FREEDOM FROM FREEDOM: THE BENEFICIAL ROLE

OF CONSTRAINTS IN COLLABORATIVE CREATIVITY

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Freedom from Freedom: The Beneficial Role of Constraints in Collaborative Creativity

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Early evidence shows that constraints enhance groups' performance. However, the literature is scant on how constraints support collaborative creativity while showing they undermine individual creativity. The creative process involves exploring novel possibilities widely. This dissertation examines how groups and teams leverage constraints to coordinate exploration in a creative process. Using time pressure as a focal constraint, this research suggests that group members use deadlines to pace their collaboration relying on organizational encouragement. Analysis provides strong empirical evidence supporting this argument. When helping behaviors are pervasive, leveraging the diverse skills and knowledge of group members accelerates the search for novel ideas. Examining the effect of another constraint, researchers have posited a negative effect of rewards on individual creativity when rewards restrict choice. This assumes a binary effect of choice: individuals are either absolutely free or absolutely controlled. An all or nothing view is counterintuitive given the motivating power of rewards. Reward criteria may help groups bound a consideration set of alternatives rendering a search more manageable. Results offer initial support for this hypothesis. Investigating heuristics and biases as constraints, research shows that entrepreneurs do not avail themselves of rational, risk-analytic methods to make decisions. Rather, they rely on error-prone heuristics and biases as simplifying mechanisms to make fast decisions under conditions of uncertainty and ambiguity. Exploring how entrepreneurial teams use heuristics and biases to make challenging decisions that require a high level of creativity, analysis indicates teams leverage heuristics and biases in two ways: as sieves to winnow less promising ideas, and as tie-breakers to make a final selection from comparable ideas. Using a constraint-within-constraint approach, teams achieve creativity by exploring ideas widely while maintaining coherence through coordination. This research highlights the counter-intuitive importance of constraints for the creative work of groups. Contributions to the creativity and entrepreneurial decision making literatures are discussed.

DEDICATION

To Eleonore, Chloe and Talia

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who shared their experiences with me and helped me uncover wonderful insights throughout my research into entrepreneurship decision-making and mentoring.

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CHAPTER I

INTRODUCTION

My freedom will be so much the greater and more meaningful the more narrowly I limit my field of action and the more I surround myself with obstacles. Whatever diminishes constraint diminishes strength. The more constraints one imposes, the more one frees one's self of the chains that shackle the spirit.

Igor Stravinsky, *Poetics of Music*
Russian composer (1882 - 1971)

Creativity hinges on variation. Without variation, the novelty condition of creativity is not satisfied. In a given context, if an idea is not novel then it must have been already proposed, evaluated and either accepted or rejected. Therefore, for an idea to be novel, it must be differentiated from all other ideas used: *something* must be added or removed from it. This view is well supported in the literature. Campbell (1960) introduced the concept of blind variation and selective retention explaining that creativity results from the evolution of ideas in a Darwinian way. In introducing variation, groups have advantages over individuals working alone because group members introduce variation beyond what an individual can (Nijstad & Stroebe, 2006) Once new ideas are generated, they must be evaluated by stakeholders who stand to benefit when those ideas are successfully implemented. Supporting this view, the *Genplore* model (Finke, Ward, & Smith, 1992), *generate and explore*, suggests the creative process involves the generation of combinations of ideas and then exploring their potential (Simonton, 1999). This

evaluative component of creativity is necessitated by the usefulness condition of creativity (Amabile, 1997).

Infinite Variation is Problematic

Unlimited variation in the creative process poses a significant challenge: how does an individual behave when facing the task of evaluating many plausible options? How do group members behave in similar situations? Infinite variation is problematic in creativity for several reasons. Among them, the cognitive effort and time required for the evaluation task increase in proportion to the number of ideas generated. Cognitive effort and time are not unlimited which leads to the "tyranny of freedom" (Schwartz, 2000). Too many choices can be detrimental to individual motivation (Iyengar & Lepper, 2000) – a key antecedent to creativity (Amabile, 1997) – leading to paralysis, poor choices and dissatisfaction with even good choices (Oulasvirta, Hukkinen, & Schwartz, 2009). Moreover, to the extent that variation introduced in a group setting departs significantly from an individual's domain-related prior knowledge, schemas or values, this may violate individuals' need for a predictable and structured environment, overwhelming them (Rietzschel, Dreu, & Nijstad, 2007). Additionally, the search for variation involves discovery and learning by "exploring the cognitive maze" (Amabile et al., 2002: 15). Exploring requires learning about the variants to understand and evaluate them. Thus, while a high degree of variation is desirable for the creative process, too much variation is problematic. Variation alone does not lead to creativity unless the variation introduced is bound in some way.

Constraints as Sieves of Variation

Constraints present a plausible mechanism to manage infinite variation in the creative process particularly in a group setting. Individuals manage complexity by resorting to simplifying strategies (Tversky & Kahneman, 1974). Thus, to the extent that constraints reduce

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the number of alternatives, constraints aid simplification. Furthermore, when attempting to solve problems, experts start by narrowing down possibilities (Chi, Feltovich, & Glaser, 1981). In the arts, there is evidence that constraints lead to creativity as well (Stokes, 2008). Stravinsky once said: "…my freedom will be so much the greater and more meaningful the more narrowly I limit my field of action and the more I surround myself with obstacles…The more constraints one imposes, the more one frees one's self of the chains that shackle the spirit (Barron, Montuori, & Barron, 1997)." From a different perspective, Simonton (2000) posited that the process of scientific creativity follows a constrained stochastic behavior. Different domains place different constraints on creativity. Scientists working on normal science are highly constrained by a given paradigm whereas those working on revolutionary science "replace old restrictions with entirely new constraints." He suggested that since a problem space is defined by constraints, scientific creativity is required when problem spaces are ill-defined compelling scientists to rely on heuristics, as constraints may be vague and unstable. Even in revolutionary science, scientists seek new constraints to replace the ones they threw out. Thus, constraints are necessary for creativity. Bounding variation allows group members to simplify the evaluation task by focusing the cognitive effort on a finite number of alternatives, the consideration set. For example, workplace routines are a form of constraint. Routines are "repeated patterns of behavior that are bound by rules and customs and that do not change very much from one iteration to another (Feldman, 2000: 611)." Help-seeking and help-giving can be imbedded in an organization's routine leading to more group creativity outcomes because routines facilitates the interaction between help-seeker and help-givers (Grodal, Nelson, & Siino, 2015; Hargadon & Bechky, 2006). It follows that constraints may be useful in explaining the group creative process.

Group Creativity Research Inadequate.

At the group level of analysis, creativity has received little attention from organizational behavior scholars (George, 2007; Gilson & Shalley, 2004; Hargadon & Bechky, 2006; Kurtzberg & Amabile, 2001; Shalley, Zhou, & Oldham, 2004). Yet, definitions of creativity suggest a group process. For example, Stine (1953: 311) defines creative work as "a novel work that is accepted as tenable or useful or satisfying by a group in some point in time." Similarly, Woodman, Sawyer and Griffin (1993) define it as "the creation of a valuable, useful new product, service, idea, procedure, or process by individuals working together in a complex social system." In her seminal review, George (2007) observed: "Perhaps what is most striking about the literature on group creativity is how much we currently do not know about the creativity of ongoing groups in organizations." In striking contrast, the extensive corpus of research on individual creativity keeps growing systematically (Zhou & Shalley, 2008).

This imbalance of attention favoring the individual over the group level of analysis on creativity is glaringly inadequate for three reasons: First, creativity is a social process (Zhou & Shalley, 2008). There is increasing acceptance that creativity is a group-level phenomenon as creative individuals often collaborate with others rather than work alone (Hargadon & Bechky, 2006). This should not surprise us since a vast majority of human beings belong to some group: a family, a school, a company, etc. In fact, Csikszentmihalyi (1996) asserts "…an idea or product that deserves the label 'creative' arises from the synergy of many sources and not only from the mind of a single person." Importantly, organizations are increasingly relying on flexible, team-based structures (George, 2007; Kozlowski & Bell, 2003; LePine, Piccolo, Jackson, Mathieu, & Saul, 2008) such as the matrix structure (Miles, Snow, Meyer, & Coleman, 1978) and virtual teams (LePine, Piccolo, Jackson, Mathieu & Saul, 2008). Second, within organizations,

collaboration is a necessity driven by increased complexity and an ever-growing need for specialization (Drazin, Glynn, & Kazanjian, 1999). Third, some scholars regard the notion of individual creativity – that of the lone genius – as a myth (Montuori & Purser, 1995; Uzzi & Spiro, 2005). Thus, investigating creativity at the individual level alone obscures a richer and more comprehensive understanding of this intriguing phenomenon.

A better understanding of group creativity inputs and processes is of critical importance to organizations. Creativity is said to be "the first step to innovation" (Amabile, 1997) and an antecedent to innovation (Gilson, 2008). Innovation is seen as a source of competitive advantage (Ford & Gioia, 2000), long-term corporate success (Amabile, 1997) and a driver of economic and business value (Van de Ven, 1986). In a 2010 IBM survey, more than 1,500 chief executive officers from 60 countries and 33 industries selected creativity as the "most crucial" requirement for "successfully navigating an increasing complex world" (America, 2010). Creativity is also important and beneficial because it has the potential for creating durable value for organizations (George, 2007). When organizations harness the collective creativity of many individual contributors, they increase their potential for delivering innovation which in turn enhances their value to stakeholders.

Yet Hargadon and Bechky (2006: 494) describe collective creativity as "a rare and fleeting phenomenon even in the most creative of organizations." Hence, research that deepens our understanding of group creativity would be useful particularly if it offers insights that lead to more predictable group creative performance.

Neglecting Group Creativity is Problematic

Our limited understanding of group creativity is problematic. Recent research into the complex interactions within groups disputes the generalizability of individual creativity

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assumptions to the group level of analysis. For example, Grodal and colleagues (2014) challenge key individual creativity assumptions in the literature. They argue that creativity ought to be understood from an interdependent process perspective rather than that of an abbreviated exchange because creative behaviors involve multiple individuals through extended encounters. Similarly, Harrison and Rouse (2013) convincingly challenge the individual-level assumption that constraints generally impede creative work. They highlight the complexity inherent in creative work and that constraints serve "the need to coordinate individuals as a cohesive group". In other words, constraints may have different effects at the group and individual levels of analysis.

Consequently, an individual perspective of what is essentially a group process may produce distorted findings that impede the progress of scholarly research. Perry-Smith (2006) suggested that researchers should consider "the broader social contexts of social relationships" when studying creativity. Using diversity research as an example, George laments, "even things we thought we might have known (e.g. diversity in groups fosters creativity) are much more nuanced than commonly thought (2007)." Thus, a focus on individual rather than group creativity severely impairs our understanding of the creative process and "may result in unintended omissions of important features" (Perry-Smith, 2006).

Green Shoots

Despite the scarce attention to group creativity in the literature, a number of scholars have taken the initial steps of proposing models that begin to lay the ground work for promising theoretical foundations in the collaborative creativity stream of research. While these and more recent models have advanced our understanding of group creativity, they fall short of fully explaining the group creative process. Moreover, none of the models reliably predict group

creativity. In this thesis, I propose that the collaborative creativity process necessarily requires 1) the introduction of variation, and 2) the adoption of appropriate constraints which serve to delineate group members' consideration sets of variants; thus coordinating their collaboration, and 3) a method or a process for negotiating and reconciling various constraints introduced by individual group members, the group context, and the actor-context interaction (Zhou & Hoever, 2014). All three models, Hargadon and Bechky's (2006) collective creativity model, Csikszentmihalyi's (1988, 1990) systems model of creativity and Campbell's (1960) variation-selection model, suffer from the problem of dealing with infinite variation possibilities. Some, as in the systems model, imply the role of constraints (through domain) but do not explicitly address it.

In Hargadon and Bechky's (2006) model, a puzzling aspect of *helping* is the seemingly infinite possibilities facing the help-seeker and help-givers. This is particularly challenging under conditions of high ambiguity where the help-seeker has few, if any, clues to follow. The challenge is twofold: 1) It's not clear how the help-seeker selects the first help-giver or the next. Perhaps help-givers are selected based on convenience: they happen to be members of the same organization (constraint is organizational membership) or serendipitously located in the same physical area (constraint is locale), 2) How does the help-seeker convey – and the help-giver process – the type, magnitude, substance and duration of the help? A similar rationale applies to Csikszentmihalyi's (1988, 1990) systems model of creativity – where the individual introduces variation – and Campbell's (1960) variation-selection model – where variation is blind. It is unclear how individuals deal with the challenge of infinite possibilities of variation.

RESEARCH TOPIC

Groups are made of individuals who interact with one another and contextual factors to produce creative ideas. One intriguing area of inquiry has to do with group processes through which creative ideas are born. In this dissertation, I attempt to responds to Hargadon and Bechky's call for future research (2006: 497) and examine conditions that interact with help-giving and help-seeking "to induce or suppress subsequent reflective reframing" leading to less fleeting and more repeatable moments of collaborative creativity. Specifically, my purpose is to answer the following question: How do constraints trigger creativity within a group? This dissertation also responds to future research directions proposed by Zhou and Hoever (2014) to understand actor-context interactions in workgroup creativity. For this dissertation, I investigate how novel and useful ideas are produced and selected in a group context using three papers as follows:

The first paper challenges the current individual-level understanding that constraints, specifically time pressure, inhibit creativity of groups. Using unique data obtained from the Center for Creative Leadership (CCL), I report evidence that time pressure fosters creativity of groups. In addition, I conduct an experiment to corroborate results. Prior research suggests organizational encouragement is a relevant mediator.

In the second paper, I use a qualitative approach (Gioia, Corley, & Hamilton, 2012) to explore how entrepreneurs make decisions in which many alternatives are constrained and then evaluated. In examining the potential constraints used in this context, I draw on Gigerenzer and Gaissmaier (2011) recent review of heuristics. In the third paper, I empirically investigate the effect of reward choice and task choice on group creativity.

CHAPTER II: PACING GROUP CREATIVITY: THE COUNTERINTUITIVE BENEFITS OF TIME PRESSURE

ABSTRACT

Although early evidence suggests that constraints (e.g. time pressure, rules) may actually enhance group creativity, little is known regarding how constraints exert this beneficial effect. We argue that team-member encouragement is one critical mechanism through which constraints positively influence group creativity and whether the resulting creativity helps or harms performance. Using field and experimental data, we find evidence largely supporting this idea. Our results contribute to the group creativity literature by highlighting a mechanism through which constraints enable group creativity and ultimately group performance. We discuss how our results may highlight the counter-intuitive importance of ambitious deadlines for creative work of groups.

INTRODUCTION

In organizations, time pressure is omnipresent while creativity is "rare and fleeting" (Hargadon, & Bechky, 2006: 494). The prevailing view in the literature is that time pressure kills creativity (Amabile, 1998, 1997; Amabile et al., 2002; Conti, Coon, & Amabile, 1996). This implies that the elimination or significant reduction of time pressure is a necessary condition for creativity to flourish. As desirable as this might be from an individual perspective, it is rather unrealistic. That is because in organizational contexts, individuals typically find themselves embedded in groups replete with constraints. Moreover, employees and entrepreneurs alike typically face conditions in which they do not have the power to alter the time constraints imposed on them. While we may be able to negotiate deadline extensions now and then, we usually have no choice but to accept time constraints or suffer unpleasant consequences. Individually and collectively, we must often keep multiple projects on track by meeting numerous deadlines and managing critical path dependencies. Yet we know people produce creative ideas in spite of the time pressure they face. Thus, we re-examine the effects of time pressure on creativity at the group level of analysis to understand how creativity is possible under these conditions. Our research addresses an important topic as relatively little research has been pursued to understand the role of perceived impediments on collective creativity (Amabile et al., 1996).

In this paper, we depart from extant research in two important ways: 1) we reject the general assumption that constraints such as time pressure are detrimental to creativity (Stokes, 2008; Barron, Montuori & Barron, 1997; Harrison & Rouse, 2013, Grodal, Nelson & Siino, 2014), and 2) we use a group rather than an individual perspective of the creative process. Specifically, we propose that when organizational encouragement is strong, time pressure leads

to enhanced creativity by providing benefits that become salient only in the context of groups and collaboration. Several types of constraints have been linked to creativity including time pressure (e.g. Amabile, 1983), rules (e.g. Harrison & Rouse, 2013), norms (e.g. Goncalo, Chatman, Duguid, & Kennedy, 2014), rewards (e.g. Amabile, 1983, 1996), etc. (Grodal, Nelson & Siino, 2014). Shining a spotlight on time pressure and its relation to creativity is appropriate and meaningful (Amabile et al., 2002). Regardless of size, focal market or profit orientation, organizations face numerous deadline-driven events from the moment they are formed. These events create time pressure and include regulatory compliance events, tax-related events, product life cycles, hiring seasons, trade shows, client budgets and purchasing cycles and others (Amabile, DeJong, & Lepper, 1976; Ancona, Goodman, Lawrence, & Tushman, 2001).

