, 2005), with some researchers arguing all creativity skills are inherently domain-specific rather than general (Baer, 1991). Similarly, other scholars have argued that creativity experiments should use realistic and consequential tasks that mirror work done in organizational settings (Hughes et al., 2018).

The experimental task used in this study was drawn from Byrne, Shipman, and Mumford (2010) and presents a complex marketing problem for which participants developed solutions. Participants were asked to assume the role of a marketing consultant recently hired on at a root beer manufacturing company, Frosty Mug Brewing Co. They were asked to address the issues being faced by the company (e.g., the 15-25 age group is no longer attracted to Frosty Mug Root Beer, company revenue is decreasing) via a marketing campaign plan. It should be noted that evidence for the validity of this experimental task in samples without professional or specialized knowledge has been demonstrated in multiple other experiments (e.g., Byrne et al., 2010; Hester et al., 2012; Medeiros, Partlow, & Mumford, 2014), as virtually all participants have at least some exposure to common marketing practices and techniques used in advertising.

After reading through the initial instructions, participants were sent fictional "emails" from various stakeholders introducing them to the task (see Appendix B) and manipulations (see Appendix C). Importantly, participants were given information bearing on the company's current situation, including the issues that they were eventually asked to address during the planning

phase of the experimental task. These issues include changing market demands, decreases in revenue, and low levels of employee satisfaction (see Appendix B).

The experimental task included five sections. First, participants were introduced to the task. They were not asked to complete any activities during this time. Second, participants were asked to define the problems being faced by Frosty Mug Brewing Co. in their own words—an activity that has been included in similar creative problem-solving tasks (e.g., Mumford, Baughman, Threlfall, Supinski, & Costanza, 1996). During this problem definition section, participants were habituated to email interruptions which served as the basis for experimental manipulations in upcoming sections. Third, participants were then asked to brainstorm ideas for addressing the issues being faced by Frosty Mug Brewing Co. Idea generation activities such as this have been used in other complex creative problem-solving experiments (e.g., Hunter, Bedell-Avers, Hunsicker, Mumford, & Ligon, 2008; McIntosh, 2018). Fourth, participants were then asked to evaluate each of the ideas they brainstormed. Again, idea evaluation activities such as this have been used in other complex creative problem-solving experiments (e.g., Licuanan, Dailey, & Mumford, 2007; McIntosh, 2018). It is during sections three and four that experimental manipulations were introduced. Participants were interrupted during either the idea generation or idea evaluation stage with a specified number of emails that were either relevant or irrelevant to the problem-solving task they had been given (see Appendix C). Lastly, participants were asked to develop a plan for the Frosty Mug Brewing Co. to address the issues being faced by the company.

Protocol and Manipulations

In order to test the research hypotheses, a 2 (interruption timing: during idea generation vs idea evaluation) × 2 (interruption amount: two vs four) × 2 (interruption relevance: relevant vs

irrelevant) research design, with a control group (no interruptions), was utilized. Similar 3-way manipulation research designs have been employed in other creative problem-solving studies in the marketing domain (e.g., Byrne et al., 2010; Martin, Elliott, & Mumford, 2019; Medeiros et al., 2014).

Figure 2 presents a summary of the study protocol. Participants completed timed covariate measures (i.e., participants have a limited amount of time to complete tasks within the measure) before the experimental task and completed the untimed covariates after the experimental task. Similar procedure sequences have been used in numerous past studies analyzing complex creative problem solving in the marketing domain (e.g., Byrne et al., 2010; Martin et al., 2019; Medeiros et al., 2014). After consenting to partake in the study, participants completed a set of timed covariate measures, including a divergent thinking measure and a measure of cognitive ability (see additional information in the covariates section below). Next, participants were provided with the general task instructions (see Appendix B) and were then instructed to begin the low-fidelity experimental task.

Study Activity

Informed consent (3 min)
Divergent thinking measure (10 min)
EAS cognitive ability measure (5 min)
Task instructions and background information (5 min)
Problem definition task (3 min)
Idea generation task (5 min)
Idea evaluation task (5 min)
Plan writing task (10 min)
Big 5 personality measure (3 min)
Planning measure (10 min)
Trait breadth of attention scale (3 min)
Marketing expertise measure (1 min)
Mind wandering measure (2 min)
Demographics questionnaire (2 min)

Figure 2. Chronological list of study procedures

To begin the low-fidelity simulation, participants received an email from the Vice President of Marketing, Taylor Schmidt, welcoming the participant to the team. In this email, the Marketing VP provided the participant with various documents that they were told would help them throughout their tasks. Included in these documents was information bearing on the current issues the company is facing, which served as the basis for task-relevant email interruptions. Additionally, participants were given miscellaneous paperwork and information that served as the basis for the task-irrelevant manipulations, including information about the company history, a monthly calendar, and a graphic depicting the organizational hierarchy of the fictional corporation. Through instructions, participants in experimental conditions were told that they would encounter email interruptions and that they must respond to those emails immediately.

After receiving an initial welcome and supplementary materials, participants were asked to put into their own words the problems being faced by the Frosty Mug Brewing Co. (see Appendix B). Not only did this activity allow for the researcher to habituate participants to the manipulation interruptions, it also has been found to help in later stage problem solving (Csikszentmihalyi, 1988). During this activity, all participants in experimental conditions were interrupted with two emails (see Appendix C), in which they were asked to respond to using the supplementary materials provided to them. Figure 3 presents the schedule by which email interruptions occurred for each activity. After 30 seconds of working on the problem definition activity, participants received the first email interruption. After responding, participants worked for 30 seconds and then received another email interruption. After responding, participants were given an additional 2 minutes to work on their response to the problem definition prompt. After that time had elapsed, they were instructed to move onto the next section of the experimental

task. Participants in the control condition did not receive any email interruptions throughout the entire experimental activity.

The next section of the experimental task was idea generation, which represents an early stage creative process activity (Mumford et al., 1991). During this activity, participants were asked to generate as many solutions as possible for addressing the issues being faced by Frosty Mug Brewing Co. They were told not to elaborate at this point, but rather briefly list their ideas (see Appendix B for prompt instructions). Half of participants received email interruptions exclusively during this stage – either two vs four task-relevant vs task-irrelevant message prompts (see Figure 3 for a complete schedule of interruptions). The task relevancy of these email interruptions was assessed and validated via ratings provided by a panel of judges. Specifically, eight judges, all psychology doctoral students, rated the relevancy of tasks on a 6-point Likert scale. Scale anchors include 1 (*extremely irrelevant to the task*), 2 (*moderately irrelevant to the task*), 3 (*somewhat irrelevant to the task*), 4 (*somewhat relevant to the task*), 5 (*moderately relevant to the task*), and 6 (*extremely relevant to the task*). The average rating of the four task-relevant emails ranged from 5.13 to 5.63 (M = 5.31) and the average rating of the four task-irrelevant emails ranged from 1.00 to 3.00 (M = 2.03). These rating averages help to provide substantive validity evidence of task relevancy.

After working on the activity for a designated period of time (30 seconds for high amount of interruption condition and 1 minute for low; see Figure 3), the participants who were randomly assigned to get interrupted during this section received their first interruption. Participants in the low condition for number of emails received their second and final email interruption after 1 minute of uninterrupted work. On the other hand, participants in the high condition for number of emails received an additional three emails, each separated by 30 seconds

of uninterrupted working time. In total, participants in both the high and low conditions were given a total of 5 minutes to complete this activity (not including time taken to read and answer emails). Through pilot testing, it was determined that 5 minutes was an ample amount of time to complete the activity. After completing this activity, participants were prompted to move onto the next section of the experimental task.

Interruption Schedule

Problem Definition	30 seconds of task work → email interruption → 30 seconds of task work → email interruption → 2 minutes to finish task work
Idea Generation	
Low Frequency Condition	1 minute of task work → email interruption → 1 minute of task work → final email interruptions → 3 minutes to finish task work
High Frequency Condition	30 seconds of task work → email interruption → 30 seconds of task work → email interruptions → 30 seconds of task work → email interruptions → 30 seconds of task work → final email interruption → 3 minutes to finish task work
Idea Evaluation	
Low Frequency Condition	1 minute of task work → email interruption → 1 minute of task work → final email interruptions → 3 minutes to finish task work
High Frequency Condition	30 seconds of task work → email interruption → 30 seconds of task work → email interruptions → 30 seconds of task work → email interruptions → 30 seconds of task work → final email interruption → 3 minutes to finish task work

Figure 3. Schedule by which email interruptions occurred for each experimental activity. Note that the time between interruptions begins after participants have completed responding to the previous email. All participants in experimental conditions were interrupted during the problem definition activity. However, participants were randomly assigned to be interrupted either during idea generation or during idea evaluation and were assigned to either the low or the high frequency condition. Participants were randomly assigned to conditions where email interruptions are either relevant to the task at hand or irrelevant to the task.

After generating ideas, participants were asked to evaluate those ideas. Idea evaluation represents a later stage component of the creative problem-solving process (Mumford et al.,

1991). Here, the other half of participants in experimental conditions, who did not receive interruptions in the previous activity now received email interruptions. Again, these interruptions, either two emails in the low condition or four in the high, which were either relevant or irrelevant to the task at hand with the same timetable as discussed above. Again, participants in both the high and low conditions were given a total of 5 minutes to complete this activity (not including time taken to read and answer emails). It was determined, through pilot testing, that 5 minutes was an ample amount of time to complete the activity. After completing this activity, participants were prompted to move onto the next section of the experimental task.

The experimental task ended with participants being asked to generate a plan to increase sales and market demand based on the current issues the company is facing. During this time, participants did not receive any interruptions and had as much time to complete the task as they needed. Following the final experimental activity, participants completed a series of untimed covariate measures including a personality measure (Donnellan, Oswald, Baird, & Lucas, 2006), a measure of planning skill (Marta, Leritz, & Mumford, 2005), a trait breadth of attention measure (Kimchi & Palmer, 1982), a marketing experience measure, and a mind wandering measure (Giambra, 1993) along with a demographics questionnaire. These measures are discussed in further detail below.

Measures

Control Variables

Cognitive ability. The tasks participants were asked to complete in this experiment can be cognitively demanding. Therefore, participants were asked to complete a measure of cognitive ability, specifically the verbal reasoning portion of the Employee Aptitude Survey (EAS). This measure was developed for personnel decisions (e.g., selection) in organizations and involves

relatively short and simplistic administration. The verbal reasoning measure analyzes analogical reasoning, which has been shown to be one of the best available measures of cognitive ability (Tyler, 1964). The 30-item measure presents a series of facts and conclusions and participants must choose whether each conclusion is true, false, or unknown given the facts presented. The internal consistency reliability of the scale (as calculated with coefficient alpha here and throughout) was 0.75. Moreover, Grimsley, Ruch, Warren, and Ford (1985) have provided evidence for the construct validity of this measure.

Divergent thinking. At least some creative thought is necessary to complete the complex, novel, and ill-defined experimental task at hand. Therefore, participants were asked to complete a measure of divergent thinking, an idea generation task where participants must produce alternative solutions to a problem. Divergent thinking has been shown to influence creative problem-solving performance (Vincent et al., 2002). Here, participants were asked to complete a divergent thinking task developed by Merrifield et al. (1962), which asks participants to list consequences that could stem from an unlikely event (e.g., What would be the results if people no longer needed or wanted sleep?). Responses are scored based on the number of unique consequences listed. The internal consistency reliability of the scale was .90. Evidence bearing on the validity of this measure with respect to its influence for creative thinking has been found by Mumford, Marks, Connelly, Zaccaro, and Johnson (1998).

Marketing expertise. Given the nature of the marketing task at hand, participants were asked to complete a measure analyzing their expertise regarding marketing practices. This 6-item scale presents background data questions investigating interest or involvement with marketing issues. Responses are given on a 5-point Likert scale. A sample item includes “How likely is it that you will go into advertising or marketing as a career?” Scoring is based on a sum total of

Likert scale responses. This measure was originally developed by Lonergan, Scott, and Mumford (2004) and has been used in additional creative problem-solving studies utilizing a similar experimental task (e.g., Martin et al., 2019; Medeiros et al., 2014). Additionally, the internal consistency reliability of the scale was .82.

