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Illumination and Elbow Grease:

A Theory of How Mental Models of the Creative Process Influence Creativity

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Abstract

How do people think creative ideas are generated? Anecdotally, people's beliefs about the creative process seem to span the gamut of possible behaviors. The current research develops a framework for understanding beliefs about the creative process. We propose that people's beliefs can be organized around two prominent mental models of the creative process (i.e., the Insight model and the Production model). Our framework describes how these mental models influence the prioritization of creative process behaviors (i.e., preparation-focus vs. production-focus) and subsequent idea output (i.e., novelty and feasibility). We discuss five expected patterns of performance (i.e., archetypal frames) that derive from considering which model(s) a worker holds and which model is dominant. We also discuss contextual factors that influence mental model activation. Our theory provides a framework for understanding how people think about creativity and identifies promising directions for future research.

Keywords: creativity; performance; creative process; mental models; insight; productivity; creative process behaviors

1. Introduction

“I rise early almost every morning, and sit in my chamber without any clothes whatsoever, half an hour or an hour, according to the season, either reading or writing.”

- Benjamin Franklin (p. 23, Currey, 2013)

Before Thomas Edison, reading at night was a luxury; before the Wright brothers, soaring the skies was a fantasy; before Grace Hopper, computer programming was science fiction. Societies move forward as a result of inventions that break existing boundaries and challenge the “common sense” of the time. Creativity – defined as the generation of ideas, products, and solutions that are both novel and useful (Amabile, 1983, 1988; Mumford & Gustafson, 1988) – is considered the fuel of such developments. As an early step in the innovation process (Amabile & Pratt, 2016), creativity promotes economic growth and social reform (Florida, 2004; Zhou & Shalley, 2011). Creativity also contributes to individual workers’ performance and competitiveness in organizations (Amabile, 1988; Oldham & Cummings, 1996; Zhou, 1998). Given its societal and economic value, creativity has been a popular topic among academics and practitioners for decades.

In this paper, we explore a popular question among scholars and practitioners alike: *How do people think creative ideas are generated?* In other words, what are people’s beliefs about the creative process? Given the importance of creativity to both workers and organizations, one might expect consensus around how to generate a creative idea. However, in practice, posing this question to a room of 50 executives may very well produce 50 different approaches (at least in the authors’ personal experiences). Some believe creativity results from old fashioned elbow grease, others believe it is fueled by intoxication, and others, like Benjamin Franklin, believe in

exceptional daily rituals such as stripping off one's clothes for an "air bath" (described in the opening quote; Currey, 2013).

A look at the creativity literature reveals a diversity of findings regarding people's beliefs about the creative process (Kasof, 1995; Lucas & Nordgren, 2021; Nijstad, et al., 2006; O'Connor et al., 2013; Stroebe et al., 1992) but only a smattering of broader theoretical development and integration. One reason for this is that research on creativity beliefs (also called lay beliefs, implicit beliefs, or implicit theories) has tended to focus more on beliefs about creative *people* (i.e., the attributes associated with creatives) and creative *outcomes* (i.e., the creativity of ideas, products, or solutions) than on the creative *process* (i.e., the activities that lead to creative outcomes) (Kaufman & Beghetto, 2013; Gough, 1979; Loewenstein & Mueller, 2016; Mueller et al., 2012; Runco, 2004; Runco & Bahleda, 1986; Sternberg, 1985). Another reason is that much of the research on people's beliefs about the creative process investigates beliefs about specific creativity-relevant behaviors – e.g., persistence (Lucas & Nordgren, 2015, 2020), focused attention (Baas et al., 2015), task switching (Lu et al., 2017) – rather than beliefs about the creative process more broadly. The literature currently lacks theoretical frameworks that organize beliefs about the creative process and explain how those beliefs influence performance. Indeed, Shalley and Gilson (2004) observed that the organizational creativity literature lacks theory on the cognitive antecedents of employee creativity, with past work primarily focused on affective antecedents such as intrinsic motivation and positive/negative affect (Amabile, 1985; Grant & Berry, 2011; Liu et al., 2016). These authors called for more investigation of cognitive factors. Similarly, George urged researchers to "explore in more depth how the workings of the mind play out in creativity in organizations" (2007, p. 445). Our current investigation answers these calls by proposing a theory of workers' beliefs about how to engage

in creative work. Understanding beliefs about the creative process can reveal answers to questions such as, why different workers choose to approach creative work differently and when some beliefs are more likely to yield creative outcomes than others.

In this paper, we develop a framework for organizing people's beliefs about the creative process in organizations. Central to our framework, we propose that people's beliefs are shaped by *mental models of the creative process*, which we define as personal lay theories about how to generate creative ideas. Mental models are cognitive knowledge structures that guide thinking and action (Holyoak, 1984; Ross, 1989). They promote sensemaking, problem solving, and performance (Gentner & Gentner, 1983; Kieras & Bovair, 1984; Liang et al., 1995) and are functionally similar to implicit or lay theories (Dweck & Leggett, 1988), cognitive scripts (Gioia & Poole, 1984), and primary frameworks (Goffman, 1974). Our framework proposes that two mental models (the Insight model and the Production model) influence which behaviors workers prioritize when they engage in creative work (preparation-focused versus production-focused behaviors), and that this influences idea output (novelty and feasibility). Our framework reveals five combinations of the insight and production mental models (what we call archetypal frames) that predict unique patterns of idea output. We also discuss contextual factors that influence mental model activation. In sum, our framework describes how workers' beliefs about the creative process lead them to prioritize different creative process behaviors and how this influences creative performance.