Creativity, defined as those ideas or outcomes that are both novel and useful (Amabile, 1983), is critical to organizations as it drives their long-term success (Amabile, 1997) and economic value (Elsbach & Hargadon, 2006; Van de Ven, 1986). Creativity is said to be the initial step towards innovation (Amabile, 1997) and a key antecedent to innovation (Gilson 2008). Much of the extant research on creativity in the workplace has been conducted at the individual level of analysis. For decades, psychologists focused on studying the personalities of people who were perceived to be creative (Amabile, 1983). This was followed by a period in which Amabile and others explored how social and environmental factors affect individual creativity (Amabile, 1983, 1996). Thus, for nearly half a century researchers have focused on understanding creativity from a predominantly individual perspective. However, many organizations are increasingly using team-based structures (LePine et al. 2008; Kozlowski & Bell 2003; George 2007) and virtual teams (LePine et al. 2008). Thus, we argue that examining workplace creativity at the group level is more appropriate today. Furthermore, it is unrealistic to

expect a single individual to undertake the increasingly monumental task of producing creative outcomes alone even in the simplest of organizations. This study responds to Zhou & Hoever's (2014) call for research to further understand actor-context interactions in workgroup creativity and to a call for research into "mechanisms of environmental impact" on creativity (Amabile, Mueller, Simpson, Hadley, Kramer & Fleming, 2002: 17). In doing so, we contribute to the nascent but expanding literature on group creativity in several important ways. First, by challenging the assumption that constraints broadly undermine creativity (Amabile, 1983; 1996), we explore a mechanism through which time pressure may promote rather than prevent group creativity. We suggest that constraints enhance creativity by enhancing team-member encouragement. Thus, we make an important contribution towards a better understanding of the actor-context interactions. Second, we extend the componential model of creativity (Amabile, 1983) from the individual to the group level of analysis and provide the first empirical evidence in support of the positive effects of time pressure on intrinsic motivation as proposed by the modified componential model of creativity (Amabile, Mueller, Simpson, Hadley, Kramer & Fleming, 2002). The componential model of creativity was developed to ground creativity in social psychology. It originally proposed that creativity is the product of three components: task motivation (e.g. Attitudes toward the task), domain-relevant skills (e.g. Technical skills) and creativity-relevant skills and processes (e.g. Exploring new cognitive pathways). A modified view of this model includes time pressure as one aspect of the organizational environment (Amabile, Mueller, Simpson, Hadley, Kramer & Fleming, 2002).

Time Constraints and Structure

In organizations, there are tasks to be done and individuals who must complete these tasks more often than not in concert with others. Formal and informal structures indicate to

individuals how tasks are to be completed and how things generally get done (Tushman & Nadler, 1986). Moreover, the concept of organizing embodies structure and control to manage uncertainty and maximize predictability of outcomes. Scholars refer to structure as the complex relationships between "interpersonal cognitive processes, power dependencies, and contextual constraints (Ranson, Hinings, & Greenwood, 1980 from Weick, 1993: 645). Structuring consists of shared meaning and frameworks of constraints. Shared meaning creates interpretive schemes which stabilize meaning through informal ways and interaction patterns. Frameworks reflect and facilitate meaning as they embody dominant meanings in a collective (Weick, 1993). Since structuring and frameworks are shared, structure can be viewed as having a controlling or constraining effect. That's because while individuals contribute to the constitution of structure through their interaction, they are not entirely free to act outside that structure if they wish to take advantage of the shared meaning benefits such as predictability.

While organizations derive control and predictability from structure and rules, individuals covet structure for similar benefits and to manage the unpredictability and stress resulting from an uncertain path to creativity. Evidence shows that personal need for structure (PNS), which refers to individuals' aversion to ill-structured situations and need for certainty and predictability, only hampers creative output when it is coupled with high fear of making invalid and incorrect judgments and decisions; a condition typically associated with authoritarian leadership. When fear of invalidity is low, personal need for structure promotes creative performance. The reason for this is that in situations that call for creativity, "well-known schemas do not apply, and it is not at all clear what strategy or behavior will yield an acceptable outcome" (Rietzschel et al., 2007: 855). Given the uncertainty this creates, some individuals may become confused and experience stress because their general need for a predictable environment

is violated. This implies that some constraints such as time pressure – whether external or self-imposed – may be helpful, or even necessary, for creative behavior to occur. Specifically, group members use time and deadlines to organize and coordinate individual members' tasks and activities so that their collaboration yields the desired outcomes.

Time Constraints and Coordination

Given that organizations and individuals have a need for structure, it is not surprising that some researchers have questioned reported detrimental effects of time pressure on creative group work. Indeed, time pressure has been shown to help group members coordinate. By providing boundaries, time pressure shepherds group members' interaction so as to avoid group disintegration into chaos (Harrison & Rouse, 2013) due to the de-integrative force of individual free choice or the dissensus that emerges when individuals disrupt group coordination patterns (Barker, 1993; Van Dyne & Saavedra, 1996). Moreover, under conditions of complete freedom to explore, individuals revert to the familiar to alleviate the cognitive complexity of searching for and evaluating too many options (Elsbach & Hargadon, 2006; Stokes, 2008; Finke, 1990, Finke, Ward & Smith, 1992). Finally, as counterintuitive as might be, the notion that constraints generally impede creativity has been also questioned in research that examined work standardization (Gilson, Mathieu, Shalley, & ruddy, 2005), routinization (Ohly, Sonnentag, & Pluntke, 2006), and customer innovation (Moreau & Dahl, 2005). Thus, although it flies in the face of common-sense, is it possible that time pressure helps group members quickly discard familiar ideas, coordinate their collaboration through the pacing of member activities and sharpen the group's focus on the most promising ideas?

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Organizational Encouragement and Helping Behavior

As workgroups are embedded in organizational contexts, we follow the guidance of Zhou and Hoever (2014) to explore organizational encouragement as a contextual antecedent and draw on the helping behavior literature. While its value to creativity is well documented in the literature, organizational encouragement takes on added importance under time pressure. Creativity can by encouraged primarily through supporting the generation and evaluation of idea variants. This is done by consistently encouraging risk taking, demonstrating fair evaluation of ideas, rewarding idea generation and encouraging collaborative idea flow (Amabile, Conti, Coon, Lazenby & Herron, 1996). These factors encourage creative output because they introduce group members to "a greater variety of unusual ideas (Amabile, Conti, Coon, Lazenby & Herron, 1996: 1160). Under time pressure, supervisors play a critical role in encouraging creativity as they provide initial problem definition and framing without which groups must expend precious time to define and frame a problem. In a workgroup, promoting openness to new ideas can enhance creativity. Pressed for time, a group leverages its members' knowledge bases quickly and efficiently. Due to increased specialization, group members bring to a creative collaboration a repository of explored and evaluated alternatives. For example, in the Mann Gulch tragedy, a foreman survives the inferno by starting a small fire and lying over the ashes. At the time, this was a novel technique that he had learned during prior to the tragedy (Weick, 1993). In terms of idea generation and evaluation under time pressure, groups therefore start the creative process with a distinct advantage over any of their individual members.

More recent studies on contextual antecedents of collaborative creativity – which refers to creativity that results from the collaboration of two or more individuals – are scant (Zhou & Hoever, 2014). Nevertheless, several studies suggest a promising direction (Hargadon & Bechky, 2006; Harrison & Rouse, 2013; Goncalo, Chatman, Duguid & Kennedy, 2015; Grodal, Nelson &

Siino, 2014). One study suggests ways to extend the componential model of creativity (Amabile, 1983, 1988; Amabile, 1996; Mueller et al., 2000) using a collective creativity perspective around help-giving, help-seeking, reflective reframing and reinforcing behaviors. Under time pressure, this helping behavior, where individuals pool their varied domain-relevant skills, may explain why collaborating group members stand a better chance of producing creative work than any individual alone (Hargadon & Bechky, 2006). Another study shows that creative groups impose initial constraints, which help group members coordinate their creative process using helping behaviors (Harrison & Rouse, 2013). Yet another study found that in mixed-sex groups, political correctness constrained idea generation such that group members generated ideas that were not offensive to opposite sex members (Goncalo, Chatman, Duguid & Kennedy, 2015). Lastly, a study found that helping behaviors unfold over time as a routine collective process, not as costly exchanges, shaped by the work context in which the interactions are embedded (Grodal, Nelson & Siino, 2014). This is important because it represents a significant savings of time. When help is readily available and norms show how this help can be leveraged in collaboration, individuals can focus on integrating their diverse knowledge. In contrast, when help is available but an individual seeking this help must first explain why it is needed and justify the opportunity cost to the help-giver, a great deal of time may pass. (Harrison & Rouse, 2013) These studies suggest that contextual antecedents such as organizational encouragement enhance creativity by operating in significantly different ways at the group level compared to those at the individual level.

Thus, working under the same condition of time pressure, group members enjoy advantages not available to individuals working alone. Moreover, time pressure has also been found to motivate individuals (Amabile, 1996) to double their effort and look for unusual

solutions (Campbell, 1960). We therefore propose that while time pressure undermines individual creativity, enhances group creativity.

On one hand, there is evidence in the literature that imposing time restrictions (Amabile & Gitomer, 1984) negatively impacts creativity because 1) time pressure restricts the amount of time individuals can spend exploring and reflecting on creative ideas, 2) it limits the search space or domain leaving fewer alternative ideas to be evaluated, and 3) it forces individuals to fall back on familiar routines thereby sacrificing exploration of novel input which curtails the creative potential. Thus, the negative effect of time pressure is generally attributed to limiting the individual's ability to introduce variation into the creative process.

On the other hand, there is evidence in the literature that time pressure positively affects group creativity because 1) while deadlines restrict the amount of time individuals can spend exploring and reflecting on creative ideas, group members use deadlines and time as coordination mechanisms to pace their collaboration (Gersick, 1989, 1994), 2) time pressure limits the search space or domain allowing group members to focus their shared effort – another coordination mechanism – and leverage members' diverse knowledge stores, and 3) helping behaviors and routines help group members integrate and build on each others' contributions which steers a group away from the tried and proven. In this paper, we set out to resolve this paradox (Mainemelis, 2010) in extant research around time pressure by exploring its effects on creativity in the context of groups.

THEORETICAL FOUNDATIONS

Time Pressure

In this section, we explain how constraining time – using deadlines or high workload – influence the creative process. We then review research that relies on the threat-rigidity thesis to

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support the view that time constraints negatively affect individual creativity. This has been the predominant view as noted earlier. Next, we review the few studies that have found evidence of a negative relationship between time pressure and creativity. For these studies, we point out how authors of these studies narrowly measured creativity in ways that question the generalizability of their findings. We synthesize the literature and conclude that some of these problematic issues can be reconciled by examining creativity as a collaborative group process and not as an individual endeavor. Since creativity is a collaborative process, it follows that collaborating group members need to coordinate their interactions. As much as time pressure is loathed, it offers valuable coordinating benefits as we show in this paper

In Search for Variation

Without the introduction of variation creativity is not possible because the novelty condition requires departure from status quo (Campbell, 1960; Simonton, 2003). Searching for variants can be an arduous task. Researchers have long established that creativity requires time to explore as many variants or alternative ideas as possible (Ruscio, Whitney, & Amabile, 1998), to do so by considering the "maze of available cognitive pathways" (Amabile et al, 2002, p. 3), to allow the most promising of those variants to incubate unconsciously (Lubart, 2001), to reframe the original problem (Getzels & Csikszentmihalyi, 1976; Hargadon & Bechky, 2006) and even to set aside the creativity task and forget about it for a while to circumvent mental blocks and find new approaches (Lubart, 2001; Smith, Dodds, Smith, & Dodds, 1999). More specifically, researchers have attempted to model creativity as a multi-step process that requires significant periods of dedicated time. It has been suggested that creativity proceeds through the steps of preparation, incubation, illumination and verification or through the steps of problem or task identification, preparation, response generation, then response validation leading to a decision to

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stop or repeat the process (Amabile, 1996). Taken together, extant research suggests creativity is a complex process that demands a considerable time investment on part of an individual. It follows that curtailing the amount of time necessary for creativity to germinate will necessarily hurt an individual's creative outcome.

While creativity has been hypothesized to require time, most of us suffer from what has been coined by (1999) as a time famine. If time is already scarce, and the creative process requires much time, it stands to reason that individuals struggle to be creative. Consequently, researchers have long warned of the detrimental effects of time constraints on creativity (Amabile, Conti, Coon, Lazenby & Herron,1996; Amabile 1979; Amabile, Hadley & Kramer, 2002). This is because individual employees need wide latitude to search and explore creative ideas. Employees also need to allow for idea incubation and reflection. These activities and processes thrive in contexts where restrictions are low and individuals are free to explore widely. By limiting employees' ability to engage in these activities, time restrictions, deadlines and workload pressure create time pressure which constrains individual creativity (Amabile, 1996).

As we show next, the predominant view in the literature is that time pressure negatively affects individual creativity (Harrison & Rouse, 2013). Explaining the adverse effects of time pressure on creativity, researchers have drawn on the threat-rigidity thesis (Staw, Sandelands, & Dutton, 1981) suggesting that when time pressure is perceived as a threat, individuals restrict cognitions, limit their search of new variants and narrow their response range to that which has been tried and proven. Consistent with this thesis, the componential theory of creativity (Amabile, 1996) posits that time pressure directly undermines the cognitive processes necessary for creativity. Indeed, in a longitudinal field study, empirical evidence supported the negative direct effect of time pressure on individual creativity (Amabile, Mueller, Simpson, Hadley,

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Kramer & Fleming, 2002). These authors found that employees reported as few as half the creative ideas they would produce absent interruptions, workload and time pressure. When creativity was evident, employees enjoyed periods of focus with limited collaboration and time pressure was interpreted as meaningful urgency. Since situations in which these conditions prevail are not the norm in organizations, Amabile and colleagues concluded that time pressure hinders creativity.

Under time pressure, employees resort to familiar routines, heuristics and past experience which limit creativity (Gilson & Shalley, 2004). That is to say, individuals dramatically reduce or stop their search for variation. Self-reported creativity also suffered during times when workload pressure was increased by corporate downsizing (Amabile & Conti, 1999). These results were confirmed in a four-year study (Perlow, 2001) and using a narrow definition of creativity, creative time pressure, where creative time was defined as the time allocated to creative activity (Baer & Oldham, 2006). Examining why creative output suffers in contexts of high-workload pressure, some researchers have proposed that employees are unable to schedule blocks of free time or brainstorming time to pursue creative tasks around the search for novelty (Elsbach & Hargadon, 2006). Taken together, the literature offers ample evidence of a direct negative effect of time pressure on individual creativity (Amabile, Mueller, Simpson, Hadley, Kramer & Fleming, 2002).

Consistent with the componential model of creativity, we accept that time pressure negatively affects an individual's ability to search broadly for variation to generate responses to problems or new ideas. In a group context, however, we suggest that time pressure does not affect the creativity of groups in the same way it affects the creativity of an individual working alone. That is because 1) while a group may be under time pressure, group members can conduct

as many parallel searches for new ideas as there are group members. This pooling of resource allows groups to distribute the search task across their members thereby significantly increasing the group's odds of success relative to that of any one individual. 2) An implicit assumption of the componential model of creativity is that individuals start the search task from scratch – that is, they have not previously explored variation related to the problem at hand. While this may be true for some individuals, it is possible that other group members may have done some exploration prior to the formation of the group to tackle the creativity task. Alternatively, even if individuals have not previously explored such variations, doing so in collaboration with others can be done effectively and efficiently. In organizations and startups, individuals are recruited for the special skills, experience or knowledge they bring. As such, we suggest that in the pursuit of creativity groups have a significant advantage over individuals in that they can 1) leverage the exploration of variation that has been attempted by some members prior to joining the group, and, 2) efficiently explore variation in collaboration with the skilled members of their groups.

