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Gerben Tolcamp

Tim Vriend

Bart Verwaeren

Roni Reiter-Palmon

University of Nebraska at Omaha, rreiter-palmon@unomaha.edu

Bernard Nijstad

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Disentangling the Creative Process: an Examination of Differential Antecedents and Outcomes for Specific Process Elements

Gerben Tolcamp, Tim Vriend, Bart Verwaeren, Roni Reiter-Palmon, & Bernard Nijstad

Abstract

-Building on theories of sensemaking, this study demonstrates the importance of disentangling the creative process. Specifically, we show that the specific elements of the creative process (problem construction, information search and encoding, and idea generation) are differentially related to both antecedents and specific types of creative outcomes. Using survey data from employees and their supervisors from a wide variety of organizations, we found that leader creative expectations were more strongly related to idea generation than to problem construction and to information search and encoding. Job autonomy, in contrast, was significantly related to problem construction, but not to information search and encoding or idea generation. Furthermore, we found that although idea generation is positively related to both radical and incremental creativity, problem construction is only positively related to radical creativity. We discuss implications for the study of creative processes and creativity more generally.

Keywords

Employee creativity, Creative process, Sensemaking, Job autonomy, Leader creative expectations

Because of its importance to organizational effectiveness and survival (Amabile et al., 1996; Shalley et al., 2004), employee creativity is a central topic in organizational behavior and management research (for reviews, see Anderson et al., 2014; Zhou & Hoever, 2014). This research has primarily focused on the personality traits and situational factors that predict creative outcomes, defined as ideas, products, and problem solutions that are both novel and useful (e.g., Amabile, 1983; Ford, 1996; Woodman et al., 1993). There are, however, at least three reasons why it is also important to examine the creative process, defined as individuals' engagement in behaviors and thought processes related to creativity (Drazin et al., 1999; Gilson & Shalley, 2004; Reiter-Palmon & Illies, 2004). First, engaging in creative behaviors is a prerequisite to obtain creative outcomes, and people may often prefer not to engage in these risky and uncertain behaviors (e.g., Ford, 1996). Second, it may be easier to predict engagement in the creative process than to predict creative outcomes, because

not all creative endeavors will result in creative output (Drazin et al., 1999; Gilson & Shalley, 2004). Finally, it has been suggested that the creative process consists of several conceptually distinct elements, including problem construction, information search and encoding, and idea generation (Reiter-Palmon & Illies, 2004; Zhang & Bartol, 2010), which may have differential predictors and outcomes (Mumford et al., 1991; Mumford et al., 2012). Thus, more emphasis on the creative process, and specifically how the creative process affects creative outcomes, could substantially enhance our understanding of creativity at work.

To date, however, empirical research on the creative process in work settings is scarce. Furthermore, field research among employees has mainly focused on engagement in the overall creative process, rather than differentiating among specific elements of the creative process (e.g., Volmer et al., 2012; Zhang & Bartol, 2010; Mahmood et al., 2019; Tan et al., 2019). Specifically, the creative process has mainly been treated as a unidimensional construct (creative process engagement; Zhang & Bartol, 2010). This is problematic, because this approach largely ignores an entire stream of cognitive research that considers elements of the creative process such as problem construction, information search and encoding, and idea generation conceptually distinct, each with their own antecedents and consequences (Mumford et al., 1991, 2012). Supporting these claims, some studies have indeed shown that the creative process is better represented by three separate factors consisting of problem construction, information search and encoding, and idea generation, as opposed to a unidimensional construct consisting of all elements of the creative process (e.g., Caniëls, 2019; Henker et al., 2015). However, these studies do not provide theory and predictions as to how antecedents can be differentially related to specific elements of the creative process and how these elements, in turn, are related to creative outcomes. We therefore propose that our understanding of creativity can be increased by disentangling the creative process and by examining (1) how engagement in problem construction, information search and encoding, and idea generation can be differentially predicted and (2) how these processes are linked to different types of creative outcomes.

We draw on a sensemaking perspective (e.g., Ford, 1996; Unsworth & Clegg, 2010) to further our understanding of engagement in specific elements of the creative process. The sensemaking perspective suggests that individuals intentionally choose to engage in either habitual or creative action and that they will only engage in creative action when they perceive that this leads to favorable outcomes (Ford, 1996). This process of sensemaking is a dynamic interpretation process that consists of two distinct elements: building mental models about situations or events (diagnostic frames) and subsequently articulating potential courses of action (prognostic frames) (Drazin et al., 1999; Foldy et al., 2008; Maitlis, 2005; Weick, 1995). We propose that diagnostic framing is conceptually related to the creative process activities of problem construction and information search and encoding, because these activities help in diagnosing a

situation or event, whereas prognostic framing is conceptually related to idea generation, because ideas provide potential courses of action.

We further propose that the perceived need to engage in these different sensemaking processes, and the degree to which people do this, depends on external cues. We build on findings that freedom and autonomy as well as direction and external demands (i.e., leader creative expectations) can influence creative performance (e.g., Byron & Khazanchi, 2012; Liu et al., 2016; Tierney & Farmer, 2004), but that they do so in different ways. In particular, we propose that the degree to which individuals need to develop their own diagnostic frames will be higher when the situation facilitates employees' intrinsic interest in a problem. We focus on autonomy as a potential facilitator of intrinsic motivation and predict that high autonomy will be associated with higher engagement in attempts to better understand the situation (i.e., problem construction and information search). In contrast, the need to develop their own prognostic frames, or alternative courses of action, will be higher when leaders expect creativity, which will lead in particular to high engagement in idea generation.

