Abstract
This study examines how the imposition of time pressure affects team collaboration, creative processes, and creative performance. Specifically, this study looks at how the timing of imposed constraints results in different patterns of team process across the team’s workflow. Using an experimental study of teams, results show that disruptions experienced earlier in a team’s workflow result in more steady-state time pacing behaviors and focus of attention than when time pressure is experienced later, which results in pronounced ‘spikes’ in these processes. In turn, the more variable levels of team processes that result when pressure is experienced later into workflow are associated with lower levels of creative process and creative performance, as well as lessened team ability to leverage social cognition in the form of transactive memory systems.

1. Introduction
Creativity has been linked to organizational innovation and survival [2, 19]. Having employees that can perform creatively is considered to be critical for organizations in today’s dynamic and competitive environment [23]. As such, there has been a dramatic increase in research focusing on personal and contextual factors that foster creativity [24]. At the same time, organizations are increasingly using teams as their primary work units and they are considered to be important for organizational effectiveness [14]. Given this, researchers and practitioners have begun to view team creativity as a critical factor to understand in order to help organizations survive and thrive, and focusing on how teams can develop creative ideas can potentially enhance their viability and effectiveness [19, 20, and 21].

Creativity is defined as the extent to which a product or process is both novel and appropriate [1]. As such, creativity can be viewed as an outcome (i.e., creative ideas or products) or a process, which includes how creative ideas are developed (e.g., linking ideas from different knowledge domains, scanning the environment for new alternatives to use in problem-solving). In this research we examine both creative processes and creative performance, along with other relevant team processes.

Work pressure (e.g., time pressure) is a common experience among organizational teams, and as organizations increasingly rely on teams to perform complex work over longer periods of time, it becomes more critical to understand how work pressure impacts team functioning and their creative performance [3]. Research on creativity has long considered the role that time pressure plays in shaping creative performance [4, 5, and 7]. At the center of this exploration is the question of what amount of pressure is most likely to stimulate creativity? For example, for work teams, will a high level of time pressure motivate teams to be more creative or will a low level of pressure leave a team freer to explore its creative potential? Recent research supports the premise that it may be moderate levels of pressure that enhance creative performance [5, 6].

In general, the above approaches start from the assumption that teams experience a consistent level of pressure throughout their workflows. However, teams rarely – if ever – experience pressure in a stable way throughout their time working together. In reality, teams experience periods of low, moderate, and high pressure at different points in their workflow. Yet little is known about how the variable patterns of pressure that teams actually experience will impact creative performance. For instance, are moderate but steady-state levels of pressure better for creative performance, or would a mix of high and low levels of pressure over the course of a team’s workflow be preferable? While both types of teams could be characterized by overall-moderate levels of pressure, their experiences working would be
Furthermore, we know little about the cognitive and behavioral mechanisms by which different levels of pressure combine to explain these effects. For example, many studies have posited that the right amount of pressure activates the creative process [5, 7], although none of these studies has explicitly considered the effects of pressure on the creative process, as well as the link between creative process and creative performance. We focus on team creative process, as well as other team process factors, to allow for direct observation of these processes at work. In addition to examining the effects of pressure on team behavioral and cognitive responses – in particular creative process, time pacing, and focus of attention – we are interested in the effects of pressure on emergent cognitive systems. Transactive memory system (TMS) – the shared division of cognitive labor by which a team realizes performance synergies – is perhaps the most well-articulated and researched form of a collective cognitive system [10, 12, and 13]. We examine the association of TMS with the effect of pressure on creative processes and performance.

This study looks at different patterns of pressure experienced by the team as a means to better understand the processes that explain the effects of time pressure on creative performance. In general, we contrast how team’s experience steady-state levels of moderate pressure with how they experience more variable patterns of pressure, characterized by both high and low levels of pressure at different points in their work.

This study contributes to the literature in several ways. First, we fill the gap in the literature by looking at how patterns of moderate time pressure affect team creative performance. We find that steady state moderate levels of experienced time pressure is more beneficial for creative performance than alternating between low and high levels of time pressure. Second, we examine how team processes, including team creative process, help to explain these differences in creative performance. Finally, this is the first study to examine the role of TMS for team creative performance. We find that high TMS can substitute for a lack of time pacing or focus of attention in helping to enhance creative performance.