Time Pressure and Intrinsic Motivation

Time pressure destroys creativity because it undermines intrinsic motivation (Amabile, Mueller, Simpson, Hadley, Kramer & Fleming, 2002). When an individual is under time pressure, she is compelled to perform the creativity task in response to the external pressure of time. Feeling controlled, she is much less likely to be interested in doing it at a deeply engaging cognitive level. Thus, the role intrinsic motivation plays in the creative process of individuals is undeniable. Surprisingly, researchers have found a strong positive relationship between time pressure and intrinsic motivation but not a significant relationship between intrinsic motivation and creativity (Amabile, Mueller, Simpson, Hadley, Kramer & Fleming, 2002; Shalley & Perry-Smith, 2001). Thus, the mediating effect of intrinsic motivation on the time pressure creativity

relationship was unsupported. This suggests, "constraints in the work environment may synergistically add to – rather than detract from – intrinsic motivation in some contexts" (Amabile, Mueller, Simpson, Hadley, Kramer & Fleming, 2002: 17). In fact, a modification to the componential theory of creativity to allow for "propositions of both negative and positive effects of time pressure on intrinsic motivation" and "an indirect effect through some other mechanism" has been suggested (Amabile, Mueller, Simpson, Hadley, Kramer & Fleming, 2002: 17) while others have called for further research to better understand the effects of intrinsic motivation on creativity (Rietzschel, Slijkhuis, & Yperen, 2014). To summarize, we question an indirect negative effect of time pressure on creativity.

Some researchers have reported positive effects of time constraints on individual creativity (Amabile, 1996, 1983; Amabile et al., 2002; Getzels, 1975). One explanation of these positive effects might be that individuals exhibit time-based differences such that time pressure is an externally imposed constraint, while time urgency is a self-imposed or group-imposed (internal) constraint (Mohammed & Harrison, 2013). This view is consistent with the use of time as an organizing structure that supports the coordination of group members. For example, temporal pacing suggests that groups use time as a heuristic for structuring their work process by deciding how long to give one framework a chance before trying another (Gersick, 1988; 1991 & 1994). Using time as a pacing mechanism is consistent with recent studies exploring the helping behavior and coordination in organizations (Harrison & Rouse, 2014; Grodal, Nelson & Siino, 2014). Indeed, evidence shows that punctuated equilibrium (Gersick, 1988) explains how teams welcome the generation of novel ideas up to the mid-point of a project. After the mid-point, novel ideas are seen as disruptive as the group focuses all its resources on meeting the project objectives on time (Ford & Sullivan, 2004).

Thus, while research suggests that *individual* creativity may suffer as a result of imposing time constraints on individuals, *group* creativity may thrive if time pressure complements the autonomy of group members by helping members coordinate their interactions (i.e. through pacing and time allocation). Thus, we predict the following:

Hypothesis 1: Constraints positively influence group-member encouragement.

Organizational Encouragement

Organizational encouragement has been cited as an important contextual factor affecting creativity. Organizations encourage creativity in a number of synergistic ways when managers support idea generation and risk taking, foster a collaborative and open flow of ideas within a shared vision, evaluate ideas fairly, recognize and reward creative effort, and involve employees in making decisions.

Management's support of idea generation and risk taking is particularly essential for creativity. Exploring novel ideas and proposing them not only takes time and effort, it requires that employees develop an appetite for risk and accept that some ideas if not most are likely to fail to deliver creative outcomes. Taking risks and failing can adversely affect employees' career and promotion prospects. Unequivocal support for creative endeavors is therefore crucial. Indeed, evidence shows strong support for creativity is the best predictor of innovation, accounting for 46% of the variance in overall innovation in a study of top management teams (West & Anderson, 1996). Employees therefore hesitate to engage in creativity when support for it is dubious or inconsistent. Groups sometimes include leaders who can be either transformational or authoritarian. Empirical evidence shows that group knowledge sharing and collective efficacy mediate the relationship between leadership style and group creativity such that transformational leaders positively affect group creativity while authoritarian leaders

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negatively affect it (Zhang, Tsui, & Wang, 2011). Transformational leaders tend to encourage collaboration, support subordinates in developing creativity-relevant skills and promote an encouraging environment. With encouragement perceived risk is not seen as a liability and support buffers against failure. In a group context, those who are less risk averse encourage the more risk averse members.

Organizational encouragement also suggests an environment in which management promotes a culture of collaboration and open idea communication. Collaboration for the purpose of achieving a collective performance includes direct information sharing, acknowledging and aligning work and creating a common perspective (Okhuysen & Bechky, 2009). Empirical evidence shows that when individual employees are not encouraged to collaborate, they do not seek help from each other and creativity is unlikely. When they work in a culture that reinforces collaboration for creativity, people seek and give help to one another increasing the likelihood of creativity (Hargadon & Bechky, 2006). In addition, there is evidence that when help-seeking and help giving are pervasively embedded in organizational routines, "the helping routine serves to enable and support creativity (Grodal, Nelson & Siino, 2012: 38). The availability of routine helping behaviors in an organization signals to employees that novelty can be explored quickly and efficiently with colleagues with diverse skills and knowledge. Thus, employees seeking creative ideas are not limited to their individual resources, they leverage and build on the knowledge and ideas of others. Consistent with this view, coordination is a requisite mechanism for collaborative work in organizations. One of the critical elements of coordination is the anticipation of the actions and needs of others (Rico, Sánchez-Manzanares, Gil, & Gibson, 2008: 164). Anticipating the actions and needs of others is necessary if one is ready to support and encourage them to accomplish their tasks. This requires that employees in an organization not

only have a common understanding (Okhuysen & Bechky, 2009) but that they respect the boundaries set by this common understanding while searching for novel ideas or helping their colleagues in other ways.

Using time as a coordinating mechanism is natural. Groups pace their collaborative work by budgeting time for problem framing, search and evaluation of tentative solutions (Ford & Sullivan, 2004; Gersick, 1991). Coordinating under time pressure yields similar benefits for group creativity. In a study of SWAT teams, preplanning and training limited task assignment which allowed team members' to improvise creatively under extreme time pressure (Bechky & Okhuysen, 2011). In contrast, working in a culture weak in supportive behaviors, employees showed a linear negative trend for the relationship between creative time pressure and creativity (Baer & Oldham, 2006; Zhou & Hoever, 2014). From a social entrainment perspective, which refers to adaptation of an internal group rhythm or behavior in response to an external temporal process, evidence shows that external conditions, such as time pressure, pace group behavior leading to less disagreement among group members who work harder or faster (Kelly & McGrath, 1985). This suggests that through organizational encouragement and a culture of helping behaviors, groups under time pressure need only adjust their pace. In contrast, under similar time pressure, groups in environments characterized by weak or moderate encouragement must not only adjust their pace but must also persuade others to go against cultural norms and help them while risking their career. Taken together, research suggests that while organizational encouragement is important for fostering individual creativity in general, it is fundamentally more important to group creativity under time pressure as it enables group members to pace themselves and coordinate under time pressure. We therefore predict the following:

Hypothesis 2: Group-member encouragement positively influences team creativity.

Hypothesis 3: Constraints positively influence performance through the mechanisms of team-member encouragement and then team creativity.

Hypothesis 4: Constraints positively influence performance through the mechanisms of team-member encouragement followed by team creativity and then team productivity.
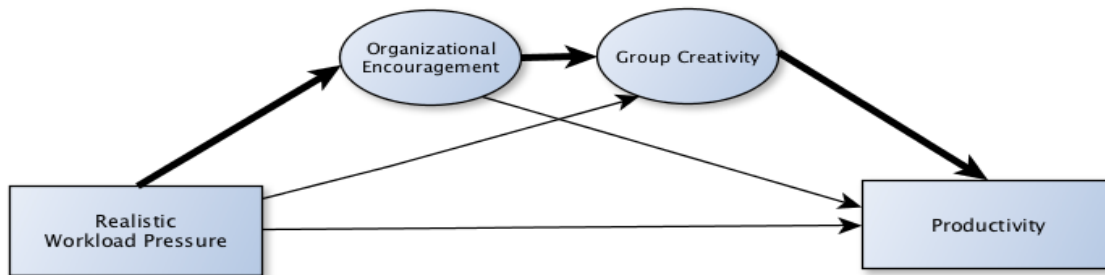
Figure 1

METHODS

Study 1

Participants

This study is based on a sample of 253 work groups representing 1,863 employees, peers, supervisors, bosses and subordinates who participated in the Center for Creative Leadership's "KEYS to Creativity and Innovation" program from February, 2006 to February 2007 (Amabile, Burnside, & Gryskiewicz, 1999). Our sample consisted of 25.1% who were non-white and 47.8% who were female. The majority of participants were executives (24.5%) or upper middle managers (23.0%) with many holding a bachelors or graduate degree (63.5%). Our sample had a mean age of 44.8 years (SD=5.56) and a mean of 12 years of experience (SD=5.02). We aggregated the observations at the group level by averaging employee, peers, supervisors, bosses and subordinates who belonged to the same group.

Measures

Before Amabile (1988) developed the componential theory of creativity, the literature on creativity was dominated with research on individual differences that might explain creativity. Diverging from that stream of research, Amabile sought to explain creativity using motivational variables rooted in social psychology. The componential theory of creativity posits three factors that affect creativity in organizations at the individual level: 1) organizational motivation and orientation towards creativity and innovation, 2) resources available to employees, and 3) management practices. In line with Amabile, Mueller, Simpson, Hadley, Kramer and Fleming (2002), we use the KEYS workload pressure scale to measure time pressure. Developed by Amabile and the Center for Creative Leadership, the *KEYS: Assessing the Climate for Creativity* instrument (formerly known as the Work Environment Inventory) was designed specifically to measure factors that are likely to impact creativity in an organizational environment (Amabile, Conti, Coon, Lazenby & Herron, 1996). Renamed as simply KEYS, this scale includes a set of ten scales: six scales measure factors that promote creativity (freedom, challenging work, managerial encouragement, workgroup supports, organizational encouragement and sufficient resources); two scales measure factors that diminish creativity (organizational impediments and workload pressure) and two criterion scales (organizational creativity and productivity). KEYS has been validated with a high-tech company with over 30,000 employees in the United States and norms have been established for it based on another study of 78 groups in 50 different organizations and is widely used in creativity research (Mathisen & Einarsen, 2004). KEYS data is collected as follows: Several employees from a given organization individually complete the KEYS survey. These employees include a focal employee, peers, supervisors, boss, direct report,

observer and other. Using a unique identifier, each employee is identified by a project indicating the employee participated in the project in some capacity. Using this unique identifier, we aggregated the individual data to the group level to conduct our analysis.

For this study, we focus on the following variables:

Realistic work load pressure. Workload pressure was measured using five items (1 = Never, 4 = Always), which include: "I have too much work to do in little time" and "I feel a sense of time pressure in my work."

Organizational encouragement Organizational encouragement was measured using 15 items (1 = Never, 4 = Always), which included: "People are encouraged to solve problems creatively in this organization" and "new ideas are encouraged in this organization."

Group creativity. Group creativity was measured using six items (1 = Never, 4 = Always), which included: "My area of this organization is creative" and "I believe that I am currently very creative in my work."

Group Productivity. Productivity was measured using five items (1 = Never, 4 = Always), which included: "Overall, this organization is effective" and "My area of this organization is efficient."

Control Variables. As our sample is drawn from a broad cross section of US organizations, we controlled for age, education and work experience consistent with pervious creativity studies (Amabile, Barsade, Mueller, & Staw, 2005).

Results

For each measure, ratings were averaged across self, boss/superior, peer, direct report and others. Table 1 shows the descriptive statistics and correlations.

Table 1

Descriptive Statistics and Correlations.

Variables	M	SD	1	2	3	4	5	6
1. Workload pressure	2.39	0.19	(.77)					
2. Organizational encouragement	2.84	0.34	.74**	(.91)				
3. Group Creativity	2.92	0.33	.61**	.76**	(.84)			
4. Productivity	3.15	0.32	.59**	.82**	.70**	(.86)		
5. Age	44.05	7.70	.09	.07	.25**	-.06		
6. Experience (years)	12.05	5.02	.08	.04	.18**	.01	.31**	
7. Education (years in school)	18.34	3.60	.12	.09	.15**	.07	.11	-.02

Note. $N = 254$ groups. ** $p<.01$, * $p<.05$

Table 2

Indirect Effects of Workload Pressure on Group Creativity and Productivity.

	Group Creativity Indirect Effects of Organizational Encouragement	Productivity Indirect Effects of Organizational Encouragement & Group Creativity
Bootstrap estimate (a_1b_1 path)	.64*	.71*
Bootstrap *SE*	.12	.07
LL 95% CI	.41	.51
UL 95% CI	.88	.91
Bootstrap estimate (a_1db_2 path)		.17*
Bootstrap SE		.06
LL 95% CI		.07
UL 95% CI		.30
Bootstrap estimate (a_2b_2 path)		.07*
Bootstrap SE		.04
LL 95% CI		.00
UL 95% CI		.17
Direct Effects		
IV on mediator 1 (a_1 path)	1.32**	1.32**
IV on mediator 2 (a_2 path)		.31**
Mediator 1 on DV (b_1 path)	.59**	.54**
Mediator 2 on DV (b_2 path)		.22**
IV on DV (path c_1')	.31**	.19*

Note. $N = 254$ teams. Unstandardized regression coefficients are reported. Bootstrap sample size = 10,000. LL = lower limit; UL = upper limit; CI = confidence interval; IV = independent variable; DV = dependent variable; Mediator 1 = Organizational Encouragement; Mediator 2 = Group Creativity.
** $p < .01$, * $p < .05$.

We conducted regressions using Hayes' (2012) PROCESS macro for SPSS with 10,000 bootstrapping samples. Workload pressure predicted organizational encouragement ($b = .31$, $p < .01$) and organizational encouragement predicted group creativity ($b = .59$, $p < .01$), supporting hypotheses 1 and 2 respectively. Results also show that the indirect effect of workload pressure on group creativity through organizational encouragement is significant ($b = .64$, $p < .05$). The

confidence interval was .41 to .88, and did not include zero, supporting hypothesis 3. Hypothesis 4 predicted that organizational encouragement and group creativity mediated the relationship between workload pressure and productivity. Bootstrapped results across 10,000 samples showed that the indirect effect of workload pressure on group productivity through the two-stage mediators of organizational encouragement and group creativity was .76, ($p < .05$, 95% CI .63 to .90). Thus hypothesis 4 is supported.

Study 2

Participants

Our sample was drawn from the University of Colorado Boulder's undergraduate subject pool. In all, 235 students participated in this experiment from October 2014 through February 2015. We instructed students to form groups resulting in a total of 79 groups. The vast majority of our groups had three members. The sample included 95 females (40.8% female), had a mean age of 20.5 years (SD=1.78), a mean of 2.7 years of school and 79.0% were white or Caucasian.

The Experimental Task

Following Berg (2014), we provided our experiment participants with the following instructions: "The university bookstore is looking for creative ideas for an innovative product to sell to students. Your goal is to develop a novel and useful idea by collaborating with members of your group. You may use any online resources." In addition, participants were assigned to one of three conditions:

1. Not enough time

2. Enough time - no rules

3. Enough time - follow rules

Once each group completed the experimental task, individual participants filled out a survey about their experience.

Judging the Creativity Task

Consistent with the literature on creativity, we recruited ten judges from the same student subject pool to rate the creative product (Cropley, 2010). We ensured that our judges had not participated in our experiment as group members. Following Shin and Zhou (2007), we used four items to assess three dimensions of team creativity after adapting them to our context. Using a 5-point scale (1 is poorly, 5 is very much), the judges are asked to score the teams' creative solutions based on the following three dimensions: novelty of idea, significance of idea and usefulness of idea. Sample items are: "How well did the team produce a new idea to solve the problem?" and "How useful is the idea?" Judges' Agreement was high (α =79.1), thus all responses to the four items were aggregated to derive a measure of group creativity.

Measures

In line with Amabile's (1996) and as noted in the previous study's measures, we used the KEYS Assessment scale as follows:

Realistic work load pressure. Workload pressure was measured using the same five items used in Study 1 (1 = Never, 5 = Always) which included: "I have too much work to do in little time."

Supportive Climate for Creativity We included supportive climate for creativity to measure group members' engagement and active support for the creativity task at hand (West & Anderson, 1998). Supportive climate for creativity was measured using eight items (1 = Never, 5 = Always), which included: "Assistance in developing new ideas is readily available in my group" and "group members provide practical support for new ideas and their application."

Organizational encouragement Organizational encouragement was measured using the same 15 items used in Study 1 (1 = Never, 5 = Always) which included: "People are encouraged to solve problems creatively in this organization."

Group creativity. Group creativity was measured using a four-item scale (1 = Never, 5 = Always) adapted from Shin and Zhou (2007), which included: "How well did the group produce new ideas" and "How useful are those ideas."

Control Variables. Because our experiment subjects were drawn from the University of Colorado Boulder's undergraduate student subject pool, our sample was homogenous in regards to race (79% were white) and undergraduate major (all majored in business administration). All experiment sessions were conducted later in the week (Wednesday, Thursday or Friday), thus we did not control for day of week. A group of three members was our predominant group size. However, on rare occasions, we accommodated groups of two and four members. Thus, we controlled for group size. In line with pervious creativity studies (Amabile, Barsade, Mueller, & Staw, 2005), we controlled for age (mean = 20.5 years old, SD=1.78), gender (each group had at least one female student, mean = 1.59, SD = .33), education (mean=2.6 years in school, SD=.49). In addition, we included workload pressure (see KEYS scale in study 1) as a covariate.