In addition, we expect that these different creative processes are differentially related to radical versus incremental creativity (Madjar et al., 2011) and empirically examine the assumption that the conceptually distinct elements of the creative process have differential effects on different types of creative outcomes (Mumford et al., 1991; Mumford et al., 2012; Mumford & Gustafson, 1988; Unsworth, 2001). Following Unsworth (2001), we propose that radical creativity requires more ownership of the early stages of the creative process, specifically problem construction and information search and encoding. In addition, given that idea generation is required for each form of creative output, we expect this stage of the creative process to be positively related to both radical and incremental creativity. Developing a better understanding of how specific elements of the creative process are related to these two types of creativity is relevant, given that both are considered important for organizational survival, but in different ways (Gilson & Madjar, 2011).

Taken together, we further develop sensemaking theories of creative action to not only consider whether employees engage in creative action, but also which actions they undertake. As such, our aim is to develop and empirically test a model that provides a more fine-grained understanding of the conceptually different elements of the creative process, by arguing and hypothesizing that problem construction, information search and encoding, and idea generation indeed have differentials antecedents and consequences. We test our hypotheses in a sample of 642 employees and their direct supervisors.

Theoretical Framework

The Creative Process

We define creative processes as individuals' engagement in behaviors and thought processes related to creativity (Drazin et al., 1999; Gilson & Shalley, 2004;

Reiter-Palmon & Illies, 2004). Over the years, several models have been proposed regarding the creative process and its core elements (e.g., Busse & Mansfeld, 1980; Finke et al., 1992; Mumford et al., 1991; Mumford et al., 2012; Sternberg, 1988). Although these models differ in the number and nature of elements included, scholars now generally agree that the core elements of the creative process include the following: (a) problem construction, (b) information search and encoding, and (c) idea generation (e.g., Gilson & Shalley, 2004; Reiter-Palmon & Illies, 2004; Zhang & Bartol, 2010). It is important to note that we focus on creativity rather than on innovation processes and do not include processes such as idea championing and idea implementation (Perry-Smith & Mannucci, 2017).

Problem construction is often considered to be the first step in the creative endeavor and is defined as the identification of the goals, restrictions, procedures, and information required to solve a problem (Mumford et al., 2012; Reiter-Palmon & Illies, 2004). Although the process of problem construction often occurs automatically, individuals may also choose to engage in this process in a more deliberate and effortful way. In the former, the problem is framed in concordance with individuals' prior experiences and mental representations, whereas in the latter, the individual actively processes the situation at hand, in order to arrive at a more detailed and unique problem representation (Mumford et al., 1991; Reiter-Palmon & Illies, 2004).

Information search and encoding is defined as the process of connecting, integrating, and encoding information (Mumford et al., 1991; Reiter-Palmon & Illies, 2004). The way in which the problem is constructed can lead to the automatic activation of knowledge structures related to the problem (Mumford et al., 1994), where a more detailed problem construction will provide more cues and therefore will activate more problem-related knowledge (Reiter-Palmon & Illies, 2004). However, it is also possible to actively search for, encode, and combine information into new knowledge (Harms et al., 2020; Ward et al., 1997), which is considered to be effortful and cognitively demanding (e.g., Mumford et al., 1991; Ward et al., 1997).

Finally, *idea generation* is defined as the production of alternative solutions or outcomes, and the individual is assumed to move on to this stage of the creative process once information is available (Reiter-Palmon & Illies, 2004). Unsurprisingly, idea generation has received most research attention, given that this process is embedded in the definition of creative outcomes (Amabile, 1983; Ford, 1996; Woodman et al., 1993). In fact, it is common practice within creativity research to equate creative outcomes with the creative quality and quantity of ideas, products, and problem solutions of research participants that were assigned to an ideation task (e.g., brainstorming, Rickards, 1999; Stroebe et al., 2010; divergent-thinking, Guilford, 1967; Reiter-Palmon et al., 2019).

All stages of the creative process are considered important in generating creative outcomes. For example, several studies show the importance of explicit problem construction for the generation of original and feasible ideas (Redmond et al., 1993;

Reiter-Palmon et al., 1997). Supporting the importance of information search and encoding, Hunter et al. (2008) showed that prompting individuals to use multiple knowledge structures (versus a single knowledge structure) before generating ideas led to solutions of higher quality and originality. Rietzschel et al. (2007) further found that activating certain knowledge structures in memory enhanced the generation of ideas related to that knowledge and their originality. Finally, research suggests that active and prolonged engagement in the idea generation process is positively related to creative outcomes. For example, sheer production is the best predictor of creative eminence (e.g., Simonton, 1997), and Ward (1994) found that ideas generated later on during the process were of higher originality than ideas generated during the beginning of the process (also see Lucas & Nordgren, 2020; Rietzschel et al., 2007). Taken together, prior research suggests that all stages of the creative process are important for creative outcomes.