Our theoretical framework makes multiple contributions to the creativity literature. Most broadly, our framework answers calls for more investigation of the cognitive antecedents of individual-level creativity (George, 2007; Shalley & Gilson, 2004). Our framework develops theoretical links from mental models (individual-level cognition) to creative process behaviors

(behavior) to idea output (performance). This provides a conceptual roadmap to chart how people's beliefs about the creative process can influence behavior and performance. We also contribute to research on people's beliefs about creativity. While past work has predominantly focused on beliefs about creative people and creative outcomes (e.g., Gough, 1979; Loewenstein & Mueller, 2006), our mental models framework develops theory around people's beliefs of the creative process. Our framework theorizes when and why workers prefer to approach creative work via different behaviors and how this can influence creative outcomes. In studying creative process beliefs, we also contribute to research on the creative process itself. Building on research that considers the time and energy costs of creative work on creative workers (Elsbach & Hargadon, 2006; Harrison & Wagner, 2016), we frame creative process engagement as a resource-constrained choice in which the volume of possible creative process behaviors is greater than the worker's available time, energy, or capital resources. With this framing, creativity not only depends on *whether* workers engage in the creative process but also on *which* behaviors they choose. We distinguish between preparation-focused and production-focused behaviors and identify mental models as a novel predictor of which behaviors workers choose to enact.

Before we develop our arguments further, we first note their scope. Our framework applies to individual-level creativity, the generation and development of novel and useful ideas by individual employees (Amabile, 1983, 1996). We consider higher levels of analysis, such as the group-level, as beyond our scope. The same goes for later stages of the innovation process, such as idea selection and implementation (Berg, 2016; Perry-Smith & Mannucci, 2017). We touch on scope considerations again in the General Discussion. We next discuss research on people's beliefs about creativity to provide context for our framework.

2. Creativity Beliefs

The past few decades have seen an increased interest in understanding people's beliefs about creativity. This research can be broadly categorized as focusing on beliefs about creative *people*, creative *outcomes*, and the creative *process* (c.f., Runco, 2004). In an early study of creative people, Gough (1979) identified an inventory of attributes that observers associate with creatives, such as being *capable*, *clever*, *original*, and *resourceful*. In a similar vein, Sternberg (1985) found that creative people are associated with *nonentrenched thinking*, *imagination*, *perspicacity*, and *inquisitiveness*. In the context of idea pitches, people associate creativity with enthusiastic presenters (Goncalo et al., 2010) and male gendered idea pitchers (Brooks et al., 2014; Proudfoot et al., 2015). One study found that screenwriters are viewed as more creative when they fit the prototypical image of an *artist*, *storyteller*, or *neophyte* (Elsbach & Kramer, 2003). Research also investigates people's beliefs about creative *outcomes* (e.g., ideas, products, solutions). For instance, an early study in this area found that people hold distinct implicit theories about the nature of artistic creativity (emotion, expressiveness), scientific creativity (logic and experimentation), and "everyday" creativity (helpful, common-sensical) (Runco & Bahleda, 1986). Research also finds that people distinguish "everyday" creativity from genius-level creativity (Kaufman & Beghetto, 2013). Loewenstein and Mueller's (2016) investigation of implicit theories and culture found that people perceive creativity to involve a combination of novelty and usefulness, with the implicit theories of people from Western cultures placing more focus on novelty and the theories of people from Eastern cultures balancing novelty and usefulness.

More recently, research has focused on people's beliefs about the creative process. This growing area of research has investigated beliefs about behaviors such as effort and persistence (Lucas & Nordgren, 2015; 2020), focused attention (Baas et al., 2015), relaxation (ten Hoopen &

Groesbeek, 2008), task switching (Lu, Akinola, & Mason, 2017), and working with others (Paulus, Dzindolet, Poletes, & Camacho, 1993). One limitation of this literature is that it has mostly focused on beliefs about individual behaviors that are relevant to creativity rather than beliefs about the creative process more broadly. As a consequence, this literature lacks theoretical integration and unifying frameworks. In fact, a recent review of creativity beliefs research noted that, “[u]nfortunately, there is little systematic research on the content or the structure of the lay theories that people hold about creativity” (Ritter & Rietzschel, 2017, p. 96)¹. This lack of theoretical integration limits the field’s understanding of how creative process beliefs influence workers’ approaches to the creative process and their subsequent performance. In the next section, we begin to lay out the arguments of our framework.

3. Mental Models of the Creative Process

3.1. Two prominent mental models

We propose that workers’ mental models of the creative process provide a lay understanding of how to effectively engage in creative work. We expect that, like any other mental model, “creative process” mental models operate via heuristic knowledge associations that – consciously or unconsciously – guide a worker’s judgment and behavior (Gioia & Poole, 1984; Holyoak, 1984). Just as a “restaurant” mental model guides appropriate and efficacious behavior at a restaurant (e.g., find the host, read the menu, order food, locate the bathroom), a “creative process” mental model should guide workers’ thoughts and behaviors when engaged in creative work. One can think of these mental models as implicitly or explicitly providing

¹ A search of creativity research in top organizational behavior, management, and social psychology journals revealed 1,635 articles with *creativity*, *brainstorming*, or *idea* in the title (see Appendix A for details). We coded these articles for whether they investigated (a) lay beliefs, perceptions, or judgments related to (b) any aspect of the creative process (both criteria broadly defined) and found that only 33 articles met these criteria (see a full list and analysis details in Appendix A). Overall, the literature search revealed a dearth of theory on the beliefs people hold about the creative process.

answers to the question, “If I want to get this work done creatively, what are the things I should do?”²

The main proposition of our framework is that two mental models of the creative process are prominent in the minds of employees: the *Insight model* and the *Production model* (Figure 1). We propose that the models exert influence by leading workers to approach the creative process differently. Whereas the Insight model leads workers to prioritize *preparation* for creative ideas, the Production model leads workers to prioritize the *production* of creative ideas. The Insight model can be characterized by a guiding heuristic to “*seed the ground for breakthrough ideas to come*” and the Production model can be characterized by a guiding heuristic to “*actively push ideas forward through trial and error*”. We propose that these two mental models are prominent because they derive from the experience of idea generation itself. In particular, from the two ways that ideation is subjectively experienced by workers: “A-ha!” moments of insight (Kounios & Beeman, 2009; Schooler & Melcher, 1995) and analytic ideation (Amabile, 1996; Newell et al., 1962). We next describe the two mental models.