2. Literature Review

Time pressure is the type of work pressure that has received the most attention in studies on creativity [5, 7]. Time pressure is defined as the limitation of time allotted for employees to finish their work. Individuals experience time pressure when they feel that they have insufficient time to do their work or that they have to work at a faster than desirable pace. Since employees need time to engage in creative cognitive processes [1], when they perceive time pressure this constrains the required cognitive processing needed for creative thought. Research that has examined the effect of time pressure on creativity has yielded inconsistent findings, from no effect to positive and negative effects [4]. Recently, Byron and colleagues [7] conducted a meta-analysis and found that stressors (e.g., perceived time pressure) could have a positive, negative, or curvilinear relationship to creativity. Amabile [2] proposed that work pressure can at times be beneficial for creativity and at other times harmful. She argued that a balanced amount of time pressure might be the most helpful to increase creativity. Much of the more recent research has taken the position that time pressure will have an inverted U-shape relationship with creative behavior [4].

According to activation theory [8, 17], people have a limited amount of cognitive resources, and different activation levels affect cognitive and behavioral responses. Mental arousal is posited to be necessary for effective functioning, but too much activation leads to overstimulation and lower performance. Using activation theory, a linear relationship is posited to exist between time pressure and experienced activation, with the greater the perceived time pressure, the higher the experienced activation [8]. This would be particularly the case for more complex tasks, such as creative tasks. If individuals feel they have too much time pressure this will cause them to freeze and devote less resources to trying to solve the problem creatively, and allocate more resources to narrowing their attention to try to finish the work in a timely manner. This will result in less exploratory thinking and more reliance on working in familiar, more routine ways, yielding less creative solutions. When time pressure is too high, individuals would be expected to be too highly activated and less likely to have the ability to deeply focus on the task and solve problems creatively. Also, they may feel as if they have no time to spend exploring different options, and providing the time for creative insights to emerge. At moderate levels of activation, individuals are optimally stimulated so creative solutions to problems are more likely to occur. Also, under moderate time pressure individuals should be more fully engaged in the task and able to optimally use their cognitive resources. When time pressure is too low, activation is expected to also be low, so the development of new ideas would be less likely. Janssen [11] found a curvilinear relationship between
time pressure and supervisor rated innovative performance. Likewise, Baer and Oldham [5] hypothesized and found a curvilinear relationship between time pressure and creativity.

Recently there has been some work that has looked at creativity as a dynamic process by examining the daily variation of creative performance levels [6] within individuals. Essentially, this work has argued that over the course of the day individuals will differ in their performance levels, and that we should study these variations to see what personal or contextual factors may be associated with them. Binnewies and Wornlien hypothesized and found that daily creativity was highest on days when an employee experienced a moderate level of time pressure. What we are doing is somewhat related for teams, in that we are looking within the teams work flow to examine the pattern of experienced time pressure and how it relates to team behavioral and cognitive processes and creative performance.

3. Hypotheses

This study looks at different patterns of pressure experienced by the team as a means to better understand the processes that explain the effects of pressure on creative performance. In particular, we focus on the effects of tightening constraints on team creative work once it has begun. We are interested in the effects of such imposed constraints on team cognition, process, and creative performance, and the effects on how teams experience time pacing and focus of attention. Finally, we consider how these constraints effect the development of team TMS and its application to the creative process.

3.2. Time pacing behavior

Previous research has emphasized the impact that task resource constraints have on response to time pressure. For instance, the tightening of time constraints has consistently been shown to increase workers’ perceptions of urgency [5]. Little is known, however, about how the effects of resource constraints may vary depending upon when in a team’s workflow the constraints are imposed. This is a particularly relevant question when teams are attempting to exhibit creative performance, where some measure of time pressure may serve to focus or motivate members’ creative performance but too much time pressure could be harmful to both the processes needed to be experienced in order to be creative as well as creative performance.