However, problem construction, information search and encoding, and idea generation are considered conceptually distinct elements of the creative process, each with their own antecedents and outcomes (Mumford et al., 1991, 2012). This suggests that contextual variables might not only shape the decision whether individuals will engage in the creative process, but also how they will do so. Unfortunately, most studies to date have not taken this suggestion into account. More specifically, there are only a few studies that distinguish among specific elements of the creative process (Binnewies et al., 2007; Caniëls, 2019; Henker et al., 2015). Henker et al. (2015) and Caniëls (2019) both conducted confirmatory factor analyses showing that a three-factor model separating problem construction, information search and encoding, and idea generation as distinct constructs fitted the data better than alternative models in which some of the elements of the creative process were combined. Binnewies et al. (2007) disentangled the creative process and showed how personal initiative mainly boosted engagement in the beginning stages of the creative process. However, these works did not develop and test theory as to how and why employees choose to engage in specific elements of the creative process. In what follows, we argue that employees use sensemaking processes to determine which creative processes to engage in, and that both autonomy and leader creative expectations can lead to engagement in creative processes, albeit in a differential manner.

Sensemaking and the Creative Process: Diagnostic and Prognostic Framing

To uncover what drives individuals to engage in creative action, several scholars have adopted a sensemaking perspective (e.g., Drazin et al., 1999; Ford, 1996 ; Unsworth & Clegg, 2010). Building on the seminal work by Weick (1995), this perspective explains how employees make intentional decisions about whether to engage in creative behavior or in more routine and habitual behavior (Ford, 1996). Specifically, the sensemaking process involves individuals' expectations regarding the appropriateness and the likely effectiveness of both creative and habitual behavioral options (Ford, 1996; Unsworth & Clegg, 2010). Given that creative action is more risky

and resource intensive, habitual action is considered the default choice (Ford, 1996). When dispositional and situational factors signal that creative action is likely to lead to favorable personal consequences, however, employees become more likely to favor creative over habitual behavior (Yuan & Woodman, 2010).

Within the sensemaking perspective, it has remained unclear why individuals would choose to engage in one type of creative act (e.g., problem construction) over another (e.g., idea generation). To be able to predict the type of action that individuals will choose, it is important to note that sensemaking consists of two distinct elements: building mental models about situations or events, and subsequently articulating potential courses of action based on these mental models (e.g., Drazin et al., 1999; Foldy et al., 2008; Ford, 1996). Based on this, Foldy et al. (2008) proposed that during sensemaking, individuals develop two distinct types of frames: diagnostic frames, defined as the way in which the problem or situation is understood, and prognostic frames, defined as the way in which the appropriate course of action is understood.

These two frames are conceptually strongly related to distinct stages of the creative process. That is, problem construction and information search and encoding can be considered preparatory processes that serve as a foundation for idea generation, which can be seen as a production process generating alternative solutions (e.g., Montag et al., 2012; Reiter-Palmon & Illies, 2004). In the context of creative action, diagnostic framing is related to the preparation stages of creativity (i.e., understanding the situation through problem construction and information search), while prognostic framing involves the production stage of creativity (i.e., idea generation to arrive at possible and appropriate courses of action). The question then is: under which conditions do employees engage in diagnostic and/or in prognostic framing?

Autonomy and Creative Expectations as Predictors of Creative Process Engagement

The idea that autonomy is an important and positive predictor of employee creativity follows from the seminal work of Amabile and colleagues (Amabile, 1983; Amabile, 1997; Hennessey & Amabile, 1998). These authors have suggested that intrinsic motivation is essential for employee creativity and that one important determinant of intrinsic motivation is freedom or autonomy (Amabile et al., 1996; Shalley et al., 2004). This suggestion has been confirmed in empirical research. For example, in one recent meta-analysis (Liu et al., 2016), it was found that job autonomy was related to employee creativity ($\rho = .32$) and that this effect was at least partly mediated by intrinsic motivation.

Initially, it was also thought that external pressure and constraints would undermine intrinsic motivation and would therefore lead to lower creativity (see e.g., Amabile et al., 1996). However, research has shown that this is not necessarily the case and that external demands can sometimes even enhance employee creative performance. For example, one meta-analysis has shown that extrinsic rewards can

enhance creativity when creative performance is explicitly required and rewarded (Byron & Khazanchi, 2012). Other work has clearly demonstrated that creative job demands (Unsworth et al., 2005) and leader creative expectations (Tierney & Farmer, 2004) are positively related to employee creativity. Thus, it appears that creativity may be enhanced not only by providing employees with freedom and autonomy, but also by providing demands and clear directions, as long as it is clearly specified that creativity is a desired outcome.

We should note that these findings are not necessarily contradictory. Indeed, it is possible to have high creative expectations of an employee and at the same time provide that employee with autonomy in how to fulfil these expectations. Yet, these findings do raise the question whether autonomy and creative expectations are interchangeable ways to stimulate creativity that have similar effects. We propose that this is not the case, but that autonomy and creative expectations relate to engagement in different creative processes.