The Insight mental model. An insight is defined as a “sudden comprehension” and is colloquially known as an “A-ha!” moment (Kounios & Beeman, 2009). We propose that the Insight mental model derives from workers’ subjective experiences with insight itself³. Moments of insight are subjectively experienced as unexpected and even serendipitous (Kounios &

² We expect that mental models of the creative process are relatively stable over time, but they are not dispositional or immutable. Analogous to the concept of “personal projects” (Little, 1983; Ollier-Malaterre, Rothbard, & Berg, 2013), mental models of the creative process prompt sets of interrelated preferences and behaviors that serve the pursuit of creative outcomes. They can change as workers gain new knowledge and experience, or undergo contextual changes such as moving to a new organization that practices a different approach to creativity.

³ There is debate about whether the cognitive processes underlying insight are unique from or the same as the processes that underlie non-insight problem solving (Weisberg, 2015). The former position is called the “special process” view and the latter is called the “business-as-usual” view. This debate has implications for whether insight and production *actually* make up two distinct routes to creativity. However, importantly for our theorizing, both sides of this debate agree that the subjective experience of insight is markedly different from that of non-insight problem solving (Weisberg, 2015) and people’s beliefs are more likely to be shaped by subjective experiences with a phenomenon than by unobservable properties of that phenomenon.

Beeman, 2009; Schooler & Melcher, 1995). Indeed, research finds people are particularly inept at predicting exactly when an insight will strike (Metcalf & Wiebe, 1987). We propose that this experience fuels an intuition that underlies the Insight mental model: people cannot force insight moments to occur on the spot but they can prepare and lay the groundwork for an insight moment to strike later on. In other words, it leads people to believe their efforts are most effectively spent on preparing for creative ideas rather than producing creative ideas. This preparation-focus is consistent with research on self-insights (i.e., epiphanies), which finds that people believe the likelihood of having an epiphany can be increased through preparatory motivation and attention regulation (Dane, 2020). This is also consistent with early models of insight that emphasized preparatory activities (incubation, in particular) over active idea generation (Wallas, 1926; although more recent models emphasize both preparatory and production behaviors, see Weisberg, 2015).

The Production mental model. The other route by which workers generate ideas is analytic ideation (Amabile, 1996; Newell et al., 1962). In contrast to “A-ha!” moments of insight, the subjective experience of analytic ideation is most saliently characterized by active and deliberate thinking. We propose that the subjective experience of analytic ideation promotes the intuition that underlies the Production mental model: deliberative ideation is the most effective way to generate creative ideas. In other words, it leads people to focus their efforts on actively ideating and pushing ideas forward rather than on preparation behaviors. Indeed, workers routinely use a variety of deliberation strategies to generate ideas, such as drawing knowledge from memory, using problem solving heuristics, applying solution templates to the problem, and incorporating information gleaned from failed ideas back into the idea generation process (Goldenberg, Mazursky, & Solomon, 1999; Fleck & Weisberg, 2013).

We note that our framework does not preclude the possibility that there are other mental models of the creative process. However, we suspect that the Insight and Production models are prominent because they originate from the subjective experience of idea generation itself. This means that one or both of the models are reinforced whenever workers generate ideas (i.e., first-hand experience) and, because of this reinforcement, they are the models workers will transmit to others via storytelling or rule and norm setting (i.e., second-hand transmission). Consistent with our conceptualization of the Insight and Production mental models, a study of prominent modern painters found that these artists exhibited work styles that map onto the guiding heuristics of the Insight and Production mental models (Galenson, 2009). Galenson found that some artists jump directly into production behaviors (he called them experimental innovators). He noted that these artists “want to make discoveries as they work, so they rarely make preparatory drawings or other plans for painting” (p. 2). This maps onto the Production mental model’s focus on actively pushing ideas forward. Alternatively, Galenson found that other creators put all their emphasis on planning (he called them conceptual innovators). These artists, in fact, placed so much value on preparation and planning that some – including Andy Warhol and Raphael – eschewed executing their ideas, relegating the actual painting of their pieces to assistants. This maps onto the Insight mental model’s focus on preparing for ideas to come.

Insert Figure 1 about here

3.2. Mental model activation

We propose that, like any mental model, the influence a given mental model has on a worker depends on whether the worker holds that mental model in the first place and whether that mental model is activated (Gioia & Poole, 1984). In our framework, it is possible that workers hold the Insight model only, the Production model only, both models, or neither model.

In the case where workers hold neither model, then there is no mental model influence. When workers hold one model or the other, encountering creative work situations activates the held model and that model exerts influence. When workers hold both the Insight and Production models, we propose that cognitive activation operates via model dominance rules typical of the mental model construct (Holyoak, 1984). First, only one mental model can be active at a given time. Similar to how only one side of a Necker cube can be perceived as prominent at any given time (not both sides), only one mental model can guide creative work at a given time. Which of the two mental models is activated depends on which model the worker holds as the default, dominant model. Workers that hold both models will develop a preference for one model over the other and this will become the dominant, or default, model and this model will automatically activate when workers encounter creative work situations.

To summarize, we theorize two prominent mental models of the creative process (the Insight and Production models). We propose that these mental models are impactful because they prime action tendencies (preparation versus production) that differentially influence behavior during creative work. We next turn to this argument.

4. Creative Process Behaviors

We propose that an important consequence of having a mental model of the creative process is that it influences how workers approach creative process behaviors. To develop this argument, we first define creative process behaviors and discuss relevant literature. We then discuss how the mental models influence engagement in creative process behaviors.

