The Elusive Benefits of Mind Wandering: How Incentive Scheme and Task Structure Facilitate Creative Incubation in a Multitask Environment

Jeffrey Hales
Georgia Institute of Technology

Wenqian Hu
Georgia Institute of Technology

Ivo Tafkov*
Georgia State University

April 2019

*Corresponding author's contact information:
School of Accountancy
Georgia State University
35 Broad Street NW, Room 510
Atlanta, Georgia 30303
Phone: 404-413-7226
itafkov@gsu.edu

We received helpful comments from James Cox, Jason Kuang, Jeremy Lill, Michael Majerczyk, Robbie Moon, Karen Sedatole, Shankar Venkataraman, and Flora Zhou; from workshop participants at Emory University's Behavioral Brownbag Series, Georgia State University's PAW research meeting, Georgia State University's CTS seminar, and Georgia Institute of Technology for their helpful comments and suggestions. We also thank Todd Swarthout and Kevin Ackaramongkolrotn for their help with the recruitment of student participants at the Experimental Economics Center Lab of Georgia State University. We gratefully acknowledge the financial support provided by Georgia Institute of Technology.

The Elusive Benefits of Mind Wandering: How Incentive Scheme and Task Structure Facilitate Creative Incubation in a Multitask Environment

Abstract: We use two experiments to investigate how incentive scheme and task structure influence creative incubation in a multitask environment where participants perform both creative and simple routine tasks. In our first experiment, where participants are given the discretion to switch between a creative and a routine task, we find that creativity-based incentives generate the most incubation benefits in terms of the greatest number of high-creativity ideas compared to quantity-based incentives and fixed wage. However, we find little evidence that incentive scheme itself can effectively "nudge" individuals to self-select into an incubation period. In our second experiment, we examine whether randomly assigning participants to switch between tasks can achieve the incubation benefits we observed in our first experiment. Results suggest that the performance advantage under creativity-based incentives disappears when the task environment is structured in a way that forces an incubation period. Taken together, our results suggest that employees need both the right incentives and self-insight with regard to the right switching time to gain incubation benefits in a multitask environment. Further, the simple way to impose an incubation period can backfire, as the interruption costs may outweigh the incubation benefits once the switching is forced during creative production.

Keywords: *creativity; incentive scheme; multitask environment; quantity vs. quality incentive; task structure; creative incubation*

1. Introduction

Organizations and researchers are increasingly interested in how performance-based incentives for a given task can affect creative performance for that task (e.g., Kachelmeier et al., 2008; Kachelmeier and Williamson, 2010; Kachelmeier et al., 2018). This research has, understandably, focused on single task environments. However, creative inspiration often arises when individuals are engaged in thoughts or activities not deliberately aimed at solving the problem, a phenomenon often referred to as creative incubation (Wallas, 1926; Koestler, 1964). Creative incubation could be particularly relevant in multitask environments, where employees engage in both creative endeavors and day-to-day routine tasks. For example, rather than working on one task until it is completed, an employee could decide to take a break from a creative task and engage for a time on simple, routine tasks, offering the opportunity for their mind to wander and for flash insights to occur. In this study, we extend prior accounting research by investigating how incentive schemes combined with different task structures influence employees' creative incubation in a multitask environment, where they perform both creative and simple routine tasks. Specifically, we investigate how incentive schemes (quantity-based vs. creativity-based vs. fixed wage) affect employees' creative task performance when employees are given the discretion to structure the routine and creative task (i.e., sequential vs. routine task intervening creative task).

Some employees work in predominantly single task settings with a high degree of repetition. Multitask environments, however, are common, particularly for employees who have creative responsibilities. In addition to creative work, these employees are often required to fulfill routine responsibilities that involve substantial amount of time and effort. For example, R&D employees responsible for innovation and insight not only conduct new research but also perform routine tasks such as attending regular staff meetings and preparing reports (Hazak, 2017). University faculty conduct academic research while also engage in administrative services. Importantly, anecdotal

accounts suggest considerable variation in the way that companies schedule the creative and routine tasks. For example, some high-tech companies such as *Google* and *Intel* grant employees much flexibility in scheduling their time to work on creative projects (Gillett, 2016), whereas others such as *Accenture* stimulate creative work through the regularly scheduled conversations and brainstorming sessions to bring the workforce together to generate ideas (Newenham, 2013). Thus, the flexibility of employees' work schedules represents an important contextual factor that can potentially influence creative incubation.

To better understand how companies can encourage creativity in a multitask setting, we first examine whether there are incubation benefits from allowing employees to switch between tasks, and whether incentive schemes differentially affect these benefits. Prior psychology literature on creative incubation suggests the possibility that routine tasks can be utilized as a critical incubation period that can ultimately aid in creative output (Smith and Blankenship, 1989; Baird et al., 2012). Linking incentives to this prior research, one possibility is that stronger incentives to deliver high-creativity ideas under creativity-based incentives could translate into a higher creative task focus during the routine task, leading to a stronger "carry-over" effect during the incubation period. On the other hand, the finding from prior research (e.g., Kachelmeier et al., 2018) that quantity-based incentives generate a free flow of divergent ideas suggests a similar type of carry-over effect from the initial stage that could facilitate incubation afterwards. Because both creativity and quantity incentives could facilitate creative incubation once participants make a switching choice, we predict a higher creative task performance for those that utilize the switching option but make no directional prediction about whether one type of the performance-based incentive scheme will dominate the other in stimulating the production of highly creative ideas.

In order to examine the role of incentive scheme in facilitating the benefits of incubation in a multitask setting, we design a computerized laboratory experiment in which participants are

required to complete one creative and one routine task. Specifically, consistent with an environment where employees' primary responsibility is creative work, participants start with the creative task and are given the discretion to switch to the routine task at any moment of the creative task. However, participants have to complete the routine task before they switch back, a setting consistent with real-world environments where employees occasionally switch to routine tasks but cannot work simultaneously on the two types of tasks. If participants choose not to switch, they work on the two tasks in a sequential order. To capture creativity, we follow prior literature and adopt the Torrance "Alternative Uses" Task, a classic and widely used measure of divergent thinking (Torrance, 2008). To operationalize a relatively undemanding routine task, participants are asked to decode capital letters into numbers and receive a piece-rate payment for the task. We manipulate the incentive scheme on the creative task between subjects such that participants' compensation on the creative task is either fixed (control condition), based only on the quantity produced, or based on the high-creativity production. The main outcome of interest is participants' creative task performance.

The results of our experiment suggest an interaction effect between incentive scheme and switching on creative task performance. On the one hand, consistent with prior findings from a single-task environment (e.g. Kachelmeier et al., 2008), we find a similar level of high-creativity output between quantity-based and creativity-based incentives for participants that work on the two tasks sequentially. However, for participants exercising the switching option, we find that they produce a greater number of high-creativity ideas under creativity-based incentives than under quantity-based incentives. Thus, the results suggest that creativity incentives can outperform quantity-only incentives in facilitating high-creativity production once individuals are provided with and seize the opportunity to switch to a routine task in a multitask environment. An important caveat to these results, however, is that a relatively small proportion of participants chose to utilize

the switching option. Only about one fourth of the participants in each condition chose to switch to the routine task before completing the creative task, suggesting that incentive scheme had little impact on participants' switching decision or their switching time. Taken together, the evidence from our experiment suggest that a creativity-based incentive scheme has some, albeit limited, potential to boost creativity if employees are not "nudged" to structure the tasks in a way that allows incubation to occur.

Informed by our first experiment, we design a second experiment to examine whether the same incubation benefits from switching to a routine task in between a creative task can be achieved if the switching is imposed. Further, while results of our first experiment are consistent with a stronger "carry-over" effect under creativity-based incentives, an alternative mechanism can be that creativity-based incentives induce more self-insight such that participants switch at a point of time that is most beneficial for them. Thus, it remains an empirical question whether self-insight with regard to the switching point is a necessary condition to achieve incubation benefits from switching.

To address these issues, we conduct a second experiment that parallels the design of our first experiment, except that participants are randomly assigned to a task structure (sequential vs. intervening) rather than making the switching decision themselves. In contrast to the results of Experiment 1, results from Experiment 2 suggest that the potential benefits of incubation might be difficult to extend to a broader base of employees by imposing task structures that include an incubation period. Specifically, for participants provided with creativity-based incentives, those assigned to the intervening task structure achieve a similar level of high-creativity output compared to those that work on the two tasks sequentially. In fact, Experiment 2 results indicate that quantity-based incentives marginally outperform creativity-based incentives for both the sequential and intervening task structure conditions.

The results of this study have important practical implications for firms that rely on creativity and at the same time require employees to perform day-to-day routine tasks. While a necessary part of organization's activities, routine tasks have generally been viewed by both practitioners and academics as a distraction and detriment to creativity (Moreau and Engeset, 2016; Hazak, 2017). Our results, however, suggest that routine tasks can be a critical source of creative inspiration. Specifically, the results suggest that firms can boost employee creativity with the right combination of incentive schemes and discretion in work scheduling in a multitask environment. When employees have certain degree of flexibility to switch between creative and routine tasks, creativity-based incentives achieve higher incubation benefits in terms of a greater volume of high-creativity output for those that seize the opportunity to incubate creative ideas.