Job Autonomy and Diagnostic Framing

Although individuals have an innate desire for sensemaking (Chater & Loewenstein, 2016), the extent to which they expend effort developing their diagnostic and prognostic frames is strongly dependent on the context. Diagnostic framing involves developing a mental model of a situation to reduce ambiguity and uncertainty (Foldy et al., 2008), and this process is influenced by others (Filstad, 2014; Maitlis, 2005; Weick, 1995). More specifically, in organizational contexts with a lot of policies, rules and procedures in place, individuals are likely to use these constraints as a lens through which they develop their diagnostic frame, as opposed to developing a more independent diagnostic frame (Madjar et al., 2011). In contrast, situations with high levels of job autonomy, defined as the extent to which a job allows freedom to schedule work, to select methods to perform tasks, and to make decisions at work (Hackman & Oldham, 1976; Morgeson & Humphrey, 2006), have less constraints in place that influence individuals' idiosyncratic interpretation of situations, thereby giving room for individuals to develop their own diagnostic frames. Indeed, Ford (1996) suggested that individuals are likely to adopt mental models of situations that are commonly accepted in the organization over developing their own mental models, unless critical thinking is being stimulated in the organization. In line with this, Akgün et al. (2012) suggested that having job autonomy is crucial for effective sensemaking, since sensemaking involves questioning existing organizational routines and practices. Indeed, Filstad (2014) suggested that leaders can facilitate employees to develop their own alternative interpretations of their work situations by giving them the freedom to do so.

With high autonomy, individuals have leeway to identify their own goals, procedures, restrictions, and information required to resolve problems; that is, job autonomy allows individuals to actively engage in sensemaking. In contrast, low job autonomy will constrain the extent to which individuals can or has to define their own goals (i.e., what problem needs to be solved) and means (i.e., what procedures to use

to resolve the problem) and will increase the likelihood that individuals will adopt diagnostic frames from others, such as their leader (Filstad, 2014; Shotter, 1993; Smerek, 2009). That is, leaders often are strongly involved in developing diagnostic frames or problem representations in the workplace (Maitlis, 2005; Shotter, 1993), and these frames are often passively accepted by subordinates (Filstad, 2014; Smerek, 2009). So individuals need to feel responsible or need to be encouraged to develop their own diagnostic frame (e.g., Akgün et al., 2012; Ford, 1996), and job autonomy is the contextual variable that has this effect (Akgün et al., 2012).

Job autonomy in general will give employees leeway as well as a sense of responsibility that will stimulate different proactive and creative behaviors. However, based on the above, we predict that autonomy will be related especially to activities that contribute to diagnostic framing. Thus, whereas autonomy will likely also relate to idea generation, we predict that the association between autonomy and problem construction and between autonomy and information search and encoding will be stronger:

Hypothesis 1: Job autonomy is more strongly related to problem construction than to idea generation (H1a), and more strongly related to information search and encoding than to idea generation (H1b).

Leader Creative Expectations and Prognostic Framing

Leader creative expectations refer to the extent to which employees perceive that their leader expects them to be creative in their job (Tierney & Farmer, 2004). Tierney and Farmer (2004) showed that these leader expectations shaped self-expectations to be creative, which in turn positively predicted employee creativity. Similarly, Carmeli and Schaubroeck (2007) found that perceived leader creative expectations was the most important determinant of self expectations to be creative, which in turn was positively related to employees' involvement in creative work (see also Unsworth & Clegg, 2010). It is therefore likely that leaders' creative expectations are an important motivator for individuals to engage in the creative process.

The concept of leader creative expectations involves providing normative cues about expected actions. It therefore qualifies as an invitation for individuals to develop their own prognostic frames and generate alternative courses of action. As such, they communicate clearly to employees that creative action is appropriate and appreciated. However, the effect of leader creative expectations is not necessarily equally strong for all elements of the creative process. Specifically, leader creative expectations can be considered an extrinsic demand to be creative, and individuals learn which criteria of task performance need to be fulfilled to meet external demands (Eisenberger, 1992; Eisenberger & Rhoades, 2001). Although the processes of problem construction and information encoding may have a marked impact on creativity, they are less saliently and less directly related to creative outcomes than idea generation: without idea generation, there will be no creative outcome to begin with. Furthermore, many consider creativity to be synonymous with idea generation. It is therefore likely that leaders

respond to outcomes of idea generation more strongly than to outcomes of problem construction and information search and that consequently it is mainly idea generation that is reinforced by leaders with high creative expectations (see also Unsworth, 2001).

In addition, Madjar et al. (2011) suggest that even in a company that values creativity, there may be social pressures in place such as a need for conformity that, although creative behavior is allowed, still implies a certain set of constraints to creative action. That is, constraints might be put on the type of tasks that allow creativity or the types of problems that individuals work on. Thus, although leader creative expectations put an explicit demand on generating ideas, this demand is less explicit on developing own problem representations and gathering additional information. Hence, even though employees need to engage in some problem construction and information search and encoding to be able to generate creative ideas (e.g., Mumford et al., 1991; Reiter-Palmon & Illies, 2004), these processes will be less affected by leader creative expectations than the process of idea generation. Therefore, we propose:

Hypothesis 2: Leader creative expectations are more strongly related to idea generation than to problem construction (H2a) and information search and encoding (H2b).

Outcomes of the Creative Process: Radical and Incremental Creativity

Research has generally concluded that engagement in any of the elements of the creative process is positively related to creative outcomes. Thus, studies found that problem construction (Redmond et al., 1993; Reiter-Palmon et al., 1997), information search and encoding (Hunter et al., 2008), and idea generation (e.g., Nijstad et al., 2010; Rietzschel et al., 2007) all contribute positively to employee creativity. Although these findings may suggest that each of the three elements of the creative process will be important to achieve creative outcomes, their respective impact may depend on the type of creativity that is involved. Research has long assumed that creativity is a unitary construct, but more recent research has established that it is important to distinguish minor from major creative contributions (e.g., Mumford & Gustafson, 1988; Unsworth, 2001). Specifically, following the ideas of Mumford and Gustafson (1988), Madjar et al. (2011) distinguished radical and incremental creativity. Radical creativity is defined as the production of ideas that differ substantially from existing practices, whereas incremental creativity is defined as the production of ideas that offer minor modification to existing practices. Although these types of creativity are different in scope, both are important for organizational survival (Gilson & Madjar, 2011).