4.1. Creative process behaviors and creativity

Creative process behaviors are the activities that employees undertake while pursuing creative outcomes, such as framing the problem, gathering information, generating ideas, and

assessing and iterating on those ideas (Amabile, 1996; Montag et al., 2012). Indeed, research finds that engagement in creative process behaviors positively predicts creativity. For example, problem identification activities – such as reframing, redefining, and problem structuring – have been found to increase creativity (Cronin & Loewenstein, 2018; Mumford et al., 1994; Reiter-Palmon & Robinson, 2009). Similarly, research finds that the quantity of ideas one generates is associated with idea creativity (Basadur et al., 2000; Beaty & Silvia, 2012; Lucas & Nordgren, 2015; Simonton, 1999). Research using Zhang and Bartol's (2010) creative process engagement scale – which includes problem identification, information gathering, and idea generation behaviors – finds positive links between creative process engagement and creative outcomes (see also, Taggar, 2002). In fact, a number of workplace creativity antecedents (e.g., psychological empowerment, leader encouragement of creativity, promotion focus) have been found to increase creativity because they promote higher creative process engagement (Henker et al., 2015; Huang et al., 2016; Zhang & Bartol, 2010). Similarly, some factors that decrease creativity (e.g., workplace ostracism) are found to do so because they reduce creative process engagement (Kwan, Leung, & Liou, 2018).

4.2. Mental models guide creative process behaviors

At any given moment in creative work, there is an array of potential creative process behaviors a worker could enact. On top of this, creativity is a non-linear and iterative process (Simonton, 1999). Thus, there may be utility in visiting some behaviors multiple times. However, employees have finite resources: time, energy, financial and social capital. Given this dynamic, the decision of which creative process behaviors to enact can be viewed as a resource-constrained choice. It is analogous to making an investment decision wherein employees decide how to best allocate their resources in order to maximize creative potential. For example,

imagine that a graphic designer is asked to create a new design idea and bring it with her to a meeting that starts in one hour. Her set of possible creative process behaviors is far larger than her time resources. How much time does she allocate to sketching a design, poking around the client's website, analyzing the assignment specifications, getting input from a colleague, etc.? We propose that these decisions are guided, implicitly or explicitly, by her mental model of the creative process.

As depicted in Figure 1, we conceptualize creative process behaviors as occupying a continuum from preparation-focused to production-focused behaviors, based on their proximity to tangible creative output. We propose that the Insight model leads workers to favor *preparation-focused* behaviors relative to *production-focused* behaviors. Preparation-focused behaviors ready the individual for creative work (e.g., energy or emotion regulation) and lay the groundwork for creative ideation (problem identification, information search, incubation). Conversely, the Production model leads workers to favor *production-focused* behaviors relative to *preparation-focused* behaviors. These behaviors are more proximate to creative output, with the most central activity being idea generation behavior itself.

We propose that mental models of the creative process influence behavior in two ways. First, they influence the *prioritization* of model-consistent behaviors such that those behaviors are given more weight in the worker's mental calculus of which creative process behaviors to enact. The Insight mental model leads workers to favor preparation-focused behaviors and the Production mental model leads workers to favor production-focused behaviors. For instance, if a worker is deciding whether to engage in incubation or idea generation, all else equal, their mental model may tip the scale in one direction or the other such that holding the insight mental model leads them to incubate (the preparation-focused behavior) and holding the production

mental model leads them to generate ideas (the production-focused behavior). The second way the mental models influence behavior is that they influence the *enactment* of creative process behaviors. We propose they lead workers to enact creative process behaviors with a model-consistent mindset. The Insight model, with its focus on preparation, leads workers to engage in creative process behaviors with a more exploratory mindset and the Production model, with its focus on production, leads workers to engage in creative process behaviors with a more output-focused mindset. While some creative process behaviors are primarily preparatory (e.g., energy regulation) and others are primarily production-focused (e.g., idea validation), many creative process behaviors involve some of both. For example, consider information search behavior such as gathering information from a website. This could be done to inspire new ways of thinking about the task (more exploratory) or to fill in the gaps of an idea they have already generated (more output-focused). Or consider problem identification behavior. A worker could analyze the problem to better understand its history, societal relevance, and the “why” of the problem (more exploratory) or to better understand the problem’s parameters to generate appropriate solutions (more output-focused).

To summarize, we propose that the Insight and Production mental models influence how workers prioritize creative process behaviors (preparation-focused versus production-focused) and how workers enact creative process behaviors (exploratory versus output-focused mindset). In the next section, we discuss how these behaviors influence performance.

5. Mental Models and Performance

We propose that holding different mental models of the creative process (i.e., the Insight vs. Production model) leads workers to prioritize different creative process behaviors (i.e., preparation vs. production behaviors). We propose that preparation-focused versus production-

focused behaviors mark a key tradeoff in the creative process such that creative workers must decide whether to allocate their resources between preparing to produce ideas and actually producing ideas. We propose that prioritizing one type of behavior over the other leads to different patterns of idea output.

5.1. *Idea output*

Our framework considers idea novelty and feasibility, the most commonly studied dimensions of idea quality (Amabile, 1996). Idea novelty refers to an idea's uniqueness or statistical rarity and idea feasibility refers to whether the idea is implementable or useful. Figure 1 depicts the patterns of idea output expected from each mental model. The Insight model leads to higher idea novelty and lower idea feasibility (but with high variance, we explain more below). In contrast, the Production model leads to higher idea feasibility and lower idea novelty (but with high variance, again, explained more below).

As an illustration of how each model influences idea output, consider the example of an employee tasked with bringing a creative idea to her supervisor by the end of the day. If she holds the Insight model, she will prioritize preparation behaviors over production. She will spend more time on activities such as framing the task and viewing the problem from different angles, which could lead her to take a more creative approach to the task. She will seek out novel information to incorporate into her ideas and she will let her ideas incubate. Given this focus, the ideas she produces are likely to be highly novel. However, the other side of the coin is that deprioritizing production behaviors means less actual idea generation and fewer "quality check" activities such as idea validation and revision. Given this, the usefulness or applicability of the worker's ideas is likely to be less well thought out. This will lead to ideas low in feasibility and may risk yielding incomplete or unpresentable ideas. While we expect low feasibility to be the

case on average, we also expect high variance. For instance, in some cases, extensive preparation could serve as a guard-rail against impractical ideas. Thus, while deprioritizing production behaviors is likely to lead to low feasibility ideas, there is likely to be high variance with some ideas proving more feasible than others.