Results

As with our earlier analysis, we use Hayes' (Hayes, 2012) PROCESS macro for SPSS with 10,000 bootstrapping samples. Table 3 represents the means, standard deviations and correlation coefficients for all variables. Table 4 shows the PROCESS bootstrapping results.

Table 3

Descriptive Statistics and Correlations.

Variables	M	SD	1	2	3	4	5	6	7	8
1. Group Creativity	3.82	.43								
2. Time Pressure	.52	.50	.23*							
3. Supportive Climate for Creativity	3.85	.44	.84**	.30**						
4. Organizational encouragement	3.95	.39	.59**	.07	.55**					
5. Age	20.57	1.78	.11	.07	.22*	-.07				
6. Gender	1.59	.33	-.02	-.15	-.11	-.07	-.02			
7. Education (Years in School)	2.65	.50	-.19	-.12	-.26*	-.23*	.34**	.12		
8. Group Size	2.95	.27	.00	-.09	-.11	.03	-.05	-.05	.08	
9. Workload Pressure	1.94	.55	-.33**	-.12	-.29**	-.40**	.21	.22	.20	-.29*

Note. N = 79 groups.   ** p<.01, * p<.05

Table 4

Indirect Effects of Time Pressure on Supportive Climate for Creativity and Group Creativity.

	Organizational Encouragement Indirect Effects of *Supportive Climate for Creativity*	Group Creativity Indirect Effects of *Organizational Encouragement* and *Supportive Climate for Creativity*
Bootstrap estimate (a_1b_1 path)	.16*	.14*
Bootstrap *SE*	.08	.07
LL 95% CI	.01	.00
UL 95% CI	.31	.30
Bootstrap estimate (a_1db_2 path)		.02*
Bootstrap *SE*		.01
LL 95% CI		.00
UL 95% CI		.06
Bootstrap estimate (a_2b_2 path)		-.01
Bootstrap *SE*		.01
LL 95% CI		-.06
UL 95% CI		.00
Direct Effects		
IV on mediator 1 (a_1 path)	.18*	.18*
IV on mediator 2 (a_2 path)		-.08
Mediator 1 on DV (b_1 path)	.49**	.78**
Mediator 2 on DV (b_2 path)		.17*
IV on DV (path c_1')	-.08	.01

Note. $N = 79$ teams. Unstandardized regression coefficients are reported. Bootstrap sample size = 10,000. LL = lower limit; UL = upper limit; CI = confidence interval; IV = independent variable; DV = dependent variable; Mediator 1 = Supportive Climate for Creativity; Mediator 2 = Organizational Encouragement.
** $p < .01$, * $p < .05$.

Our time pressure manipulation predicted group creativity ($F = 4.35$, $p < .05$). Time pressure predicted supportive climate for creativity ($b = .23$, $p < .05$) but not organizational encouragement. Thus hypothesis 1 was not supported. Supportive climate for creativity predicted organizational encouragement ($b = .50$, $p < .01$). Thus, time pressure indirectly predicts

organizational encouragement through supportive climate for creativity. Organizational encouragement predicted group creativity (b = .20, *p* < .01), supporting hypotheses 2. Results also show that the indirect effect of time pressure on group creativity through supportive climate for creativity and then through organizational encouragement is significant (b = .02, *p* < .05). The confidence interval was .00 to .07, and did not include zero, supporting hypothesis 3.

DISCUSSION

We were motivated to explore collaborative creativity under time pressure because we observed that everyone constantly faces deadlines and strives to balance multiple commitments. We also observed that in spite of recurring time pressure, creativity is possible: Employees solve problems and entrepreneurs innovate markets. Yet, extant research on individual creativity predicts that this is impossible unless time pressure is removed. To explain this paradox, we examined the relationship between a prevalent constraint, time pressure, and creativity at the group level of analysis. As far as we are aware, this is the first empirical study to explore this important relationship. We found that time pressure is positively related to group creativity and organizational encouragement mediated that relationship. Organizational encouragement and group creativity also mediated the relationship between time pressure and group productivity. Although intuitively time and workload pressure seem undesirable, our study suggests that these time constraints do not undermine collaborative creativity; they aid it.

Help-seeking and help-giving (Hargadon & Bechky, 2006) may explain how constraints support rather than undermine creativity in groups. Under time pressure, a creativity-seeking individual searches for new variants until she runs out of time. Working together within the same period of time, two or more individuals effectively expand the search effort particularly if helping is an established organizational routine (Grodal, Nelson & Siino, 2014). By covering

more search ground in the same time, a group's probability of finding a variant that is both novel and useful is significantly higher than that of an individual. In this regard, our findings regarding group creativity complement rather than contradict past research on individual creativity.

Our study contributes to the vast and expanding literature on creativity in organizations. Previous studies mainly focused on the individual level of creativity predicting negative effects of the workload pressure effects on creativity. By extending the componential theory to the group level, we found that workload pressure can induce helping behaviors in an organization where support and encouragement of employees is the norm, and that these behaviors can increase group creativity and productivity. Our findings that organizational encouragement positively mediates the relationship between time pressure and group creativity suggests that we cannot extend findings related to creativity constraints at the individual level to the group level without careful examination.

Strength, Limitations and Future Directions

Our study benefited from several key strengths. First, both our field data and experiment relied on large samples of groups. Our field data spanned multiple organizations over an extended period of time. Second, we steered clear of self-reporting bias by relying on the consensual assessment technique (Amabile, 1983). In our field data and experiment, our dependent variable, group creativity was measured using multiple observers. Third, in extending the componential theory of creativity, we used the same KEYS Assessment scales that Amabile and colleagues (1996) used to develop the original model.

A few limitations are worth noting. One of the limitations of our study is that productivity was measured using ratings from various group members' perspectives and we were unable to use objective measures such as sales or revenue figures to ascertain the employees' claims of

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productivity since we were blind to the true identity of the participating employees and their organizations and could not match these objective measures with the employee ratings.

Another limitation is that we did not measure group members' elaboration of ideas or their level of collaboration. In the field sample, it was not possible for us to gleam the extent to which group members elaborated their ideas. In our experiment, while we were in a position to observe group members' elaborations, capturing this data would have required a small army of observers; a requirement that was well beyond our limited resources. We note that some groups elaborated extensively (some group members were observed forming initial friendships and intention to continue elaborating after the experiment) while others included members who spoke few words. As with many other experiments that relied on student subject pools, we were limited to run our experiment for 30 minutes. Perhaps future researchers can test different task durations.

We did not examine the effect of many constraints beyond our focal two constraints, time pressure and organizational rules, nor where we in a position to suggest an optimal number or types of constraints that might promote creativity in groups and teams. Furthermore, the complimentary relationship between autonomy and constraints is worthy of further investigation. At the individual level of creativity, autonomy plays an important supportive role. At the group level of creativity, we show that constraints play an equally important and supportive role. We propose that future research explore the possibility of "bounded autonomy" which we refer to as an individual's autonomy to pursue creativity within the boundaries of one or more constraints.

CONCLUSION

In the workplace, where collaboration is not only expected but also highly encouraged by managers, our study finds that two ubiquitous constraints, time or workload pressure and organizational rules, contribute to enhanced group-level creativity as they bound group

members' search for novel ideas that might be useful. Thus, while these constraints are typically

despised, they help individual group members coordinate their collaboration and pool their

resources. Individuals stand to benefit when their collective creativity leads to higher

productivity for the entire organization. Managers ought to ensure that the deadlines and rules

they set are minimal and meaningful so that they guide without stifling creativity of groups. Our

findings point to creativity constraints as a rich and promising stream for future research.

CHAPTER III: FILTERING NOISE: HOW ENTREPRENEURS USE HEURISTICS AND BIASES TO MAKE DECISIONS THAT REQUIRE CREATIVITY

ABSTRACT

In making challenging decisions, new venture teams leverage team members' deep diversity to generate and evaluate an extensive set of alternatives. The literature does not address how new venture teams evaluate an exploding number of alternatives under conditions of ambiguity, uncertainty and time pressure. This study explores how heuristics and biases support new venture teams' decision-making processes beyond the current conceptualization of simplifying mechanisms. Rather than focus on heuristics as error-prone shortcuts that entrepreneurs use under conditions of ambiguity, uncertainty and time pressure, this study explores how heuristics filter a large number of alternatives as sieves providing a focal consideration set.

INTRODUCTION

For nascent ventures, early decisions are critical because they define a business (Abell, 1980) in important and lasting ways that are difficult to reverse (Fauchart & Gruber, 2011). These decisions include who to include in the founding team, how much time to devote to the new venture (full-time or part-time), which sources to tap for start-up capital (savings, angel investors, loans), how to price the initial product or service, choice of distribution channels and many others. New venture teams make these early decisions that follow venture formation but precede many other decisions (Fauchart & Gruber, 2011) and long-term outcomes such as venture growth. They challenge new venture teams and demand their creativity because appropriate decision choices are not obvious given the uncertainty, ambiguity and complexity typical of the entrepreneurial environment. Creativity, defined as the development of new concepts that are deemed useful by target users (Stine, 1953), contributes to venture innovation (Baron & Tang, 2011) and ultimate success (Chowdhury, 2005), which makes it central to many decisions entrepreneurial teams make. For the purposes of this study, we define creativity broadly as the development of novel and useful ideas or solutions (Amabile, 1983).

In making these consequential decisions, entrepreneurs "face situations that tend to overload their information-processing capacity and are characterized by high levels of uncertainty, novelty, emotion, and time pressure" (Baron, 1998: 275). Under such conditions, entrepreneurs often use heuristics and biases to simplify problems and avoid being overwhelmed with complexity as they make fast decisions in uncertain environments (Busenitz & Barney, 1997; Gigerenzer & Gaissmaier, 2011). Indeed, research shows entrepreneurs use over 100 different heuristics in making decisions (Manimala, 1992). In spite of this evidence, we know little about how entrepreneurs benefit from heuristics and biases in making decisions (Shepherd,

Williams, & Patzelt, 2015). In this paper, we use a creativity lens to explore how heuristics and biases facilitate creative entrepreneurial decision-making. We suggest that a critical benefit of heuristics and biases is that they simplify decision choices by selectively *filtering* desirable alternatives from all others. As sieves, heuristics and biases help entrepreneurs pan for nuggets of ideas much like their predecessors panned for gold less than 150 years ago.

To understand how heuristics and biases affect entrepreneurial decisions, we focus on those early venture-defining decisions and their immediate outcomes. This is important for several reasons. First, new ventures form their culture and establish norms at an early stage and decisions made during that stage have cascading implications and important imprinting effects on later venture growth and success (Busenitz, Plummer, Klotz, Shahzad, & Rhoads, 2014; Fauchart & Gruber, 2011). Second, to assess venture performance, researchers have relied on measures of sales and employment extensively as indicators of new venture growth. However, new venture teams make many intermediate decisions, each of which may impact a venture's performance in important ways that impact future success (Klotz, Hmieleski, Bradley & Busenitz, 2014). As such, examining early decisions and their proximal outcomes may yield important insights that have been overlooked using distal growth outcomes such as sales or employment. Third, researchers have questioned the assumption that high growth is the only goal and primary motivation of new venture teams (Klotz, Hmieleski, Bradley & Busenitz, 2014). Some teams may choose to grow at a measured pace, prioritize profit over growth or purposely maintain a small or medium size venture (Mullins, 2010). Others choose to start new ventures for reasons unrelated to growth such as pursuing their passion and achieving work-family balance (Cooper & Artz, 1995). Focusing on early decisions to examine the use of heuristics and biases

in new venture team decision-making is appropriate because early decisions are made within short time frames and have immediate outcomes, which facilitates the study of proximal factors.

In this study, we focus on teams rather than individual founders given consistent evidence showing that high growth entrepreneurs tend to work in teams (Dimov, 2007), a vast majority of high growth new ventures are started and led by teams and that new venture teams are instrumental in developing new firms (Klotz, Hmieleski, Bradley & Busenitz, 2014). Moreover, creativity, a corner stone of entrepreneurship, is a social process (Zhou & Shalley 2008). We use Klotz and colleagues' (2014) definition of a new venture team as "the group of individuals that is chiefly responsible for the strategic decision making and ongoing operations of a new venture." These new venture teams tend to "have greater managerial discretion and wider latitude of action than most teams" (Klotz, Hmieleski, Bradley & Busenitz, 2014). Given these observations, we draw on the creativity literature in organization behavior and use Woodman, Sawyer and Griffin's (1993) definition of team creativity as "the creation of a valuable, useful new product, service, idea, procedure, or process by individuals working together in a complex social system."

Entrepreneurship are typically depicted as creative people who produce creative outcomes by making decisions in fast-paced environments (Uy, Foo, & Aguinis, 2010). Intuitively entrepreneurial decisions, such as those mentioned earlier, invoke creativity (Dimov, 2007) in two ways: 1. Entrepreneurs look for and develop new and useful concepts in response to market, technology and other challenges, or their situational contexts present them with new and potentially useful ideas. Indeed, entrepreneurial creativity involves diagnosing and adapting to change as well as creating change (Short, Ketchen, Shook, & Ireland, 2009). Indeed, researchers have theorized that entrepreneurs' active engagement in the search for new information and ideas leads to a stronger positive effect of creativity on product or service innovation (Frese & Gielnik,

2014). 2. As they explore new ideas, entrepreneurs constantly face alternatives from which they must choose. Under conditions of extreme ambiguity and uncertainty, choosing is difficult as no course of action is assured. Entrepreneurs therefore seek selection information and validation from advisors, mentors and potential customers (Ford & Gioia, 2000). Thus, entrepreneurial decision-making involves a creative process. Consider, for example, the task of naming a new venture. A *good* brand name requires creativity, as it must optimally satisfy a number of important requirements: it must be unique, relevant, memorable, flexible and available as a domain name while generating excitement and lending itself to legal protection. The flexibility requirement is important to nascent ventures because a name must also withstand the test of time by remaining relevant as the venture and its target markets evolve in unforeseen ways. This is a challenging and risky decision as there are literally thousands of name options from which to choose. A name that becomes irrelevant or problematic over time may confuse customers, distract employees and force the venture to invest scarce resources to re-brand its image. Even serial entrepreneurs – defined as entrepreneurs who have formed more than one venture – face many of the same decisions each time they form a new venture as contextual factors are heterogeneous among firms and markets.

Hence, this study aims to understand how using heuristics and biases leads new venture teams to be more creative. On one hand, challenging decisions demand the creativity of entrepreneurs, creativity requires the active search for and the integration of divergent information (Foo, Uy, & Murnieks, 2013) and doing so is cognitively complex and taxing. On the other hand research shows that entrepreneurs rely on heuristics and are biased in making decision and that they use heuristics and biases as simplifying mechanisms (Gigerenzer & Gaissmaier, 2011).

THEORETICAL FOUNDATIONS

Making difficult decisions that lead to irreversible outcomes under extreme conditions of uncertainty, complexity and time pressure is the hallmark of entrepreneurs. In line with Busenitz and Barney's (1997) speculation that without the use of heuristics and biases many entrepreneurial decisions would have never been made, I examine how heuristics and biases facilitate entrepreneurial decision making by exploring the effects of heuristics and biases on active search and knowledge integration using the blind-variation, selective-retention model of creativity (Campbell, 1960; Simonton, 1980). This approach is promising because entrepreneurs are creative people who typically generate a large number of novel ideas with ease (Foo, Uy & Murnieks, 2013). Thus, the focus of this paper is on how heuristics and biases guide the winnowing of the most promising ideas from the rest.

Entrepreneurial Decision Making

In reviewing the literature on entrepreneurial decision making, there is ample evidence that entrepreneurs make decisions by using simplifying strategies and mechanisms. They do so because, unlike other decision makers, they are compelled to make decisions using incomplete and ambiguous information in a compressed time frame before an opportunity is missed (Busenitz, 1999). Researchers have tried to understand entrepreneurs' simplifying strategies from a risk oriented perspective following the landmark work of Simon on bounded rationality (1986). However, research shows that entrepreneurs do not make decisions by assigning risk estimates to alternatives and then choosing the optimal risk-return alternative. Researchers sought to understand entrepreneurs' simplifying strategies using (Tversky & Kahneman, 1974)work on heuristics and biases which led to many insights. Entrepreneurs are biased and susceptible to heuristics such as overconfidence and representativeness (Busenitz, 1999; Busenitz and Barney,

1997) as well as the heuristics of illusion of control and belief in the law of small numbers (Keh, Foo, & Lim, 2002). Even though research shows that entrepreneurs do not make decisions using a risk-benefit lens, research on heuristics and biases continues to be guided by the bounded rationality and risk perspective.