Radical and incremental creativity have been linked to different dispositional and contextual antecedents (Gilson et al., 2012; Gilson & Madjar, 2011; Madjar et al., 2011), which suggest that they may result from distinct creative processes. Research has found that willingness to take risk, career commitment, resources for creativity, and intrinsic motivation were more strongly related to radical creativity, whereas organizational commitment, presence of creative co-workers, and extrinsic motivation

were more strongly related to incremental creativity (Gilson & Madjar, 2011; Madjar et al., 2011). Importantly, radical creativity was more problem-driven, whereas incremental creativity was more solution-driven. Mumford and Gustafson (1988) further suggest that problem construction might be more important for creative ideas that represent major changes, in comparison to creative ideas that represent minor changes. Similarly, Unsworth (2001) suggested that the type of creative outcomes generated are in part a function of the extent to which the problem is already formulated before the individual starts the creative process. However, studies to date have not yet empirically examined how and whether specific elements of the creative process uniquely contribute to different types of creative outcomes.

Moreover, whether and to which degree individuals actively engage in problem construction and information search and encoding are considered fundamental for the idea generation process and the eventual generation of incremental or radical ideas. Specifically, it is suggested that idea generation draws from the knowledge and information that becomes available from these preparatory elements of the creative process (Mumford et al., 1991, 2012; Reiter-Palmon & Illies, 2004): Active problem construction and information search and encoding will lead to a broader and more diverse knowledge-base, which provides more opportunity for highly novel ideas (Reiter-Palmon & Illies, 2004). Radical creativity moves away from existing practices and, therefore, requires a broad and open problem space. It requires active problem construction and information search and encoding, because individuals cannot strongly rely on existing frameworks and structures to make sense of the situation at hand. Incremental creativity, in contrast, extends existing frameworks, by introducing minor modifications to current practices and products. Therefore, the problem space is more strongly predefined and constrained. Consequently, incremental creativity requires less problem construction and information search and encoding. Thus, we propose:

Hypothesis 3: Problem construction (H3a) and information search and encoding (H3b) are more strongly positively related to radical creativity than to incremental creativity.

Finally, we propose that engagement in idea generation is important for both radical and incremental creativity. Idea generation is an integral part of the definition of both radical and incremental creativity (Madjar et al., 2011). Indeed, idea generation is the process through which output is produced, which may or may not be creative. However, if individuals fail to engage in idea generation, there will be no output to begin with, and therefore, no creative output either. Thus:

Hypothesis 3c: Idea generation is positively related to both radical and incremental creativity.

Method

Research Setting and Participants

The data collected were part of a larger study on creativity and innovation, with data collected at multiple levels within organizations. (See Appendix for a data transparency table.) Participants in our study were employed in one of 25 companies. The companies sampled operated in a variety of industries, including biotech, engineering, information and computer technology, logistics, and pharmaceutical. We invited 3956 employees and 410 supervisors to participate in our study. A total of 1809 employees (response rate = 46%) and 288 supervisors (response rate = 70%) completed the survey. These are well within the range of normal response rates in management research (Anseel et al., 2010). After linking supervisor-employee dyads for which full information was available, we were left with a final sample of 642 employees (122 female, 520 male). The average age of the employees was 44.01 years (SD = 11.22). The number of supervisors in the sample was 167.

Measures

Employees completed the measures of leader creative expectations, job autonomy, problem construction, information search and encoding, and idea generation. Supervisors rated their subordinates on radical and incremental creativity.

Leader Creative Expectations

Leader creative expectations were measured with the three-item scale developed by Tierney and Farmer (2004). Responses were given on a five-point Likert scale, ranging from 1 (“completely disagree”) to 5 (“completely agree”). An example item is: “My supervisor expects me to do creative work.” The scale was internally consistent ($\alpha = .85$).

Job Autonomy

Job autonomy was measured with the three-item subscale developed by Spreitzer (1995). Responses were given on a five-point Likert scale, ranging from 1 (“completely disagree”) to 5 (“completely agree”). An example item is “I have considerable opportunity for independence and freedom in how I do my job.” The scale was internally inconsistent ($\alpha = .83$).

Creative Process Engagement

Engagement in creative processes was measured using the scales developed by Zhang and Bartol (2010). Respondents answered the following question: “In your job, to what extent do you engage in the following actions when seeking to accomplish an assignment or a task.” Responses were given on a Likert scale, ranging from 1 (“never”) to 5 (“very frequently”). *Problem construction* was measured with a three-item subscale, and an example item is “I spend considerable time trying to understand the nature of the problem.” *Information search* and *encoding* was measured with a three-item subscale, and an example item is “I consult a wide variety of information.” *Idea generation* was measured with the 5-item subscale, of which one item was dropped beforehand due to

lack of face validity.¹ An example of a remaining item is “I generate a great number of alternatives to the same problem before I choose the final solution.” Internal consistency was acceptable ($\alpha = .65, .65, \text{ and } .79$).