In contrast, if the worker holds the Production model, she will prioritize production behaviors over preparation. Her instinct will be to put pen to paper and generate ideas. She will spend more time on activities such as ideation and quality checking her ideas (i.e., idea validation) and her engagement in preparatory activities (e.g., problem identification, information search) will be conducted in a more solution-oriented and less exploratory manner. This focus will lead to ideas that are higher in feasibility, particularly when those behaviors lead to deemphasizing behaviors that can encourage deviation from the task requirements (e.g., problem reframing). The upside of holding the Production model is that this worker is likely to bring workable ideas to the table. However, the other side of the coin is that because she deprioritizes thinking about the problem in different ways and bringing in new information, her ideas are likely to be more status quo and less novel. While we expect low novelty on average, it is possible that a focus on production behaviors can yield high novelty ideas through chance or in-depth exploration of an idea category, particularly when there is ample time for iteration and revision (Beaty & Silvia, 2012; De Dreu et al., 2008; Simonton, 1999). Thus, we theorize low idea novelty but with high variance.

5.2. Mental model archetypal frames

We propose that workers can hold the Insight model, the Production model, both models with one model as dominant, or neither model. These dynamics produce five mental model combinations that we conceptualize as five archetypal frames through which employees construe

creative work (Figure 2). We use the term “frame” to indicate both (a) the ubiquitous influence of the archetype on a worker’s perception and judgment and (b) that if the worker’s mental model (or combination of mental models) changes, the frame will change as well. Next, we describe the expected patterns of output associated with each archetypal frame.

Insert Figure 2 about here

The Nonstarter Frame. Simply holding a mental model of the creative process (*versus* not) leads workers to filter task information more quickly, prioritize creative process behaviors, and to feel more efficacious about creative work (Gioia & Poole, 1984). Conversely, holding no mental model may lead workers to experience creative work as more cognitively demanding and feel lower self-efficacy, factors that negatively influence performance (Lucas & Nordgren, 2015; Tierney & Farmer, 2002). All else equal, we expect that not holding a mental model of the creative process yields fewer ideas, lower idea novelty, and lower idea feasibility.

The Erratic Artist Frame. This frame results when workers hold only the Insight model, and it leads them to prioritize preparation-focused behaviors. Because of the high amount of thought, planning, and preparation, their final ideas are likely to be high in novelty. The Erratic Artist frame can lead workers to generate the organization’s most novel ideas. However, a precipitous focus on preparation over production poses the risk of producing low feasibility ideas or no ideas at all. This could occur because workers choose to focus on novelty at the expense of feasibility (Rietzschel, Nijstad, & Stroebe, 2010) or because a focus on preparation leads workers to budget too little time for production behaviors and they end up with half-baked or incomplete ideas (Buehler, Griffin, & Ross, 1994). Consequently, the Erratic Artist frame produces unreliable creators. It, on average, yields high novelty but low feasibility ideas.

The Cookie-Cutter Contributor Frame. This frame results when workers hold only the Production model, and it leads them to prioritize production-focused behaviors. In contrast to the Erratic Artist frame, workers with the Cookie-Cutter Contributor frame precipitously prioritize production behaviors. These workers consistently generate high feasibility ideas. Like a utility player, workers with the Cookie-Cutter Contributor frame are the most versatile ideators in an organization. However, the deprioritization of preparation behaviors risks generating low novelty ideas. Consequently, workers with the Cookie-Cutter Contributor frame risk being an interchangeable creator that generates high feasibility but low novelty ideas.

The Reliable Artist Frame. This frame results when workers hold the Insight model as dominant but are able to switch between the Insight and Production models. With the Insight model dominant, these workers' default is to prioritize preparation-focused behaviors. Similar to the Erratic Artist frame, these workers' default tendency is to produce ideas that are high in novelty and low in feasibility. However, workers with the Reliable Artist frame are able to switch between the Insight and Production models, such that they mitigate the neglect of production-focused behaviors. The increased focus on production behaviors increases the likelihood that there will be time and energy resources for idea validation, revision, and iteration, which reduces the risk of generating low feasibility ideas. Workers with the Reliable Artist frame are predisposed to preparation but they are aware of the Production model and can switch to it. These workers generate high novelty and moderate feasibility ideas.

The Inventive Contributor Frame. This frame results when workers hold the Production model as dominant but are able to switch between the Production and Insight models. With the Production model dominant, these workers' default is to prioritize production-focused behaviors. As with the Cookie-Cutter Contributor frame, workers with the Inventive Contributor frame will

gravitate toward producing feasible ideas. However, switching between the Production and Insight models minimizes the neglect of preparation behaviors. This willingness to switch focus to preparation behaviors infuses ideation with new ideas, opinions, and inputs, that increase the likelihood of injecting novelty (Audia & Goncalo, 2007; Berg, 2014). Workers with the Inventive Contributor frame are predisposed to production but they are aware of the Insight model and can switch to it. These workers generate high feasibility and moderate novelty ideas.

We have established two mental models and the five archetypal frames that derive from holding those models. A reasonable next question for workers that hold both the Insight and Production models is what activates one model over the other, or what prompts workers to switch models?

6. Task Context Contingency Factors

The Insight and Production mental models have opposing effects on the prioritization of creative process behaviors and subsequent idea output. It is important to consider factors that lead one model to become activated over the other. Given that mental models of the creative process are activated by the presence of creative work, we expect that certain elements of the creative task context might influence which model is activated. Here we propose two elements of the creative task context that act as contingency factors that influence model activation.