Evaluating Alternatives

In addition to simplification mechanisms decision-makers use, decision-making involves evaluating alternatives. Absent alternatives, a decision is not necessary. Absent alternatives that depart from status quo, creativity is not possible. Evaluation involves comparing alternatives, which helps decision makers ascertain the alternatives' strengths and weaknesses, builds confidence that the most viable alternatives have been considered, reduces the risk of uncertainty by providing a fall back position and, by simultaneously evaluating many alternatives, reduces the risk of escalation of commitment to one alternative (Eisenhardt, 1989). Thus, while research shows that entrepreneurs do not approach decisions using a risk-benefit frame, comparing alternatives may provide similar benefits. In new venture teams, evidence suggests cognitive comprehensiveness – a team-level variable which refers to casting a wide net and evaluating as many options as possible – is important for complex and innovative decision-making (Chowdhury, 2005). Evaluation of alternatives is collectively done by team members who do not necessarily follow a serial process of evaluating ideas only after generating them. Research from the creativity literature suggests that evaluations are "temporary and evolve as ideas develop, rather than as one-time decisions" (Harvey & Kou, 2013: 374). This suggests that evaluation is part of the process that produces creative ideas and that the entrepreneurial process does not follow "a planned sequence in which identification always precedes evaluation" (Shane, 2012: 14).

Decision Making and Creativity

Complementing the risk-oriented view of decision-making, we explore the use of

heuristics and biases on entrepreneurs from a creativity perspective. As noted earlier, creativity

involves the production of novel and useful ideas, products or services (Amabile, 1983). The

creativity perspective requires two tasks: the generation of original ideas that depart from status

quo and their evaluation to determine their usefulness. In the previous section, I discussed idea

evaluation using the process of dialectical inquiry. I now turn to the inputs of the evaluation: the

ideas generated by entrepreneurial teams using active search and knowledge integration.

Active Search and Knowledge Integration

The entrepreneurship literature addresses active search and knowledge integration as they

relate to opportunity identification (Foo, Uy & Meurniks, 2013). I suggest that entrepreneurs

engage in active search and knowledge integration to accumulate information relating to a

decision at hand. Indeed, active search and knowledge integration are integral to decision making

as they describe the creative process from an entrepreneurial perspective. Generating creative

ideas requires the exploration of numerous possibilities (Ruscio et al., 1998). This is

accompanied by exploring the "maze of available cognitive pathways" (Amabile et al, 2002: 3)

and letting ideas incubate unconsciously (Lubart, 2001). Frequently, creative teams are known to

reframe original problems (Hargadon & Bechky, 2006; Getzels & Csikszentmihalyi, 1976) and

even to set aside the creativity task and forget about it for a while to circumvent mental blocks

and find new approaches (Lubart, 2001; Smith & Dodds, 1999). Active search doesn't always

follow a systematic strategy and entrepreneurs explore ideas or solutions to problems using a

myriad of ways. Active search can have depth (Rietzschel, Dreu & Nijstad, 2007) as well as

range (Fredrickson & Branigan, 2005). Knowledge integration involves "creatively forming

connections (Baron & Ensley, 2006) among complex and seemingly independent events" and information (Foo, Uy & Murnieks 2013). Moreover, team diversity – specifically deep diversity which refers to diversity of experience, skill or knowledge – enhances team decision-making by bringing broader perspectives and a greater pool of alternative solutions and innovative ideas together (Chowdhury, 2005; Knouse & Chretien, 1996; Milliken & Martins, 1996). Lastly, Mumford and Gustafson (1988) suggest that the highest levels of creativity are the result of very different schemata or cognitive structures coming together. Yet, entrepreneurs operate under limiting conditions that include: time pressure, fast-paced environments, cognitive capacity limitations, knowledge corridors, etc. How then do new venture teams manage the "information explosion" encountered during active search and knowledge integration?

The Role of Heuristics and Biases in Entrepreneurial Decision Making

During this part of the creative process, research shows that teams in non-entrepreneurial contexts impose boundaries on their search to make the search process efficient and effective and to coordinate their interaction (Hargadon & Bechky, 2006; Grodal, Nelson & Siino, 2014; Amabile 1983; Getzels 1975). I suggest that entrepreneurial teams use heuristics and biases to manage their search for new ideas and alternatives in a similar way. Research suggests the search for ideas or alternatives is expansive since options and alternatives and their combinations are unlimited. In addition, research shows that decision-making is inherently complex (Foo, Uy & Murnieks, 2013).

Heuristics are efficient strategies that ignore part of the information thereby saving a decision-maker time and effort (Gigerenzer & Gaissmaier, 2011). Biases are differences between human judgments and rational norms. Heuristics and biases have been viewed as irrational and error-prone shortcuts of subjective judgment. For example, researchers have shown that

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overconfidence is tied to the availability heuristic, belief in the law of small numbers is tied to the representativeness heuristic and planning fallacy is tied to the anchoring heuristic (Keh, Foo & Lim, 2002). However, in a recent review, Gigerenzer and Gaissmaier (2011) questioned this treatment of heuristics and biases on the basis that for many decisions, the assumptions of rational models cannot be met. Under these conditions, they argue that using heuristics and biases can lead to decisions that are comparable to those of rational models if not better. Indeed, there is evidence that heuristics and biases trigger the perception of new opportunities and innovative ideas (Alvarez & Busenitz, 2001; Holcomb, Ireland, Holmes Jr., & Hitt, 2009). Also, Manimala (1992) identified a list of 109 different heuristics entrepreneurs use in their decision-making which distinguish between highly innovative and less innovative entrepreneurs.

Building on the foundation provided by the preceding theoretical overview, this study answers Shepherd, Williams and Patzelt's (2015) call to explore the following research questions:

1. How do entrepreneurs use heuristics and biases to achieve more creativity in making decisions?

2. How do entrepreneurs do so as a team?

METHOD

For this study, I used an inductive design. Entrepreneurs face numerous decision-making situations that call for creativity particularly during the early stages of venture formation. Studying the potential use of heuristics throughout the decision-making process favors an inductive design for the following reasons: 1) although there are many possible heuristics that a team might use (Manimala, 1992), each may be rarely and unpredictably used depending on the

decision substance, context and team members involved, 2) we cannot assume that specific heuristics are widely used across teams and that these can be captured retrospectively through a survey, and 3) entrepreneurial team members may or may not be conscious of their use of heuristics (Sternberg & Lubart, 1999). Furthermore, the literature on entrepreneurial decision-making is highly fragmented (Shepherd, Williams & Patzelt, 2015) and I draw on models of collective creativity that have not been empirically tested. My proposed approach closely follows that which has been suggested by Gioia, Corley & Hamilton (2012). Encouraging originality, these researchers expressed concern that the traditional approach of construct elaboration risks constraining us to what we already know. Currently, what we know falls short of explaining and predicting entrepreneurial decision-making when creativity is required.

Following Schilpzand, Hekman and Mitchell (2014), I employ a critical incident approach to uncover commonalities across entrepreneurial teams, vertical markets and emerging technologies. As these authors suggest, applying the critical incident approach using multiple incidents straddles the space between fact and fiction shinning the spotlight on team members' own account of how a decision was made using creativity.

Study Setting

Since the focus of this study is to understand how heuristics are used by entrepreneurial teams in early stage ventures, I focused on firms that have been in business for five years or less. I did not target a specific vertical market or technology to allow for maximum variation in perspective and contexts. Taking advantage of Boulder's entrepreneurial ecosystem, firms in my sample were all located in Boulder and Denver, Colorado.

Sampling

I used a theoretical sample in order to first identify the widest possible range of challenging decisions that called for creativity and then surfacing how new venture teams use heuristics and biases in making those creative decisions. This approach allowed me to follow focal concepts as I gathered data seeking maximum variation and constantly made comparisons (Fauchart & Gruber, 2011; Strauss & Corbin, 1998). Since a direct approach to asking entrepreneurs about their use of heuristics and biases risked triggering social desirability and self-presentation concerns, I conducted trial interviews with creative decision makers to test question and terms prior to conducting the interviews used in this study. The interview protocol is included in the appendix.

Data Sources

Given the nature of new venture decision-making, which is characterized by making many decisions quickly, I collected data using direct interviews with 21 entrepreneurs. I identified these entrepreneurs using shared contacts on LinkedIn and through snowball sampling where I asked interviewees to introduce me to other founders they know. Data from the new ventures' own websites was used as needed.

DATA ANALYSIS

As suggested by Gioia, Corley & Hamilton (2012), I used the interview protocol and revised it in response to "giving voice to informants" and emerging insights. I collected data from individual entrepreneurs and performed the coding for analysis using NVivo version 10 for Windows. Ongoing interviews suggested changes to the questions used in my protocol and, as a result, I modified the protocol questions several times early in the process. All interviews were professionally transcribed.

Open Coding

In coding the data, I used open coding to identify first-order categories. I consciously tried to use the words used by interviewees during this initial stage. Over time, I started seeing similarities and differences among the initially large number of categories generated following the recommended approach (Gioia, Corley & Hamilton, 2012). I then attempt to aggregate the number of categories giving them labels and descriptors that may shed light on what might be at play behind decision making and the potential role of heuristics and biases. During this phase, I relabeled second order descriptors as I tried to remain accurate to the meaning of the underlying quotes.

Axial Coding

Next, I cycled between interview data, categories, label descriptors and the literature often in order to develop my data structure and model. For example, several interviewees mentioned that they searched broadly for new information and ideas from diverse sources such as customers, employees, advisors and thought leaders. This was congruous with the construct of cognitive comprehensiveness (Chowdhury, 2005) providing consistency and face validity to my analysis. I repeated this process until it became evident from the analysis that I had reached theoretical saturation resulting in no new insights.

FINDINGS

The analysis reveals that new venture teams leverage heuristics and biases in two effective ways that are integral to a creative process for making challenging decisions: as sieves and tie-breakers. Creativity calls for the generation of novel ideas and entrepreneurs do that and then use their heuristics and biases as sieves to filter those ideas. As decision alternatives are developed and evaluated, new venture teams eventually face a trade-off dilemma: the remaining

alternatives are effectively tied. To break the tie, new venture teams use heuristics and biases. The analysis shows that this interesting use of heuristics and biases is for the purpose of achieving team coherence in line with nascent research into collective creativity (Grodal, Nelson & Siino, 2014; Harrison & Rouse, 2014). The emergent data structure and emergent model of creative decision making in new ventures is summarized in figures 1 and 2 below.
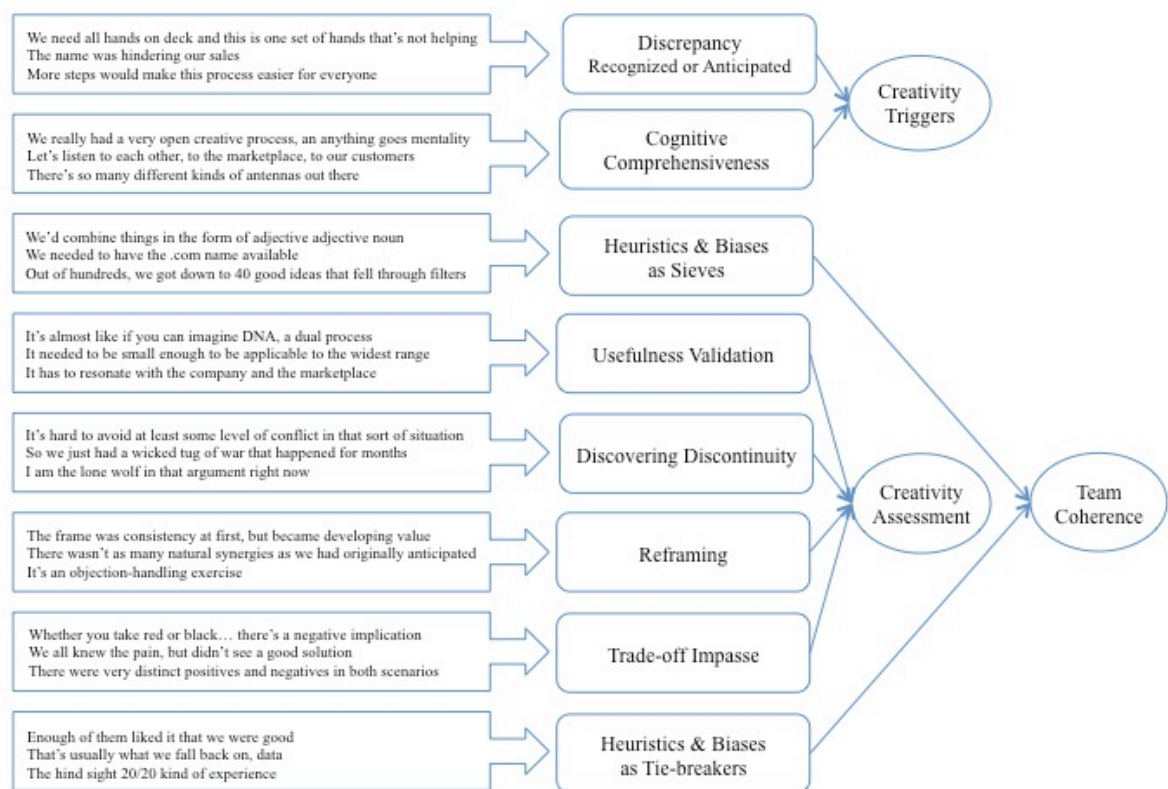
Figure 1: Emergent Data Structure

Figure 2: Emergent Model of the Constraint-within-Constraint Concept in Creative Decision Making Using Heuristics and Biases
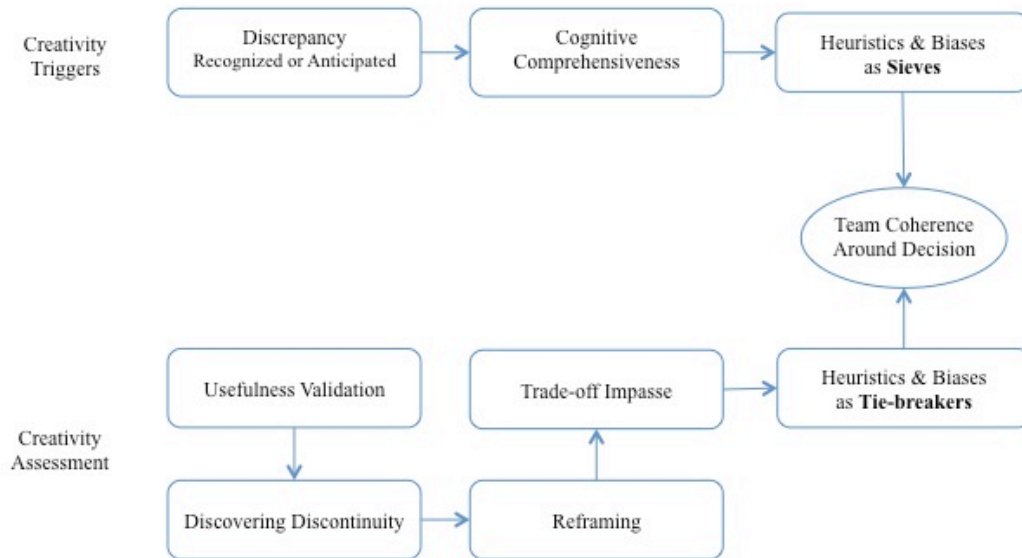
This section is organized as follows. First the concepts and themes leading to the use of heuristics and biases as sieves are detailed under the aggregate dimension: creativity triggers. Second, the concepts and themes leading to the use of heuristics and biases as tie-breakers are detailed under the aggregate dimension: creativity assessment. Finally, the outcome dimension of team coherence is detailed.

Creativity Triggers

The creativity triggers dimension includes the following themes: Discrepancies, Cognitive Comprehensiveness and Heuristics and Biases as Sieves. I labeled this dimension *creativity triggers* because the data shows that recognition or anticipation of a discrepancy prompts the search for novelty which leads to creativity.

Discrepancies

The data shows that in new ventures, challenging decisions often arise from perceived discrepancies. One or more members of the new venture team recognizes or anticipates a discrepancy between status quo and a desired state. The discrepancy is communicated to the rest of the team who then recognize it or agree it is likely to happen. Regardless of the specific discrepancy mentioned, a common thread is that the new venture team determines the discrepancy must be resolved. As the first representative concept reveals, the meaning associated with concepts in this theme is that the discrepancy disrupts team members' coordination and threatens the teams' progress toward important goals. The quote "We need all hands on deck and this is one set of hands that's not helping" emphasizes the value placed on collaboration among team members. When a team member fails to contribute to that collaboration, the entire team suffers. This is consistent with the literature on helping behavior (Hargadon & Bechky, 2006) and coordination (Okhuysen & Bechky, 2009).