Mind wandering. Mind wandering, or one's propensity to have unintended spontaneous shifts of attention (Giambra, 1993) has been shown to influence performance on divergent thinking tasks (Baird et al., 2012). Therefore, as a control measure, participants were asked to complete the Daydreaming Frequency subscale of the Imaginal Process Inventory, originally developed by Singer and Antrobus (1972) (Giambra, 1993). This 12-item subscale includes questions such as, "When I am at a meeting or show that is not very interesting, I daydream rather than pay attention." All items are scaled on a 5-point Likert scoring system. Giambra (1993) has provided evidence for the internal consistency and test-retest reliability of this measure. The internal consistency reliability of the scale in the current study was .94.

Personality. Big Five personality variables, particularly extraversion and openness to experiences, have been found to be significantly and positively related to creative performance (Sung & Choi, 2009). Moreover, it has been shown that people high in neuroticism tend to have difficulties focusing their attention on the task at hand (Diehl et al., 2006). Therefore, as a control measure, participants completed a Big Five personality inventory. Specifically, participants completed the mini-IPIP inventory (Donnellan et al., 2006), which is a 20-item short form of the International Personality Item Pool originally developed by Goldberg (1999). Donnellan et al. (2006) found internal consistency coefficients were at or above .60 across a series of studies. Somewhat higher internal consistency coefficients were found in the current study (i.e., agreeableness = .71; conscientiousness = .76; extraversion = .82; neuroticism = .56; openness =

.74). Donnellan et al. (2006) note that while smaller scales tend to have somewhat lower internal consistency reliability, the mini-IPIP exhibited high reliability coefficients and the validity coefficients were similar to the full IPIP-FFM scales. Lower internal consistency represents a tradeoff that must be weighed against the practical benefits of using a 20, rather than 50 item scale (Donnellan et al., 2006).

Planning. Given that participants were asked to create a marketing plan as a final activity during the experimental task, they were given a control measure of planning skill. Specifically, participants were asked to complete Marta et al.'s (2005) measure of planning skills where they were shown various business scenarios and asked to complete a series of questions aimed at key elements of planning, such as identification of causes and downstream consequences. In this measure, participants are given a list of options to choose from and scoring is based off of the total number of correct options chosen. The internal consistency reliability of the scale in the current study was .71.

Trait breadth of attention. Trait breadth of attention has been shown to be moderately related to creative performance, wherein individuals with a broader breadth of attention tended to perform better on a creative task (Kasof, 1999). Therefore, participants were asked to complete a breadth of attention measure developed by Kimchi and Palmer (1982), where participants are shown a series of figures and are scored based on whether they attend to the global or local features. The internal consistency reliability of the scale was .81.

Attention checks. Given the nature of this online study, it was necessary to detect and control for careless responding from participants. Meade and Craig (2012) suggest including a number of bogus items throughout the survey (e.g., "Respond with 'somewhat disagree' for this item"). Instructed response items such as this provide many benefits, including simple

construction, a clear metric for scoring, and an unlikely chance for incorrect interpretation. As per the recommendations of Meade and Craig (2012), a total of three attention check items were included. Including more than this saturation tends to annoy participants and become unnecessary. It was determined that any participant who failed two of the attention checks would be removed from the analyses, however, no participants met this criterion and therefore the full data set was analyzed.

Dependent Variables

For each of the following dependent variables listed below, three raters evaluated responses and assigned values to them on a 5-point Likert scale. Before beginning the rating process, these raters underwent frame-of-reference training (Bernardin & Buckley, 1981). In this training, judges are familiarized with the operational definition for each variable. Raters are additionally familiarized with the ratings scales and rating anchors used to evaluate responses. After being familiarized with this information, the judges were asked to read through one quarter of participant responses, as to familiarize themselves with the data set and nature of responses. After reading through a subset of responses, judges were asked to practice applying the variable definitions and rate a small sample of the data. Discrepancies in ratings were discussed until consensus was reached. After consensus was reach on the sample of data, raters began rating sections of the full data set. Regular meetings were held to resolve any discrepancies in ratings. Interrater agreement estimates were calculated using the r_{wg}* index (LeBreton & Senter, 2008).

Idea generation. Participants were asked to generate a list of ideas for solving the issues being faced by Frosty Mug Brewing Co. that were evaluated on four criteria: number, flexibility (r_{wg}* = .71), quality (r_{wg}* = .84), and originality (r_{wg}* = .88). Although these criteria are not the

focal dependent variables of the experiment, secondary analyses were conducted to examine differences based on experimental conditions.

Number represents the actual count of ideas generated by the participant. Flexibility is the category or theme shifts, therefore representing the actual uniqueness of ideas (Runco, 1985). The quality variable represents the overall completeness and usefulness of the idea and originality is the extent to which the idea is novel and creative (Besemer & O'Quin, 1999). All variables were rated on a 5-point Likert scale and scores were based on the average rating determined by a set of trained raters.

Idea evaluation. After generating ideas for solving problems being faced by the Frosty Mug Brewing Co., participants were asked to evaluate these ideas. Their evaluations were rated on numerous variables, including extensiveness (r_{wg}* = .83), risk level (r_{wg}* = .84), outcome consideration (r_{wg}* = .84), and outcome timeframe (r_{wg}* = .87) (adapted from Blair & Mumford, 2007 and Byrne et al., 2010). As mentioned above, although these criteria are not the focal dependent variables of the experiment, secondary analyses were conducted to examine differences based on experimental conditions.

Extensiveness is simply the extent to which the evaluation is complete and involves intricate details. Risk level has to do with whether the participant evaluated the risk (i.e., probability of acquiring loss) involved in idea implementation. Outcome consideration is the extent to which the participant considered possible outcomes, benefits, and drawbacks of idea implementation. On the other hand, outcome timeframe is the degree to which the forecasted outcomes emphasize potential short-term vs long-term consequences of idea implementation. All variables were rated on a 5-point Likert scale and scores were based on the average rating determined by a set of trained raters.

Plans. Finally, participants were asked to develop a final plan for helping solve Frosty Mug Brewing Co.'s issues. These plans were evaluated on their quality (r_{wg}* = .85) (Besemer & O'Quin, 1999), originality (r_{wg}* = .82) (Besemer & O'Quin, 1999), and elegance (r_{wg}* = .75). As mentioned in the idea generation dependent variable section, quality is the overall usefulness of the plan, originality is the level to which the plan is unexpected or novel, and elegance represents the degree to which the participant's plan is articulately arranged in a succinct way. All variables were rated on a 5-point Likert scale and scores were based on the average rating determined by a set of trained raters.

Results

Analyses

To analyze the effects that the experimental manipulations (i.e., email interruptions during idea generation vs idea evaluation, two vs four email interruptions, and task-relevant vs task-irrelevant email interruptions) had on creative problem solving, as measured by the quality, originality, and elegance of marketing plans, a series of statistical tests were used. To begin, a one-way analysis of covariance (ANCOVA) with simple planned comparisons was used to test the hypothesized main effects for Hypotheses 1a and 1b. Separate ANCOVAs were run for each of the outcome variables. Simple planned comparisons were used to compare the experimental conditions to the control group. Hierarchical regression analyses were first run to determine which covariates to include in each of the ANCOVAs. Covariates were only retained as control variables if they were significant at the $p < .05$ level.

Next, a 2 × 2 × 2 ANCOVA test was used to analyze Hypotheses 2a, 2b, 3a, 3b, 4a, and 4b. For significant interactions, further analysis of adjusted means and standard errors were conducted where differences existed. Moreover, for significant three-way interactions, additional

ANCOVA testing was conducted, where each manipulation level was isolated in order to understand how each two-way interaction functioned across the manipulation level (per the recommendations of the UCLA Institute for Digital Research & Education Statistical Consulting; n.d.).

Although the focal dependent variables of this experiment are the quality, originality, and elegance of marketing plans, secondary ANCOVAs were run to examine the impact of experimental conditions on the dependent variables rated for the idea generation task (i.e., number, flexibility, quality, originality) and the idea evaluation task (i.e., extensiveness, risk level, outcome consideration, outcome timeframe). Again, hierarchical regression analyses were run to determine which covariates to include in each of the secondary ANCOVAs. Table 1 shows the means, standard deviations, and correlations for all study variables.

Table 1.

Means, Standard Deviations, and Correlations

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Divergent thinking	5.98	2.26																						
2. Cognitive ability	25.34	6.20	-.06																					
3. Marketing expertise	13.32	4.55	.14*	.01																				
4. Mind wandering	36.94	10.19	.04	.11	.15*																			
5. Agreeableness	16.15	2.85	-.04	.00	.03	.01																		
6. Conscientiousness	14.41	3.40	.11	-.16*	.05	-.20**	-.03																	
7. Emotional stability	12.50	3.04	.02	-.07	.04	.09	.15*	-.08																
8. Extraversion	12.90	3.87	.21**	-.13	.19**	-.16*	.34**	.10	-.08															
9. Openness	14.75	3.06	-.02	.15*	.11	.32**	.28**	-.05	-.01	.07														
10. Planning	9.02	1.78	-.03	.21**	.03	.03	-.05	.03	-.01	-.13	-.03													
11. Trait breadth of attention	5.33	1.49	.09	-.02	.04	.03	-.05	-.07	.09	-.10	-.04	-.06												
12. Attention checks	0.13	0.42	.02	-.04	.03	.05	-.06	.02	-.16*	.04	-.05	.01	-.01											
13. IG number	8.60	3.63	.43**	-.08	.25**	-.02	.03	.05	.06	.23**	-.01	-.06	.19**	.03										
14. IG flexibility	7.29	3.23	.32**	-.07	.18**	-.01	.09	.00	.02	.15*	.03	-.04	.14*	.05	.81**									
15. IG quality	2.98	0.88	-.04	.20**	-.01	.04	.12	-.10	.00	-.10	.06	.20**	.07	-.05	-.04	.19**								
16. IG originality	3.08	0.81	.06	.13	.03	.06	.08	-.12	.05	-.06	.04	.15*	.13*	-.02	.14*	.39**	.81**							
17. IE extensiveness	2.71	0.84	-.02	.21**	-.02	-.02	.11	-.02	.04	-.13	.05	.14*	.10	-.13	-.09	.10	.81**	.72**						
18. IE risk level	2.28	1.05	.04	.11	-.07	.05	.03	-.04	.08	-.08	.07	.16*	.10	-.04	-.11	.01	.51**	.47**	.48**					
19. IE outcome consideration	2.66	0.87	.03	.20**	.00	.02	.08	-.05	.04	-.11	.05	.11	.12	-.11	-.02	.18**	.80**	.71**	.87**	.70**				
20. IE outcome timeframe	2.66	0.80	.06	.19**	.01	.00	.12	-.03	.08	-.09	.05	.07	.17*	-.09	.03	.24**	.80**	.76**	.81**	.58**	.87**			
21. Plan quality	3.16	0.79	.03	-.01	.20**	.03	.12	.06	-.03	.06	.02	.14*	.06	-.02	.24**	.27**	.25**	.20**	.18**	.09	.17*	.19**		
22. Plan originality	2.51	0.75	.09	.04	.15*	-.07	.10	.06	.05	.05	-.02	.18**	.04	-.04	.24**	.22**	.24**	.28**	.18**	.10	.16*	.18**	.67**	
23. Plan elegance	3.11	0.68	-.01	.04	.07	.02	.10	.05	-.02	.04	.04	.08	-.01	-.02	.15*	.17*	.28**	.20**	.26**	.19**	.27**	.22**	.83**	.57**

Note. IG = idea generation. IE = idea evaluation. $N = 216$. *$p < .05$, **$p < .01$; two-tailed.

Hypothesis Testing

Hypotheses 1a and 1b

Hypothesis 1a posited that, compared to a control group, participants who received attentional interruptions during idea generation would have better creative problem-solving performance. Conversely, Hypothesis 1b predicted participants who received email interruptions during idea evaluation would have worse creative problem-solving performance compared to a control group.