Radical and Incremental Creativity

Radical and incremental creativity were evaluated by managers and measured with the scales developed by Madjar et al. (2011). Responses were given on a five-point Likert scale, ranging from 1 (“completely disagree”) to 5 (“completely agree”). An example item for radical creativity is “This employee proposes breakthrough ideas that substantially depart from existing procedures, processes or products.” An example item for incremental creativity is “This employee proposes ideas for minor modifications to current procedures, processes or products.” Both subscales were internally consistent ($\alpha = .95 \text{ and } .89$).

Control Variables

We controlled for demographic variables that have been shown to relate to creativity and may covary with our independent variables as well, including age (Ng & Feldman, 2008), gender (Baer & Kaufman, 2008; Conti et al., 2001), education (Amabile, 1983; Benedek et al., 2014; Tierney et al., 1999), and organizational and job tenures (Scott & Bruce, 1994). Consistent with recommendations in the methodological literature (Becker et al., 2016), we also ran the same analysis without control variables and found that the results remained stable.

Confirmatory Factor Analysis

To assess the validity of the measurement model, we conducted a confirmatory factor analysis comparing our focal model to alternative models. We assessed model fit by examining the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). The proposed, focal 7-factor model provided a good fit to the data ($\chi^2 [188] = 422.45$; CFI = .97; TLI = .96; RMSEA = .04 [.04; .05], SRMR = .04). Table 1 shows the various models that have been computed. Our focal model provided superior fit compared to a model where the three subscales of creative process engagement were combined into one factor (model 1, $\Delta\chi^2 [11] = 458.41, p < .001$), hereby confirming the importance of disentangling the creative process into specific elements. The proposed model also showed a better fit than an alternative model in which radical creativity and incremental creativity were combined into one factor (model 2, $\Delta\chi^2 [6] = 635.68, p < .001$).

Furthermore, confirmatory factor analysis revealed a better fit for the proposed model compared with a model in which job autonomy and leader creative expectations

¹ The item that was dropped from the idea-generation scale appeared to be conceptually loading on both idea generation and information search and encoding. The item was “I consider diverse sources of information in generating new ideas.”

were combined into one factor (model 3, $\Delta\chi^2 [6] = 1843.74$, $p < .001$). Furthermore, given that the measurement of leader creative expectations, job autonomy, and engagement in creative processes (i.e., problem construction, information search and encoding, and idea generation) was provided by one single informant (i.e., employees) and that all measurements were administered through the same method (i.e., surveys), common method variance may exist and potentially bias the observed relationships among our study variables (Podsakoff et al., 2003). To address this, we aimed to assess the extent to which common method variance is present and influences the study variables and their relationships (Williams & McGonagle, 2016). Although we were unable to reliably estimate all the prescribed models because of the minimal number of items per factor (four items for idea generation and three items for all other study variables), we were able to estimate the percentage of common method variance by using an unweighted least squares estimator to re-estimate our baseline model and compare this to a Method_U model in which all items loaded on an uncorrelated latent method factor. These results indicated that the Method_U model had a better fit than the baseline model ($\Delta\chi^2 [33] = 124.70$, $p < .001$) and that the uncorrelated latent method factor accounted for 12.51% of the variance in the substantive indicators, which is lower than proportions of method variance typically reported elsewhere (Malhotra et al., 2006; Podsakoff et al., 2012). Thus, common method variance does not appear to be a major issue in this data.

Table 1 Confirmatory factor analyses

Factor structure	χ^2	<i>df</i>	<i>RMSEA (90%)</i>	<i>CFI</i>	<i>TLI</i>	<i>SRMR</i>	$\Delta\chi^2$	<i>df</i>
Baseline model (7 factors)	422.45	188	.04 (.04; .05)	.97	.96	.04		
Model 1 (5 factors)	880.87	199	.07 (.07; .08)	.91	.89	.06	458.41***	11
Model 2 (6 factors)	1058.13	194	.08 (.08; .09)	.88	.86	.07	635.68***	6
Model 3 (6 factors)	2266.19	194	.13 (.12; .13)	.71	.66	.09	1843.74***	6

N = 642. $\Delta\chi^2$ and Δdf relative to baseline model. Model 1: creative processes on one factor. Model 2: job autonomy and leader creative expectations on one factor. Model 3: radical and incremental creativity on one factor

****p* < .001

Results

Descriptive Statistics

Table 2 shows the means, standard deviations, and zero order correlations among all study variables. Leader creative expectations were positively correlated with problem construction ($r = .15$, $p < .001$), information search and encoding ($r = .17$, $p < .001$), and idea generation ($r = .28$, $p < .001$). Job autonomy correlated positively with problem construction ($r = .18$, $p < .001$), information search and encoding ($r = .14$, $p < .001$), and idea generation ($r = .13$, $p < .01$). For incremental creativity, we found positive correlations with problem construction ($r = .14$, $p < .001$), information search and encoding ($r = .12$, $p < .01$), and idea generation ($r = .19$, $p < .001$). For radical creativity, we found positive correlations with problem construction ($r = .15$, $p < .001$), and idea generation ($r = .19$, $p < .001$), and a marginal correlation with information search and encoding ($r = .07$, $p = 0.088$).