The second representative concept, "the name was hindering our sales" shows that discrepancies can result from the inconsistency between how the team is perceived by its target customers versus its members. Indeed, another interviewee mentioned that "we now have 50 employees and if you ask each one who we are as a company, you'll get 51 different answers." In resolving the discrepancy, this team involved their customers in a company identity and rebranding exercise. The data seems to point out that new venture teams see customers as extended team members that must be coordinated. The third representative concept: "More steps would make this process easier for everyone," shows that discrepancies can be process-oriented. This particular quote refers to the difficulty this team had integrating their activities with those of their key customers. These quotes indicate that team coordination is not only critical to new venture teams but that they also extend the concept of coordination to their early customers.

Cognitive Comprehensiveness

Driven by a desire to change the status quo in order to eliminate a discrepancy, new venture teams embark on a wide search for options (Chowdhury, 2005). Searching for and generating novel ideas is a core component of the creative process. The data shows that new venture teams initiate their search without imposing any constraints. The representative concepts are:

"We really had a very open creative process, an anything goes mentality"

"Let's listen to each other, let's listen to the marketplace, let's listen to our customers"

"There's so many different kinds of antennas out there"

These quotes show a deliberate effort to cast a wide net and research as many alternatives as possible taking advantage of diverse team members, customers, suppliers and even markets as this quote describes:

"as you listen to different points of view and different communications and ask specific questions, some input is ... input that you ask questions about and you get direct feedback, versus conversations that are happening in the marketplace that maybe you don't even know what the starting point was for that conversation or that piece of feedback. The one thing is when you mash all that together, you start to develop things, and you see things emerging, and you can kind of categorize things and group things together in terms of what people are feeling, what they're thinking, what they want and what they need."

This approach allows ideas to evolve in a Darwinian way using blind variation in line with the creativity literature (Campbell, 1960) and is supported by evidence from the entrepreneurship literature that new venture teams examine many options when they approach complex decisions (Chowdhury, 2005).

Heuristics and Biases as Sieves

Having explored widely in search of new ideas, data indicates that new venture teams focus next on ways to refine the selection of ideas. The representative concepts in this theme reveal the use of heuristics and biases as filtering mechanisms. For example, after developing a list of 100 words for a rebranding project, one interviewee mentioned using the heuristic adjective-adjective-noun (exemplified by BMW's *Ultimate driving machine* tag line) to filter the list. Another new venture team required that their new company name have a corresponding ".com" domain name to filter the naming concept the team developed. In reporting judges' data, another entrepreneurial team only considered visualization options.

This quote details how new venture teams use heuristics and biases as filtering mechanisms:

> "Understanding that you have 30 overall consideration, and understanding which I like to, five or six that are absolutely a must. They cannot be sacrificed. They cannot be compromised upon. Then you make sure that those are first taken care of. Then the rest of them you work through a series of it being the highest priority. We want it to be this shape, we want it to be this thickness, we want it to be this color or material, or what have you. You work down that list of must haves till you get to nice to haves. Then you try and keep as many nice to haves, but also recognize when the data's telling you otherwise."

Creativity Assessment

The creativity assessment dimension includes the following themes: Usefulness Validation, Discovering Discontinuity, Reframing, Trade-off Impasse and Heuristics and Biases as Tie-breakers. I labeled this dimension creativity assessment because although new venture

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teams do not stop looking for new alternatives, their focus in this part of the process is on validating the utility of the alternatives under consideration.

Usefulness Validation

Data shows that new venture teams winnow the most promising alternatives while remaining open to new alternatives that may be developed or uncovered during the validation stage. As one interviewee put it:

"The ideas with the antennas is a tricky aspect because there's so many different types of antennas out there. There's floppy antennas, there's rigid antennas, antennas that attach to the cord, there's antennas that can be free form in any size and shape you want. How do we ... What seems like the best idea now? Let's move forward with it, and if we get to a point where it will no longer work, then we address that and it's fine. Eventually it's just to move forward with it.

It's almost like if you can imagine DNA, a dual process or whatever. Each one goes out away from itself and there's a bunch of decisions and designs to make and then they come back together and say, "Does this work?" Again, you take things apart and you make decisions based on that. Then it will come back together again and we'll see if that works. Yeah, it's a continual process of that where you go independently and then bring it back to make sure that you're not getting to far off course with the other considerations.

Or again, with the DNA thing, choose one of them for now, continue to develop other areas ... Put that in place, shift our focus to whatever's next. Then maybe where you just pick one a new solution pops up because a new generation of a certain product by the manufacturer, and guess what? It's 20% smaller 30%

more power efficient than the last model. That's a trick too…so we have to build

with two minds. That, we're building now with what's possible today, but we're

also building for what might be possible once we're actually ready to launch this

thing commercially in six to eight months."

These interviews also show that the validation process is challenging and includes team

members and customers:

"Lots of things were challenging about the writing exercise. First and

foremost was probably ... getting to the essence of where you are as a company

and why you're different and why you're valuable, and doing that in a very

consistent, powerful, emotive way. Having a great economy of words and using

the right words and getting down to the essence of the brand is probably the most

challenging thing. Also, the way it resonates with the customer and ... [what you

promised them, what the customer is interested in.] It has to resonate with the

company, it has to resonate with the market place, and that's super hard to do."

These quotes can be construed to mean that sifting through alternatives to winnow the

best options is an ongoing exchange in which alternatives are developed and assessed against

criteria (team criteria, customer criteria and market criteria).

Discovering Discontinuity

Consistent with recent findings in creativity research, data shows that in the process of

assessing the usefulness of alternatives, new venture teams discover discontinuity (Harrison &

Rouse, 2014): a disagreement or difference in assessment that stops or slows down the process.

The quotes show that those who took dissenting positions had good reasons for taking the

positions they did. More importantly, team members on the opposite side of the argument

engaged the dissenters to flesh out the issue causing the discontinuity. The following quotes illustrate this point:

"We had an old developer here… who definitely had a little bit of push back when it came to switching to the hourly business model."

"There is general agreement that I've probably slowed things down a little more than at least one, the more junior guy would have. He is really pushing me to take it entirely to an offshore team now for build, and I'm not comfortable doing that."

"well, that impressions thing was definitely iterative and collaborative. None of us had seen something like it before, so there was resistance."

"So we just had a wicked tug-of-war that happened for truly months and months"

"I think personally, I was the one most trying to, I guess, provide something for the other party in their leaving. Everybody else was sort of fed up and ready to burn a bridge if they had to."

"I am the lone wolf in that argument right now."

These quotes give the impression that team members are negotiating the boundaries of their collaboration in order to achieve team coherence (Harrison & Rouse, 2014).

Reframing

Another common thread across a number of interviews was that interviewees indicated that the framing of the decision had changed since the initial discrepancy surfaced. Frames refer to "the decision-maker's conception of the acts, outcomes, and contingencies associated with a particular choice (Tversky & Kahneman, 1982)." New venture teams appear to be reflectively

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reframing, which refers to making new sense of their situation, and is an important aspect of

collaborative creativity (Hargadon & Bechky, 2006) as the following quotes show:

"The frame was consistency at first, but it became more of ... an exercise

in developing value"

"Changing, I think, from a client to a customer also gives a company a

little more autonomy to operate, right, when you have customers as opposed to

clients. A client is just another form of a boss while a customer is using your

product that can provide input to, you're not at their beck and call as much."

"The products were different enough that there wasn't as many natural

synergies as we had originally anticipated."

Another interviewee mentioned that what was originally framed as routine procedure was

reframed as "it's an objection handling exercise."

Trade-off Impasse

At this point in the life span of a decision, new venture teams mention facing difficult

trade-offs. As one interviewee illustrated:

"Yes. I mean if you think about it like, you choose a red car or a black car,

and one person says a red car is stopped by the police more often so we're going

to get more speeding tickets. The black car is hotter in the summer and so it's

going to be really hot and you're going to have to roll down the windows and it'll

take you longer to get somewhere because you have to cool off the car every time

you get into it. Okay, both are reasonable arguments against both of those colors.

Maybe they're for intents and purposes equal in terms of the decision to choose

red or black. "

This quote demonstrates an important challenge new venture teams face in making decisions. After exploring a large number of alternatives, filtering and winnowing them down to two alternatives, there is no easy way to choose between them given a high degree of uncertainty and ambiguity. Like two racers who arrive at the finish line side by side, finding a clear deciding criterion is difficult as this quote shows: "There were very distinct positives and negatives in both scenarios."

Another interviewee shared that "we all knew the pain, but didn't see a good solution." This is a vivid illustration of the difficult situation new venture teams face at this point: after all the effort that has been invested in the decision making process thus far, the teams face a frustrating impasse.

Heuristics and Biases as Tie-Breakers

To break a tie between two comparable alternatives, I found that new venture teams use heuristics and biases. For instance, the interviewee who suggested the red-black car analogy offered this comment:

"For two people who trust each other to take a firm stance on that and ... create an impasse over a decision like that, you're going to have to move on and people have to be a referee against that. If you have a great culture and experienced people, you can work it out and figure out, are you going to take red or black. Whether you take red or black, you have the same consequence. There's a negative implication, you're going to get on the side of whichever decision you make and everybody's going to work and we're going to have a red car, and that red car is going to get stopped by the police and every time it happens we're going to be okay with that because we're behind this red decision."

This quote suggests that new venture teams reach a point that I shall refer to as *variation saturation*: there are no new alternatives to consider and that negative consequences must be expected and accepted.

In breaking a trade-off impasse, new venture teams have relied on the experience of senior team or board members: "the hindsight 20/20 kind of experience", research data: "that's usually what we fall back on, data", customer feedback or the informal consensus of the team: "enough of them liked it that we were good."

Team Coherence

Throughout these interviews, maintaining team coherence seemed to be strongly evident in the data. What triggered the need to make a creative decision in the first place was a discrepancy that threatened or posed the potential to threaten team coherence. For instance, one interviewee said that: "I think that is true for most teams since you need to have at least a certain amount of cohesion in order to get you where you want to go." Becoming aware of the threat, new venture team members follow a creative process in response. This leads them to two junctures where their team cohesion is put to the test: 1) How to filter too many alternatives uncovered during an extensive search process. Teams used heuristics and biases to filter alternative and maintain their coherence as this interviewee indicates:

> "It seems like you brainstormed in a structured way, if you will, in a way
> where you built on each other's thoughts, got there. It wasn't wild brainstorming,
> like 'write whatever on the board' kind of thing. You were heading in a certain
> direction."

2) How to break a tie between highly comparable alternatives that resulted from a collaborative assessment process.

"…it's not a yielding kind of a thing, or it's not a giving up or handing it over kind of mentality. It's like, okay, we have two valid choices here. A CEO is going to figure it out. The CEO is going to come down on one side or the other, or something like that. Once that decision happens, it's a totally different dynamic when everybody trusts that decision versus somebody coming in and breaking up the fight, basically."

DISCUSSION

I initiated this research to elucidate how entrepreneurial teams use their heuristics and biases to make creative decisions. As I noted earlier, prior research has established that these teams use heuristics and biases to simplify the decision process. The implication here is that the simplification approach is error-prone given that it is a subjective shortcut (Gigerenzer & Gaissmaier, 2011). My findings extend this research and provide a new explanation for how the simplification operates in the entrepreneurial context. More importantly, my findings offer a novel insight by showing how new venture teams nest one heuristic or bias within another: a constraint within a constraint concept. Beyond the simplifying benefits of heuristics and biases, my results explain how new venture teams leverage heuristics and biases to maintain team coherence consistent with the creativity literature (Harrison & Rouse, 2014).

My research questions: *How do entrepreneurs use heuristics and biases to achieve more creativity in making decisions? And How do they do so as a team?*

New venture teams leverage heuristics and biases in two effective ways: as sieves and as tie-breakers. Creativity calls for the generation of novel ideas and entrepreneurs do that and then use their heuristics and biases as sieves to filter those ideas. Heuristics and biases as sieves not only separate potentially useful ideas from others, they provide important boundaries that help

the new venture team maintain coherence. Thus, heuristics and biases simplify the decision

making process by reducing an exploding number of creative ideas and directing the team's

focus to a bounded consideration set of alternatives. Within this bounded consideration set, new

venture teams use heuristics and biases to break ties which result from further winnowing

alternatives. This particular application of heuristics and biases is *rational* because under

conditions of extreme uncertainty, ambiguity, complexity and time pressure, access to detailed

and accurate information necessary for making risk-benefit analyses is practically impossible.

Building assumption upon assumption farther into the future weakens the validity of the analysis

as one interviewee explained:

> "We had previously really mapped out a really thorough, really elaborate,
>
> sophisticated Excel spreadsheet to quarterly, annual forecasting based upon
>
> assigned projects that average value of X, or breaking out payments, or over
>
> certain periods of time and things like that. And then assigning different costs, the
>
> whole mapping different things out. The whole reality just that the more detailed
>
> you get with work estimating that, the less accurate it's going to be in the long
>
> run, because you ... that's why plans never work."

CONCLUSION

This study explores how heuristics and biases support new venture teams' creative

decision-making processes beyond the current conceptualization of simplifying mechanisms.

Data shows how new venture teams use heuristics and biases in nested manner to achieve higher

levels of creativity in decision-making. Rather than focus on heuristics as error-prone shortcuts

that entrepreneurs use under conditions of ambiguity, uncertainty and time pressure, the analysis

shows that entrepreneurs use the concept of a constraint-within-constraint. One use of heuristics

and biases is to filter a large number of alternatives providing a focal consideration set. Nested within the first use, other heuristics and biases are used to break ties between closely comparable alternatives.

CHAPTER IV: TO REWARD OR NOT REWARD: DISENTANGLING THE EFFECTS OF REWARDS AND SEARCH CHOICE ON COLLABORATIVE CREATIVITY

ABSTRACT

Among the predictors of the rewards-creativity relationship, research shows that creativity-contingent rewards support creativity when individuals freely choose their reward or choose how to engage in a creativity task. Controlling either the choice of reward or the choice of how to engage in a creativity task seems to undermine creativity. However, evidence from the choice literature indicates that exploring an unlimited number of choices (rewards and ideas) can overwhelm individuals undermining their intrinsic motivation, and in turn, their creativity. In practice, rewards are used to motivate creativity suggesting the possibility of reward efficacy for creativity purposes. Taking a group perspective, we suggest that reward information, such as rules that stipulate how the reward is earned, help group members coordinate and facilitate the search task by reducing the number of alternatives to be explored *without eliminating choice*. Using a laboratory experiment, we test the effect of reward choice and task choice on group creativity. We find that there is no significant relationship between reward choice and group creativity. Our findings regarding the effect of choice in how to engage in a creativity task were inconclusive. Our research nevertheless contributes to the creativity literature by offering a potential link to reconcile the gap between the self-determination and the learned industriousness predictions of creativity. Our research questions raise important implications and suggest promising directions for research.

INTRODUCTION

The value of creativity to organizations is undisputed. Ray Bingham, CEO of Cadence

Design Systems once said: "The biggest threat to the U.S. economy is lack of creativity…. It's

really a question of innovate — or die" (Bingham 2001: 24 from Elsbach & Hargadon, 2006).

Creativity is the source of all innovation (Amabile, 1996). The need for creativity in business

organizations and society at large has been exacerbated by the fact that collaborative creativity is

difficult to trigger and sustain (Hargadon & Bechky, 2006). Political and business leaders place a

high premium on creativity and, in response, scholars have taken an interest in understanding

how to motivate creativity (Byron & Khazanchi, 2012). Given the critical importance of and the

difficulty in motivating creativity, organizations continue to adopt rewards in various forms as

part of their motivation strategies (Deci, Koestner, & Ryan, 1999) in stark contrast to research

showing that rewards undermine individual creativity. While research has focused on rewarding

individuals for creative outcomes (i.e. creativity-contingent rewards), in this paper we explore

the effects of rewards on group creativity (George, 2007). Specifically, we expect creativity-

contingent rewards to have different effects on individual versus group creativity because

individuals interact within groups. For instance, while irrelevant to an individual, coordination

between group members is critical for collaboration (Okhuysen & Bechky, 2009). Rewards, and

their associated information, may help group members coordinate their collaborative creativity

process.