For Hypotheses 1a and 1b, marketing expertise, $F(1, 212) = 8.72$, $p = .004$, $\eta_p^2 = .04$, was a significant covariate for plan quality. Moreover, marketing expertise, $F(1, 211) = 4.86$, $p = .028$, $\eta_p^2 = .02$, and planning, $F(1, 211) = 6.83$, $p = .010$, $\eta_p^2 = .03$, were both significant covariates for plan originality. However, there were no significant covariates for plan elegance. The one-way ANCOVA results for Hypotheses 1a and 1b regarding plan quality, originality, and elegance revealed that there were no significant main effects of interruption timing (i.e., during idea generation vs idea evaluation) on plan quality, $F(2, 212) = .20$, $p = .819$, $\eta_p^2 = .00$, plan originality, $F(2, 211) = .02$, $p = .977$, $\eta_p^2 = .00$, or plan elegance, $F(2, 213) = 1.05$, $p = .352$, $\eta_p^2 = .01$. Table 2 presents the estimated marginal means and standard errors for plan quality, originality, and elegance. Consistent with Hypothesis 1a, participants in the idea generation condition scored higher compared to those in the control group across all three outcome variables; however, none of the differences were statistically significant: plan quality, $t(212) = 0.38$, $p = .701$, $\eta_p^2 = .00$, originality, $t(211) = 0.21$, $p = .833$, $\eta_p^2 = .00$, and elegance, $t(213) = 1.37$, $p = .171$, $\eta_p^2 = .01$. In contrast to Hypotheses 1b, participants in the idea evaluation condition scored higher (not worse) compared to those in the control group across all the outcome variables. Thus, Hypotheses 1a and 1b were not supported.

Table 2.

Estimated Marginal Means and Standard Errors for Hypotheses 1a and 1b – Quality, Originality, and Elegance

	Idea Generation		Idea Evaluation		Control	
Dependent Variable	*M*	*SE*	*M*	*SE*	*M*	*SE*
Quality	3.15	.08	3.19	.08	3.08	.16
Originality	2.52	.08	2.51	.08	2.48	.15
Elegance	3.17	.07	3.09	.07	2.96	.14

Note. Idea generation (n = 95); Idea evaluation (n = 97); Control group (n = 24).

Hypotheses 2a and 2b

Table 3 presents the ANCOVA results for Hypotheses 2a, 2b, 3a, 3b, 4a, and 4b. For Hypotheses 2a, 2b, 3a, 3b, 4a, and 4b, marketing expertise, $F(1, 183) = 8.38$, $p = .004$, $\eta_p^2 = .04$, was a significant covariate for plan quality. Moreover, marketing expertise, $F(1, 182) = 4.89$, $p = .028$, $\eta_p^2 = .03$, and planning, $F(1, 182) = 8.00$, $p = .005$, $\eta_p^2 = .04$, were both significant covariates for plan originality. However, there were no significant covariates for plan elegance. Hypotheses 2a and 2b reflect a two-way interaction between interruption timing and interruption amount. Specifically, compared to participants receiving a fewer number of email interruptions (i.e., two emails), participants who received a greater number of attentional interruptions (i.e., four emails) during idea generation would have better creative problem solving. On the other hand, those participants who received a greater number of attentional interruptions during idea evaluation would have worse creative problem solving than those who received a fewer number of interruptions during idea evaluation. As shown in Table 3, there were no significant two-way interactions between interruption timing and amount: plan quality, $F(1, 183) = .14$, $p = .705$, $\eta_p^2 = .00$, plan originality, $F(1, 182) = .06$, $p = .806$, $\eta_p^2 = .00$, or plan elegance, $F(1, 184) = .011$, $p = .916$, $\eta_p^2 = .00$. Thus, Hypotheses 2a and 2b were not supported.

Table 3.

ANCOVA Results for Hypotheses 2a, 2b, 3a, 3b, 4a, and 4b – Quality, Originality, and Elegance

	Quality		Originality		Elegance	
Source	*F*	η_p^2	*F*	η_p^2	*F*	η_p^2
Marketing expertise	8.38**	.04	4.89*	.03	--	--
Planning	--	--	8.00**	.04	--	--
Interruption timing	0.06	.00	0.03	.00	1.05	.01
Interruption amount	4.12*	.02	2.70	.02	4.08*	.02
Interruption relevance	0.45	.00	0.00	.00	0.25	.00
Interruption timing × interruption amount	0.14	.00	0.06	.00	0.01	.00
Interruption timing × interruption relevance	2.28	.01	1.19	.01	0.43	.00
Interruption timing × interruption amount × interruption relevance	5.55*	.03	5.93*	.03	7.56**	.04

Note. Interruption timing = emails during idea generation vs idea evaluation; Interruption amount = two vs four email interruptions; Interruption relevance = task-relevant vs task-irrelevant email interruptions. $N = 192$. * $p < .05$; ** $p < .01$.

Hypotheses 3a and 3b

Hypotheses 3a and 3b reflect a two-way interaction between interruption timing and interruption relevance. Specifically, compared to participants who received task-relevant email interruptions, participants who received task-irrelevant email interruptions during idea generation would have better creative problem solving. On the other hand, compared to those participants who received task-relevant email interruptions, participants who received task-irrelevant email interruptions during idea evaluation would have worse creative problem solving. As shown in Table 3, there were no significant two-way interactions between interruption timing and relevance: plan quality, $F(1, 183) = 2.28$, $p = .133$, $\eta_p^2 = .01$, plan originality, $F(1, 182) = 1.19$, $p = .276$, $\eta_p^2 = .01$, or plan elegance, $F(1, 184) = .43$, $p = .511$, $\eta_p^2 = .00$. Thus, Hypotheses 3a and 3b were not supported.

Hypotheses 4a and 4b

Hypotheses 4a and 4b reflect a three-way interaction. Specifically, compared to all other conditions, participants who received a greater number (i.e., four) of task-irrelevant email interruptions during idea generation would have better creative problem solving. On the other hand, compared to all other conditions, participants who received a greater number of task-irrelevant email interruptions during idea evaluation would have worse creative problem-solving performance. As shown in Table 3, there was a significant three-way interaction for all three outcome variables: plan quality, $F(1, 183) = 5.55$, $p = .020$, $\eta_p^2 = .03$, plan originality, $F(1, 182) = 5.93$, $p = .016$, $\eta_p^2 = .03$, and plan elegance $F(1, 184) = 7.56$, $p = .007$, $\eta_p^2 = .04$. However, the pattern of adjusted means was not in the hypothesized direction. The pattern of adjusted means was very similar across all three outcome variables; therefore, I only show the adjusted means for plan quality (see Figure 4). As shown in Figure 4, participants who received four task-irrelevant email interruptions during idea generation did not have better creative problem-solving performance compared to the other conditions. Additionally, participants who received four task-irrelevant email interruptions during idea evaluation did not have worse creative problem-solving performance compared to other conditions. Thus, the pattern of adjusted means does not support Hypotheses 4a or 4b. Nevertheless, additional exploratory findings regarding the significant three-way interaction will be discussed in the section below.

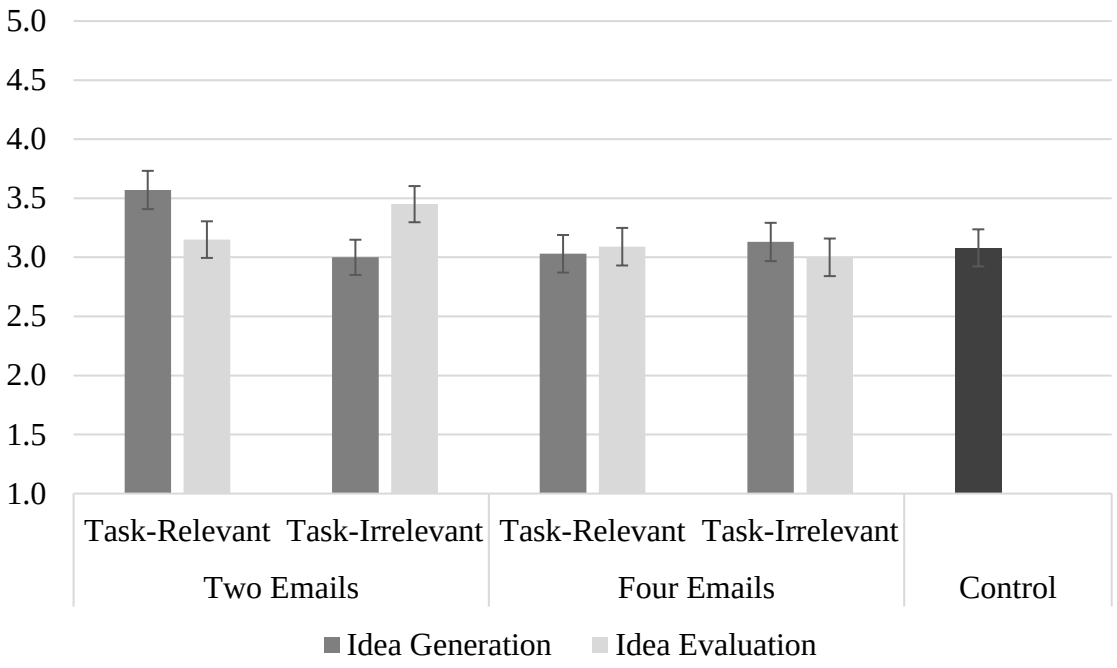

Figure 4. Adjusted mean quality ratings for each experimental condition, plus the control for reference. Error bars are ±1 standard error.

Exploratory Findings

Focal Dependent Variables

Unrelated to my hypotheses, exploratory analyses (see Table 3 ANCOVA results) revealed a significant main effect and a significant three-way interaction for the focal dependent variables. With respect to the main effect for interruption amount (i.e., two vs four emails), it was found that participants who received two email interruptions exhibited significantly higher plan quality ($F(1, 183) = 4.12$, $p = .044$, $\eta_p^2 = .02$) and elegance ($F(1, 184) = 4.08$, $p = .045$, $\eta_p^2 = .02$) compared to those participants receiving four email interruptions. However, this main effect does not tell the whole story and should be considered and interpreted in light of the significant three-way interaction.

Significant three-way interactions are characterized by a two-way interaction that is stronger at a particular level of a third variable. Therefore, to interpret a significant three-way

interaction, it is recommended that each two-way interaction is examined in such a way that each is isolated across levels of the third variable (UCLA Institute for Digital Research & Education Statistical Consulting, n.d.). See Table 4 for this statistical decomposition of each level for the three manipulations.

Table 4.

Three-Way Interaction Results – Quality, Originality, and Elegance

Manipulation Level Breakdown	Remaining Two-Way Interaction	Quality		Originality		Elegance	
		F	η_p^2	*F*	η_p^2	*F*	η_p^2
Idea generation	Interruption amount × interruption relevance	4.89*	.05	3.14	.03	6.42*	.07
Idea evaluation	Interruption amount × interruption relevance	1.43	.02	1.77	.02	1.98	.02
Two emails	Interruption timing × interruption relevance	7.66**	.08	6.52*	.07	5.73*	.06
Four emails	Interruption timing × interruption relevance	.34	.00	.80	.01	2.22	.02
Task-relevant	Interruption timing × interruption amount	1.97	.02	2.45	.03	3.79	.04
Task-irrelevant	Interruption timing × interruption amount	3.63	.04	3.54	.04	3.76	.04

Note. $*p < .05$; $**p < .01$.

With respect to the interruption timing breakdown (found in the first two rows of Table 4), there were significant results for the idea generation manipulation level for two out of the three outcome variables. Although these findings help us to understand the significant three-way interaction, the results generally indicate small effect sizes (University of Cambridge Cognition and Brain Sciences Unit, 2009).

On the contrary, a stronger and more consistent story was found for the two vs four email interruption manipulation level breakdown, where effect sizes were moderate in magnitude for all three dependent variables. As shown in the middle two rows of Table 4, when participants

were interrupted two times, the remaining two-way interaction between interruption timing and interruption relevance was significant for all three dependent variables: plan quality, $F(1, 92) = 7.66$, $p = .007$, $\eta_p^2 = .08$, originality, $F(1, 91) = 6.52$, $p = .012$, $\eta_p^2 = .07$, and elegance, $F(1, 93) = 5.73$, $p = .019$, $\eta_p^2 = .06$. On the other hand, when participants received four email interruptions, there was no significant two-way interaction between interruption timing and interruption relevance for any of the outcome variables. The pattern of adjusted means was very similar for all three outcome variables; therefore, I only discuss and show the adjusted means for plan quality (see Figure 5). Figure 5 shows that (for those in the two email interruption condition) participants who were interrupted during idea generation with task-relevant emails ($M = 3.56$, $SE = .16$, 95% CI [3.24, 3.88]) had better creative problem-solving performance compared to those who were interrupted during idea generation with task-irrelevant emails ($M = 2.99$, $SE = .15$, 95% CI [2.69, 3.28]). Conversely (for those in the two email interruption condition), participants who were interrupted during idea evaluation with task-relevant emails ($M = 3.20$, $SE = .15$, 95% CI [2.89, 3.51]) had worse creative problem-solving performance compared to those who were interrupted during idea evaluation with task-irrelevant emails ($M = 3.48$, $SE = .15$, 95% CI [3.18, 3.79]). In sum, participants exhibited better creative problem-solving performance when interrupted with task-relevant emails during idea generation or task-irrelevant emails during idea evaluation, but these findings only hold true for when participants received two email interruptions and not four. Moreover, compared to the control condition, who received no interruptions ($M = 3.08$, $SE = .17$, 95% CI [2.74, 3.43]), this same pattern of findings is evident.