Problem type. The type of problem can influence the activation of the Insight *versus* Production model. Here we draw on the distinction between open and closed problems (Getzels & Csikszentmihalyi, 1976; Unsworth, 2001). Open problems are those for which the problem is not well specified and could be approached in many different ways. For instance, a call to “Expand market share by 10%” is a relatively open problem. Closed problems are those for which the problem is clearly defined and the next steps are straightforward. For instance, a call to

“Implement market expansion Plan A” is a closed problem⁴. We propose that for workers that hold both the Insight and Production mental models, the Insight model is more likely to be activated by creative tasks involving relatively open problems and the Production model is more likely to be activated by creative tasks involving relatively closed problems. Open problems benefit from the extensive preparation behaviors prioritized by the Insight model. Alternatively, closed problems are ripe for solution generation and benefit from the production behaviors prioritized by the Production model.

Creativity requirement. Madjar, Greenberg, and Chen (2011) distinguish between radical and incremental ideas. Radical ideas “differ substantially from an organization’s existing practices,” and incremental ideas “imply few changes in frameworks and offer only minor modifications to existing practices and products” (p. 731). We propose that, for workers holding both models, tasks that call for radical creativity are more likely to activate the Insight model and tasks that call for incremental creativity are more likely to activate the Production model. A creative process that focuses on problem identification and bringing in new information and ideas is more likely to result in ideas that substantially differ from the organization’s existing practices than one that de-emphasizes these features. Further, the Insight model places focus on incubation, which facilitates larger conceptual leaps through unconscious processing than does deliberate idea production (Nordgren et al., 2011). In contrast, the Production model is more likely to result in incremental ideas. The focus on ideation and solution results in a pool of ideas that represent small and feasible advancements (c.f., De Dreu et al., 2008).

7. General Discussion

⁴ While it is the case that an entirely closed problem would not require creativity, problem type is conceptualized as a continuum from relatively open to relatively closed (Unsworth, 2001), and in practice, few organizational tasks are entirely closed.

In this paper we proposed a framework to better understand how people think about the creative process. We proposed that two mental models of the creative process (i.e., the *Insight* and *Production* models) shape how workers engage in creative work and influence performance. Specifically, the insight mental model leads people to favor preparation-focused behaviors (e.g., information search, incubation) and the production mental model leads people to favor production-focused behaviors (e.g., idea generation, idea validation). These behaviors then lead to different patterns of idea output for those holding the Insight model (lower idea quantity, higher novelty, and lower feasibility) versus the Production model (higher idea quantity, lower novelty, and higher feasibility). We described five creative worker archetypes that arise from different combinations of model awareness and model dominance. Finally, we proposed contextual contingency factors that influence model effectiveness. In the remainder of the paper, we discuss theoretical contributions, future research directions, and practical implications.

7.1. Theoretical contributions

We answer a call in the organizational creativity literature for research on the cognitive antecedents of employee creativity (George, 2007; Shalley & Gilson, 2004). Given that past research on the individual-level predictors of employee creativity has predominantly focused on affective factors, such as positive and negative affect and intrinsic motivation (Amabile, 1985; Liu et al., 2016), researchers have recognized the need to increase theory development around intra-individual cognitive predictors of creativity. For instance, George urged researchers to “explore in more depth how the workings of the mind play out in creativity in organizations” (2007, p. 445). We answer this call by developing a framework that explains how workers’ mental models of the creative process (cognition) influence engagement in creative process behaviors (behavior) and subsequent idea output (performance).

Our framework also contributes to research on creativity beliefs. This research has mostly focused on beliefs about creative people and creative products (e.g., Berg, 2014; Mueller et al., 2012; Sternberg, 1985; Tierney & Farmer, 2002). A growing literature has begun to investigate beliefs about the creative process (Baas et al., 2015; Lu et al., 2017; Lucas & Nordgren, 2015, 2020), however, this literature has lacked theoretical integration (Ritter & Rietzschel, 2017). In this regard, we offer the mental models' framework as one path forward. We propose that mental models of the creative process shape workers' beliefs, link those beliefs to creative process behaviors, and influence idea output. Our framework, to our knowledge, is the first to systematically link creativity beliefs to creative process behaviors and creative outcomes. We believe our framework can help guide research on creative process beliefs and begin to synthesize existing phenomena in the literature. For instance, research finds that people undervalue the role of effort and persistence in an ideation session (Lucas & Nordgren, 2015, 2020). In other words, people tend to undervalue their own ability to produce creative ideas. Other research finds that people think creativity is better facilitated by relaxation (ten Hoopen & Groesbeek, 2008) and by de-focused attention and stepping away from the problem (Baas et al., 2015). Together, these beliefs align with the Insight model and its valuation of preparation-focused behaviors (e.g., energy regulation, incubation) and devaluation of production-focused behaviors (e.g., effortful idea production). This pattern of results raises intriguing questions for future research. For instance, is the Insight model more culturally prominent than the Production model (and might this vary cross-culturally; Loewenstein & Mueller, 2016). What are the implications for creative output? Furthermore, Lucas and Nordgren (2020) find that creativity beliefs are more accurate among people with more everyday experience with creative problem-solving. This raises the interesting possibility that people with different levels of experience or

expertise may rely on different mental models (Amabile, 1983). The relative prominence of the Insight versus Production models and the implications of this for creative work is a promising question for future research.