While our results suggest that incubation benefits do exist, we caution that they cannot be easily achieved. The simple way to impose an incubation period can potentially backfire, as the interruption cost can outweigh the incubation benefits once the switching is forced during creative production. Thus, our study informs about one benefit of granting employees discretion in task structuring: employees can utilize the routine task to incubate creative ideas at a time that is *chosen* by them. On the contrary, when employees work on the creative and routine tasks in a sequential order or have no opportunity to switch between tasks *when needed*, quantity-based incentives in the multitask environment still fare well in delivering high-creativity production, a finding that is consistent with prior studies in single-task environments (Kachelmeier et al., 2008; Kachelmeier et al., 2018).

Our study extends the existing accounting research that examines how performance-based incentives affect creative task performance in a single task environment (e.g., Kachelmeier et al., 2008; Kachelmeier and Williamson, 2010; Kachelmeier et al., 2018). Our results demonstrate that in a multitask environment, creativity-based incentives can outperform quantity-only incentives in

motivating high-creativity output when employees are provided with and seize the opportunity to take the interruption *when needed*. We also add to the literature that investigates creativity in the multitask environment. While prior research recommends a focused task strategy in a multitask environment (Bruggen et al., 2018), our study suggests a complementary role of creative and routine tasks such that the mind wandering state during routine tasks can actually facilitate creative inspiration.[1] Last, the current accounting literature does not speak to how different incentive schemes can influence the way in which employees structure the multiple tasks, which goes beyond the direct incentive effect on performance. While our results suggest that incentive scheme may not function as an effective "nudging" mechanism that guides individuals to self-select into an incubation period, we caution that the simple solution to impose an incubation does not bring the desired performance improvement.

2. Hypothesis Development

Background

Employee creativity plays a critical role in organization's innovation process (Amabile, 1996). As such, firms increasingly look to their employees to provide creative solutions as a way to address important problems and gain access to innovation. However, on top of their creative endeavors, employees across rank and functional areas are also required to fulfill their day-to-day routine responsibilities. For instance, R&D employees not only conduct new research but also perform routine works such as reports, applications, and administrative tasks (Hazak, 2017). Though a necessary part of organizations' activities, routine works have generally been viewed by both practitioners and academics as distracting and detrimental to creativity (Amabile et al., 2002;

[1] Bruggen et al. (2018) study a setting in which participants can freely allocate their time across a routine and creative task to investigate how non-binding input and/or output targets on the routine task affect creative task performance. They manipulate the presence of input and/or output targets while holding incentive scheme constant. Thus, their study does not inform how incentive scheme interacts with task structure in affecting creative task performance.

Hazak, 2017; Moreau and Engeset, 2016). For example, companies such as *Disney* distinguish between employees who do "routine work" and those who engage in "imaginative work" such that employees are less likely to switch from one type of work to the other (Sutton, 2001).

However, anecdotal accounts of creative inception have long implied the benefits of an incubation period – the "eureka moment" often comes out when the mind is *not* focused on the problem. In particular, psychologists described four successive phases in the creative process: intense but unsuccessful confrontation with the problem; a decision to put the problem aside; an incubation period with no further conscious work; illumination in which unexpected insights enter consciousness (Wallas, 1926). Hence, the psychology literature suggests that one way to achieve creativity is to temporarily put aside the creative work and switch to some unrelated tasks. Consistent with this idea, some high-tech companies such as *Google* and *Netflix* give employees time off their regular creative projects to engage in some other creativity-unrelated activities (Braff, 2018). Thus, routine tasks, while distract the mindset away from creativity, can potentially aid in creativity, if the two types of tasks are structured in the right way. However, despite the abundance of anecdotal accounts, questions remain as to how employees can achieve the incubation benefits and whether enforcing an incubation period can bring the same boosts in creative output.

In the next section, we consider the psychological evidence on the incubation effects and develop predictions on how incentives can facilitate creative incubation and the consequent creative task performance in a multitask environment.

Incubation Effects

Anecdotes of intellectual discovery share a common theme – creative inspiration often arises when one temporarily puts aside the unsolved problem (e.g., Ghiselin, 1985). Consistent with the anecdotal reports, empirical psychology research generally supports the existence of the incubation effects (Sio and Ormerod, 2009). This research suggests superior performance for those who return

to a creative problem after a delay rather than work continuously on the problem (Smith and Blankenship, 1989; Baird et al., 2012). The organizational behavior literature on procrastination and creativity further suggests that pausing in the middle of the creative work and engaging in some less productive tasks can encourage individuals to consider remote possibilities, rather than "seizing and freezing" on one particular idea (Grant, 2016, pp. 94-97).

Importantly, the incubation literature suggests that routine tasks with low cognitive load can be a critical source of incubation. Specifically, prior psychology research indicates that the mental state of mind wandering can facilitate creativity that goes beyond the benefits of a simple resting period or a fresh new look, as low cognitive demand tasks have been shown to yield stronger incubation effects than a simple resting period (Baird et al., 2012; Sio and Ormerod, 2009). Recent neuroimaging work provides hints that help explain the uniqueness of the incubation effects. Specifically, studies find increased cooperation between executive and default networks, a sign for creative cognition, only during the mind wandering states but not resting states (Smallwood and Schooler, 2015; Beaty et al., 2015; Cai et al., 2009).

Despite the empirical evidence that supports the benefits of engaging in some undemanding routine task during an incubation period, prior literature has not investigated the role of incentive scheme in achieving these benefits. In a multitask environment where individuals perform both creative and routine tasks, incentive scheme not only motivate effort duration and/or intensity, but also direct individuals' attention among various tasks (Holmstrom and Milgrom, 1991; Bonner and Sprinkle, 2002). Thus, questions remain as to whether incentive schemes can differentially affect individuals' decisions to switch between creative and routine tasks and their mind focus during the incubation period. In the following section, we develop predictions for the incentive effect in achieving creative incubation in a multitask environment.

Incentive Schemes and Incubation

The accounting literature has examined the effect of different incentive schemes on creative task performance in a single task environment (Kachelmeier et al., 2008; Kachelmeier et al., 2018; Kachelmeier and Williamson, 2010). This research finds that creativity-based incentives are unable to translate into a greater high-creativity output, whereas quantity-only incentives "do no harm" in generating high-creativity ideas. While this research focuses on the effects of incentives on creative task performance in a single task environment, we extend the literature by examining the effect of incentive scheme on creative task performance in a multitask environment where individuals are given the discretion to switch to a routine task in between the creative task.

The effect of financial incentives on creativity has been a topic of debate (e.g. Amabile, 1996; Hennessey, 2003; Grant and Berry, 2011). The general theme within the accounting literature is that creativity and incentives can be compatible (e.g. Kachelmeier et al., 2008; Kachelmeier et al., 2018; Chen et al., 2012). Extending the traditional agency-theoretic assumption to the domain of creativity, we would expect a higher level of creative task focus during the routine task if creativity-based-incentives stimulate more creative efforts and thoughts than quantity-based incentives. That is, the stronger incentive to produce high-creativity output under creativity-based incentives can probably translate into a stronger "carry-over" effect during the incubation period. Further, the stronger incentives under creativity-based incentives can motivate individuals to recognize and utilize the incubation benefits more than those under quantity-based incentives. In other words, creativity-based incentives may induce more self-insight with regard to the incubation effects than quantity-based incentives, such that individuals switch at a point of time that is most beneficial for them. On the other hand, prior research in a single task environment has documented superior creative performance after an incubation period under quantity-based incentives but not under creativity-based incentives (Kachelmeier et al., 2018). This research posits that quantity-based

incentives stimulate the preparation phase of the creative process by rewarding as many initial ideas as possible. The initial unrestricted generation of divergent ideas establishes an impetus for incubation and the eventual creative insights.

While Kachelmeier et al. (2018) showed superior creative performance after an incubation period under quantity-based incentives, but not under creativity-based incentives, it is worth noting that our setting differs from theirs in important ways. In their study, they investigate the effect of incentive scheme on creative task performance in an *imposed* incubation setting, whereas we begin with an *endogenous* incubation setting. The endogenous incubation maximizes the chances of finding the potential incubation effects as it allows individuals to switch at a point of time that is *chosen* by them, thus making the switching time a critical factor in determining the incubation effects and the creative task performance. Thus, in this setting, incentive schemes might differentially impact the extent to which individuals generate self-insight with regard to a beneficial switching time and consequently influence the incubation effects.

Further, in Kachelmeier et al.'s main experiment, participants are unaware that they will perform the creative task again at the end of the first stage experiment. Awareness of the second-stage task along with the performance-based incentives on creative performance that continue after the incubation period creates strong incentives for individuals to incubate creative ideas. Thus, our setting allows us to discern how incentive schemes differentially influence the "carry-over" effect during the incubation period.[2] Overall, our study investigates the incubation effects in a controlled laboratory setting where participants have both opportunity and stronger incentives to incubate creative ideas while working on an undemanding routine task. Hence, it is possible that creativity-

[2] Kachelmeier et al. (2018) conduct a follow-up experiment in which participants at the end of the first stage do know that the same incentive scheme will continue in a second stage task. However, they exclude creativity-based incentives and compare only quantity-based incentives to fixed pay in the follow-up experiment.

based incentives stimulate a stronger "carry-over" effect and more self-insight, which can facilitate creative incubation in our setting.