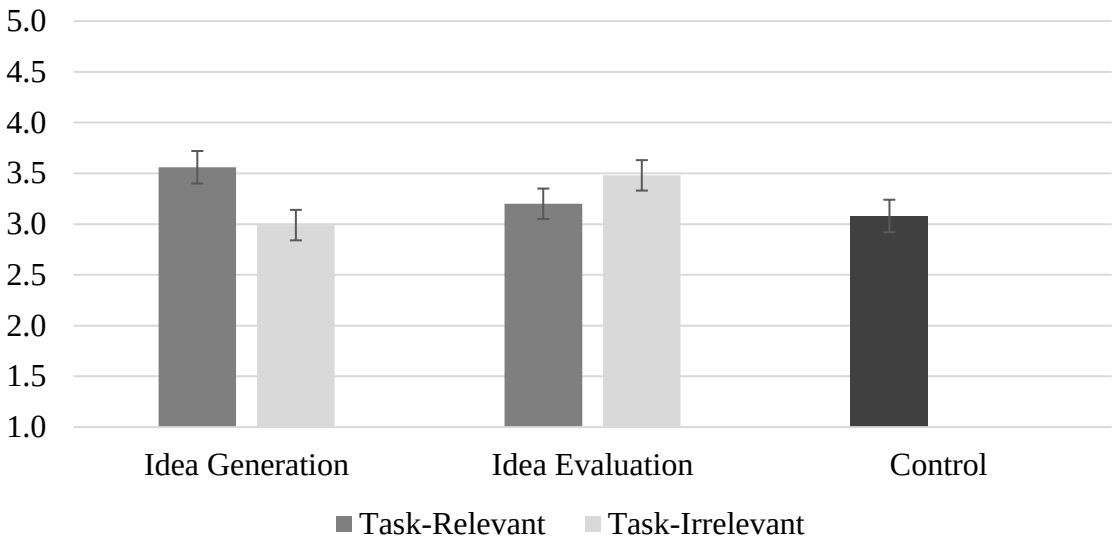

Figure 5. Adjusted mean quality ratings for the significant two-way interaction between interruption timing and interruption relevance for the two email interruption manipulation level, plus the control condition for reference. Error bars are ±1 standard error.

Secondary Dependent Variables

Beyond the findings related to the focal dependent variables, there were statistically significant exploratory findings for the secondary dependent variables related to the idea generation and idea evaluation activities. However, given the number of statistical tests performed as well as small effect sizes observed, statistically significant exploratory results should be interpreted with caution, as they might be the result of a Type I error (Agresti & Finlay, 2009).

Recall that participants were asked to generate and then evaluate an initial set of ideas before moving on to the final creative problem-solving activity. The generated ideas were rated on four different variables: number, flexibility, quality of ideas, and originality (see Table 5). Additionally, the idea evaluations were rated on four variables: extensiveness, risk level, outcome consideration, and outcome timeframe (see Table 6). However, with respect to the idea evaluation ANCOVA results, there were no significant main effects or interactions for any of the

outcome variables. Therefore, let us turn our attention to the ANCOVA results for the idea generation outcome variables (Table 5).

Table 5.

ANCOVA Results for Idea Generation Variables

	Number		Flexibility		Quality		Originality	
Source	*F*	η_p^2	*F*	η_p^2	*F*	η_p^2	*F*	η_p^2
Cognitive ability	--	--	--	--	7.26**	.04	--	--
Divergent thinking	32.68***	.15	23.65***	.114	--	--	--	--
Marketing expertise	5.92*	.03	--	--	--	--	--	--
Personality - Extraversion	4.57*	.03	--	--	--	--	--	--
Planning	--	--	--	--	6.99**	.04	7.61**	.04
Trait breadth of attention	11.74***	.06	--	--	--	--	4.68*	.03
Interruption timing	4.59*	.03	2.80	.02	.41	.00	.04	.00
Interruption amount	1.69	.01	1.06	.01	4.53*	.02	3.06	.02
Interruption relevance	.55	.00	3.52	.02	.48	.00	.55	.00
Interruption timing × interruption amount	.22	.00	.95	.01	.14	.00	1.11	.01
Interruption timing × interruption relevance	.06	.00	.26	.00	.22	.00	.71	.00
Interruption amount × interruption relevance	3.53	.02	3.84*	.02	.182	.00	.90	.01
Interruption timing × interruption amount × interruption relevance	.95	.01	1.25	.01	.81	.00	.62	.00

Note. Interruption timing = emails during idea generation vs idea evaluation; Interruption amount = two vs four email interruptions; Interruption relevance = task-relevant vs task-irrelevant email interruptions. $N = 192$. * $p < .05$; ** $p < .01$, *** $p < .001$.

Table 6.

ANCOVA Results for Idea Evaluation Variables

Source	Extensiveness		Risk Level		Outcome Consideration		Outcome Timeframe	
	F	η_p^2	*F*	η_p^2	*F*	η_p^2	*F*	η_p^2
Cognitive ability	9.77**	.051	--	--	8.56**	.045	10.54***	.054
Planning	--	--	5.73*	.030	--	--	--	--
Trait breadth of attention	--	--	--	--	--	--	6.00*	.032
Interruption timing	.22	.001	.22	.001	.27	.001	.94	.005
Interruption amount	3.59	.019	2.53	.014	2.15	.012	3.03	.016
Interruption relevance	.24	.001	.12	.001	.07	.000	.52	.003
Interruption timing x interruption amount	.84	.005	.15	.001	.22	.001	.52	.003
Interruption timing x interruption relevance	.00	.000	.03	.000	.01	.000	.21	.001
Interruption amount x interruption relevance	.19	.001	.04	.000	.28	.002	.00	.000
Interruption timing x interruption amount x interruption relevance	.51	.003	1.79	.010	.93	.005	.43	.002

Note. Interruption timing = emails during idea generation vs idea evaluation; Interruption amount = two vs four email interruptions; Interruption relevance = task-relevant vs task-irrelevant email interruptions. $N = 192$. * $p < .05$; ** $p < .01$, *** $p < .001$.

As shown in Table 5, there was a significant main effect for interruption timing on the number of ideas generated. Participants who were interrupted during idea generation ($M = 9.06$, $SE = .32$, 95% CI [8.44, 9.69]) produced significantly more ideas than those interrupted during idea evaluation ($M = 8.10$, $SE = .31$, 95% CI [7.49, 8.72]). Moreover, consistent with the exploratory findings for the focal dependent variables, there was a significant main effect for interruption amount on the quality of ideas generated. Participants who were interrupted twice ($M = 3.16$, $SE = .09$, 95% CI [2.99, 3.33]) had higher quality ideas compared to those who were interrupted four times ($M = 2.90$, $SE = .09$, 95% CI [2.73, 3.07]).

Finally, there was a significant two-way interaction between interruption amount and interruption relevance for idea generation flexibility. As shown in Figure 6, participants who were interrupted two times with task-irrelevant emails had the highest rated idea flexibility (M = 8.30, SE = .42, 95% CI [7.47, 9.12]), whereas participants in the other conditions had fairly similar idea flexibility ratings, even when compared to the control group.

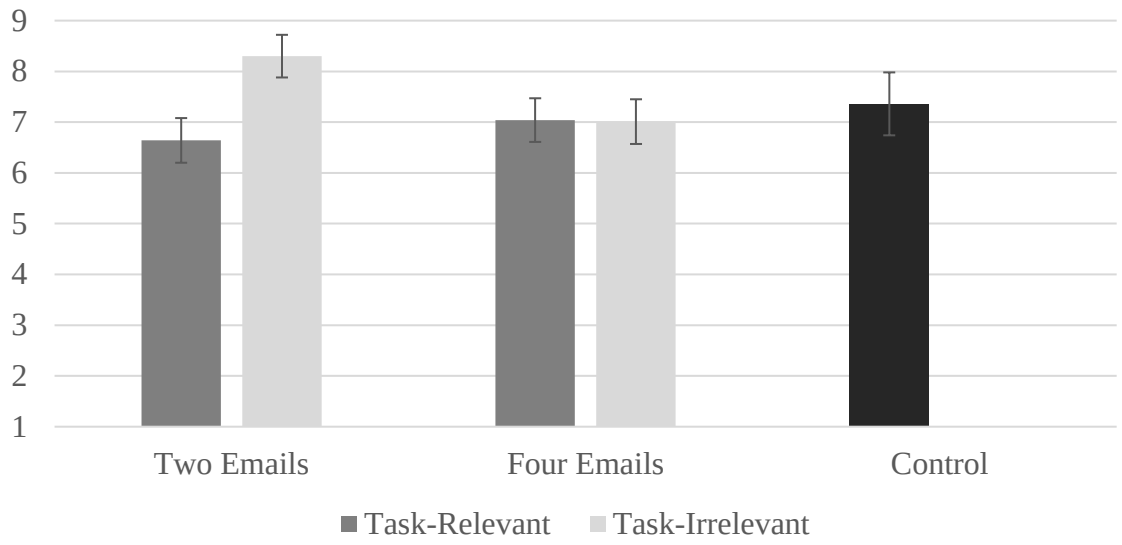

Figure 6. Adjusted mean idea flexibility for each experimental condition in the two-way interaction between interruption amount and interruption relevance, plus the control for reference. Error bars are ±1 standard error.

Discussion

Some researchers have posited that a broad breadth of attention helps creativity (Friedman et al., 2003; Kasof, 1997; Mendelsohn, 1976). These researchers have argued that broadly focusing attention allows for individuals to think about a large range of stimuli, which can help a person avoid fixation and connect seemingly disparate ideas (i.e., remote associations), resulting in better creative performance (Friedman et al., 2003; Howard-Jones & Murray, 2003; Kasof, 1997; Mendelsohn, 1976; Mendelsohn & Griswold, 1964). Limited research findings help support this view (Friedman et al., 2003; Howard-Jones & Murray, 2003).

Conversely, other researchers have proposed that flexible attention may be better for creative performance (Finke et al., 1992; Vartanian et al., 2007; Zabelina & Robinson, 2010). The idea here is that broad attentional scope may help creativity during early, generative phases of the creative problem-solving process, but that narrowly focusing attention helps in later, exploratory stages of the creative problem-solving process. Again, some limited findings help support this view (Vartanian et al., 2007; Zabelina & Robinson, 2010).

As outlined above, findings within the domain of attention and creativity are inconclusive. Moreover, there are many methodological limitations present within this research domain. In order to address these concerns and investigate the phenomena further, this study aimed to analyze the impact that attentional interruptions have on creative problem solving, using a scenario and attentional interruptions that were intended to emulate creative problem-solving activities in the real-world. Using a 2 × 2 × 2 between subjects design with a control group, three email interruption manipulations (i.e., interruption timing, interruption amount, and interruption relevance) were embedded into a creative problem-solving scenario within the marketing domain. Generally speaking, my hypotheses were not supported, but before discussing

additional exploratory findings and implications, it is important to acknowledge some key limitations of the study.

Limitations

While this study addresses many of the methodological weaknesses present in this literature, it is not without its limitations. First, the experimental task is a low-fidelity simulation, meaning the experimental activities were constructed to simulate the real world, but do not actually represent such. Consequently, this impacts our ability to generalize results to real-world settings. Second, only one task domain is represented here, specifically creativity in the marketing domain. Therefore, the results do not necessarily reflect creative problem solving in other domains. Third, the order and timing of manipulations are fixed, and results cannot speak to combinations or different orders of manipulations. Fourth, since this is an online study where participants were unproctored, the researcher could not control real-world distractions in their environments. Although explicit instructions were given at the beginning of the study noting that participants should complete the entire study in a quiet, distraction free environment, within a single sitting, the researcher cannot guarantee this. Consequently, this presents another limitation of the study. Future research is needed to address these study design limitations and investigate the phenomena in the real world, in additional domains, and with variable orders and combinations of manipulations. Further discussion related to these points can be found at the end of this section.