We argue that the timing of the constraint imposition will materially impact the pattern of time pacing behaviors exhibited by teams through the course of their workflow. When deadlines are constrained later into a team's creative work, members will be more likely in the earlier stages of team workflow to feel that they have adequate time to generate creative ideas, leading to a greater sense of complacency, equating to initially lower levels of time pacing. When work is then constrained later into the workflow, members will experience greater time pacing behaviors in the final stage of work as a result of the perception that little time remains to complete the task. Thus teams constrained later -- starting from lower levels of time pacing -- will exhibit more pronounced time pacing behaviors following the constraint. Teams whose work is constrained earlier will have less time to grow complacent before the constraint is imposed. Furthermore, when the constraint is imposed earlier, teams will perceive that they have more time remaining in which to adjust their workflow to the new constraint, resulting in less felt time pacing. This will result in team’s exhibiting a more moderate and less variable pattern of time pacing behavior that effectively guides team activities throughout the remainder of its workflow while not disrupting the
cognitive and behavioral processes needed to lead to creative performance. Therefore, teams constrained later in their workflow are likely to experience significantly more variable patterns of time pacing behavior than those constrained earlier.

**h1:** Subjecting teams to an accelerated deadline earlier in their workflow will cause them to exhibit more steady-state (i.e. less variable) patterns of time pacing behavior than those subjected to an accelerated deadline later in their workflow.

### 3.3. Focus of attention

The timing of constraints imposed on team workflow is also likely to affect the team’s focus of attention with regard to performing creatively on the task. Teams whose work is constrained later into their workflow will have more time in the beginning stages of work during which the lack of a proximal deadline will allow members’ focus on the task to waver and wane. Thus, these teams are likely to experience a greater depreciation in focus of attention earlier in the team’s process. When teams do experience the constraint later into the workflow, it will cause them to attempt to overcompensate by significantly ramping up focus of attention relative to earlier, un-constrained levels. They will be focusing more on task completion than trying to come up with a creative approach, which should be harmful for their creative performance. On the other hand, when deadlines are constrained earlier in a team’s process, the team will have less time before the constraint for the team’s focus of attention to depreciate. When the constraint is imposed, it will serve to moderately increase members’ focus on the task at hand. This results in a more steadily increasing pattern of focus of attention for teams constrained earlier in their workflow. Therefore, teams constrained later into their workflow will experience a significantly more variable pattern of focus of attention than teams constrained earlier.

**h2:** Subjecting teams to an accelerated deadline earlier in their workflow will cause them to exhibit more steady-state (i.e. less variable) patterns of focus of attention behavior than those subjected to an accelerated deadline later in their workflow.

### 3.4. Creative process

The creative process flows from idea generation to idea selection and refinement, with sequential iterations between generation, selection, and refinement of ideas [18]. Team’s experiencing constraints later in their workflow will engage in weaker creative processes following the imposition of constraints. These teams experience higher time pacing and focus of attention, curtailing idea generation and refinement stages of creative process, moving quickly and directly to converging on one solution by selecting an idea from those already generated. On the other hand, teams disrupted earlier in their workflow will perceive that they have more time to recover from and adjust to the new constraints, thus maintaining higher levels of creative process.

**h3:** Subjecting teams to an accelerated deadline later in their workflow will cause them to exhibit lower levels of creative process behaviors than those subjected to an accelerated deadline earlier in their workflow.

### 3.5. Creative performance

The development and maintenance of an effective creative process will be difficult for teams constrained later in their workflow, since they will have a higher sense of time pacing and stronger focus of attention on completing the task which would cause there to be depreciation in their ability to engage in creative processes. When constrained earlier in the process, teams can recover and adjust their creative process. When constrained later, there is little time to recover and instead the overall flow of the creative process will depreciate, leading them to focus only on task completion without regard to how creative their final output is, thus, their creative performance will be lower.

**h4:** Subjecting teams to an accelerated deadline later in their workflow will cause them to exhibit lower levels of creative performance than those subjected to an accelerated deadline earlier in their workflow.

### 3.6. Mediation of creative process

Time pacing and focus of attention influence teams’ creative performance through creative process. The iterative nature of the stages of the creative process require team members to go back and forth with their ideas and exchange, discuss, and integrate information they are holding. However, in order to perform creatively, the teams should be able to pace their time and adjust themselves to time pressure. Team member participation is an essential
component of team creative process engagement [9]. Hence, there should be enough time allowed for each member to share their opinions and have a discussion about their teams’ decisions.