The above discussion suggests that both creativity-based and quantity-based incentives can generate incubation benefits once participants make a switching choice. However, the literature on the incentive effects remains much more unsolved than to support a directional prediction regarding the relative ability of creativity-based vs. quantity-based incentives in facilitating incubation. Accordingly, we investigate the relative effects of performance-based incentive schemes on incubation as an empirical question. Overall, we predict a main effect of the incubation effects (i.e., an intervening task structure) with the following hypothesis:

H1: *Regardless of the type of the performance-based incentive scheme (i.e., creativity-based or quantity-based incentive scheme), high-creativity production will be higher for participants who choose an intervening task structure than for those who choose a sequential task structure.*

For participants who choose *not* to switch to the routine task, the chosen sequential task structure essentially replicates prior studies' single-task settings (e.g. Kachelmeier et al., 2008). Based on the prior findings, we expect a similar level of high-creativity output under quantity-based and creativity-based incentives for the sequential task structure.

3. Experiment 1

Participants

We recruited 122 students from a large university in the southeastern United States to participate in one of the 8 sessions of a laboratory experiment. Participants receive an average payment of $15 for approximately 40 minutes of participation in the study. Forty percent of the participants are male, with an average age of 21.6 years old. Participants come from diverse background including Business, Economics, Psychology, Biology, Chemistry etc. As our experimental task does not require specific knowledge in a particular field, the diverse educational

background allows us to draw more general implications about creativity. All interactions took place via a computerized z-Tree program (Fischbacher, 2007).

Experimental Task

Participants are required to complete one creative and one routine task in a laboratory setting.[3] Specifically, participants are informed at the beginning of the experiment that they will work on one creative task for 6 minutes and one routine task for 6 minutes (referred to as Task A and Task B in the experiment respectively).[4] Consistent with an environment where employees' primary job is creative work, all participants start with the creative task. At any moment during the creative task, participants can switch to and complete the 6-minute routine task and return back to the creative task for the remaining of the 6 minutes (if they do not switch, they will be directed automatically to the routine task after the creative task). Prior organizational behavior literature suggests that break or interruptions in a creative task can be beneficial or detrimental depending on the timing of the break (Jett and George, 2003). Consistent with prior studies showing that employees' discretion in the work can facilitate creativity (Shalley, 1991; Zhou, 1998), we leave both the switching decision and switching time to the participants' own choices. This design choice allows participants to utilize the switching option *when needed* and thus maximizes our chances to find the incubation effects. No matter how participants structure the two tasks, the experimental design ensures the same amount of time on the routine and creative task for all the participants.

To capture creativity, we follow prior literature and adopt the Torrance "Alternative Uses" Task, a classic and widely used measure of divergent thinking (Torrance, 2008; Guilford, 1967). Specifically, participants are asked to develop creative ideas for nonobvious uses for a common

[3] The experiment was approved by the Institutional Review Board (IRB) of the University where the data was collected.
[4] The 6 minutes of time on the creative task is chosen as the original Torrance "Alternative Uses" task suggests a time duration of 10 minutes for the purpose of test of creativity. We shorten the time length to 6 minutes and keep the time the same as the routine task such that there is less cognitive depletion on both tasks.

object (cardboard boxes is used in the experiment). Participants are also informed that a panel of independent raters will evaluate their submitted creative ideas afterwards based on creativity. Following prior psychology and management accounting literature on creativity (Amabile, 1996; Chen et al., 2012), we define a creative idea as one that is "original, innovative, and potentially implementable". To operationalize a relatively undemanding routine task, we adopt a decoding task in which participants decode capital letters into numbers using a decoding table that is provided to them (Fisher et al., 2002). This task requires participants to follow known procedures to increase productivity, which represents the nature of a routine task (Hodgson, 1997). The instructions inform participants about the description of the two tasks, switching choice, and incentive scheme before they start the tasks. To mitigate the possibility that participants switch out of curiosity to the routine task, they also engage in a practice round of the routine task.

Participants receive a piece-rate compensation on the decoding task to avoid them engaging in a resting period during the routine task. Consistent with an environment where employees' primary job is creative work, the payment rate for each correctly decoded letter is designed such that the average payment of the routine task is lower than that of the creative task. Specifically, participants earn an experimental currency of "tokens" and receive 2 tokens for each correctly decoded letter in the experiment.[5] The conversion rate from tokens to dollars is calibrated afterwards for both the creative and routine task, to ensure an average payment of $10 for the creative task and $5 for the routine task. To avoid cognitive depletion and to capture an undemanding task that potentially allows the mind to wander, we impose a 2-second gap before the next letter (along with the decoding table) showing up on the screen after participants click the "Submit" button for each decoded letter. Finally, participants across conditions are informed that "we value your performance

[5] This rate is chosen as prior similar studies indicate that participants decode an average of 130 letters in 9 minutes (Bruggen et al., 2018). Hence, in our study, participants are expected to decode 50-60 letters in 6 minutes. Thus, participants are expected to earn 100 tokens, which is half of the tokens they expect to earn from the creative task.

on both tasks; you are advised to make use of the time on both tasks wisely." This statement provides all participants with the same objectives on the two tasks and mitigates any dysfunctional behavior on the routine task. However, participants' economic incentives to submit the creative ideas differ by condition, as explained next.

Experimental Design

We manipulate the incentive schemes on the creative task between subjects such that participants' compensation on the creative task is either fixed (control condition), based only on the quantity produced, or based on the high-creativity production (creative ideas with an average creativity rating of 6 or higher on a 10-point scale). To allow rating of the ideas, all participants are informed that they will receive their payment in approximately two weeks. As in prior literature (Kachelmeier et al., 2008), the instructions explain that the only reason for this waiting period is that "different versions of the research require waiting, and we want to pay all participants at the same time." Thus, the experimental conditions hold constant the delay in the payment that is necessitated in the creativity-based incentive condition.

Incentive Scheme Manipulation

We manipulate the incentive schemes offered to the participants on the creative task. In the quantity-based incentive condition, participants are informed that their compensation on the creative task depends *only* on the quantity of creative ideas they submit, irrespective of the creativity ratings those ideas receive, using a payment rate of 10 tokens for each creative idea. In the creativity-based incentive condition, participants are informed that they will be compensated only for the ideas that receive an average creativity rating of *six or higher* on a 10-point scale by the panel of independent raters, with 60 tokens for each idea above the threshold.[6] Thus, in this condition, only high-

[6] This rate is chosen as prior accounting studies indicate that "approximately 15 percent of creative ideas received a creativity rating at or above 6" (Kachelmeier et al., 2018). Thus, we choose the unit payment per idea for the creativity-based incentive condition to be 6 times the unit payment for the quantity-based incentive condition.

creativity ideas "count". Participants in the fixed wage condition are informed that they will receive 200 tokens for developing creative ideas, irrespective of how they perform in the task. The fixed wage condition sets a benchmark for comparing the incremental effect of quantity vs. creativity incentives. Last, in order to hold the average compensation constant across conditions, we calibrate the conversion rate from tokens to dollars afterwards. Participants are informed of this calibration and the expected compensation from the creative and the routine task before they start the tasks.[7] Thus, we hold the average *magnitude* of the compensation on the creative task constant across conditions, while manipulating the *nature* of the compensation.

Measure of Creative Performance

To measure the creativity level of participants' creative ideas, we follow prior literature (Kachelmeier et al., 2008; Chen et al., 2012) and recruit another group of participants as independent raters. We conducted the creativity ratings through the platform of Amazon Mechanical Turk, which provides access to a large participant pool while also reduces the rater fatigue in laboratory rating sessions. 380 raters were recruited and compensated with $1.25 for the evaluation of creative ideas. Each creative idea was evaluated by 7 to 11 raters.[8, 9] Being blind to our experimental conditions, the raters first read through the instructions of their task and were informed that the creative ideas were developed by university students as part of a research study. The raters were instructed that the evaluation should be based on creativity alone and were provided with 10 randomly selected ideas before they started the evaluation so as to have a sense of the range of creativity that is present. Working independently, the raters evaluated each creative idea using a

[7] Specifically, we converted token to US dollars at a rate of $0.05 ($0.052) [$0.055] per token in the fixed wage (quantity-based incentive) [creativity-based incentive] condition. Using the ex post calibration, we achieve equal average payment on both the creative and routine task across different incentive conditions.
[8] There are a total of 1990 creative ideas generated. We divided all the ideas into 38 parts, with raters randomly assigned one part to evaluate. Each rater evaluated 52 or 53 creative ideas, depending on the random assignment of evaluation.
[9] We aimed at 10 evaluations per idea. The difference is caused by some raters pause in the middle and did not finish the evaluation. We omit the incomplete evaluations in calculating the creativity ratings.

full scale from 1 (=not at all creative) to 10 (=very creative).[10] We averaged the ratings from all the raters for each creative idea to obtain our measure of creative performance.

Experiment 1 Results

In Experiment 1, we examine the effects of different incentive schemes and participants' self-selected task structure on their creative task performance. Creative task performance is captured by high-creativity production measured by the number of creative ideas in the top quartile.[11]

Descriptive Statistics and Tests for Creative Task Performance

The descriptive statistics for high-creativity production are summarized in Panel A of Table 1 and depicted in Figure 1. Theories from prior literature suggest the possibility that both quantity-based and creativity-based incentives can facilitate creative incubation. Results, however, reveal an interaction effect such that creativity-based incentives outperform quantity-based incentives in yielding a larger volume of high-creativity production for those that exercise the switching option (5.25 vs. 3.00 for creativity- and quantity-based condition respectively); whereas quantity-based incentives fare no worse than creativity-based incentives for those that work on the two tasks sequentially (3.78 vs. 4.29 for creativity- and quantity-based condition respectively). ANOVA results presented in Panel B of Table 1 report a significant interaction effect between incentive scheme and switching decision on creative task performance ($F = 3.20$, two-tailed $p = 0.078$).[12] Follow-up analysis of simple main effects, reported in Panel C of Table 1, indicate that switching marginally improves high-creativity output under creativity incentives ($F = 1.67$, one-tailed $p = 0.098$), but does not improve high-creativity output when quantity incentives are provided ($F =$

[10] The raters can also identify the creative ideas as "Not a Valid Use", which is treated as a score of zero in the rating.
[11] Untabulated tests indicate there is no significant difference in gender, age, and work experience across different incentive conditions, suggesting successful randomization.
[12] Three subjects switched to the routine task immediately after they started the creative task (i.e., within 5 seconds on the creative task they made a switch). We reclassify these subjects as essentially choosing a sequential task structure. Results are qualitatively similar if we treat them as adopting an intervening task structure.