Analytical Strategy

To test our hypotheses, we conducted regression analyses through path analyses using Lavaan 0.6-9 in R (Rosseel, 2012). We conceptualized all variables at the individual level of analysis. Because the data has a nested structure in which supervisors rated multiple employees on radical and incremental creativity, the observations violate the independence assumption. To account for the dependency of observations given by the same supervisor, we used a cluster-robust estimator (Rogers, 1994) to cluster the standard errors derived from the regression models at the supervisor level ($N = 167$). We tested hypotheses of differential effects (i.e., that certain relations are stronger than other relations) through linear equations in which we contrasted the unstandardized regression weights for the respective paths. Results of these analyses are reported in Tables 3 and 4.

Hypothesis Testing

Hypothesis 1 predicted that job autonomy is (a) more strongly related to problem construction than to idea generation and (b) more strongly to information search and encoding than to idea generation. The results indeed showed a positive relationship between job autonomy and problem construction ($b = 0.09$, $p = .010$), but no significant relationship between job autonomy and information search and encoding ($b = 0.06$, $p = .152$) or between job autonomy and idea generation ($b = 0.02$, $p = .676$). Furthermore, the relationship between job autonomy and problem construction was marginally significantly stronger than the relationship between job autonomy and idea generation ($b = 0.07$, $z = 1.72$, $p = .085$). However, the relationship between job autonomy on information search and encoding was not significantly stronger than relationship between job autonomy and idea generation ($b = 0.04$, $z = 0.88$, $p = .378$). Thus, Hypothesis 1 was partially supported.

Hypothesis 2 predicted that leader creative expectations are related to problem construction, information search and encoding, and idea generation, but that relationships with idea generation would be stronger than relationships with problem construction and information search and encoding. The results indeed showed a positive relationship between leader creative expectations and problem construction ($b = 0.08$, $p = .018$), between leader creative expectations and information search and encoding ($b = 0.12$, $p < .001$), and between leader creative expectations and idea generation ($b = 0.24$, $p < .001$). Furthermore, the relationship between leader creative expectations and idea generation was indeed significantly stronger than the relationship between leader creative expectations and problem construction ($b = 0.16$, $z = 3.96$, $p < .001$) and information search and encoding ($b = 0.12$, $z = 2.76$, $p = .006$). Thus, Hypothesis 2 was fully supported.

Hypothesis 3a proposed that problem construction is more strongly related to radical creativity than to incremental creativity. Results show that problem construction is positively related to radical creativity ($b = 0.25$, $p = .001$) and unrelated to incremental

Table 2 Means, standard deviations and correlations

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender (0 = female; 1 = male)	0.81	0.39	-											
2. Age (years)	44.01	11.22	.08*	-										
3. Organizational tenure (years)	13.04	11.79	.05	.67***	-									
4. Job tenure (years)	8.77	8.53	.13**	.51***	.49***	-								
5. Education	2.81	0.83	-.13***	-.23***	-.27***	-.25***	-							
6. Leader creative expectations	3.43	0.71	.06	.09*	.06	.03	.00	(.85)						
7. Job autonomy	3.88	0.68	.06	.00	.00	-.02	.11**	.36***	(.83)					
8. Problem construction	3.89	0.54	.13***	-.07	-.12**	-.11**	.14**	.15***	.18***	(.65)				
9. Information search and encoding	3.84	0.57	.04	-.07	-.07	-.10**	.13**	.17***	.14***	.47***	(.65)			
10. Idea generation	3.53	0.63	.12**	-.06	-.03	-.03	.02	.28***	.13**	.40***	.34***	(.79)		
11. Incremental creativity	3.78	0.70	.04	-.09*	-.11**	-.13***	.15***	.07	.12**	.14***	.12**	.19***	(.89)	
12. Radical creativity	2.31	0.94	.13***	-.03	-.02	-.01	.17***	.05	.15***	.20***	.07	.19***	.38***	(.95)

N = 642

p* < .05; *p* < .01; ****p* < .001

creativity ($b = 0.04$, $p = .412$). Furthermore, consistent with our hypothesis, the relationship between problem construction and radical creativity is stronger than the relationship between problem construction and incremental creativity ($b = 0.21$, $z = 2.71$, $p = .007$). Hypothesis 3b proposed that information search and encoding is more strongly related to radical creativity than to incremental creativity. Results show that information search and encoding was marginally significantly related to radical creativity in an unexpected direction ($b = -0.12$, $p = .087$) and unrelated to incremental creativity ($b = 0.03$, $p = .573$). Notwithstanding these non-significant relationships, inconsistent with our hypothesis, the relationship between problem construction and radical creativity was weaker than the relationship between problem construction and incremental creativity ($b = -0.16$, $z = 2.17$, $p = 0.30$). Finally, in line with Hypothesis 3c, idea generation was found to be positively related to both incremental creativity ($b = 0.17$, $p = .001$) and radical creativity ($b = 0.22$, $p < .001$). Taken together, we found partial support for Hypothesis 3.

Supplementary Analyses

We performed supplementary analyses to further scrutinize the robustness of our findings and explore alternative conceptual configurations. Because the cross-sectional design of our study precludes us from making statements or drawing conclusions of a causal nature (Spector, 2019), these supplementary analyses should only be considered exploratory.