**h5:** The negative relationship between team time pacing behavior after the deadline change and creative performance will be mediated by team creative processes.

Furthermore, in order to maintain team creativity, team members should retain their focus of attention after they receive the deadline constraint. Paying attention to other team members’ ideas is important for the integration of ideas [15]. If the teams can maintain high levels of focus of attention, they can stay focused on the task and continue generating, selecting, and refining ideas.

**h6:** The negative relationship between team focus of attention behavior after the deadline change and creative performance will be mediated by team creative processes.

### 3.7. Transactive memory system

The timing of team workflow constraints will also influence the extent to which teams develop a functioning transactive memory system. Teams experiencing constraints later in the workflow will be further into the development of their TMS, making the structure more rigid at the point of constraint. Teams with a more developed TMS are less likely to recognize the need to adapt the TMS when the team is confronted with constraints. Constraints imposed later in the workflow also leave teams less time to recover and continue the development of their TMS following the stall resulting from the constraint. When constraints are tightened earlier in a team’s workflow, a team’s TMS will be in a more formative stage at the time of the constraint. This means the constraint will help the team to better understand the distribution of expertise as members observe how each other respond to the constraint. Additionally, by giving members the opportunity to observe each other’s reactions to the constraint earlier, team members will be able to more effectively incorporate what they learn about each other, strengthening the formation of the TMS. These teams will also have more time following the constraint to recover and continue the effective development of their TMS.

**h7:** Subjecting teams to an accelerated deadline later in their workflow will cause them to develop less functioning TMSs.

For teams experiencing time pressure later in their workflow, the lower levels of TMS realized by these teams will compound the negative effects of high time pacing behaviors and focus of attention. The extent to which the imposition of constraints impedes the development of teams’ TMS will further weaken teams’ ability to cope with the fluctuations in time pacing behavior and focus of attention experienced as a result of the constraint. Similarly, the negative effects teams experience as a result of pronounced levels of focus of attention following the disruption will be more pronounced when teams have weaker TMS. In such instances, a less functioning TMS will further undermine team members’ ability to be creative in the face of higher levels of time pacing behavior and focus of attention.

**h8:** Levels of team TMS development will interact with higher levels of time pacing behavior to predict lower levels of creative performance for teams subjected to an accelerated deadline later in their workflow.

**h9:** Levels of team TMS development will interact with higher levels of focus of attention behavior to predict lower levels of creative performance for teams subjected to an accelerated deadline later in their workflow.

### 4. Methods

#### 4.1. Design and participants

A 1 X 3 experimental design was used in which teams of participants were randomly assigned to one of three time pressure conditions. Time pressure was manipulated by shortening their allotted task time (i.e., deadline change). The deadline changing conditions occurred at 5 minutes, 10 minutes, or 15 minutes into the teams’ task time. As part of the manipulation of shortening the time allotted, these three conditions were all originally told that they would have 40 minutes for the task. Then, at five minutes (or 10 minutes or 15 minutes) into the task the researcher informed them that “The owners are becoming anxious about what their next step will be. So they have asked for the teams to speed-up their time table for delivering their 5 year business plan. As such, the total time allotted for this task is now 20 minutes, which means you have 15 (10 or 5) minutes left to work.” Therefore, all teams in every condition had 20 minutes to complete the task.

One hundred and fifty six individuals were randomly assigned to three person teams for a total of
52 teams. Participants were undergraduates in a large university in the United States. 49% of the participants were female. The average age was 20.5, and ranged from 19 to 28. The majority of them were majoring in Business Administration (0.89%), with the rest majoring in a variety of disciplines. There were 19 teams in the 5 minute, 16 in the 10 minute, and 17 in the 15 minute deadline constraining conditions. All were part of a subject pool in which students in a Human Resource Management course are required to participate in up to three hours of research studies or write a research paper.