1.53, one-tailed $p = 0.892$). Further, the other pair of simple effects suggests that creativity-based incentives yield performance advantage over quantity-based incentives once participants make a switching choice ($F = 2.73$, two-tailed $p = 0.099$), but not when they adopt a sequential strategy ($F = 0.50$, two-tailed $p = 0.482$). Thus, the analyses above lend support to the incubation benefits, but only under the creativity-based incentives. Collectively, these results suggest that high-creativity production can be motivated with creativity-based incentives, once participants are provided with and seize the opportunity of an incubation period. Consistent with prior creativity studies in a single task environment (Kachelmeier et al., 2008; Kachelmeier et al., 2018), we find that quantity incentives "do no harm" in generating high-creativity volume compared to creativity incentives in the sequential task structure condition.

--- Insert Table 1 and Figure 1 about here ---

Descriptive Statistics and Tests for Switching Behavior

As we make the switching decision endogenous in our experiment to maximize the chances of finding the incubation effects, another outcome of interest is participants' switching behavior. Specifically, although it is hard to predict *ex ante* whether incentive schemes can influence individuals' switching decisions or their switching time in a multitask environment, making the switching decision endogenous in our experiment allows us to empirically investigate this question. Panel A and Panel B of Table 2 provides descriptive statistics for participants' switching frequency and their switching time across incentive conditions. All incentive conditions combined, 24% of participants choose to switch to the routine task in between their creative task. Follow-up proportion tests reveal no significant difference between each pair of incentive conditions for participants' switching likelihood (all two-tailed p-values ≥ 0.304). Also, incentive schemes seem to have little impact on the point of time participants choose to switch, as both t-test and Wilcoxon rank-sum test report no significant difference in participants' time spent on the creative task before switching

across conditions (all two-tailed p-values ≥ 0.394). Thus, the descriptive statistics suggest that the incentive schemes that elicit *many* ideas vs. *few good* ideas have little impact on whether and how quickly individuals choose to switch to the routine task in between the creative task.

--- Insert Table 2 about here ---

To further explore participants' switching behavior, we use logistic and multiple regressions to test for the determinants of participants' switching decision and switching time. Results from the logistic and multiple regressions, reported in Table 3 and 4 respectively, indicate a significant main effect of the creative performance before switching in determining both the switching tendencies and the time of switching. Specifically, across different regression models, the number of ideas and the average rating of all the ideas before switching are significantly negatively correlated with participants' switching likelihood and positively correlated with the time spent on the creative task.[13] In other words, those that keep a momentum in delivering creative performance in terms of a larger number of ideas and a higher average creativity rating are less likely to switch and stay longer on the creative task. However, across almost all the models in Table 3 and 4, neither incentive scheme nor the interaction between incentive scheme and creative task performance before switching has significant impact on participants' switching decision or switching time.[14] Thus, incentive scheme itself does not differentially influence participants' switching behavior.

--- Insert Table 3 and Table 4 about here ---

Additionally, we capture the motives underlying participants' switching choices via a post-experimental question that asks participants to rank the extent to which each of the five statements provided to them describe the reasons for their switching decision. Table 5 summarizes the

[13] For participants that chose not to switch, we use the respective performance measures for the full 6 minutes on the creative task as a proxy for the creative performance before switching. Results are qualitatively similar when we use some specific time cut-offs, such as performance in the first 3 minutes, to capture performance before switching.
[14] One exception in the results is Model 3 of the multiple regressions: creativity-based incentives marginally increase the time spent on the creative task before switching (two-tailed $p = 0.077$).

descriptive statistics for participants' reported ranking of the statements and a Wilcoxon rank-sum test for the differences in the ranking between quantity and creativity incentive conditions. Results indicate that participants in all incentive conditions rank incubation benefits (Reason 4) and a dead end in generating ideas (Reason 1) as the top two reasons for their switching decision. Interestingly, while participants with creativity incentives are more likely to switch out of the inherent challenge under the creativity requirement (i.e., significant difference exists in the Reason 1 ranking across conditions), incentive scheme does not differentially affect participants' awareness of the incubation benefits (i.e., no significant difference exists in the Reason 4 ranking across conditions).

--- Insert Table 5 about here ---

Overall, results from our experiment suggest that incentive scheme itself has little impact on participants' self-selected task structure, i.e., their switching tendency and switching time. Further, the results that incentive scheme does not interact with creative task performance in determining participants' switching behavior mitigate the possibility that incentive schemes differentially prompt good or poor performers to switch between tasks. These results alleviate the endogenity concern in our investigation of the incentive effects on creative task performance as we reported in the previous section.

Discussion

Taken together, results from our first experiment provide support for the existence of the incubation effects, but only when an incubation period is paired with the right incentive to produce high-creativity output. However, we note that a relatively small proportion of participants make a switching choice in all conditions in the experiment. Hence, while an interruption can be beneficial for individuals when they are exhausted in generating ideas, it seems that a relatively small proportion of individuals realize the incubation benefits and most of them simply seize to the task to the end. Further, while results from our experiment are generally consistent with a stronger "carry-

over" effect under creativity-based incentives, an alternative mechanism can be that participants provided with creativity-based incentives generate more self-insight compared to those with quantity-based incentives such that they switch at a point of time that is most beneficial for them. Importantly, *ex ante*, it remains an empirical question whether self-insight with regard to the right switching time is a necessary condition for individuals to achieve incubation benefits. To test the necessity of self-insight and a potential remedy for the problem of insufficient individuals realize the incubation benefits, we conduct a second experiment, which we discuss next.

4. Experiment 2

Theory and Motivation

Whereas the design choice of self-selected task structure is suitable for the context and aim of Experiment 1, Experiment 2 examines a setting where the task structure (sequential vs. intervening) is randomly assigned. A potential implication arising from Experiment 1 is that there might not be a sufficient number of employees spontaneously taking a break from the creative task when an interruption can actually be beneficial for them. A straightforward remedy from the management control perspective is to simply impose a desired work schedule such that employees will have to switch tasks at a predetermined time. Relatedly, in practice some routine tasks such as staff meetings are usually scheduled regularly such that employees have to switch tasks at a particular time (Fried, 2016; Jeffery, 2018). Hence, in Experiment 2, by randomly assigning participants to switch between tasks, we test whether the incubation benefits we observed in Experiment 1 can be achieved among a broader audience with a forced incubation interval.

While a predetermined task structure can force more individuals into incubation, the forced switching can potentially impose an interruption cost that breaks the impetus in creative production. Thus, it remains an empirical question whether a forced task structure can achieve the performance boost as *ex ante* it is hard to predict the relative effect of the incubation benefits and the interruption

costs. Further, with exogenously imposed task structure, while participants may have the same "carry-over" effect during the incubation period, their self-insight with regard to a beneficial switching time may not play a critical role in determining the incubation effects as in Experiment 1. As such, this setting allows us to disentangle whether individuals' self-insight regarding an optimal timing of switch is a necessary condition to achieve performance advantage from incubation. Specifically, if we observe the same pattern of results in this setting, self-insight is not a necessary condition for incubation to occur. If the creativity boost under creativity-based incentives disappears, then *both* the "carry-over" effect during the incubation and the self-insight to take a break *when needed* are necessary conditions for individuals to benefit from an incubation period. Overall, we test the effect of incentive schemes and task structures on creative task performance as an empirical question in Experiment 2. This leads to the following hypothesis in the null form:

H2 (null)*: There will be no difference in the creative task performance between participants compensated with quantity-based incentives and those compensated with creativity-based incentives when the intervening task structure is exogenously imposed.*

Experimental Overview and Design

The design of Experiment 2 parallels that of Experiment 1, except that participants are randomly assigned to a particular task structure rather than make the switching decision themselves.[15] Participants are required to complete the same two tasks and follow the same procedures as in Experiment 1. Two factors are manipulated between subjects, resulting in a 2 x 2 experimental design: incentive scheme on the creative task (quantity-based vs. creativity-based incentives) and task structure (sequential vs. intervening). All participants start with the creative task and work on both the creative task and routine task for 6 minutes. Participants assigned to the

[15] Different from Experiment 1, the fixed wage condition is excluded in Experiment 2, as our primary interest is in the performance difference between quantity-based vs. creativity-based incentive conditions.

sequential task structure condition finish the creative and the routine task in a sequential order (i.e., A-B). Participants assigned to the intervening task structure condition work the first 3 minutes on the creative task, switch to the routine task for the next 6 minutes, and return back to the creative task for the remaining 3 minutes (i.e., an alternating order of A-B-A). In other words, they are forced to switch to the routine task at the midpoint of the creative task.[16] Importantly, participants are informed of their task structures before they start the two tasks. Last, to obtain a measure of creative task performance, we use the same rating scheme and procedures as in Experiment 1 and conduct the rating through Amazon Mechanical Turk platform.[17]