Fifth, because of the lack of research looking into the nature of attentional interruptions (e.g., frequency of interruptions), the basis for choosing how many email interruptions represented the low condition (i.e., two) and the high condition (i.e., four) was extremely limited. Previous creative problem-solving research using a similar experimental task also included two

vs four prompts as the low vs high condition, respectively (e.g., Scott et al., 2005). Additionally, due to the length of time which it takes to complete both the idea generation and the idea evaluation tasks in this experiment, I determined that two vs four email interruptions were appropriate frequencies to represent the manipulation levels. However, the lack of research regarding the frequency of attentional interruptions does present a limitation in the study. In light of the exploratory findings surrounding the interruption amount manipulation, it is critical that future research investigate the impact of different interruption amounts (e.g., zero vs one vs two vs three, etc.). Along somewhat similar lines, it would be interesting to see future research investigate interruption intensity. In other words, researchers should investigate whether the extensiveness of the interruption (e.g., time and/or cognitive resources needed to process the interruption) impacts creative problem solving.

Finally, many of the activities in the literature that are used to influence attention lack similarity to real-world attentional interruptions (e.g., Stroop-like tasks, drawing completion tasks). Consequently, there is a lack of evidence bearing on the impact that the nature of real-world attentional interruptions (e.g., task-relevant, task-irrelevant) have on creative problem solving. Although our task-relevant vs task-irrelevant manipulations were constructed with the intent to either focus participants' attention on the task at hand or focus their attention on irrelevant matters, the lack of empirical support for these manipulations does present another limitation in the study. There are likely more aspects involved with task relevancy that were not accounted for in this study and future research should aim to address this issue. To illustrate this point, a simplistic task-irrelevant interruption, such as the interruptions centered on scheduling events in our study, may function quite differently than a complex task-irrelevant interruption, such as an interruption prompting thought about a different marketing problem for a completely

separate scenario. While both are irrelevant to the actual task at hand, one would likely spur more thought around creative problem solving in the marketing domain and may consequently impact creative performance. This example highlights the importance of understanding domain relevance vs task relevance regarding interruptions and creative problem solving. Therefore, future research should work to classify and investigate other features of interruptions that may be pertinent to creative problem-solving performance.

Throughout this manuscript, many methodological issues were identified in the attention and creativity and literature. Although this study sought to address some of these concerns (e.g., unrealistic creativity tasks, insufficient measurement of creativity), there were still many limitations associated with the current methodology as outlined above. On one hand, laboratory experiments versus non-experimental field studies, especially randomized control studies, have many benefits, including greater control (Antonakis et al., 2010). This includes a better ability to (a) draw causal inferences (Antonakis et al., 2010), (b) minimize confounding variables (Brem & Utikal, 2019), (c) create variable levels difficult to observe in field settings (Anderson, De Dreu, & Nijstad, 2004), and (d) measure variables that are otherwise difficult to observe in field settings (Anderson et al., 2004). Laboratory research can provide valuable insight into fundamental behavioral patterns and help build theory (Brem & Utikal, 2019). On the other hand, laboratory research has its own set of limitations. Principally, the possible loss of generalizability to the real world due to the artificial laboratory environment (Ackerman & Kanfer, 1993). In other words, this is an issue of external validity. Moreover, laboratory research has been criticized for use of unrepresentative samples (e.g., undergraduate students) and difficulty in conducting longitudinal research (Brem & Utikal, 2019). Indeed, Anderson et al. (2004) report that creativity researchers are reluctant to employ laboratory research and

experimentation, possibly due to the tendency for journal editors and reviewers to discourage this type of research. Therefore, the question arises as to the extent to which similarities are necessary across laboratory and real-world settings in order to assume external validity (Locke, 1986). However, there is very little research exploring this question. For example, in their review of the creativity and innovation literature, Anderson et al. (2004) found no studies combining field and laboratory methodologies.

With the aforementioned points in mind, to address the methodological limitations present in the study and the attention and creativity literature more broadly, it would be advantageous to pair laboratory and field studies (Anderson et al., 2004). By combining approaches, there will be compensatory effects where the limitations of one method are compensated by the benefits of the other and vice versa. Whereas basic experimental research, as is the case with the current study, can provide insight into fundamental cognitive patterns, field research can highlight how these cognitive processes and patterns emerge in a given context.

Ideally, field research would be conducted overtime (Anderson et al., 2004), with special attention paid to observing and analyzing all contextual and otherwise confounding variables. This allows researchers to better understand how and why laboratory results do or do not translate to real-world settings. More specifically, if real-world data can be collected over time, then cross-lagged panel analysis can be conducted. Cross-lagged panel models are estimates using longitudinal data where relationships are estimated from one variable to another (Kearney, 2017). In other words, this design and analysis technique allows for researchers to estimate the "directional influence variables have on each other over time" (Kearney, 2017, p. 312). A primary benefit of this technique is that causal influence between variables can be estimated, as

compared to cross-sectional and simple predictive designs—which are commonly used in field research—where causality is much more difficult to infer.

When thinking about what an ideal cross-lagged field study design in the domain of marketing and creativity might look like, researchers should consider studying marketing teams across the lifespan of a project. This type of situation would be great for studying creativity and attention in the real world for a number of reasons. An example that can be used to illustrate these benefits would be a project that involves creating a new ad campaign for an established product. Before discussing the benefits of this type of setting and scenario, it should first be noted that companies often use project management software and timelines to plan out the life cycle of a given project. These scheduled timelines include all project tasks, how long each of those tasks should take, on what days/times the tasks will be completed, and which employees are assigned to a given task.

One benefit is that naturalistic and more objective data can be collected in this type of setting. For example, data related to stages of the creative problem-solving process can be easily gathered and coded. Tasks that would be coded as early stage creative problem solving (e.g., information gathering, concept selection, idea generation) might take the form of brainstorming sessions or market trend analysis. Conversely, project tasks that would be coded as late stage processes (e.g., idea evaluation, implementation planning, monitoring) might take the form of final advertisement design and piloting activities. Additionally, objective data on interruptions can be gathered. Companies have the ability to keep track of email and phone usage information when employees use company devices. Therefore, with these types of rich data sets, researchers can deduce when, and during what project tasks, that phone/email interruptions occurred. Furthermore, the time spent on the phone/email interruption can also be calculated as a proxy to

extensiveness. Moreover, objective employee data can be collected such as years of experience, serving as a measure of expertise. With respect to objective outcome measures, data can be calculated from the number of views/clicks that the advertisement receives after being deployed. These view/click counts can be compared to the previous ad campaign. Similarly, product sales from before vs after new campaign deployment can be analyzed.

In addition to the variables outlined above, which are more objective in nature, researchers can also collect more traditional forms of subjective survey data from project team members. For example, measures of cognitive persistence, affect, and cognitive load (please see a detailed discussion of these variables and their possible influence on creative problem solving later on in the manuscript) can be collected at particular time points, such as at the end of certain project tasks or at the end of a given time period (e.g., weekly). Moreover, additional subjective outcome measures can be collected, such as supervisor or expert ratings of advertising campaign quality and originality.

Taken together, the key cross-lagged variables that can be added into the model include interruption type (e.g., email, phone call, text message), number of interruptions, interruption extensiveness (e.g., time spent on interruption), stage of the creative problem-solving process interruption was received (i.e., early vs late stage), member expertise, levels of cognitive persistence, affect, and cognitive load. With respect to outcomes, a number have been suggested here, including more objective outcome data such as the attention the advertisement received (i.e., view/click counts), the change in product sales (i.e., change from old to new ad campaign), as well as subjective expert and supervisor ratings of advertisement quality and originality.

By using a cross-lagged model with real-world data, we are able to better understand the relationships among these variables. Often, the direction of the relationship can be assumed or

purported, but this type of methodological approach allows us to better understand causality. Namely, it can be statistically deduced whether a given variable is causing another, whether there is a bidirectional reciprocal relationship between variables, or whether there is no relationship at all between the variables for a given outcome. By including this type of advanced analysis technique using real-world field data, as well as more objective variable measures, many of the limitations outlined throughout this manuscript can be addressed and help further theory development and improve practical implications of the attention and creativity literature.

Findings and Implications

Bearing these limitations in mind, this study still offers valuable insight into the phenomena at hand. To begin, Hypotheses 1a and 1b set out to understand the impact that attentional interruptions have on early vs late stages of the creative problem-solving process. Compared to a control group with no interruptions, there were no differences in creative problem-solving performance when participants were interrupted during idea generation vs idea evaluation. Next, when looking at the two-way interaction between interruption timing and interruption amount, as well as the two-way interaction between interruption timing and interruption relevance, there were no significant differences for creative problem-solving performance, as predicted in Hypotheses 2a, 2b, 3a, and 3b. Moreover, although there was a significant three-way interaction effect between all three manipulations, an analysis of the adjusted means and standard errors show that findings were not in the hypothesized direction as predicted in Hypotheses 4a and 4b.

The aforementioned findings do not provide evidence for common viewpoints held by attention and creativity researchers. Namely, that broadening attentional focus (i.e., attending to a larger range of stimuli and not filtering out information) improves creativity (Friedman et al.,

2003; Kasof, 1997; Mendelsohn, 1976), especially during early, or generative phases of the creative problem-solving process (Finke et al., 1992; Vartanian et al., 2007; Zabelina & Robinson, 2010), whereas narrowing attentional focus (i.e., attending to a small range of stimuli and filtering out information) improves creativity during later, exploratory phases (Finke et al., 1992; Vartanian et al., 2007; Zabelina & Robinson, 2010).

The lack of consistency in findings may be due to the nature of the creative problem-solving task at hand and how creative problem solving was operationalized, which I discuss in more detail in the sections below. It appears that when the complexity and realism of the creative problem-solving task is increased, as is the case with my experiment, previous findings in this domain were not replicated, as illustrated by the lack of support for all of my hypotheses. This point is underscored by the exploratory findings related to initial idea generation (i.e., divergent thinking), where being interrupted during idea generation did indeed increase the number of ideas generated and being interrupted with task-irrelevant emails did indeed improve idea flexibility (but only when interrupted with two and not four emails). These aforementioned exploratory findings do in fact support previous research results (e.g., Friedman et al., 2003; Howard-Jones & Murray, 2003; Vartanian et al., 2007; Zabelina & Robinson, 2010), but did not extend to the final creative problem-solving task.

Future research should aim to understand the mechanisms that explain why the findings in this study were incongruent with previous work in this domain. Perhaps individuals are cognitively processing attentional interruptions in different ways, especially complex interruptions involving both internal and external stimuli (e.g., emails) as compared to simplistic ones relying on external stimuli (e.g., noise distractions). Indeed, Benedek (2018) highlighted the underrepresentation of internal attentional stimuli in the creativity and attention literature. Given

the criticality of internally directed attentional processes (e.g., imagination, developing remote associations) for creative problem solving, Benedek (2018) suggests that future creativity research should explicitly consider the role of both internal and external attentional stimuli, as they are believed to involve different brain mechanisms. This research need is particularly salient when the nature of real-world attentional interruptions is considered. People are constantly being interrupted throughout their working days with various types of interruptions (e.g., conversations with coworkers, phone calls, emails, meetings, etc.). Understanding how interruption type and interruption extensiveness impact complex creative problem solving will be crucial for understanding the cognitive and attentional processes involved in real-world creative problem-solving performance.

Moreover, another possible reason for the lack of consistency between findings in the current study and previous research in the attention and creativity domain (e.g., Friedman et al., 2003; Howard-Jones & Murray, 2003; Vartanian et al., 2007; Zabelina & Robinson, 2010) has to do with how creativity was operationalized. When creativity is operationalized beyond divergent thinking, self-report measures, and/or non-domain specific tasks, this appears to impact findings. Although related, divergent thinking is not synonymous with creative performance (Mumford et al., 1991; Runco & Acar, 2012; Sternberg & O'Hara, 1999; Ward et al., 1999). Additionally, scholars often caution against the use of self-report measures of creativity (Bass et al., 2008). Furthermore, researchers have argued that creativity skills are domain specific (Baer, 1991). Therefore, it is crucial to have experimental creativity tasks that extend beyond divergent thinking, self-report measures, and non-domain specific tasks. Indeed, scholars have called for creativity researchers to use more realistic tasks that mirror organizational work (Hughes et al., 2018), and this study attempted to address said concerns. Future research should seek to

understand how more complex and/or domain specific operationalizations of creativity interact with interruptions during the creative problem-solving process.