We also contribute to research on the creative process (e.g., Amabile, 1988; Zhang & Bartol, 2010). Our framework encourages researchers to frame creative process engagement as a decision involving resource allocation tradeoffs. Perhaps mirroring the broader literature's predominant focus on creativity as a positive outcome (Gilson, 2008), past research, at least implicitly, takes a "more-is-better" view of creative process behaviors (Amabile & Pratt, 2016). This is reasonable, given the variety of creative process behaviors found to positively predict performance (e.g., Zhang & Bartol, 2010). However, it is also the case that creative workers have finite amounts of time, energy, and capital resources that limit how much a worker can, or should, engage in creative process behaviors (Elsbach & Hargadon, 2006; Harrison & Wagner, 2016; Khessina et al., 2018). Our framework builds on this work by framing creative process engagement as a resource-constrained choice in which the volume of possible creative process behaviors that a worker could engage is typically greater than the worker's available time, energy, and capital resources. Thus, creative performance not only depends on *whether* workers engage in the creative process, but also on *which* behaviors they choose. We distinguish between preparation-focused and production-focused creative process behaviors and identify mental models of the creative process as a novel predictor of which creative process behaviors workers choose to enact. While both preparation-focused and production-focused creative process behaviors have been found to predict creativity, distinguishing them raises questions about whether there are more or less optimal combinations and whether they have differential antecedents and consequences. As Zhang and Bartol asserted, "[a] finer-grained investigation of

the...aspects of creative process engagement is a logical next step” (2010, p. 121). We hope future research will continue to develop this distinction.

7.2. Unanswered questions and future research directions

On top of the promising directions for research discussed above, in this section we speculate about three unanswered questions for future research.

What causes workers to switch mental models? We proposed workers that switch between the Insight and Production models are the most consistently creative (i.e., the Reliable Artists and Inventive Contributors). An interesting question for future research is what prompts workers to switch models. One possibility is that workers develop knowledge about factors that promote model effectiveness (e.g., problem type, creativity requirement) and switch models when they recognize those conditions in the work context. At the same time, we suspect that the ability to track and respond to such indicators in real time is cognitively demanding and this ability may develop with expertise and experience. Another possibility is that workers use simple heuristic cues to switch models. For instance, workers may use the task midpoint as a cue to switch models (Gersick, 1988; Lu, Akinola, & Mason, 2017). Workers may also use their own positive and negative affective states as a cue to switch mental models (George & Zhou, 2007; Lucas & Nordgren, 2015). Affective states could also impact model switching by leading works to overlook switching cues. For example, extreme negative or positive affective states could lead workers to lose track of time and forget to “switch at the midpoint” or become less attuned to relevant contextual contingency factors. The relationship between these switching cues also raises the interesting question of how much model switching is a conscious versus non-conscious process.

A related question is whether there is an optimal model switching strategy. That is, do workers switch models at the right time? There may be cases where “optimal” and “non-optimal” switching could be identified, such as when a worker has focused solely on preparation and time has run out or solely focused on production and they have hit a creative wall. However, in other cases, the “optimal” amount of switching may be unknowable. We suspect that in many cases the balance of preparation and production behaviors achieved by *some amount* of model switching (versus the “optimal” amount) is the more important factor in promoting creativity.

What is the relationship between mental models and motivation? An interesting consideration is whether mental models influence worker motivation differently. One hypothesis is that workers are more motivated when they hold the Insight model than the Production model because the former is more strongly associated with “A-ha!” moments of insight, which are motivating to anticipate and experience because of their association with positive affect and serendipitous and mystical qualities (Topolinsky & Reber, 2010). However, there is also merit to the opposite hypothesis. Workers may be more motivated when they hold the Production model than the Insight model because the former is more likely to produce tangible outputs that can be measured, celebrated, and produce feelings of accomplishment (Amabile & Kramer, 2011). We see the relationship between mental models and affect/motivation as an interesting area for future research.

What is the role of mental models beyond individual-level idea generation? Ideas follow a long path from generation to implementation (Amabile & Pratt, 2016; Perry-Smith & Mannucci, 2017). While our framework applies to the generation of creative ideas, a natural future direction is to explore how the Insight and Production models influence other stages of the creativity and innovation process. For instance, do the Insight and Production models influence

how workers evaluate the ideas of others or how they communicate their ideas (e.g., Carton & Lucas, 2018)? One prediction is that holding the Insight model, compared to the Production model, leads evaluators to favor high novelty ideas that make conceptual leaps and appear emblematic of an “A-ha!” moment. It is also possible, and we think likely, that different stages of the process may have unique mental models that are specific to the activities involved at that stage (e.g., idea selling, forecasting, championing, implementation). Echoing calls for research across the stages of creativity and innovation (Anderson et al., 2014; Perry-Smith & Mannucci, 2017), we encourage future work to consider mental models at different stages of the creativity and innovation process. Future research should also explore mental models at higher levels of analysis. For example, mental models of the creative process at the group level might include group-level phenomena (Gilson & Shalley, 2004), such as creative synthesis (Harvey, 2014), group coordination (Harrison & Rouse, 2014), intimate co-creation (Rouse, 2020), group norms (Goncalo et al., 2015), or team composition (Miron-Spektor et al., 2011). Additionally, future research could explore whether and how individuals’ mental models influence a group’s shared mental model.

7.3. Practical implications

We believe our framework will be useful to leaders and creative workers. One takeaway is that beliefs about the creative process can be organized around the Insight and Production mental models. This may be useful for those looking to put more structure and process around their approach to creativity, which can sometimes feel more like a list of “do’s and don’ts” than a process. Indeed, we propose that simply having a mental model of the creative process is advantageous to not having one (i.e., the Nonstarter). Another takeaway is to encourage workers to develop both the Insight and Production mental models so that their creative work contains a

mix of preparation and production behaviors, rather than focusing exclusively on preparation (and risk having nothing to show when the deadline comes) or focusing exclusively on production (and risk generating mundane ideas). Finally, our framework suggests circumstances under which leaders may want to emphasize one mental model over the other. For example, the Production model may be more effective than the Insight model when the problem type is open, the creativity requirement is incremental, time is limited, and the task is interdependent. Conversely, leaders could start with a desired mental model in mind and use it to determine how they should shape the work context. For instance, if leaders want their employees to adopt the Insight model, they can call for radical creativity, provide time slack, and task independence. In sum, we see our mental models framework as a tool that workers can use to better understand how they think about their own creative work and that leaders can use to shape the creative work of others.