Participants

Experiment 2 was conducted at the same university as Experiment 1. 125 students participated in one of our 5 sessions of a laboratory experiment. Participants are randomly assigned to one of the treatment conditions. Similar to Experiment 1, participants took approximately 40 minutes to complete the experiment and earned an average payment of $15. Thirty three percent of the participants are male and the average age is 20.5 years old. Participants come from diverse education background which allows us to draw more general implications about creativity. All interactions took place via a computerized z-Tree program (Fischbacher, 2007).[18]

Experiment 2 Results

In Experiment 2, we test whether the performance advantage under creativity incentives can be achieved in a larger group of participants once the incubation period is enforced. Creative task

[16] The 3-minute switching point is chosen both because the midpoint is the most natural cutoff point and statistics from Experiment 1 suggest that the average time participants spent on the creative task before switching is 152 seconds. Thus, we impose the midpoint of 3 minutes as the switching point in Experiment 2.
[17] Participants developed a total of 2633 creative ideas in Experiment 2. We recruited 260 raters from MTurk and each rater earned $1.25 for completion of the evaluation. Each rater evaluated 101 or 102 ideas, with each creative idea received 9 to 11 ratings. We average all the ratings to derive a measure of creativity for each creative idea.
[18] As in Experiment 1, untabulated tests indicate that there is no significant difference in gender, age, and work experience across different conditions, suggesting successful randomization.

performance is measured by high-creativity production as proxied by the number of creative ideas in the top quartile. As we do not have directional prediction for the incentive effect under forced incubation, the analyses in this section are based on two-tailed tests.

Descriptive Statistics and Tests for Creative Performance

Data presented in Panel A of Table 6 and depicted in Figure 2 provide descriptive statistics for the number of high-creativity ideas in each treatment condition in Experiment 2. Results show that participants assigned to the sequential task structure condition produced a marginally higher level of high-creativity output under quantity incentives than creativity incentives (5.28 and 6.59, for creativity and quantity condition respectively). However, the performance improvement from switching under creativity-based incentives disappear in this setting (4.81 and 5.47 for creativity and quantity condition respectively). ANOVA results presented in Panel B of Table 6 indicate a marginally significant main effect of incentive scheme ($F = 2.82$, two-tailed $p = 0.096$), a non-significant main effect of task structure ($F = 1.86$, two-tailed $p = 0.18$), and a non-significant interaction effect ($F = 0.31$, two-tailed $p = 0.58$). The overall pattern of results supports a marginally higher volume of high-creativity production under quantity-based incentives. Importantly, follow-up simple main effects suggest that creativity incentives no longer produce superior creative performance once switching is enforced during the creative task ($F = 0.62$, two-tailed $p = 0.432$).

--- Insert Table 6 and Figure 2 about here ---

To explore the "carry-over" effect during the incubation period under different incentives, our *ex post* questionnaire elicits participants' mind focus during the routine task. Specifically, participants were asked to indicate the extent to which they agree with the statement "I was still thinking about Task A while I worked on Task B" on a 7-point Likert scale with "1" labeled "Strongly Disagree" and "7" labeled "Strongly Agree". Table 7 provides the descriptive statistics and ANOVA tests for participants' self-reported mind focus, a proxy for the extent to which they

mind wandered on the creative task during the routine task. ANOVA results in Panel B of Table 7 reveal a marginally significant interaction effect between incentive scheme and task structure on the extent of participants' mind wandering ($F = 2.66$, two-tailed $p = 0.105$). Importantly, the pattern of results for the mind wandering measure mirrors the creative performance pattern in Experiment 1, which lends support for the "carry-over" effect as a mechanism that drives the superior performance from incubation under creativity-based incentives.[19]

--- Insert Table 7 about here ---

Taken together, our results indicate that the performance advantage from switching under creativity-based incentives disappears once the switching is enforced during the creative production. A forced intervening task structure essentially produces the pattern of results that mimic the results in the sequential task structure conditions – quantity-based incentives fare no worse than creativity-based incentives in yielding high-creativity production. Thus, creativity incentives cannot improve high-creativity output even when the opportunity for incubation is provided but not at a point of time that is beneficial to the individuals. One potential explanation is that the interruption costs from switching can outweigh the incubation benefits from a break. Taken together, results from our two experiments suggest that employees need *both* the right incentives and self-insight about the right switching time to benefit from an incubation period. A forced incubation period does not produce the desired performance outcome.[20] These findings are consistent with prior organizational behavior literature that it is the ability to take a break *when needed* rather than the switching behavior itself that matters for creativity (Madjar and Shalley, 2008).

[19] We did not ask the mind wandering measure in Experiment 1, as asking the extent of mind wandering in Experiment 1 can be subject to strong self-selection biases. That is, individuals foresee the incubation effects will choose to switch in Experiment 1's setting. Hence, we use Experiment 2's process measure to provide support for the "carry-over" effect under creativity-based incentives.

[20] In both of our two experiments, we did not detect any significant differences in the routine task performance across different treatment conditions, nor did we detect any significant differences across the two experiments. This result can be partially attributed to the piece-rate payment in the routine task. Thus, the incubation benefits documented in our experiments are not achieved at the expense of decreased performance on the routine task.

5. Conclusion

We use two experiments to examine how different incentive schemes and task structures influence creative incubation in a multitask environment where participants perform both creative and simple routine tasks. In our Experiment 1, where participants are given the discretion to switch to a routine task in between the creative task, we find that creativity-based incentives generate more incubation benefits in terms of a higher volume of high-creativity ideas compared to quantity-based incentives. However, we find little evidence that incentive scheme itself can effectively "nudge" individuals to self-select into an incubation period. As a potential remedy for the problem of insufficient number of individuals realizing the incubation benefits, we use a forced incubation period in our Experiment 2 to examine whether randomly assigning participants to switch between tasks can achieve the same incubation benefits in a broader base of participants than we observed in Experiment 1. Results indicate that a forced incubation can backfire, as the performance boost under creativity-based incentives disappear once the switching is enforced. Overall, results from our two experiments suggest that *both* incentives and self-insight with regard to a beneficial switching time are necessary conditions to realize incubation benefits in a multitask environment.

The results of this study have important practical implications for firms that rely on creativity and at the same time require employees to perform day-to-day routine tasks. Our results reveal that rather than a distraction to creativity, routine tasks can be a critical source of creative inspiration. Firms can boost employee creativity with the right combination of incentive schemes and discretion in work scheduling in a multitask environment. Our study informs about one benefit of granting employees discretion in task scheduling: employees can utilize the routine task to incubate creative ideas at a time that is *chosen* by them. While our results suggest that incubation benefits do exist, we caution that these benefits cannot be easily achieved. Imposing an incubation period can potentially backfire, as the interruption cost can outweigh the incubation benefits once the switching

is forced during creative production. As our results caution that the simple solution to impose an incubation does not bring the desired performance improvement, future research can explore alternative "nudging" mechanisms that can effectively prompt individuals to switch tasks when an interruption can be beneficial for them. For instance, information systems that track employees' creative production in real time may enable companies to force a switch of tasks when employees slow down on generating creative ideas.

Reference:

Amabile, T. M. (1996). Creativity in context: Update to "The social psychology of creativity.": *Westview Press*.

Amabile, T. M., Hadley, C.N., & S. J. Kramer, S.J. (2002). Creativity under the gun, *Harvard Business Review*, 80, 52-63.

Baird, B., Smallwood, J., Mrazek, M. D., Kam, J. W., Franklin, M. S., & Schooler, J. W. (2012). Inspired by distraction: mind wandering facilitates creative incubation. *Psychological Science*, 23(10), 1117-1122.

Beaty, R. E., Benedek, M., Silvia, P. J., & Schacter, D. L. (2016). Creative Cognition and Brain Network Dynamics. *Trends in Cognitive Sciences*, 2(20), 87-95.

Bonner, S., & Sprinkle, G. (2002). The effect of monetary incentives on effort and task performance: Theories, evidence, and a framework for research, *Accounting, Organizations and Society*, 27 (4-5), 303-345.

Braff, D. (2018). How to Design a 21st Century Time-Off Program. https://www.shrm.org/hr-today/news/hr-magazine/0418/pages/how-to-design-a-21st-century-time-off-program.aspx

Brüggen, A., Feichter, C., & Williamson, M. G. (2017). The Effect of Input and Output Targets for Routine Tasks on Creative Task Performance. *The Accounting Review*, 93(1), 29-43.

Cai, D. J., Mednick, S. A., Harrison, E. M., Kanady, J. C., & Mednick, S. C. (2009). REM, not incubation, improves creativity by priming associative networks. *Proceedings of the National Academy of Sciences*, 106(25), 10130-10134.

Chen, C. X., Williamson, M. G., & Zhou, F. H. (2012). Reward system design and group creativity: An experimental investigation. *The Accounting Review*, 87(6), 1885-1911.

Fischbacher, U. (2007). z-Tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics* 10 (2): 171-178.

Fisher, J. G., Maines, L. A., Peffer, S. A., & Sprinkle, G. B. (2002). Using budgets for performance evaluation: Effects of resource allocation and horizontal information asymmetry on budget proposals, budget slack, and performance. *The Accounting Review*, 77(4), 847-865.

Fried, J. (2016). Status meetings are the scourge. https://m.signalvnoise.com/status-meetings-are-the-scourge/

Ghiselin, B. (Ed.). (1985). The creative process: Reflections on the invention in the arts and sciences. Univ of California Press.