Beyond the findings discussed above, there were some interesting statistically significant exploratory findings uncovered in this study, primarily centering on the number of interruptions received. First, with respect to the focal dependent variables (i.e., plan quality, originality, and elegance), there was a significant main effect for interruption amount. Participants who received two email interruptions had significantly better plan quality and elegance compared to those participants who received four email interruptions for plan quality and elegance. However, when each condition level (i.e., receiving two vs four interruptions) was compared to the control group, no significant differences were found. This may be the case because the control group sample size (n = 24) was much smaller than both the low, two email condition (n = 97) and high, four email condition (n = 95) sample sizes. Consequently, the standard error for quality, originality, and elegance was almost twice as large for the control group than for the low and high interruption amount conditions. Indeed, when there are large differences in standard deviations or standard errors, this can impact results and one's ability to detect significant differences between groups (Agresti & Finlay, 2009).

However, these main effect findings should be considered in light of the significant three-way interaction uncovered in the exploratory analyses. It was found that the two-way interaction between interruption timing and interruption relevance was significant for all three outcome variables, but only when participants received two email interruptions (not four). More specifically, participants who received two, task-relevant emails during idea generation and those who received two, task-irrelevant emails during idea evaluation had the highest ratings for all three outcome variables. Next, with respect to the secondary dependent variables (e.g., idea

generation number, flexibility, quality, and originality), it was found that receiving two, but not four, interruptions improved the quality of initial ideas generated. Moreover, it was found that receiving two, but not four, task-irrelevant emails improved initial idea flexibility.

Humans have a limited capacity to process information (Chun et al., 2011). The exploratory findings discussed above center on receiving two email interruptions rather than four. It is possible that four interruptions cognitively overloaded participants, therefore hindering their creative problem-solving performance. Cognitive load refers to the level of mental activity required in a given situation (Ward & Mann, 2000). Indeed, researchers have found that a high cognitive load negatively impacts an individual's ability to incorporate broad attentional stimuli, which typically improves divergent thinking performance through remote associations when working on a creative idea generation task (Bose, Folse, & Burton, 2013). However, expertise might also play a role in this relationship between cognitive load and diminished creative production. Researchers have found that experts tend to handle cognitive loads more efficiently than novices when working on creative design tasks (Sun & Yao, 2012). Although participants in this study completed a marketing expertise measure, a majority of the sample reported limited marketing experience. Consequently, our results cannot speak to the relationship between domain expertise, cognitive load, and creative performance. Clearly, more work is needed in order to understand these relationships and future research should address these gaps in the literature. It is critical for future research to focus on understanding the influence that various interruption quantities (e.g., one vs two vs three vs four, etc.), as well as the type and extensiveness of those interruptions, have on creative problem solving. In other words, is there a curvilinear effect for quantity of interruptions, and if so at what quantity might interruptions

begin to cognitively overload individuals? Moreover, what factors (e.g., individual differences, interruption characteristics) influence this overload point?

In a similar vein, another possible explanation for the findings in this study has to do with cognitive persistence and affective states. Cognitive persistence represents a person's motivation and ability to sustain cognitive effort and is especially crucial during cognitively challenging—yet achievable—tasks (Teubner-Rhodes, 2020). A person who displays cognitive persistence will make an effort to overcome mental challenge (Teubner-Rhodes et al., 2017). While cognitive persistence does involve aspects of ability, it also involves one's motivation and attitude to overcome challenges. Indeed, meta-analytic research has shown that positive mood states associated with an approach motivation focus (i.e., a form of positive affect such as pride, happiness, enthusiasm, etc., associated with moving toward a desired goal; Davidson & Irwin, 1999) enhances creative performance (Baas et al., 2008).

Although cognitive persistence and affective states were not examined in this study, these variables may offer some explanation into the findings. To explain further, with respect to the creative problem-solving process, different cognitive mechanisms are thought to be involved for different stages of the process (Baas et al., 2008). As discussed throughout, narrowly focusing attention during early stages of creative problem solving might contribute to fixation (Howard-Jones & Murray, 2003), which is thought to hinder creative performance. It would stand to reason that someone with high levels of cognitive persistence and approach motivation mood states would have increased focused, which might translate to fixation, thus hindering creative performance during idea generation stages. However, cognitive persistence and motivation focused mood states might help during later, evaluative stages where the problem space is less ambiguous and more structured (see Mumford et al., 1991) and individuals must concentrate on

and examine the specific aspects relevant to the problem. With respect to the significant three-way interaction observed in this study, it may be that individuals with high levels of cognitive persistence and motivation focused mood states were able to overcome cognitive hurdles and exhibit better creative performance, but only when interrupted with attention narrowing interruptions (i.e., task-relevant) during early, generative stages of creative problem solving and with attention broadening interruptions (i.e., task-irrelevant) during later, evaluative stages (but not vice versa). Future research is needed in order to understand exactly how cognitive persistence and affective states interact with attention (broad and narrow), interruptions, and stages of the creative problem-solving process. Once these relationships are better understood, then training or intervention programs might be developed in order to improve, for example, individuals' skills in handling cognitive challenges or negative mood states during difficult tasks or during particular parts of the creative problem-solving process.

However, there may be other explanations for the significant three-way interaction in this study. Recall that participants exhibited better creative problem-solving performance when interrupted with task-relevant emails during idea generation or task-irrelevant emails during idea evaluation (but only when interrupted with two and not four emails). This finding contradicts arguments that a broad breadth of attention (i.e., attending to a large range of stimuli, such as task-irrelevant interruptions) is best for early, or generative, phases of creative problem solving, whereas a narrow breadth of attention (i.e., attending to a small range of relevant stimuli, such as task-relevant interruptions) is best for later, or evaluative, phases of creative problem solving (Finke et al., 1992; Vartanian et al., 2007; Zabelina & Robinson, 2010). The task-relevant interruptions prompted participants to identify the primary issues related to the creative problem-solving task at hand (e.g., the 15-25 age group is no longer attracted to Frosty Mug Root Beer,

company revenue is decreasing). An argument can be made that these task-relevant issues are actually problem constraints. Therefore, participants in the task-relevant conditions were asked to find and recall problem constraints that they had previously read through. It has been found that introducing constraints during early stages of the creative problem-solving process improves creative problem-solving performance (Medeiros et al., 2018). With that in mind, the nature of the task-relevant interruptions may explain the finding that receiving two, task-relevant emails during idea generation resulted in the best overall creative performance. As echoed throughout the Discussion section, more work is needed in order to understand how interruption characteristics impact complex creative problem solving. More specifically, if researchers can investigate and develop a taxonomy of interruption types and/or characteristics, then scholars will be better positioned to systematically study how various types/elements of interruptions interact with, for example, other situational or task characteristics to impact creative problem solving. The key here is to make sure that we fully represent and understand interruption characteristics so that future research can investigate the causal mechanisms by which interruptions impact creative problem solving.

Conclusion

In sum, the current study aimed to understand the helpfulness vs harmfulness of attentional interruptions on creative problems solving. While none of the hypotheses were supported, these null findings, as well as significant exploratory findings, help advance our understanding of the impact that attentional interruptions have on creative problem solving. Importantly, when participants worked on a complex and organizationally relevant task, there was no impact on creative problem-solving performance based on when attentional interruptions were introduced (i.e., early, idea generation stage vs late, idea evaluation stage). However,

exploratory findings point to the positive influence that receiving a low number (e.g., two) of interruptions has on creative problem-solving performance. Future research should seek to extend these findings, with an emphasis on including complex, real-world-like interruptions and more encompassing measures of creative problem solving. Additionally, in light of exploratory findings, future research should seek to classify and investigate other features of interruptions that may be pertinent to creative problem-solving performance.

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Appendix A



Figure A1. Hypothesized pattern of means corresponding to Hypotheses 1a and 1b as measured by quality, originality, and elegance. Note that cell means are based on a 5-point Likert scale.

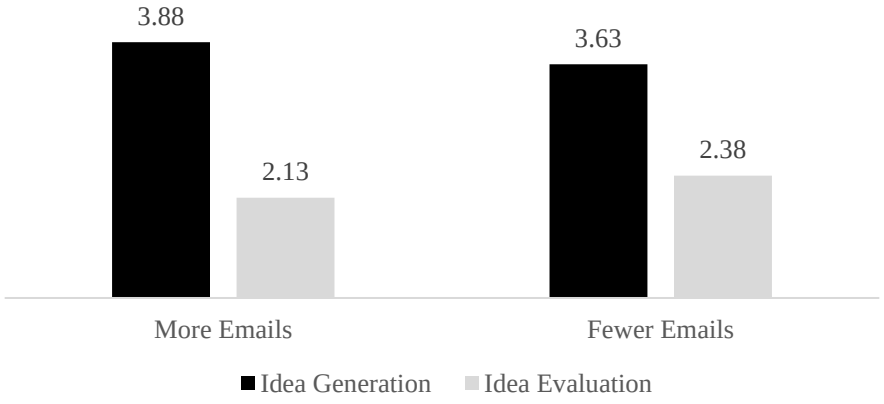


Figure A2. Hypothesized pattern of means corresponding to Hypotheses 2a and 2b as measured by quality, originality, and elegance. Note that cell means are based on a 5-point Likert scale.

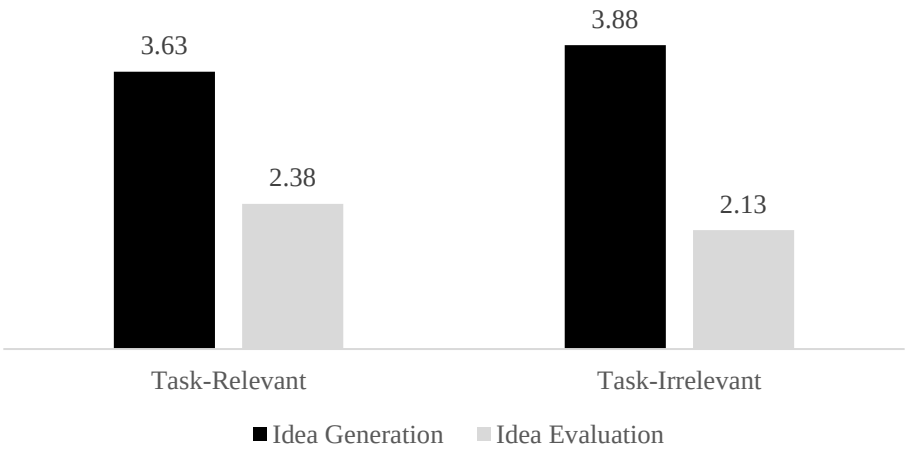


Figure A3. Hypothesized pattern of means corresponding to Hypotheses 3a and 3b as measured by quality, originality, and elegance. Note that cell means are based on a 5-point Likert scale.

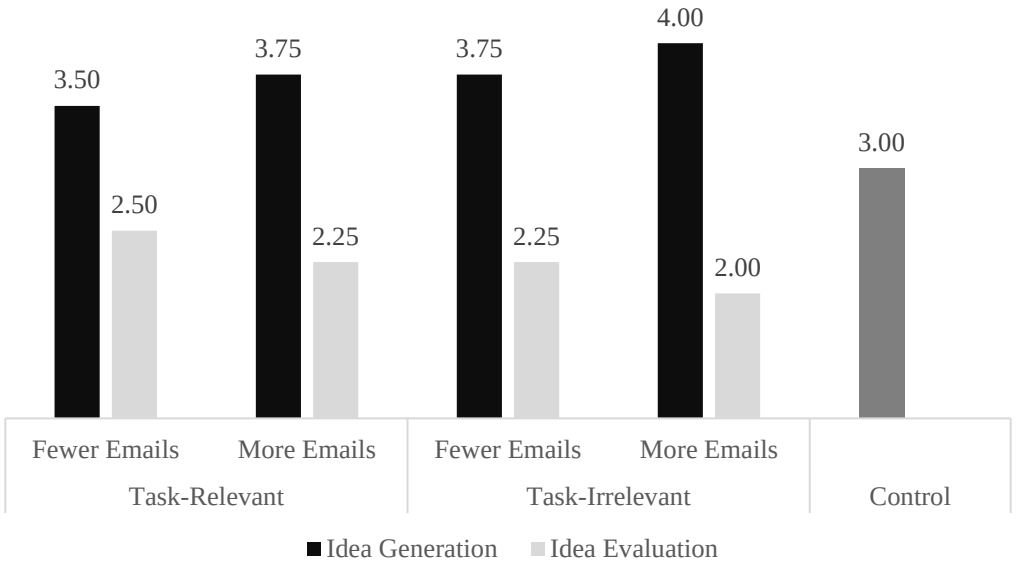


Figure A4. Hypothesized pattern of means for creative performance as measured by quality, originality, and elegance. Note that cell means are based on a 5-point Likert scale.