4.2. Task

A complex heuristic task was developed for this study that required teams of participants to come up with a five year transition plan for a restaurant in which their founder and creative chef was retiring, yet the restaurant and associated businesses (e.g., cooking school, cookbooks) were to continue. The task was based on an actual head chef, Ferran Adria, and his el Bulli restaurant which is world renowned for their innovative cuisine, food presentations, and overall dining experience. The teams were asked to individually read a passage providing background on the history of the business, the founder, their diverse business holdings, and what their task would be. Specifically, they were told that their team’s task was to help determine the future of the el Bulli Enterprises following Adria’s upcoming retirement in six months. They were asked to develop a five-year plan detailing what el Bulli Enterprises should do next to continue its success in Adria’s absence. They were told to first discuss this in their team, and then they should write the team’s recommendation on a form provided. They were also told that their proposal would be evaluated based on its innovativeness. In addition, they were informed that those teams whose solution was rated by the judges to be in the top 20% of teams participating will receive $75 cash ($25 member). This was done to try to create a strong incentive to fully participate in the team process to produce a good outcome. The task was pretested to ensure that it was interesting and that a range of creative outcomes could occur. Pretesting also helped to figure out the correct amount of time to allot to this task. Specifically, the vast majority of students completed the task in 20 minutes.

4.3. Procedures

When the participants arrived at the behavioral laboratory they were given standard instructions as a whole group about general procedures for the study. They were asked to read the task individually and given time to read and think about the task. Then they were put into teams of three individuals and escorted to private rooms for the rest of the session. Further instructions were given, and a video-camera was turned on in each room to tape the discussions. At the appropriate time, the researcher reentered the room and gave the manipulations of shortening the time deadline. After a total task time of 20 minutes, the experimenter asked each team for their 5 year plan write up, and then asked to individually fill out a final questionnaire that contained questions about their teams’ TMS, experienced time pressure, and demographic characteristics.

4.4. Measures

Creative Performance. Using the consensual assessment technique [1], three raters independently coded each of the teams 5 year plan with respect to the following three factors: overall creativity, novelty, and usefulness. Each of these factors was explained to the raters, and any questions they had were answered. They rated these on a 1-7 point scale with 1=not at all creative/novel/useful to 7=extremely creative/novel/useful. Once the ratings were completed rwgs were calculated to make sure that there was sufficient agreement among the three raters to merit averaging their ratings into one composite score. The rwg scores were 0.80, 0.78, and 0.78 for overall creativity, novelty, and usefulness respectively, indicating relatively high agreement. Therefore, the judges’ ratings were aggregated, and the three components were averaged into a team creative performance score. The Cronbach alpha for these three items was 0.85.

Process Factors. We had three process factors. Each of these was coded by two independent coders who watched each team’s videotape using a similar 7 point scale as above for each factor. All these process variables were coded for every 5 minute interval after the team discussion started, throughout the 20 minutes that the team was working on the task. The rwgs for these were high so therefore, the two coders’ ratings of these process factors were combined to form a rating of each process factor for each team. These three process factors were: team time pacing, focus of attention, and creative process. Each of these process factors were defined for the two coders so that there would be greater consistency in their coding. Time pacing consisted of one item: “The team seemed to experience a high degree of urgency”. Specifically, the raters were told to observe how the teams managed their time, how often they were
mentioning time and their deadline, and how quickly they were working. The rwg for the total 20 minutes period averaged across the 4 time periods was .71. Focus of attention was captured with one item: “Team discussion was generally focused and concentrated”. The raters were told to evaluate whether the team members were paying attention to keeping an active discussion, or were they talking about things outside of the scope of the task, and/or remaining silent. The inter-rater agreement (rwg) between the judges for the total 20 minute period averaged across 4 time periods was 0.85. Team creative process consisted of 6 items which captured whether they generated a number of ideas, built on each other’s ideas, and constructively critiqued each other’s ideas. Since this measure had multiple items, after checking for appropriate agreement, these items were averaged. The rwg between the two raters for the total 20 minute period averaged across 4 time periods is 0.92. Due to the iterative nature of creative processes, we focused on the creative process that occurred before and after the deadline change occurred, rather than observing all 4 time periods. Therefore, the raters coding of the creative process of the teams were collapsed to form two time periods: from the beginning of work until the deadline change was introduced (i.e. creative process before) and from the time that the deadline change occurred until the end of the team discussions (i.e. creative process after). The rwg between the two raters for creative process before the deadline change was 0.92; and after the change was 0.95.