Gillett, R. (2016). 5 reasons Google is the best place to work in America and no other company can touch it. https://www.businessinsider.com/google-is-the-best-company-to-work-for-in-america-2016-4

Guilford, J. P. (1967). The nature of human intelligence. New York, NY: McGraw-Hill.

Grant, A. (2016). Originals: How Non-Conformists Move the World.

Grant, A. M., & Berry, J. W. (2011). The necessity of others is the mother of invention: Intrinsic and prosocial motivations, perspective taking, and creativity. *Academy of Management Journal*, 54(1), 73-96.

Hazak, A. (2017). Non-creative tasks: a turn off for creative R&D employees. *TUT Economic Research Series*.

Hennessey, B. A. (2003). The social psychology of creativity. *Scandinavian Journal of Educational Research*, 47(3), 253-271.

Hodgson, G. M. (1997). The ubiquity of habits and rules. *Cambridge Journal of Economics*, 21(6), 663-684.

Holmstrom, B., & Milgrom, P. (1991). Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design. *Journal of Law, Economics, & Organization*, 7, 24-52.

Jeffery, R. (2018). The People Management guide to meetings (and how to survide them). https://www.peoplemanagement.co.uk/long-reads/articles/pm-guide-meetings-solve-them

Jett, Q. R., & George, J. M. (2003). Work interrupted: A closer look at the role of interruptions in organizational life. *Academy of Management Review*, 28(3), 494-507.

Kachelmeier, S. J., Reichert, B. E., & Williamson, M. G. (2008). Measuring and motivating quantity, creativity, or both. *Journal of Accounting Research*, 46(2), 341-373.

Kachelmeier, S. J., & Williamson, M. G. (2010). Attracting creativity: The initial and aggregate effects of contract selection on creativity-weighted productivity. *The Accounting Review, 85*(5), 1669-1691.

Kachelmeier, S. J., Wang, L. W., & Williamson, M. G. (2018). Incentivizing the creative process: From initial quantity to eventual creativity. *The Accounting Review In-Press*.

Koestler, A. (1964). The Act of Creation (Dell, New York).

Madjar, N., & Shalley, C. E. (2008). Multiple tasks' and multiple goals' effect on creativity: Forced incubation or just a distraction?. *Journal of Management*, 34(4), 786-805.

Moreau, C. P., & Engeset, M. G. (2016). The downstream consequences of problem-solving mindsets: How playing with LEGO influences creativity. *Journal of Marketing Research*, 53(1), 18-30.

Newenham, P. (2013). Five ways to create a culture of innovation in the workplace. https://www.irishtimes.com/business/five-ways-to-create-a-culture-of-innovation-in-the-workplace-1.1557801

Sio, U. N., & Ormerod, T. C. (2009). Does incubation enhance problem solving? A meta-analytic review. *Psychological Bulletin*, 135(1), 94.

Smith, S. M., & Blankenship, S. E. (1989). Incubation effects. *Bulletin of the Psychonomic Society*, 27(4), 311-314.

Smallwood, J., & Schooler, J. W. (2015). The science of mind wandering: empirically navigating the stream of consciousness. *Annual Review of Psychology*, 66, 487-518.

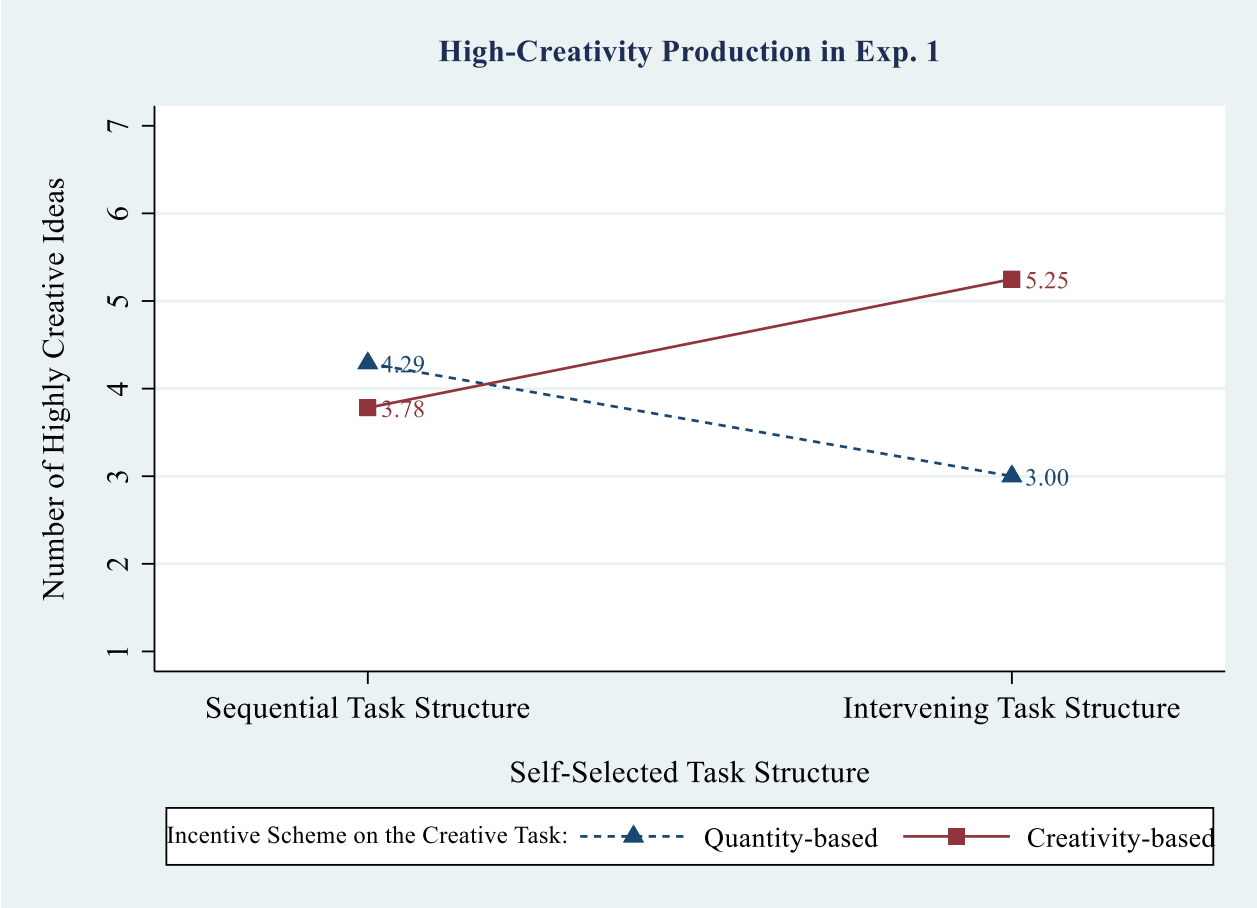
Sutton, Robert I. (2001). The Weird Rules of Creativity. *Harvard Business Review*, September, 95–103.

Torrance, E. P. (2008). Torrance Tests of Creative Thinking: Norms-technical manual, verbal forms A and B. Bensenville, IL: Scholastic Testing Service.

Wallas, G. (1926). The Art of Thought. *New York: Harcourt Brace*

Figure 1: Observed Pattern of Results – Experiment 1

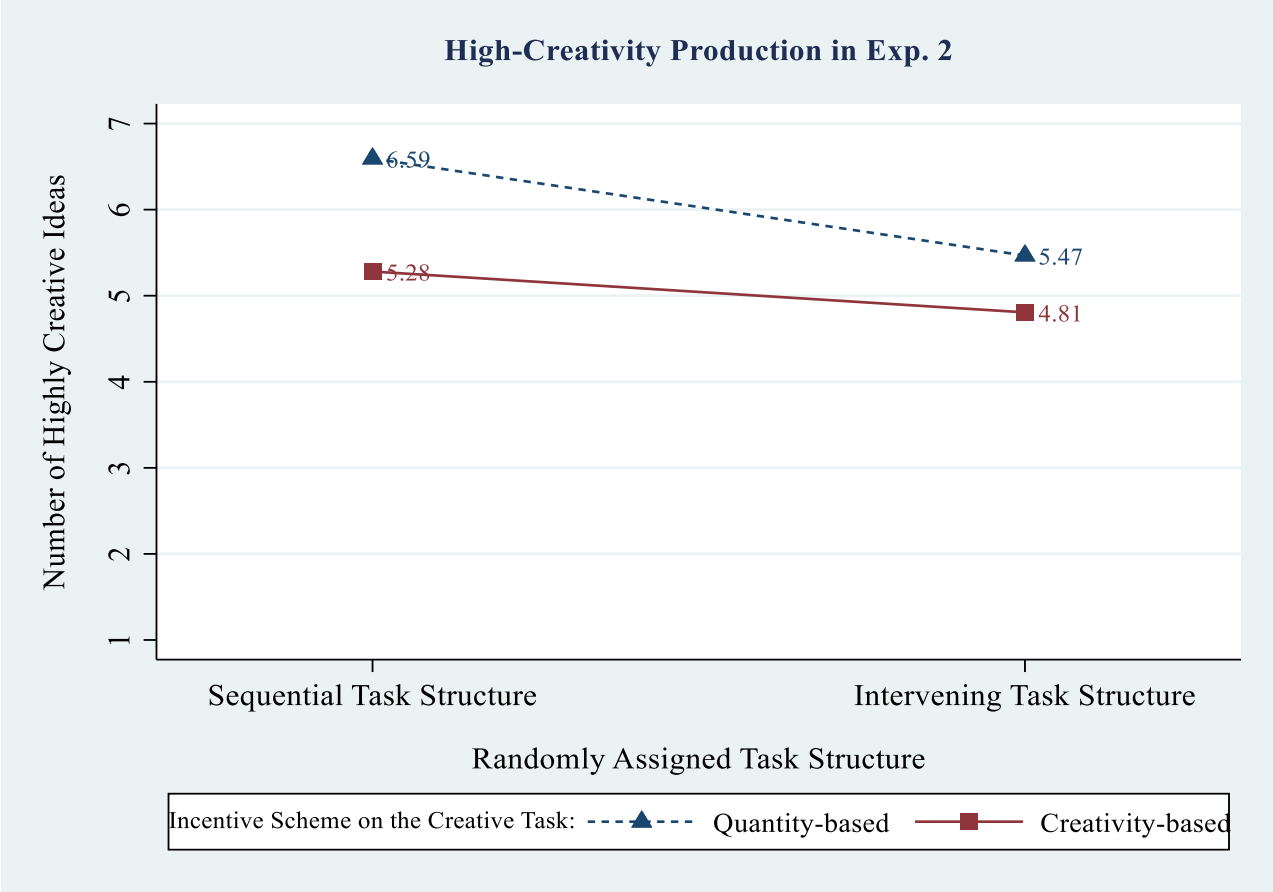
Incentive Scheme on the Creative Task, Participants' Self-Selected Task Structure, and High-Creativity Production