Appendix B
Qualtrics Survey Flow of Experimental Activity

General Instructions

For the following sections, you will be taking on the role of a marketing consultant at Frosty Mug Brewing Co. You have just been hired as a consultant for this company and the Vice President of Marketing, Taylor Schmidt, has sent you an email welcoming you to the team. For your information, your email address is Consultant@frostymug.com. ***Click on to the next page to view this email and follow all instructions carefully***.

Frosty Mug Brewing Co.

From: Taylor.Schmidt@frostymug.com
To: Consultant@frostymug.com
CC: Blair.Howard@frostymug.com
Subject: WELCOME

Welcome!

Congratulations on being hired as a marketing consultant for the Frosty Mug Brewing Co.! We are very excited to have you on our team and are excited to have you start doing some project work with us.

I have cc'd your direct supervisor, Blair Howard, on this email. They will be in contact with you about upcoming assignments and tasks.

Attached are some documents that will help orient you to your new position. The company history, your schedule for this month, and the Frosty Mug Brewing Co. corporate structure are all included. Please read through each of these documents carefully, as you may be asked to refer back to them at some point.

Welcome aboard,

Taylor Schmidt
Vice President of Marketing
Frosty Mug Brewing Co.
5301 Legacy Drive
10th Floor
Fort Worth, TX 76024
Telephone: 972-555-5134
Fax Number: 972-555-6324

Email Attachments

Click on to the next page to view the three email attachments sent to you by Taylor Schmidt, the Vice President of Marketing. ***Read through them carefully*** and then follow further instructions.

Company History

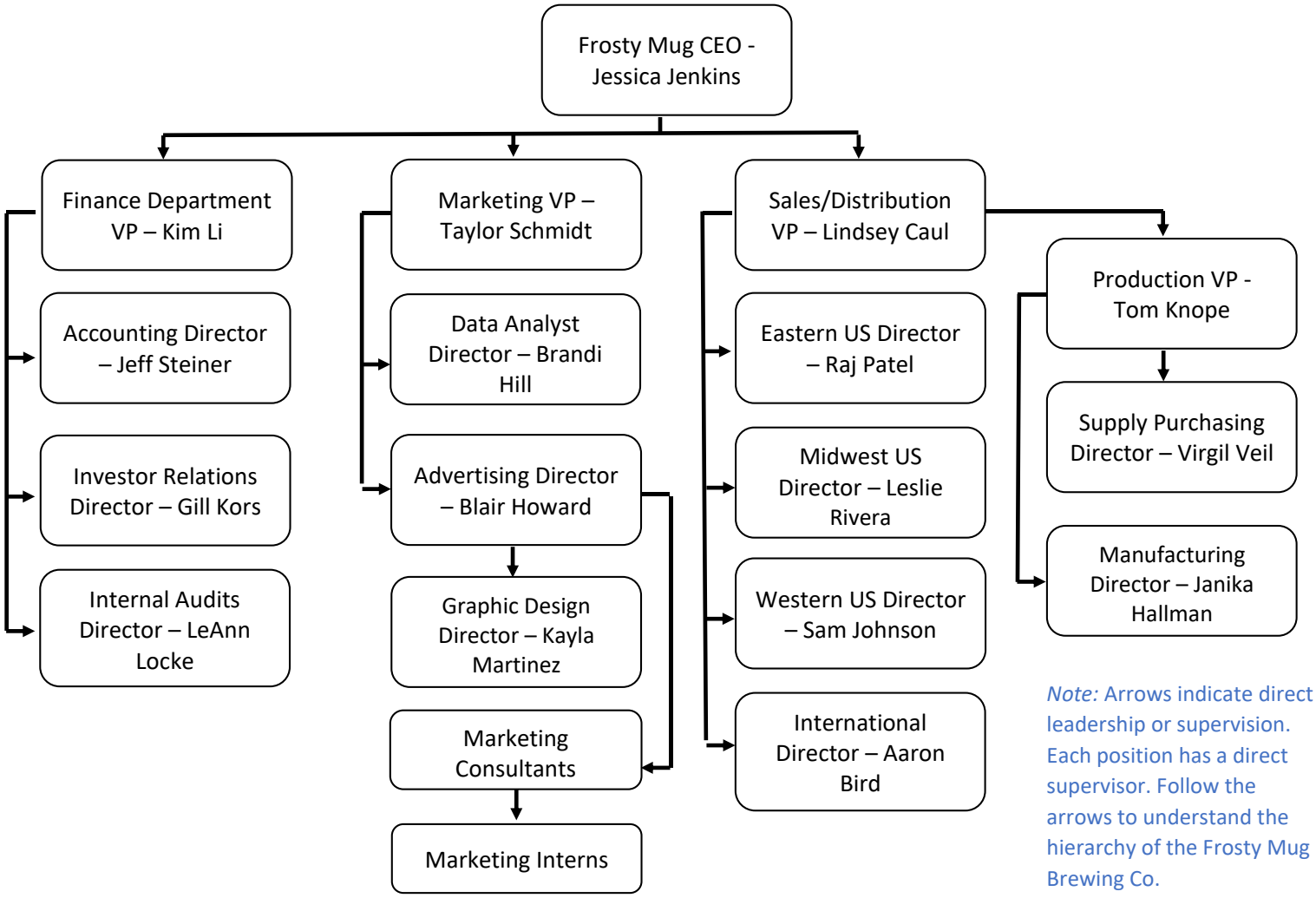
Founded in 1919 by the Reynolds family, the American Breweries Company, also known as Frosty Mug Brewing Co., located in Fort Worth, Texas, was originally formed to create a substitute beverage during the era of Prohibition. Despite its success, American Breweries Company closed its doors after the end of Prohibition, but the Frosty Mug Brewing Co. trademark was purchased by the Arnold family who operated the Eastern Bottling Company. In the late 1930s, it was then sold to the Lexington Bottling Company where the popular soda received continued success for twenty years. After World War II, quality and great taste were not enough to keep Frosty Mug Root Beer competitive, resulting in decreased popularity and distribution.

In 1976, the Frosty Mug Brewing Co. trademark was sold to Kelley Cola Beverages, which was then sold to the Palmer Company in 1980. After the Palmer Company merged with Thirsty Beverages, Frosty Mug Root Beer grew increasingly popular and was eventually distributed throughout most of North America. Ultimately, Thirsty/Palmer Beverages Incorporated was acquired by The Clayworth-Hollingberry Beverage Company of London, England. Today, Frosty Mug Brewing Co. is operated as a separate division of the Clayworth-Hollingberry Beverage Company.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
				1	2 Corporate retreat @ 8:00 AM – 4:00 PM	3
4 Send survey reminder to marketing team	5	6 Marketing team survey due @ 4:00 PM	7	8 Marketing conference in Dallas	9 Marketing conference in Dallas	10
11	12	13	14 Guest speaker luncheon @ 11:00 AM – 1:00 PM	15 Market trends seminar @ 8:00 AM – 12:00 PM	16	17
18 Building maintenance being done – No work	19 Marketing brainstorm meeting @ 9:00 AM – 10:30 AM	20	21 Investor meeting @ 1:00 PM – 3:00 PM	22	23	24
25	26	27 Meeting with interns @ 8:00 AM – 8:45 AM	28	29 Karen Jones – Retirement party @ 4:30 PM	30	31

Note: This is your schedule for the month. Pay close attention to your appointments and obligations.

Frosty Mug Brewing Co. Corporate Structure



Note: Arrows indicate direct leadership or supervision. Each position has a direct supervisor. Follow the arrows to understand the hierarchy of the Frosty Mug Brewing Co.

Frosty Mug Brewing Co.

From: Blair.Howard@frostymug.com
To: Consultant@frostymug.com
Subject: TASK INSTRUCTIONS

Hello,

Now that you've finished looking through your orientation documents (the attachments Taylor sent you), we are asking you to begin working on some tasks.

Please click on the next page to start your new task.

Regards,

Blair Howard
Director of Advertising
Frosty Mug Brewing Co.
5301 Legacy Drive
8th Floor
Fort Worth, TX 76024
Telephone: 972-555-9616
Fax Number: 972-555-2259

Instructions

Please read through the following background information on the current issues being faced by Frosty Mug Brewing Co. ***Please pay close attention to the information***, as you will need it for your next tasks.

Current Situation

The tradition of the original, old-fashioned taste is still carried on in every bottle of Frosty Mug Root Beer. However, today's soda market is fiercely competitive and Frosty Mug Brewing Co. has again been facing difficult times. It seems that one age group (15-25) is no longer attracted to Frosty Mug Root Beer, because it is seen as "Grandpa's favorite soda." In a recent market poll, 85% of respondents from this age group said they rarely buy root beer and usually only buy it to make root beer floats. Also, 75% of these respondents said they are not particular about which brand of root beer they purchase when making floats. Furthermore, many young adults are also straying away from sugary beverages and venturing to products with more nutritional benefits. As a result, the revenue of Frosty Mug Brewing Co. has been decreasing, and the low-level employees have not been satisfied in their roles which has resulted in an increased turnover rate – meaning more people are quitting.

Please click on the next page to read your task instructions.

Instructions

As a new marketing consultant, your job is to create a marketing campaign that will increase sales and consumer interest for Frosty Mug Root Beer. Before you can begin work on your marketing campaign, there are a few other tasks you must complete first.

We have hired you because of your experience and background. Because of this, you may be receiving emails from various organizational members and corporate associates. ***You will likely be interrupted by these emails. However, you must respond right away. After you have responded then you can get back to work on the task at hand***.

Please click on the next page to get started.

Defining the Situation

In order to help you create the best marketing campaign you can, we are asking you to complete a few activities.

In the space provided on the next page, ***please put into your own words the problems being faced by the Frosty Mug Brewing Co***. Specifically, list the goals, procedures, constraints, and any other information/questions relevant for solving these problems.

This will be a timed activity. ***You will have 3 total minutes to work on the activity*** (not including answering emails). You will not be able to click forward until the three minutes is finished, so ***please wait patiently if you finish early***.

Just as a reminder, listed below is the current situation information.

The tradition of the original, old-fashioned taste is still carried on in every bottle of Frosty Mug Root Beer. However, today's soda market is fiercely competitive and Frosty Mug Brewing Co. has again been facing difficult times. It seems that one age group (15-25) is no longer attracted to Frosty Mug Root Beer, because it is seen as "Grandpa's favorite soda." In a recent market poll, 85% of respondents from this age group said they rarely buy root beer and usually only buy it to make root beer floats. Also, 75% of these respondents said they are not particular about which brand of root beer they purchase when making floats. Furthermore, many young adults are also straying away from sugary beverages and venturing to products with more nutritional benefits. As a result, the revenue of Frosty Mug Brewing Co. has been decreasing, and the low-level employees have not been satisfied in their roles which has resulted in an increased turnover rate – meaning more people are quitting.

Generating Ideas

Now that you are done defining the problem, we are asking that you to ***generate several potential ideas for addressing the issues facing Frosty Mug Brewing Co.***

When you are generating ideas, ***please do not elaborate on the ideas at this point, just list them briefly.***

This will be a timed activity. ***You will have 5 total minutes to work on the activity*** (not including answering emails). You will not be able to click forward until the five minutes is finished, so ***please wait patiently if you finish early***.

Just as a reminder, listed below is the current situation information.

The tradition of the original, old-fashioned taste is still carried on in every bottle of Frosty Mug Root Beer. However, today's soda market is fiercely competitive and Frosty Mug Brewing Co. has again been facing difficult times. It seems that one age group (15-25) is no longer attracted to Frosty Mug Root Beer, because it is seen as "Grandpa's favorite soda." In a recent market poll, 85% of respondents from this age group said they rarely buy root beer and usually only buy it to make root beer floats. Also, 75% of these respondents said they are not particular about which brand of root beer they purchase when making floats. Furthermore, many young adults are also straying away from sugary beverages and venturing to products with more nutritional benefits. As a result, the revenue of Frosty Mug Brewing Co. has been decreasing, and the low-level employees have not been satisfied in their roles which has resulted in an increased turnover rate – meaning more people are quitting.