7.4. Conclusion

We introduced a framework for understanding people's beliefs about how to generate creative ideas. We proposed that beliefs about the creative process reflect two prominent mental models (the Insight and Production models) and that these mental models guide creative process behaviors (preparation-focused and production-focused behaviors) and idea output (idea quantity, novelty, and feasibility). We proposed novel hypotheses and new directions for theory building and we are hopeful that future research will take up these ideas. But for now, what do we make of our 50 executives with 50 different approaches to generating creative ideas? Can we say who is right and who is wrong? Our framework suggests that creative outcomes result from creative process beliefs that facilitate a mix of preparation- and production-focused behaviors that accord with the contingencies of the creative work context. In other words, perhaps

Benjamin Franklin had it right all along: “*I rise early almost every morning, and sit in my chamber without any clothes whatsoever, half an hour or an hour, according to the season, either reading or writing*” (Currey, 2013). Franklin’s conviction in the “air bath” facilitated a mix of preparation (i.e., reading) and production (i.e., writing) behaviors, and who knows how many creative ideas.

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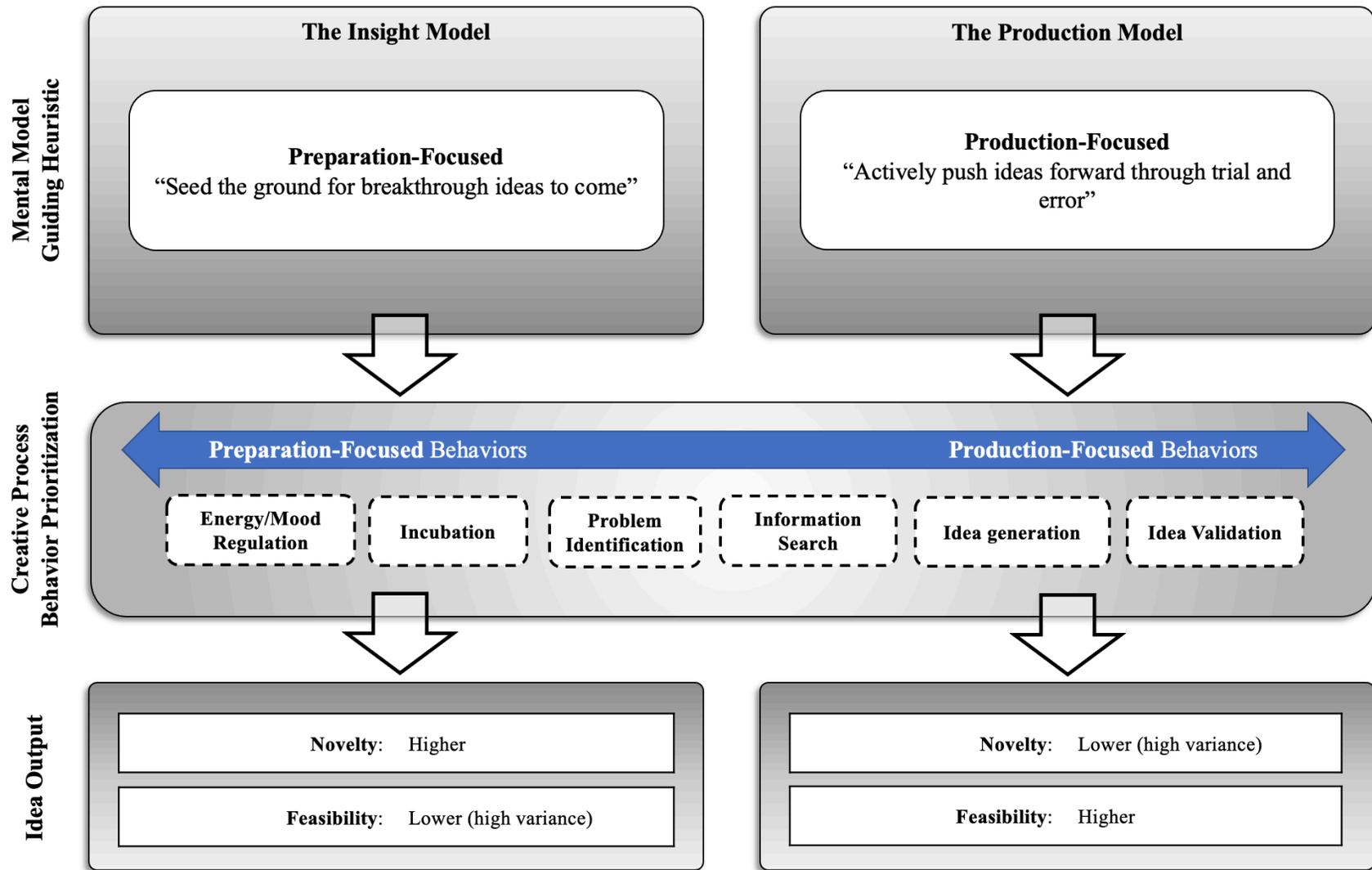


Figure 1. Mental models of the creative process theoretical framework.

	Archetypal Frame	Dominant Model	Contingent Model	Creative Process Behavior Prioritization	Idea Output
	Nonstarter	--	--	--	Novelty ↓ Feasibility ↓
	Erratic Artist	Insight	--	Preparation	Novelty ↑ Feasibility ↓ (variance ↑)
	Cookie-Cutter Contributor	Production	--	Production	Novelty ↓ (variance ↑) Feasibility ↑
	Reliable Artist	Insight	Production	Preparation by default; can switch to Production	Novelty ↑ Feasibility \bar{X}
	Inventive Contributor	Production	Insight	Production by default; can switch to Preparation	Novelty \bar{X} Feasibility ↑

Note: ↑ = higher level; ↓ = lower level; \bar{x} = mean level.

Figure 2. Archetypal frames derived from workers' dominant and contingent mental models of the creative process.