TMS. We measured the teams’ development of a TMS. In the final questionnaire, team members were asked to answer 15 questions adapted from Lewis [10] after they completed the task in order to measure TMS ($\alpha=0.73$). Two sample items are: “Each team member has specialized knowledge of some aspect of our project” and “Our team worked together in a well-coordinated fashion”. There was very good agreement between team members (rwg = 0.96), hence their scores were averaged to compute the team level TMS.

Experienced time pressure. In order to ensure that all teams experienced the same overall level of experienced time pressure, in the final questionnaire we had them respond to 6 questions that we wrote for the study. Two sample items are: “I felt we had sufficient time to complete the task”, “I felt that the amount of time left was an issue in how we worked on the task” ($\alpha=0.94$). There was good agreement (rwg = 0.83), hence their scores were averaged to compute the team level of experienced time pressure.

5. Results

In order to examine the underlying mechanisms that could cause differences in team creative performance, the effect of time pressure due to deadline constraints on time pacing, focus of attention, creative process, and TMS were analyzed. A one-way ANOVA for between group differences indicates that overall levels of felt pressure were not significantly different for the three conditions ($F=1.051, p>0.05$). However, it is hypothesized that the patterns of felt pressure influences the behavioral and cognitive responses of teams in different ways.

Our first set of hypotheses was tested using a MANOVA approach to split-plot design. The split-plot design lets the main effect of the treatment (i.e. timing of the deadline change), the main effect of time (i.e. change in process variable of interest in five minute intervals) and the interaction effect of treatment and time (i.e., comparison of within group differences among the treatment groups) to be observed and tested simultaneously. As hypothesized, the MANOVA tests of the interaction effect of time and treatment condition indicates that the extent of change in the level of time pacing is significantly different among the three treatment conditions (Roy’s largest root $F=14.986, p<0.01$). Specifically, teams that received a deadline change later in their workflow (i.e., 15 minute condition) exhibited lower levels of time pacing as they worked on the task until they received the deadline change when their time pacing significantly spiked compared to the earlier and middle conditions. On the other hand, for teams that experienced time pressure earlier in their workflow (i.e. 5 and 10 minute conditions), time pacing was smaller and steadier throughout their workflow compared to the fifteen minute condition (See Figure 1). Therefore, Hypothesis 1 is supported.
Similarly, the extent of change in the level of focus of attention is significantly different among the three treatment conditions (Roy’s largest root $F=4.047; p<0.05$). Specifically, groups that received the deadline change later in their workflow (i.e., 15 minute condition) had lower levels of focus of attention as they worked on the task until they received the change in their deadline. After their deadline changed, they experienced a pronounced increase in their focus of attention during the last quartile compared to the early and middle conditions. On the other hand, teams that experienced the deadline change earlier in their workflow exhibited a more steady-state focus of attention (See Figure 2). Thus, Hypothesis 2 is supported.

Since creativity is an iterative process unlike pacing and focus of attention, analyzing the pattern of creative process across four time periods is not as meaningful. Rather than observing patterns of creative process across time, we argue that focusing on how the teams’ creative process changes in response to deadline changes is the more central issue. Therefore, creative process ratings of teams were aggregated into 2 time periods: before and after the deadline change. Although there are no significant main effects of time ($F=1.154, p>0.05$) and treatment effects ($F=1.158; p>0.05$); as hypothesized the MANOVA tests of the interaction effect of time and treatment condition is significant (Roy’s largest root $F=3.557, p<0.01$) (See Figure 3). Specifically, repeated measures ANOVA tests indicate that for teams that received deadline changes in the 5th ($F=2.101, p>0.05$) and 10th ($F=0.189, p>0.05$) minute of their workflow, there were no significant differences between the creative processes before and after the change. However, for teams that received the deadline change in the 15th minute, there was a significant decrease in creative process ($F=5.276, p<0.05$). Therefore, Hypothesis 3 is partially supported.

These changes in team processes translate to differences in team creative performance. One-way ANOVA results indicate that there is significant between group differences ($F=6.381, p<0.01$). Specifically, a Tukey post-hoc comparison indicates that the creative performance of teams that received the constraint earlier on is significantly higher than teams that received the constraint during the last quartile ($p<0.05$). Similarly, teams that received the deadline change after 10 minutes of working had significantly better creative performance than teams that had the deadline change during the last quartile ($p<0.01$). However, there is no difference between the early and middle conditions, partially supporting Hypothesis 4.