Evaluating Ideas

Now that you are done generating a list of ideas, we are asking that you to ***evaluate your potential ideas for addressing the issues facing Frosty Mug Brewing Co***.

This will be a timed activity. ***You will have 5 total minutes to work on the activity*** (not including answering emails). You will not be able to click forward until the five minutes is finished, so ***please wait patiently if you finish early***.

On the next page, you will see an example of how to do this.

Example of How to Evaluate an Idea

Problem:

- How to entertain children and their parents at a birthday party

Potential Solutions:

- Rent bouncing castle
- Hold party at pool

Evaluations:

- Rent bouncing castle
    - There may not be a place to set up the bounce castle
    - Requires parents to supervise instead of enjoying the party
    - Potential to cause injury to children
- Hold party at pool
    - If pool is public there may be other children and families
    - May be harder to keep track of children
    - Some children may not know how to swim

Evaluating Ideas

On the next page, you will see your ideas listed. Please leave your original idea as is (meaning do not erase or change it) and add in your evaluation by putting a dash and adding your comment afterwards.

EXAMPLE:
1. Original idea - Add dash and put evaluation here
2. Original idea - Add dash and put evaluation here

This will be a timed activity. ***You will have 5 total minutes to work on the activity*** (not including answering emails). You will not be able to click forward until the five minutes is finished, so ***please wait patiently if you finish early***.

Below is the list of ideas you generated.

1.
2.
3.

Frosty Mug Brewing Co.

From: Blair.Howard@frostymug.com
To: Consultant@frostymug.com
Subject: TASK INSTRUCTIONS

Hi,

Thank you for completing all of those tasks. Now that you are prepared, we are asking you to complete one final task, to ***generate a plan for the Frosty Mug Brewing Co. to increase sales and consumer interest.***

Please click on the next page to start your final task*.*

Good luck,

Blair Howard
Director of Advertising
Frosty Mug Brewing Co.
5301 Legacy Drive
8th Floor
Fort Worth, TX 76024
Telephone: 972-555-9616
Fax Number: 972-555-2259

Final Plan

Your final task as a marketing consultant for Frosty Mug Brewing Co. is to generate a plan on how to increase sales and consumer interest for this product based on current issues the company is facing. ***Be sure to include as much detail as possible***.

Just as a reminder, listed below is the current situation information.

The tradition of the original, old-fashioned taste is still carried on in every bottle of Frosty Mug Root Beer. However, today's soda market is fiercely competitive and Frosty Mug Brewing Co. has again been facing difficult times. It seems that one age group (15-25) is no longer attracted to Frosty Mug Root Beer, because it is seen as "Grandpa's favorite soda." In a recent market poll, 85% of respondents from this age group said they rarely buy root beer and usually only buy it to make root beer floats. Also, 75% of these respondents said they are not particular about which brand of root beer they purchase when making floats. Furthermore, many young adults are also straying away from sugary beverages and venturing to products with more nutritional benefits. As a result, the revenue of Frosty Mug Brewing Co. has been decreasing, and the low-level employees have not been satisfied in their roles which has resulted in an increased turnover rate – meaning more people are quitting.

Appendix C
Manipulation Emails

Problem Definition Emails

The following two interruption emails were selected for the problem definition activity. Participants were asked to put into their own words the problems being faced by the Frosty Mug Brewing Co. This activity allows for the researchers to habituate participants to the manipulation interruptions. Participants were asked to respond to these email inquiries and were then able to go back to working on the task at hand as soon as they have replied.

Frosty Mug Brewing Co.

From: Kayla.Martinez@frostymug.com
To: Consultant@frostymug.com
Subject: BOARD OF DIRECTORS MEETING

Hello,

My name is Kayla and I am the Director of Graphic Design here at Frosty Mug Brewing Co. The design team is trying to set up a meeting with the Board of Directors to discuss the direction they would like to see our new logo to go.

As a Marketing Consultant, you will need to attend this meeting. We have found 3 dates/times that will work for everyone in our department, so please let us know which one works best with your schedule.

- On the 15th from 10:00 AM to 12:00 PM
- On the 20th from 3:00 PM to 5:00 PM
- On the 27th from 8:00 AM to 10:00 AM

Thank you,

Kayla Martinez
Director of Graphic Design
Frosty Mug Brewing Co.
5301 Legacy Drive
2nd Floor
Fort Worth, TX 76024
Telephone: 972-555-9923
Fax Number: 972-555-1930

Frosty Mug Brewing Co.

From: Karen.Duffy@frostymug.com
To: Consultant@frostymug.com
Subject: INFO NEEDED FOR UPCOMING MEETING

Hi,

My name is Karen and I was recently hired on as a new intern in the Marketing Department. I am very excited to get started working for this great company!

All interns from every department, including finance, sales, marketing, and human resources are having a meeting next week to discuss issues pertaining to Frosty Mug Root Beer. I have spoken to some of the finance interns about some of the problems facing our root beer brand, but I was not able to talk to anyone in Human Resources. Is there anything I should know about employee satisfaction here at Frosty Mug Brewing Co. before I go into this meeting with everyone else? I just want to make sure that I have all of the background information I need.

Regards,

Karen Duffy
Marketing Intern
Frosty Mug Brewing Co.
5301 Legacy Drive
8th Floor
Fort Worth, TX 76024
Telephone: 972-555-2256
Fax Number: 972-555-8292

Task-Irrelevant Emails

The following four task-irrelevant emails ask participants questions related to some of the miscellaneous paperwork they will receive in the beginning of the experiment. None of these questions are related to the issues being faced by Frosty Mug Brewing Co., that in which participants will be asked to develop a plan for addressing. Rather, these questions are related to irrelevant topics, such as scheduling and contact information. Participants were asked to respond to these email inquiries and were then able to go back to working on the task at hand as soon as they have replied.

Frosty Mug Brewing Co.

From: Brody.Eclair@frostymug.com
To: Consultant@frostymug.com
Subject: CONTACT INFORMATION

Hey!

My name is Brody and I am a new intern here in the Frosty Mug Marketing Department. I was told that I need to reach out to the International Director of Sales/Distributions to gather some information, however, I am finding it difficult to find this person's contact information. Do you know the name of the International Director?

Thanks!

Brody Eclair
Marketing Intern
Frosty Mug Brewing Co.
5301 Legacy Drive
8th Floor
Fort Worth, TX 76024
Telephone: 972-555-9365
Fax Number: 972-555-9466

Frosty Mug Brewing Co.

From: Brandi.Hill@frostymug.com
To: Consultant@frostymug.com
Subject: COMPANY HISTORY INFO

Hi,

My name is Brandi Hill and I am a data analyst in the Frosty Mug Marketing Department. We are trying to gather information on whether our customers will like a throwback bottle design. But in order to find this out I need to know what year Frosty Mug Brewing Co. was originally founded. Unfortunately, I cannot seem to find the company history document in our file database. Your boss, Blair, said you have this information, so do you mind letting me know what year the company was founded in?

Thanks!

Brandi Hill
Marketing Data Analyst
Frosty Mug Brewing Co.
5301 Legacy Drive
4th Floor
Fort Worth, TX 76024
Telephone: 972-555-6694
Fax Number: 972-555-1404

Frosty Mug Brewing Co.

From: Jamal.Carter@frostymug.com
To: Consultant@frostymug.com
Subject: SURPRISE PARTY

You are invited!

One of the Frosty Mug Brewing Co. front desk administrative assistants, Ashley Duwart, has just been accepted into graduate school and will be leaving us here at Frosty Mug in a couple weeks. We are planning a surprise going away party for her and would like all of the Frosty Mug employees to join us!

The party is this month on Friday the 8th at 4:30 PM. Please let us know if you are able to join! You can RSVP by replying to this email.

Best,

Jamal Carter
Front Desk Administrative Assistant.
Frosty Mug Brewing Co.
5301 Legacy Drive
1st Floor
Fort Worth, TX 76024
Telephone: 972-555-1113
Fax Number: 972-555-9342

Frosty Mug Brewing Co.

From: Tia.Hughes@frostymug.com
To: Consultant@frostymug.com
Subject: FINANCE DEPARTMENT QUESTION

Hello,

I am a new intern in the marketing department. I have been asked to contact Gill Kors, the Director of Investor Relations in the Finance Department, to set up a meeting with all Marketing Consultants to discuss our budget for the upcoming month. They said that anytime in the next few weeks will work, so would you please pick a day and time that you are free for about 2 hours and let me know when that is?

Thank you,

Tia Hughes
Marketing Intern
Frosty Mug Brewing Co.
5301 Legacy Drive
8th Floor
Fort Worth, TX 76024
Telephone: 972-555-7977
Fax Number: 972-555-0427

Task-Relevant Emails

The following four task-relevant emails ask participants questions related to the current issues being faced by the Frosty Mug Brewing Co. These current issues are directly related to the final task, that in which participants will be asked to develop a plan for addressing the problems at Frosty Mug Brewing Co. Participants were asked to respond to these email inquiries and were then able to go back to working on the task at hand as soon as they have replied.

Frosty Mug Brewing Co.

From: Kayla.Martinez@frostymug.com
To: Consultant@frostymug.com
Subject: BOARD OF DIRECTORS MEETING

Hello,

My name is Kayla and I am the Director of Graphic Design here at Frosty Mug Brewing Co. The design team was contacted by a very important member of the Board of Directors to discuss the marketing poll results regarding Frosty Mug Root Beer.

I was unable to find the answers for the board member. However, I was told that you have information on the marketing poll results. Essentially, the board member wants to know what age group is least attracted to Frosty Mug Root Beer. Also, they wanted to know what percentage of respondents said they rarely purchase root beer.

This information will help guide the next board meeting, so please be sure to get back to us as soon as possible!

Thank you,

Kayla Martinez
Director of Graphic Design
Frosty Mug Brewing Co.
5301 Legacy Drive
2nd Floor
Fort Worth, TX 76024
Telephone: 972-555-9923
Fax Number: 972-555-1930

Frosty Mug Brewing Co.

From: Aaron.Bird@frostymug.com
To: Consultant@frostymug.com
Subject: SALES QUESTION

Hello,

My name is Aaron and I am the International Director of Sales/Distributions for Frosty Mug Brewing Co. I was told that your team put out a marketing survey and got back some interesting results. I am wondering, what reason or purpose did respondents say they most often used our root beer for? Once you get back to me with that information, we can better target our international sales of Frosty Mug Root Beer.

Thanks,

Aaron Bird
International Director of Sales/Distribution
Frosty Mug Brewing Co.
5301 Legacy Drive
11th Floor
Fort Worth, TX 76024
Telephone: 972-555-2889
Fax Number: 972-555-9709

Frosty Mug Brewing Co.

From: Jamal.Carter@frostymug.com
To: Consultant@frostymug.com
Subject: SURVEY RESULTS

Hello,

During our last meeting with the Investor Relations team, there was discussion about a marketing survey that your team in Marketing gave to consumers. From what we discussed the results were somewhat alarming. Someone mentioned that many survey respondents said they do not care which brand of root beer they purchase. Can you please provide me with the exact percentage of respondents who said that when buying root beer, they do not care which brand they purchase?

Thank you for this information. I think it will help our team better decide what direction we need to go in with respect to finding future investors.

Best,

Jamal Carter
Investor Relations
Frosty Mug Brewing Co.
5301 Legacy Drive
7th Floor
Fort Worth, TX 76024
Telephone: 972-555-1113
Fax Number: 972-555-9342

Frosty Mug Brewing Co.

From: Tia.Hughes@frostymug.com
To: Consultant@frostymug.com
Subject: PRODUCT COMPETITION

Hello,

I am a new Graphic Design Intern in the Marketing Department. I have been tasked with working on a new bottle design. Someone on my team said we should make the bottle look more like our biggest competition. But when we were discussing what types of drinks are our biggest competition there was some disagreement. Then someone mentioned the marketing survey your team put out a while back. So, when thinking about the young adult target market, what category/type of drinks are they buying more often than root beer? This will really help us to know how we should design our bottle!

Thanks for your help,

Tia Hughes
Marketing Intern
Frosty Mug Brewing Co.
5301 Legacy Drive
8th Floor
Fort Worth, TX 76024
Telephone: 972-555-7977
Fax Number: 972-555-0427