History is peppered with numerous accounts of influential figures and organizations who

have offered significant rewards to induce desperately needed innovation and solve historically

challenging problems; all of which require creativity (Masters & Delbecq, 2008). Inducement

prizes have been offered for measuring longitude at sea in the 1500s and again in the 1700s

(Davidian, 2005), for crossing the Atlantic in search for gold (Christopher Columbus), for finding remedies for outbreaks of various diseases (Campbell, 2006), for successfully completing the first solo flight from New York to Paris in 1927 (famously won by Charles Lindbergh) and for building a reusable manned space craft capable of carrying three people to 100 kilometers above earth twice in two weeks (Masters & Delbecq, 2008). Non-monetary rewards, including recognition and fulfillment, have induced people to be creative when lives or human suffering were at stake typically following calamities (e.g. Tsunamis), accidents (e.g. Mining accidents) and survival incidents (e.g. saving the Apollo 13 astronauts following the damage of their air filtration system which threatened their lives if a creative solution had not been found quickly). In addition, although strongly abhorred, examples of reward-induced creativity include many famous bank, artwork or diamond heists in which robbers used creativity to gain prized possessions. These examples show that people do achieve creative outcomes in response to offers of rewards and that they collaborate in groups to win them.

Motivating individuals to produce creative ideas using extrinsic rewards has been the subject of an unsettled debate in the creativity literature (Zhou & Hoever, 2014; Zhou & Shalley, 2008; Byron & Khazanchi, 2012). Dominating this debate, the self-determination view suggests that extrinsic rewards impose control over individuals creating a perception of pressure and depriving them of the experience of choice and a strong sense of volition (Deci, 1971; Gagné & Deci, 2005). For this reason, self-determination theory predicts that extrinsic rewards undermine individual creativity. Nevertheless, as we noted earlier, practitioners use rewards to motivate creativity suggesting the possibility of reward efficacy for this purpose. To explain this contradiction, we examine the effect of extrinsic rewards on creativity at the group level of

analysis and propose that rewards promote creativity in groups while undermining individual creativity.

For individuals, freedom in choosing how to engage in a creativity task is important. However, the claim that reward or task choice motivates creativity is vague because 1) it is unclear whether creativity suffers as a result of limited reward or task engagement choice or both, 2) total freedom of choice does not necessarily guarantee a creative outcome because evaluating too many alternatives can be cognitively taxing overwhelming group members, which leads to frustration and diminished intrinsic motivation (Patall, Cooper, & Robinson, 2008), and 3), in a group context, exploring an unlimited set of possibilities can be daunting. To the extent that individual choices differ, how do individuals reconcile their task or reward choices to maximize the benefit of collaboration? Since intrinsic motivation is critical to creativity (Amabile, 1996), we face the paradox that both control and freedom undermine creativity in groups.

We suggest that when facing an infinite set of alternatives, group members seek information to make their search for creativity manageable and to coordinate their collaboration. To the extent that a reward provider stipulates rules for earning the reward, group members use these rules as filters or sieves to eliminate alternatives in order to direct focus and effort efficiently to those alternatives that comply with reward rules. As an added benefit, exploring alternatives within the boundary of reward rules increases the likelihood that the proposed creative idea satisfies the reward provider, which significantly increases a group's chances of winning the reward. In addition, other informational aspects of rewards, such as the reward value or prestige, drive behavior by signaling the importance and value of creativity, which leads group members to direct their efforts towards a shared goal (Eisenberger, 1992).

In spite of extensive use of rewards throughout history and scholarly research in this stream, it is still unclear how rewards affect creativity (Byron & Khazanchi, 2012). Some studies have found that rewards undermine creativity (e.g. Amabile, 1983), while others have found that rewards enhance creativity (e.g. Eisenberger & Rhoades, 2001). These studies relied on the self-determination and the learned industriousness theories, each of which has led to "diametrically opposed" predictions (Byron & Khazanchi, 2012: 1). This paper answers persistent calls for research into how different antecedents jointly affect creativity (Zhou & Hoever, 2014; Zhou & Shalley, 2008) and how the reward context offers choice and imposes control on the creative process (Byron & Khazanchi, 2012).

Addressing these calls for research at the group level of analysis is of critical importance to creativity research. Motivation, intrinsic or extrinsic, is an individual level construct and much of the extant research has focused on individual-level analysis (Amabile, 1983). However, the predominant organizational unit is a workgroup in which collaboration is not only desired and expected, it is highly encouraged (George, 2007; Kozlowski & Bell, 2003; LePINE et al., 2008). Extending our understanding of the rewards-creativity relationship to groups raises important and interesting questions. First, since creativity requires individuals to search for variation in order to find novel ideas, motivation theorists suggest that rewards support creativity when they offer freedom in rewards and in how the search task is conducted (Amabile, 1983; 1996). However, we observe that reward options tend to be limited in practice (Masters & Delbecq, 2008). In terms of task conduct, we pose the question: How are group members to begin their search, proceed with it and eventually cohere around a creative idea? Second, in a group context, another relevant question is: How are members to coordinate their collaboration to build on one another's contributions and enable the group to achieve more creative outcomes (Okhuysen &

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Bechky, 2009; Hargadon & Bechky, 2006)? Perhaps, rewards that provide information for group members to coordinate their creative collaboration are likely to enhance group creativity.

Research suggests that groups may have advantages over individuals in the pursuit of creative outcomes. For instance, group members' interactions and engagement may be more salient than the rewards offered. Research shows that when the importance or value of rewards is not emphasized, more divergent thinking is evident – an important input of creativity (Eisenberger & Selbst, 1994). Collectively, a group may benefit from motivation contagion where the most motivated group members engage those who are initially less motivated. Thus, by examining the rewards-creativity relationship at the group level, our research provides important boundary conditions that may improve the creativity predictions of self-determination theory. In this paper, we proceed as follows: First, we highlight relevant theoretical issues in the literature following the path laid out by a recent meta-analytical review (Byron & Khazanchi, 2012). Next, we highlight the ambiguity of the choice control construct and its resulting implications for creativity. We then propose an empirical model and hypotheses that we test in a laboratory experiment. Finally, we report results and discuss findings and implications.

THEORETICAL FOUNDATIONS

The main debate around the effect of extrinsic rewards on creativity is rooted in two theories and their associated assumptions and mechanisms used by researchers on both sides: the self-determination theory (Deci & Ryan, 1985) and the learned industriousness theory (Eisenberger, 1992). Self-determination theory (Deci & Ryan, 1985) is based on the premise that extrinsic rewards control individual behavior. Self-determination theory predicts that extrinsic rewards cause individuals to feel controlled, which restricts their freedom to choose how to go about their task, which in turn diminishes their personal volition and intrinsic motivation, a

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widely regarded source of creativity. Rewards induce individual motivation extrinsically and refer to: "extrinsic forms of reinforcement such as money, prizes, desirable activities or outcomes, praise, or recognition" (Byron & Khazanchi, 2010: 2). Extrinsic rewards also constrain individual choice when the reward creates conditions in which supervisors closely monitor or impose strict rules on individuals tasked with creativity. Much of the evidence supporting the widely influential self-determination theory comes from "laboratory experiments and field studies in domains other than work organizations (Gagne & Deci, 2005: 350)." In contrast, the learned industriousness theory (Eisenberger, 1992) suggests that extrinsic rewards provide individuals with information that signal the importance and value of creativity. Thus, individuals adapt their behavior towards the target goal of creativity doubling their effort to earn promised rewards.

In this debate, a key difference between the two main theoretical views is their assumptions regarding high cognitive aversion. Self-determination theory assumes individuals are not averse to high cognitive effort as they are driven to apply that effort by their psychological need for growth, challenge and a coherent sense of self. The learned industriousness theory, on the other hand, assumes that individuals are averse to high cognitive effort and therefore seek to apply such effort efficiently. Thus, self-determination theory assumes motivation determines creative performance, whereas the learned industriousness theory assumes learned habits determine creative performance (Byron & Khazanchi, 2012). The mechanisms used by these two theories also differ. In the self-determination frame, aspects of rewards and reward contexts lead to one of two effects: 1) they enable internalization of motivation to carry out the target activity – i.e. extrinsic motivation increases intrinsic motivation, or 2) they increase an individual's feelings of being controlled – i.e. extrinsic motivation decreases intrinsic

motivation. In addition to the volume of research on the second condition, researchers have established that the first condition is rare (Hennessey & Amabile, 2010). In the learned industriousness frame, rewards reduce the aversion of high cognitive effort leading an individual to increase effort and interest in the creative task. Both mechanisms act on an individual's freedom and competence.

There are bridging possibilities that may potentially reconcile the differences between the two theories and their predictions. In the self-determination view, the theory's: "assumption that autonomy has uniformly positive effects does not account for the possibility that choice may, in some cases, create confusion about where and how to direct one's effort, thus decreasing intrinsic motivation and subsequent performance (Byron & Khazanchi, 2012: 2)." In the learned industriousness view, the assumption that individuals are aversive to high cognitive effort precludes the possibility that the creative task may be intrinsically motivating. In addition, the learned industriousness theory ignores the importantly detrimental effects of controls in the context of creativity (Byron & Khazanchi, 2012).

Other researchers have explored this topic from different perspectives. There is evidence that individuals are motivated by a combination of intrinsic and extrinsic motivations: They place different values on different rewards and choose tasks that align with their intrinsic motivation while maximizing extrinsic rewards (Vroom, 1964). Other researchers have suggested an actor-context interactionist approach to creativity research citing a number of ways rewards benefit creativity (Zhou & Hoever, 2014) These include the expectation of or actual rewards under perceived performance pressure (Eisenberger & Rhoades, 2001), supervisor expectation of employee creativity through a Pygmalion-like process (Tierney & Farmer, 2004), employees' creative self-efficacy (Tierney & Farmer, 2011), work and non-work support

(Madjar, Oldham, & Pratt, 2002), perceived organizational support that was partly mediated by frequent feedback from multiple sources (De Stobbeleir, Ashford, & Buyens, 2011) and desired creative climate (Choi, 2004). In addition, extrinsic motivation has been found to enhance creativity when it is additive – that is to say when the rewards are intended to support intrinsic motivation and when intrinsic motivation is already strong (Hennessey & Amabile, 2010). In a meta-analysis of rewards and creative performance, researchers hypothesized and meta-analytically tested a set of five moderators: a) reward contingency, b) performance feedback, c) choice control, d) task engagement, and e) task complexity. Shining a spotlight on one of these moderators, choice control, we aim to extend and empirically test this framework and by doing so, bridge the gap between the self-determination and learned industriousness predictions of the rewards-creativity debate (Byron & Khazanchi, 2012). To this end, we examine the effect of reward choice and search choice on group creativity. Reward choice refers to the individual's freedom to choose from different motivating rewards. Search choice refers to an individual's freedom to choose how and where to search for novel alternatives in pursuit of creativity.

We propose viewing choice control as a continuous rather than a binary construct. That is, individuals experience choice on a continuum that ranges from no choice to free choice with varying degrees in between. We suggest that researchers have inappropriately assumed a binary effect of choice and choice control on creativity: individuals are absolutely free to exercise their creativity or they are completely controlled. This assumption is rooted in self-determination theory and suggests that when offered fewer options, an individual may fail to perceive the experience of choice compared with more options (Patall, Cooper & Robinson, 2008). Consequently, more options is better and limits imposed on the number of options are not welcome. This all or nothing view is counterintuitive. Research shows that in experiments

involving product purchases and essay writing, individuals performed better when given 6 choices (products or essay topics) than when they were given 30 choices (Iyengar & Lepper, 2000). In a creative task, searching for alternatives (i.e. variation) may lead to possibilities that are theoretically infinite. Reward information and criteria that aid in filtering options are therefore useful because they bound our consideration set of alternatives making our search more manageable. Suppose a family moved to a new city and started a search for a new home. Unless family members constrain their search using one or more rules (e.g. a specific neighborhood, distance from work, price, etc.), the search is likely to prove daunting and may fail if the number of viable alternatives overwhelms family members.

Choice and Control

Choice is a powerful motivator because it increases perceived volition according to self-determination theory (Deci, 1980). Indeed, researchers report that choice of rewards and choice of tasks in which to engage are some of the dimensions of choice that increase individual volition (Amabile, 1983; Amabile, 1996; Byron & Khazanchi, 2012). In contrast, diminished volition was linked to instructions that limit autonomy and intrusive observation of performance by supervisors. From a different perspective, the ego-depletion self-regulatory model perspective suggests negative effects of choice. Citing the pervasive belief in American society that choice is beneficial and that it is a meaningful way for individuals to define themselves, researchers conducted a meta-analytic review of the effects of choice on intrinsic motivation and related outcomes. Evidence suggests that choice is a complex construct that is not always beneficial (Patall, Cooper & Robinson, 2008) and that its effect may not be linear (Iyengar & Lepper, 2000). At some level, a large number of choice options can overwhelm and demotivate individuals because cognitive effort increases as the number of choice alternatives increases.

Thus, while removing the perception of choice by imposing strict controls is detrimental to creativity, too many choices may lead an individual to feel overwhelmed (Patall, Cooper & Robinson, 2008). Indeed, results show that the moderating effect of number of choices on intrinsic motivation was a significantly robust finding. It follows that individuals benefit from mechanisms that narrow down the number of alternatives to be explored and evaluated without eliminating choice altogether. In a group context, group members face the same issues with respect to choice that individuals face. In addition, group members must also collaborate to constructively integrate their individual efforts, which necessitates the adoption of coordinating mechanisms (Harrison & Rouse, 2013). We elaborate on this topic next.

The Necessity of Coordination in Groups

In a review of the coordination literature, coordination is a central purpose of organizations of all sizes (Okhuysen & Bechky, 2009). The growth of the railroads in the eighteenth century illustrates this notion. The railroads relied on printed timetables to coordinate collaboration on a massive scale: loading and unloading passengers and cargo and avoiding crashes when two trains used the same track at the same time. Timetables allowed coordination because a standardization mechanism was invented, the Railroad Standard Time, which divided the continental United States into four time zones and replaced over 500 local time zones. When it was introduced, Railroad Standard Time was seen as a coercive constraint because, in order to benefit from the railroad, small towns had to respect it. Furthermore, coordination is critical for groups to avoid disintegrating into chaos as a direct result of individual free choice or when individuals break away from group norms and patterns (Barker 1993; Van Dyne & Saavedra, 1996).

The Coordinating Benefit of Constrained Choice

Rewards come with rules that stipulate how rewards must be won. While imposing restrictions, rules and plans enable coordination as they increase the level of cooperation across individuals in a group (Okhuysen & Bechky, 2009; Pinto et al. 1993). Rules play a similar role in that they "coordinate by providing a template for task completion, by bringing people together, and by creating a common perspective across groups (Okhuysen & Bechky, 2009: 477)." As coordinating mechanisms that limit but do not eliminate choice, rules help group members coalesce, focus on a common problem domain and exchange information. Groups sometimes select their own coordinating rules during the initial phase of the creative process, problem identification or problem definition (Amabile 1983; Getzels 1975). Moreover, standardization, which relies on rules, has been shown to improve the impact of creativity on customer satisfaction (Gilson, et al., 2005).

Evidence from the improvisation literature also supports this positive effect of using rules to coordinate. For example, routines stimulate improvised plans (Miner, Bassof, & Moorman, 2001). SWAT teams have been shown to rely on pre-planning to reinforce and limit task assignment in the presence of uncertainty and contingencies (Bechky & Ohkhuysen, 2011). Evidence from research domains outside of organizational behavior is also supportive. In a study of distributed online creative collaboration, researchers compared collaborative work on animated movies known as *collabs* with that of open source software. They found that leaders with solid reputations who commanded respect in their communities were instrumental in providing early planning and structure to their group members (e.g. Rules in the form of technical specifications), which in turn reduced confusion and conflict as the projects progressed (Luther, Caine, Ziegler, & Bruckman, 2010). Similarly, tight client briefs – client specifications

that provide more direction and less autonomy to creative teams in advertising – were described as "liberating" because they led to more team trust (Hackley, 2000)

Taken together, research shows that it is possible to produce creative ideas by reducing without eliminating task choice. We therefore suggest that disentangling the effects of choice control of rewards from that of the search task would clarify the currently equivocal relationship between rewards and creativity. To summarize, research into creativity indicates that extrinsic rewards hinder creativity by restricting choice of rewards, tasks and participation. However, intuitively we know that creativity can be produced under conditions of no reward choice and no reward at all. This suggests that disentangling choice control of rewards from other antecedents of creativity would help clarify how the reward and reward context offer choice or impose control on creativity at the group level of analysis (Byron & Khazanchi, 2012). To be clear, we focus on the contrast between choice versus no choice. We do not address the reward versus no reward contrast. Thus, we propose the following hypotheses:

Hypothesis 1: Reward choice compared to no reward choice positively predicts group creativity.

Hypothesis 2: Search task choice compared to no search task choice positively predicts group creativity.