The next set of hypothesis argues that creative process that occurs after the deadline change mediates the relationship between team processes (i.e. team time pacing and focus of attention) and team creative performance. To test for mediation, the bootstrapping technique suggested by Preacher, Rucker, & Hayes [16] was conducted with 5000 bootstrapping resamples. The results indicated that creative process after the deadline change did not significantly mediate the relationship between time pacing after the change and creative performance, since the 5% confidence interval of the bootstrapping technique included the zero value (-0.06-0.09). Hence, Hypothesis 5 is not supported. On the other hand, the effect of focus of attention that occurred after the deadline change on team creativity is significantly mediated by creative process after the change. The 5% confidence interval of the bootstrapping technique did not include the zero value (0.01, 0.30), providing support for Hypothesis 6.
One-way ANOVA results showed no significant differences among the three conditions in terms of TMS (F=0.05, p>0.05), failing to support Hypothesis 7. The interaction hypotheses were tested with hierarchical regressions on creative performance as the dependent variable. In order to test the interaction hypotheses, we considered time pacing and focus of attention that occurred after the deadline change. These measures are captured by averaging pacing and focus of attention scores for each 5-minute period that occurred after the deadline change. Prior to analysis, all the variables are grand mean centered. The analysis for Hypothesis 8 shows the main effect of TMS is significant (β=0.449, p<0.01), while the main effect of time pacing after the time constraint is received is not significant (β=0.060, p>0.05). The R² change with the addition of the interaction effect of these two is significant (R² change = 0.083, p<0.05). Hypothesis 8 is supported with a significant interaction (β=-0.460, p<0.05). The second hierarchical regression to test the interaction effect of TMS and focus of attention showed that both TMS (β=0.507, p<0.01), and focus of attention (β=0.121, p<0.05) after receiving the time pressure constraint have significant main effects on creativity (β=0.123, p<0.05). The interaction between TMS and focus of attention is also significant (R² change = 0.126, β=-427, p<0.01), providing support for Hypothesis 9. The interaction plots (See Figures 4 and 5) and the simple slopes test indicate that when level of time pacing is low, TMS has a positive significant effect on creative performance (t=2.00, p<0.05), however when time pacing is high, the effect of TMS on creative performance is negated (t=-1.17, p>0.05), providing support for Hypothesis 8. Similarly, when there is low focus of attention, the TMS-creative performance relationship has a positive significant relationship (r=3.95, p<0.05); while this relationship becomes insignificant with high levels of focus of attention (t=-1.5, p>0.05), supporting Hypothesis 9.

### 6. Discussion

This study demonstrates that moderate, steady state levels of time pressure are more beneficial for creative performance than more variable, pronounced levels of time pressure. Specifically, we found that when time pressure is experienced toward the end of a team’s workflow, it could significantly impede the teams’ collaborative processes and reduce team creative performance. Moreover, this research found that this reduction in creative performance may have occurred because these teams decreased their engagement in creative processes. The findings in this study are consistent with prior research that suggests disruptions cause teams to increase their focus on performance-related activities [22]. However, this research adds a critical dimension to this perspective by demonstrating that the nature of a team’s focus will vary depending upon when in their workflow the disruption is experienced.

From a practical perspective, this research can lead organizations to more effectively manage teams whose work is frequently disrupted by changes to deadlines and other external requirements, particularly teams whose work involves collaboration to solve complex problems and innovate. Where managers have discretion in such cases, all effort should be made to disrupt teams’ work earlier rather than later in their workflow. Also, managers should try to encourage a more steady state work flow for teams rather than having their work flow fluctuate dramatically during a project. Finally, the results of this research points to the detrimental effect of later deadline changes on creative performance. Managers may want to seriously consider avoiding doing this as much as possible if they are truly seeking creative work rather than more routine work.
Future research should further examine the issue of time pressures effect on creativity by looking at also what happens when individuals are given more time than they expect to work on a task. Also, work on the effect of other work pressures on creativity is needed. For example, the effect of additional or unexpected work pressure on creativity would be interesting to examine.

7. References