This figure plots participants' total number of highly creative ideas submitted during the 6 minutes on the creative task in Experiment 1. The numbers denote the number of highly creative ideas, measured as ideas with an average rating above 5.7 (i.e., creative ideas in the top quartile). Participants receive either fixed wage, quantity-based incentives or creativity-based incentives on the creative task. Participants start with the creative task and are given the discretion to switch to the routine task at any moment during the creative task, resulting in a self-selected intervening or sequential task structure. The fixed-wage condition, which serves as a control condition for comparison of the incremental effect of performance-based incentives on creative performance, is excluded from the main tests, as our primary interest is in the difference between quantity-based and creativity-based incentives on the creative task performance.

Figure 2: Observed Pattern of Results – Experiment 2

Incentive Scheme on the Creative Task, Randomly Assigned Task Structure, and High-Creativity Production



This figure plots participants' total number of highly creative ideas submitted during the 6 minutes on the creative task in Experiment 2. The numbers denote the number of highly creative ideas, measured as ideas with an average rating above 5.7 (i.e., creative ideas in the top quartile). Participants receive either quantity-based or creativity-based incentive scheme on the creative task. Participants are randomly assigned to finish the two tasks in a sequential task structure (i.e., A-B) or an intervening task structure (i.e., A-B-A). Crossing the two factors results in the four conditions plotted above.

T A B L E 1

Descriptive Statistics, ANOVA and Simple Effects for High-Creativity Production in Experiment 1

Panel A: Descriptives for Participants' High-Creativity Production

	Incentive Scheme on the Creative Task			
Switch to Task B	Fixed Pay (Control)	Quantity-based Incentives	Creativity-based Incentives	Mean {S.D.}
Yes	4.38	3.00	5.25	4.12
	{2.97}	{3.40}	{3.81}	{3.41}
	n = 8	n = 10	n = 8	n = 26
No	4.00	4.29	3.78	4.02
	{2.61}	{2.83}	{2.47}	{2.62}
	n = 33	n = 31	n = 32	n = 96
Mean {S.D.}	4.07	3.98	4.08	
	{2.65}	{2.99}	{2.80}	
	n = 41	n = 41	n = 40	

Panel B: ANOVA for Participants' High-Creativity Production, Excluding Control Condition

Source	*df*	Mean Square	*F*-Statistic	*p*-Value
Incentive Scheme	1	10.51	1.27	0.263
Switching Decision	1	0.11	0.01	0.908
Incentive Scheme*Switching Decision	1	26.39	3.20	0.078
Error	77	8.25		

Panel C: Simple Effects

Effect of Switching to Task B	*df*	*F*-Statistic	*p*-Value
Effect of switching under quantity-based incentive on creative task	1	1.526	**0.892**
Effect of switching under creativity-based incentive on creative task	1	1.673	**0.098**

Effect of Incentive Scheme	*df*	*F*-Statistic	*p*-Value
Effect of incentive scheme when participants choose to *switch*	1	2.727	0.099
Effect of incentive scheme when participants choose *not to switch*	1	0.495	0.482

This table reports the descriptive statistics and hypotheses tests of participants' high-creativity production in the creative task in Experiment1. High-creativity production is measured as the number of ideas with an average rating above 5.7 (i.e., creative ideas in the top quartile). Panel A contains the mean {standard deviation} of participants' high creativity production in each of the conditions. Panel B reports ANOVA results for the effect of incentive scheme (quantity-based vs. creativity-based) and switching decision (yes vs.

no) on participant's high creativity production. The fixed-wage condition is excluded in the main tests, as our primary interest is in the difference between quantity-based and creativity-based incentives on the creative performance. Panel C reports the results of the simple effects tests that break down the simple main effect and help us identify the pattern of results.

Reported p-values are two-tailed unless testing a one-tailed prediction, as signified by bold face.

T A B L E 2

Descriptive Statistics of Participants' Switching Behavior – Experiment 1

Panel A: Descriptives for Frequency (Percentage) of Participants Choose to Switch

	Incentive Scheme on the Creative Task		
Switch to Task B	Fixed Pay (Control)	Quantity-based Incentives	Creativity-based Incentives
Yes	19.51%	29.27%	22.50%
	n = 8	*n* = 12	*n* = 9
No	80.49%	70.73%	77.50%
	n = 33	*n* = 29	*n* = 31
Total	n = 41	n = 41	n = 40
Proportion test (*two-tailed p-value*):			
Fixed pay vs. quantity incentive	0.3037		
Fixed pay vs. creativity incentive	0.7413		
Quantity vs. creativity incentive	0.4871		

Panel B: Descriptives for Participants' Switching Time (Time Spent on The Creative Task Before Switching, in Seconds)

	Incentive Scheme on the Creative Task		
	Fixed Pay (Control)	Quantity-based Incentives	Creativity-based Incentives
Switching Time (in seconds)	148.63	139.92	170.00
	{52.09}	{97.17}	{78.06}
	n = 8	*n* = 12	*n* = 9
Test of means (*two-tailed p-value*):	T-test	Wilcoxon Rank Sum Test	
Fixed pay vs. quantity incentive	0.8200	0.8170	
Fixed pay vs. creativity incentive	0.5226	0.4125	
Quantity vs. creativity incentive	0.4559	0.3938	

This table contains the descriptives for the frequency (percentage) of participants who choose to switch to the routine task before finishing the creative task (Panel A) and the mean {standard deviation} of participants' switching time (Panel B) in each treatment condition in Experiment 1. The table also reports test statistics for the proportion of participants who choose to switch (Panel A) and the mean switching time (Panel B) between each pair of treatment conditions. Participants receive either fixed wage, quantity-based incentives or creativity-based incentives on the creative task, resulting in the three conditions reported above. Participants start with the creative task and are given the discretion to switch to the routine task at any moment during the creative task. Participants have a total of 6 minutes to work on the creative task and 6 minutes to work on the routine task. Switching time is measured as the time (in seconds) spent on the creative task before they switch to the routine task. All reported p-values are two-tailed.

T A B L E 3

Logistic Regression for Participants' Switching Decision – Experiment 1

DV: Dummy Variable for Switching Decision	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Incentive Scheme	-0.354	-0.529	-0.854	0.652	-0.797
	(-0.693)	(-0.870)	(-1.460)	(0.279)	(-0.798)
NumIdeasBefSwitch		-0.083**	-0.102**	-0.087**	-0.107**
		(-2.318)	(-2.435)	(-2.005)	(-2.089)
AvgRatingBefSwitch		-0.426*		-0.296	
		(-1.853)		(-0.976)	
HighCreativeBefSwitch			-0.003		0.034
			(-0.017)		(0.170)
Incentive Scheme*NumIdeasBefSwitch				0.006	0.013
				(0.081)	(0.142)
Incentive Scheme*AvgRatingBefSwitch				-0.280	
				(-0.580)	
Incentive Scheme*HighCreativeBefSwitch					-0.088
					(-0.280)
Intercept	-0.882**	2.192**	0.684	1.697	0.673
	(-2.571)	(1.973)	(1.136)	(1.279)	(0.994)
Observations	81	81	81	81	81
LR chi-square	0.484	16.003	11.614	16.356	11.693
Prob. > chi-square	0.486	0.001	0.009	0.006	0.039

This table reports the coefficients and t-statistics (in parentheses) from logistic regressions with switching decision as the dependent variable in Experiment 1. Switching Decision is coded as 1 if a participant choose to switch to the routine task during the creative task, and 0 otherwise. Incentive Scheme is coded as 0 if participants receive quantity-based incentive and 1 if participants receive creativity-based incentives on the creative task. The fixed-wage condition is excluded in the main tests, as our primary interest is in the difference between quantity- and creativity-based incentives on the creative task performance. NumIdeasBefSwitch, AvgRatingBefSwitch, HighCreativeBefSwitch are the number of ideas, average rating of all the ideas, and the number of highly creative ideas, respectively, that participants produced on the creative task before they switched to the routine task. For participants who chose not to switch, NumIdeasBefSwitch, AvgRatingBefSwitch, HighCreativeBefSwitch is the respective creative performance for the full 6 minutes on the creative task. Highly creative ideas is defined as the creative ideas that have an average rating above 6.