Extant research does not propose how individuals or groups ought to manage an overwhelming number choices as they explore and evaluate new ideas. Thus, the question of where and how to direct one's creative effort in the presence of unlimited choice remains unanswered. We propose that coordinating mechanisms such as reward rules serve this purpose. In addition, some researchers have used novelty of ideas as a proxy for creativity (e.g. Goncalo, Chatman, Duguid & Kennedy, 2015). Since an idea is deemed creative if it satisfies both the novelty and usefulness conditions of creativity (Amabile, 1996), we therefore suggest:

Hypothesis 3: The relationship between rewards choice control and group creativity is mediated by both search task choice control and novelty of idea.

METHOD

Participants

Our sample was drawn from the University of Colorado Boulder's undergraduate subject pool. In all, 228 students participated in this experiment from October 2014 through February 2015. We instructed students to form groups resulting in a total of 78 groups. The vast majority of our groups had three members. The sample included 89 females (39.0% female), had a mean age of 20.2 years (SD=1.56), a mean of 2.5 years of school and 83.3% were white or Caucasian.

The Experimental Task

Following Berg (2014), we provided our experiment participants with the following instructions: "The university bookstore is looking for creative ideas for an innovative product to sell to students. Your goal is to develop a novel and useful idea by collaborating with members of your group. You may use any online resources." In addition, participants were assigned to one of four conditions:

1. Reward Choice - subjects were offered a choice of 1) $5 bookstore gift card, $5 Amazon gift card or $5 Starbucks gift card. These options were selected to appeal to students while offering them a selection of choices.

2. No reward choice - subjects in this condition were told they would receive a $5 bookstore gift card.

3. Uncontrolled search choice - no rules were offered to direct the subjects search for creative ideas.

4. Controlled search choice: subject were given two rules: ideas proposed by the group cannot be wearable or edible.

Once each group completed the experimental task, individual participants filled out a survey about their experience.

Judging the Creativity Task

Consistent with the literature on creativity, we recruited eight judges from the same student subject pool to rate the creative product (Cropley, 2000). We ensured that our judges had not participated in our experiment as group members. Following Shin and Zhou (2007), we used four items to assess three dimensions of team creativity after adapting them to our context. Using a 5-point scale (1 is poorly, 5 is very much), the judges are asked to score the teams' creative solutions based on the following three dimensions: novelty of idea, significance of idea and usefulness of idea. Sample items are: "How well did the team produce a new idea to solve the problem?" and "How useful is the idea?" Judges' Agreement was high ($\alpha =79.7$), thus all responses to the four items were aggregated to derive a measure of group creativity.

Measures

Reward Choice. Reward choice was manipulated by randomly assigning subjects to one of two reward choice conditions: no choice ($5 bookstore gift card) or the choice condition ($5 bookstore gift card, $5 Amazon gift card or $5 Starbucks gift card). We offered three reward options in the reward choice condition in line with research showing the optimal number of choices is more than two and less than five (Patall, Cooper & Robinson, 2008).

Search Task Choice Search task choice was manipulated by randomly assigning subjects to one of two search choice conditions: Uncontrolled search choice (subjects were free

to search without any rules) and controlled search choice. We operationalize this condition by requiring that subjects to avoid ideas that were wearable or edible.

Novelty of Idea. Novelty of Idea was measured by counting the frequency of ideas across the entire sample. A low frequency indicated the novelty of an idea.

Group creativity. Group creativity was measured using a four-item scale (1 = Never, 5 = Always) adapted from Shin and Zhou (2007), which included: "How well did the group produce new ideas" and "How useful are those ideas."

Control Variables. Because our experiment subjects were drawn from the University of Colorado Boulder's undergraduate student subject pool, our sample was homogenous in regards to age (mean = 20.2 years old), race (83% were white) and undergraduate major (all majored in business administration). All experiment sessions were conducted later in the week (Wednesday, Thursday or Friday), thus we did not control for day of week. A group of three members was our predominant group size. However, on rare occasions, we accommodated groups of two and four members. Controlling for group size had no effect on our results and was therefore removed.

RESULTS

Table 5 represents the means, standard deviations and correlation coefficients for all variables. Comparing group means of the reward choice versus no reward choice groups, the difference was not significant (t=.414, p<.5). Thus, hypothesis 1 was not supported. Similarly, comparing group means of the search task choice versus no search task choice groups, the difference was not significant (t=.077, p<.782). We then tested hypothesis 3 using Hayes' (Hayes, 2012) PROCESS macro for SPSS with 5,000 bootstrapping samples. Table 6 shows the PROCESS bootstrapping results which show that hypothesis 3 was not supported either.

Table 5

Descriptive Statistics and Correlations.

Variables	*M*	*SD*	1	2	3	4
1. Reward Choice	-.02	1.00				
2. Search Task Choice	.00	1.00	.00			
3. Novelty of Idea	1.87	1.46	.05	.07		
4. Group Creativity	3.04	.65	.07	.03	.154	
5. Gender	1.60	.33	-.17	-.12	.07	-.23*

Note. N = 78 groups.   ** p<.01, * p<.05

Table 6
Indirect Effects of Reward and Search Task Choice on Group Creativity.

	Organizational Encouragement Indirect Effects of *Novelty of Idea*
Bootstrap estimate (a_1b_1 path)	.01
Bootstrap *SE*	.02
LL 95% CI	-.02
UL 95% CI	.05
	Direct Effects
IV_1 on mediator (a_1 path)	.09
IV_2 on mediator	.12
Mediator 1 on DV (b_1 path)	.08
IV_1 on DV (path c_1')	-.01
IV_2 on DV	.02

Note. N = 78 teams. Unstandardized regression coefficients are reported. Bootstrap sample size = 5,000. LL = lower limit; UL = upper limit; CI = confidence interval; IV_1 = independent variable 1, Reward Choice Control; IV_2 = independent variable 2, Search Task Choice Control; DV = dependent variable; Mediator = Novelty of idea.
** *p* < .01, * *p* < .05.

DISCUSSION

We sought to disentangle the effects of reward choice and search task choice on group creativity. We expected to find no difference between the reward choice condition and the no reward choice condition. Our prediction was supported, as hypothesis 1 was unsupported. To the extent that rewards do not signal or dictate how group members ought to pursue the creativity task (i.e. how and where they should search for variation), whether or not group members have a choice in rewards does not affect their creativity directly beyond inducing group members to engage in the creativity task. However, we expected to find a significant difference between the search task choice and the no search task choice. We could not find support for hypothesis 2. A likely explanation for this result is that our search task control was not restrictive enough. In the search task choice condition, we controlled subjects' choices by imposing a rule that excluded edible and wearable ideas. This may not have been restrictive enough: even after excluding edible and wearable ideas, the remaining possibilities are still infinite. Interestingly, restricting search task choices did not negatively affect group creativity as predicted by the self-determination theory.

We note that in our time pressure experiment (see chapter II), we manipulated time pressure (low time pressure, high time pressure) and rules (rules, no rules). In this time pressure experiment, we found a significant positive relationship between rules and self-reported creativity ($F=6.575$, $p<.01$) and also a significant positive relationship between rules and novelty ($F=4.546$, $p<.01$), where novelty was measured by counting the frequency of each idea and novel ideas were those that were suggested less frequently.

Strengths, Limitations and Future Directions

Our study raises important and yet unanswered questions. In practice, rewards continue to be employed to motivate creativity in organizations. Yet, extant research shows an unclear relationship between extrinsic rewards and creativity. Next, we offer suggestions for pursuing the questions we raise in this paper. At the group level of analysis, understanding how intrinsic motivation scales beyond an individual is useful. Collectively, groups may benefit from motivation contagion where the most motivated group members engage those who are less motivated. Thus, rewards may be used to motivate one or two members of a group who may in turn motivate their fellow group members.

All subjects in our experiment received the same reward value even though some groups produced ideas that were more creative than others. We purposely designed the experiment in this way to comply with requirements set by our institutional review board. However, future researchers may want to explore the effect of a more competitive reward design in which more creative ideas win higher prizes. In addition, regardless of reward effect, students in a college setting may be motivated to collaborate because they tend to be more inclined to forge new friendships with other students. The norm on most college campuses – which emphasizes communal living, intramural sports, class team projects, etc. – orients students to be disposed to seeking and accepting new friendship overtures. Thus, conducting laboratory experiments suffers from this effect, as it is difficult to control for students pro-social motivation and rule it out as a factor of creativity in groups.

Although self-determination details processes by which extrinsic motivation can become autonomous, researchers have mostly ignored this potentially useful construct and its effect on work motivation. While intrinsic motivation is related to inherently interesting tasks, autonomous extrinsic motivation is more predictive than is intrinsic motivation for important

tasks that are not necessarily interesting but that require discipline and effort because they are personally important for one's chosen goals (Gagné & Deci, 2005). Thus, future researchers may design studies to explore the relationship between autonomous extrinsic motivation and creativity. As Gagné and Deci note:

"All of the studies of reward effects on intrinsic motivation have been done with the dichotomous conceptualization of intrinsic versus extrinsic motivation. Little research has examined reward effects with respect to the internalization of extrinsic motivation. The differentiated view of extrinsic motivation presented by self-determination theory provides a basis for examining the effects of tangible rewards on motivation in a more rigorous and careful way that includes a consideration of the effects of rewards and work climates on internalization as well as intrinsic motivation. The field is in need of just such research. (Gagne & Deci, 2005: 354)."

Practical Implications

Managers can motivate their employees to be more creative in workgroups using rewards. The rewards must be compelling enough to motivate employees to invest time and effort to win them. Symbolic or token rewards are ineffective in the context of creativity as individual employees weigh their expected benefits (the reward) against their cost (the investment of time and effort to win).

Offering too many reward choices can potentially confuse employees as they try to understand which reward is attainable and which is likely to offer more benefits and satisfaction. Managers are well advised to limit rewards to no more that three to five options to simplify the selection process and help employees focus on the creative task.

CONCLUSION

From a group perspective, we sought to examine how reward information, such as rules that stipulate how the reward is earned, help group members coordinate and facilitate the search task by reducing the number of alternatives to be explored without eliminating choice. While we did not find support for our hypotheses, our analysis did not support extant theories of individual creativity either. This suggests that additional experimentation may offer new insights. Several factors may have interfered with our experiment. It is possible that students did not see much value in a $5 reward. Thus, additional experimentation under different conditions may be helpful. For example, rather than offer each team member the same $5 reward, we can offer one substantial reward of $300 to the most creative idea in a 4-hour scrimmage. More broadly, understanding how rewards affect groups' creativity points to a useful and important direction for future researchers. For instance, in the entrepreneurial context, angel investors and other early stage investors provide valuable mentoring to teams propelling their new ventures. These early stage investors provide much needed mentoring to new venture teams.

CHAPTER V

GENERAL DISCUSSION

Understanding how creativity is collectively triggered and guided by constraints exposes one to a wide range of interesting contexts as the need for creativity is fundamental to all endeavors. Constraints have been cast in the literature as the villains of creativity for good reason. Individuals who long for creativity perceive them as barriers. In spite of that, when individuals collaborate in mindful ways, those constraints transform into guides that shepherd the collaboration towards creativity. For this dissertation, I examined constraints that are broadly relevant to startups as well as global organizations: time pressure, rewards, rules, heuristics and biases.

Exploring collaborative creativity under time pressure provided an opportunity to extend what we know about its effect on individual creativity – that time pressure undermines it – to groups by showing that helping behaviors and organizational encouragement support group member interactions as they pace themselves towards realizing creative outcomes. Indeed, help-seeking and help-giving (Hargadon & Bechky, 2006) explains how and why constraints support rather than undermine creativity in groups. Future researchers may wish to explore the transition of time pressure from a negative effect on individual creativity to a positive effect on group creativity. In other words, how is the negative effect of time pressure neutralized by adding collaborators?

Turning to rewards and rules, we see a similar pattern. Offering extrinsic rewards in and of itself does not appear to impair creativity. Rather, it is the reward rules or criteria that constrain the search for new ideas leading to creativity. Consistent with the literature on extrinsic motivation, individuals wrestle to produce new idea variants viewing the imposed constraints as

limiting. However, when individuals collaborate, additional resources are enlisted in the search effort leading to creative ideas that comply with reward rules and criteria. Future researchers may wish to explore the extent to which reward rule specificity influences collaborative creativity: is there a significant difference in creative outcomes between reward rules that are highly specific versus rules that are more general?

Finally, my research extends the constraints-creativity relationship findings to entrepreneurship and new venture teams. Beyond using heuristics and biases to simplify decision making, I uncover a unique and rational way in which entrepreneurs perform this simplification by nesting one heuristic or bias within another: a constraint within a constraint concept. Leveraging heuristics and biases in this manner allows teams to respond to unpredictable and unavoidable disruption to maintain team coherence. In doing so, entrepreneurial teams show a great deal of adaptability since they cannot realistically control events under conditions of extreme uncertainty, ambiguity, complexity and time pressure. This suggests an interesting area for future research: exploring the tension in entrepreneurial teams between the need to maintain coherence, hence the use of heuristics and biases for coordination, and the need to adapt to a changing environment which suggests they may constantly question the appropriateness of their chosen constraints at any given time.

My research demonstrates that the disadvantages of constraints can be turned into advantages with mindful collaboration: When all else fails, collaborate. These results suggest that we cannot extend what we know about individual creativity constraints to groups without careful examination. A key contribution to the vast and expanding literature on creativity in organizations is extending the componential theory to the group level. Another important contribution is extending the literatures on entrepreneurship decision making to the teams and

the group level of analysis. In this regard, I extend the literature on heuristics by offering a novel and useful explanation for how entrepreneurs' decision-making simplifications are as accurate as and more practical than risk-benefit models.

In closing, this research promises interesting directions and questions. For example, categorizing constraints into meaningful categories may indicate which are supportive of collaborative creativity and which are not. In addition, it would be interesting to explore how the same constraint might be used in different ways to produce different creative outcomes in combination with other constraints. In groups, members may respect different constraints which suggests that coherent teams may be more effective in reconciling conflicting choices of constraints.

Across all walks of life, collaborative creativity is not only a common theme but it is also highly desirable by different people for different reasons. This makes this research stream and its future branches most engaging.

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Creative Decision Making in New Venture Teams

The purpose of this study is to explore the role of constraints in decision-making situations that require creativity. We want to identify explicit constraints and tease out those that are implicit or unobvious.

Questions to Ask

Initial Questions

Explore decisions made by this team to identify at least one that required creativity. Then probe to verify that interviewee has at least one focal decision that required creativity in mind.

- What decisions seem challenging now? In the past?
- Which decisions had positive/negative outcomes?
- Which did you make alone. Which you couldn't make without the team's input?
- How did you feel about these decisions? Why? Which would you do over if you could? What would you do differently?
- *Tell them a creative solution is one that is both novel and useful then ask...* Can you think of a creative solution or step that someone suggested, which helped the team make the decision?
- Think of key decisions you've had to make as a team for your venture. Ignore routine decisions that involve familiar issues and inputs (for example, where to go for lunch). *If necessary, I'll suggest examples: launch your product or service in a new vertical or geographic market. Pause till interviewee confirms she has such a decision incident in mind (adapted from Flanagan, 1954).*

The Focal Decision

- *Let's focus on one decision… identify it and validate the creativity component.*
- Why did you consider this decision challenging?
- What were the circumstances leading to this decision?
- When did you first face it? When did you make the decision?
- How did you frame the decision? Did that frame change?
- What happened? Who was involved? What did you do?
- *Remind them a creative solution is one that is both novel and useful then ask...* What compelled

the team to be creative as you made this decision?
- How novel was the solution? Radically novel? Or incrementally novel?
- How useful was the solution? Very useful or somewhat useful?
- Were there factors pushing you to make the decision quickly? Or did you have plenty of time?

Constraints & Heuristics

Probe for boundaries, constraints or heuristics used by team members.
- Are there rules of thumb or lessons learned that guided your decisions? If so, what were they?
- Did anyone set boundaries for themselves or the team as you got started?
- Where there "must have's" or "non-negotiables"?
- Were there lines that you wouldn't cross?
- Why did you not/cross the line?
- Was there a cost to not/crossing the line? What was at stake?
- Did anyone suggest you not/cross the line?
- Roughly how many alternatives did you/the team generate?
- Roughly how many alternatives did you/the team consider?
- How did you as a team coordinate?
- How/Why did you eliminate some alternatives?
- Were there alternatives that you considered "off limits" or unacceptable?
- Did you seek outside help of any kind? When did you do that? Why? What was the expected benefit? What was the outcome?
- Did you make a decision? If yes, what was your choice? If no, why do you think it's lingering?
- One of your teammates mentioned decision X, do you recall that decision? If yes, repeat questions.

If necessary and relevant…
- Request to see supporting documents if possible.
- Request the option to follow up at a later time for further clarification.
- Request opportunity to attend a decision-making meeting.