*, **, *** denote two-tailed statistical significance at 10%, 5%, and 1%, respectively.

T A B L E 4

Multiple Regression for Participants' Switching Time – Experiment 1

DV: Switching Time	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Incentive Scheme	21.665	21.337	42.156*	-21.684	31.696
	(0.959)	(0.958)	(1.795)	(-0.297)	(0.783)
NumIdeasBefSwitch		2.592**	3.350**	2.553*	3.988**
		(2.502)	(2.488)	(1.983)	(2.434)
AvgRatingBefSwitch		23.475***		19.105*	
		(3.087)		(1.699)	
HighCreativeBefSwitch			-0.560		-6.024
			(-0.095)		(-0.766)
Incentive Scheme*NumIdeasBefSwitch				0.415	-1.654
				(0.183)	(-0.562)
Incentive Scheme*AvgRatingBefSwitch				8.506	
				(0.551)	
Incentive Scheme*HighCreativeBefSwitch					12.612
					(1.052)
Intercept	295.585***	152.215***	236.482***	170.901***	238.946***
	(18.628)	(4.247)	(9.599)	(3.615)	(8.535)
Observations	81	81	81	81	81
R-squared	0.012	0.215	0.118	0.219	0.131
Adj. R-squared	-0.001	0.185	0.084	0.167	0.073
F	0.921	7.034	3.436	4.209	2.261

This table reports the coefficients and t-statistics (in parentheses) from multiple regressions with switching time as the dependent variable in Experiment 1. Switching Time is measured as the duration of time (in seconds) that participants spent on the creative task before they switch to the routine task. Incentive Scheme is coded as 0 if participants receive quantity-based incentive and 1 if participants receive creativity-based incentives on the creative task. The fixed-wage condition is excluded in the main tests, as our primary interest is in the difference between quantity- and creativity-based incentives on the creative task performance. NumIdeasBefSwitch, AvgRatingBefSwitch, HighCreativeBefSwitch are the number of ideas, average rating of all the ideas, and the number of highly creative ideas, respectively, that participants produced on the creative task before they switched to the routine task. For participants who did not switch, NumIdeasBefSwitch, AvgRatingBefSwitch, HighCreativeBefSwitch is the respective creative performance for the full 6 minutes on the creative task. Highly creative ideas is defined as the creative ideas that have an average rating above 6.

*, **, *** denote two-tailed statistical significance at 10%, 5%, and 1%, respectively.

T A B L E 5

Descriptive Statistics of Participants' Switching Reasons in Experiment 1

Descriptives for Participants' Switching Reasons

	Incentive Scheme on the Creative Task			Difference in Means
Reasons	Fixed Pay (Control)	Quantity-based Incentives	Creativity-based Incentives	Quantity vs. Creativity
Reason 1:I felt like I was running out of good ideas in Task A.	1.67	1.92	1.14	0.774*
	{1.21}	{1.24}	{0.38}	
	n = 6	*n* = 12	*n* = 7	
Reason 2: I wanted to take a break from Task A.	4.00	3.58	3.29	0.298
	{0.63}	{1.00}	{1.11}	
	n = 6	*n* = 12	*n* = 7	
Reason 3: I got bored working on Task A.	3.67	4.08	4.43	-0.345
	{1.51}	{0.79}	{0.98}	
	n = 6	*n* = 12	*n* = 7	
Reason 4: I thought I would come up with additional ideas while working on Task B	2.50	2.00	2.57	-0.571
	{1.38}	{1.13}	{1.13}	
	n = 6	*n* = 12	*n* = 7	
Reason 5: I felt like I could earn more money by working on Task B.	3.17	3.42	3.57	-0.155
	{1.33}	{1.51}	{0.98}	
	n = 6	*n* = 12	*n* = 7	

This table contains the statements used to capture participants' reasons to switch to the routine task and the mean {standard deviation} of the rank of importance for each statement by each condition in Experiment 1. Participants rank each of the statements based on the extent to which they describe the reasons for why they chose to switch, with "1" for the most important reason, "2" for the second important reason, …, and "5" for the least important reason. A two-sample Wilcoxon rank-sum (Mann-Whitney) test is used to test the null hypothesis that participants' self-reported ranks derive from the same population for quantity- vs. creativity-based incentive conditions. The Wilcoxon rank-sum test is used for each individual statement.

*, **, *** denote two-tailed statistical significance at 10%, 5%, and 1%, respectively.

T A B L E 6

Descriptive Statistics, ANOVA and Simple Effects for High-Creativity Production in Experiment 2

Panel A: Descriptives for Participants' High-Creativity Production

	Incentive Scheme on the Creative Task		
Task Order	Quantity-based Incentives	Creativity-based Incentives	Mean {S.D.}
Intervening	5.47	4.81	5.13
	{3.08}	{2.44}	{2.77}
	n = 30	n = 31	n = 61
Sequential	6.59	5.28	5.94
	{4.24}	{3.06}	{3.73}
	n = 32	n = 32	n = 64
Mean {S.D.}	6.05	5.05	
	{3.74}	{2.76}	
	n = 62	n = 63	

Panel B: ANOVA for Participants' High-Creativity Production

Source	*df*	Mean Square	*F*-Statistic	*p*-Value
Incentive Scheme	1	30.38	2.82	0.096
Task Order	1	20.03	1.86	0.175
Incentive Scheme*Task Order	1	3.32	0.31	0.580
Error	121	10.76		

Panel C: Simple Effects

Effect of Task Order	*df*	*F*-Statistic	*p*-Value
Effect of task order under quantity-based incentive on creative task	1	1.827	0.176
Effect of task order under creativity-based incentive on creative task	1	0.330	0.566

Effect of Incentive Scheme	*df*	*F*-Statistic	*p*-Value
Effect of incentive scheme under the *sequential* task order	1	2.561	0.110
Effect of incentive scheme under the *intervening* task order	1	0.617	0.432

This table reports the results of hypotheses tests of participants' high-creativity production in the creative task in Experiment 2. High-creativity production is measured as the number of ideas with an average rating above 5.7 (i.e., creative ideas in the top quartile). Panel A contains the mean {standard deviation} of participants' high-creativity production in each of the treatment conditions. Participants receive either quantity-based or creativity-based incentive on the creative task. Participants are randomly assigned to finish the two tasks in a sequential task order (i.e., A-B) or an intervening task order (i.e., A-B-A). Crossing the two factors results in

the four conditions reported above. Panel B reports ANOVA results for the effect of incentive scheme (quantity-based vs. creativity-based) and task order (intervening vs. sequential) on participant's high creativity production. Panel C reports the results of the simple effects tests that break down the simple main effect and help us identify the pattern of results.

All reported p-values are two-tailed.

T A B L E 7

Descriptive Statistics, ANOVA and Simple Effects for Mind Focus on Creative Task in Experiment 2

Panel A: Descriptives for Mind Focus on Creative Task During Routine Task

	Incentive Scheme on the Creative Task		
Task Order	Quantity-based Incentives	Quality-based Incentives	Mean {S.D.}
Intervening	2.97	4.16	3.57
	{2.03}	{2.33}	{2.25}
	n = 30	*n* = 31	*n* = 61
Sequential	3.34	3.28	3.31
	{2.07}	{2.17}	{2.11}
	n = 32	*n* = 32	*n* = 64
Mean {S.D.}	3.16	3.71	
	{2.04}	{2.27}	
	n = 62	n = 63	

Panel B: ANOVA for Mind Focus on Creative Task During Routine Task

Source	*df*	Mean Square	*F*-Statistic	*p*-Value
Incentive Scheme	1	10.01	2.16	0.144
Task Order	1	1.97	0.43	0.515
Incentive Scheme*Task Order	1	12.34	2.66	0.105
Error	121	4.64		

Panel C: Simple Effects

Effect of Task Order	*df*	*F*-Statistic	*p*-Value
Effect of task order under quantity-based incentive on creative task	1	0.475	0.491
Effect of task order under creativity-based incentive on creative task	1	2.631	0.105

Effect of Incentive Scheme	*df*	*F*-Statistic	*p*-Value
Effect of incentive scheme under the *sequential* task order	1	0.013	0.908
Effect of incentive scheme under the *intervening* task order	1	4.694	0.030

This table reports process measures that capture participants' mind wandering on the creative task during the routine task in Experiment 2. Panel A reports the mean {standard deviation} of the mind wandering measure by each condition. Participants were asked to rate the extent to which they agree with the statement "I was still thinking about Task A" that describes their mind's focus while they worked on the routine task. Participants rate their agreement with the statement on a 7-point Likert scale with "1" labeled "Strongly

disagree" and "7" labeled "Strongly Agree". Participants receive either quantity-based or creativity-based incentive on the creative task. Participants are randomly assigned to finish the two tasks in a sequential task order (i.e., A-B) or an intervening task order (i.e., A-B-A). Crossing the two factors results in the four conditions reported above. Panel B reports ANOVA results for the effect of incentive scheme (quantity-based vs. creativity-based) and task order (intervening vs. sequential) on the extent to which participants mind wander on the creative task during the routine task. Panel C reports the results of the simple effects tests that break down the simple main effect and help us identify the pattern of results.

All reported p-values are two-tailed.