First, because the logic of and support for our hypotheses could suggest mediation, we explored the possibility of Table indirect relationships between leader creative expectations and job autonomy and radical and incremental creativity as mediated by the creative process variables. To this end, we reran the statistical models reported in Tables 3 and 4 while simultaneously controlling for the effects of leader creative expectations and autonomy on radical and incremental creativity. These analyses revealed, first, that adding leader creative expectations and job autonomy does not alter the relationships between the creative processes and creative outcome variables. Second, although leader creative expectations was unrelated to radical creativity ($b = -0.07$, $z = -1.39$, $p = .164$) and incremental creativity ($b = -0.00$, $z = -0.05$, $p = .957$), job autonomy was significantly related to radical creativity ($b = 0.15$, $z = 2.51$, $p = .012$) and marginally to incremental creativity ($b = 0.07$, $z = 1.74$, $p = 0.082$). Third, as reported in Table 5, we used the Monte Carlo method of resampling to compute confidence intervals for the indirect relationships (Preacher & Selig, 2012) and found that leader creative expectations was indirectly related to incremental creativity through idea generation ($b = 0.041$, 95% LLCI = .016, 95% ULCI = .071) and to radical creativity through problem construction ($b = 0.019$, 95% LLCI = .002, 95% ULCI = .042) and idea generation ($b = 0.055$, 95% LLCI = .025, 95% ULCI = .090). Furthermore, job autonomy was indirectly related to radical creativity through problem construction ($b = 0.020$, 95% LLCI = .003, 95% ULCI = .047). Notwithstanding the cross-sectional nature

of our data, these results suggest that distinct indirect effects between our study variables are possible.

Table 3 Unstandardized regression coefficients with cluster-robust standard errors

	Problem construction				Information search and encoding				Idea generation			
	<i>b</i>	<i>s.e.</i>	<i>z</i>	<i>p</i>	<i>b</i>	<i>s.e.</i>	<i>z</i>	<i>p</i>	<i>b</i>	<i>s.e.</i>	<i>z</i>	<i>p</i>
Constant	2.92***	0.16	18.23	0.000	3.05***	0.22	13.74	0.000	2.70***	0.22	12.05	0.000
Gender (0 = female; 1 = male)	0.19**	0.06	3.47	0.001	0.07	0.06	1.21	0.225	0.17**	0.06	2.88	0.004
Age (years)	0.00	0.00	0.70	0.483	-0.00	0.00	-0.58	0.560	-0.00	0.00	-1.60	0.109
Organizational tenure (years)	-0.00	0.00	-1.55	0.122	-0.00	0.00	-0.02	0.985	0.00	0.00	0.13	0.900
Job tenure (years)	-0.00	0.00	-1.26	0.208	-0.00	0.00	-1.23	0.220	-0.00	0.00	-0.21	0.833
Education	0.07**	0.02	2.91	0.004	0.07*	0.03	2.16	0.031	0.01	0.03	0.21	0.837
Leader creative expectations	0.08*	0.03	2.36	0.018	0.12***	0.03	3.58	0.000	0.24***	0.04	5.33	0.000
Job autonomy	0.09*	0.03	2.58	0.010	0.06	0.04	1.43	0.152	0.02	0.04	0.42	0.676

Table 4 Unstandardized regression coefficients with cluster-robust standard errors

	Incremental creativity				Radical creativity			
	<i>b</i>	<i>s.e.</i>	<i>z</i>	<i>p</i>	<i>b</i>	<i>s.e.</i>	<i>z</i>	<i>p</i>
Constant	2.58***	0.31	8.43	0.000	0.27	0.33	0.80	0.422
Gender (0 = female; 1 = male)	0.08	0.07	1.18	0.238	0.28**	0.10	2.83	0.005
Age (years)	0.00	0.00	0.07	0.945	-0.00	0.00	-0.64	0.521
Organizational tenure (years)	-0.00	0.00	-0.52	0.602	0.00	0.00	0.84	0.402
Job tenure (years)	-0.01	0.00	-1.92	0.055	0.00	0.01	0.51	0.609
Education	0.10**	0.03	2.90	0.004	0.21***	0.05	3.85	0.000
Problem construction	0.04	0.05	0.82	0.412	0.25**	0.08	3.21	0.001
Information search and encoding	0.03	0.06	0.56	0.573	-0.12	0.07	-1.71	0.087
Idea generation	0.17**	0.05	3.37	0.001	0.22***	0.06	3.62	0.000

N = 642

p* < .05; *p* < .01; ****p* < .001

Second, although the logic of our hypotheses suggests the abovementioned model, alternative (causal) relationships between our study variables would also be possible. On the one hand, engaging in creative processes may influence individuals' perceptions of job autonomy and leader creative expectations as a form of sensemaking (Liu et al., 2019; Weick, 1995). On the other hand, employees that have successfully generated creative ideas previously may be motivated to engage in (further) creative actions in the future (Goncalo et al., 2010). To preliminarily explore these possibilities, we estimated and contrasted various additional regression analyses. Because these models are not nested, we used the Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample-size adjusted BIC (SSBIC) to compare the fit across these models.

These analyses revealed that models in which we regressed problem construction (AIC = 983.67, BIC = 1023.85, SSBIC = 995.28), information search and encoding (AIC = 1083.08, BIC = 1123.26, SSBIC = 1094.69), or idea generation (AIC = 1171.87, BIC = 1212.05, SSBIC = 1183.48) on leader creative expectations, job autonomy, and the control variables had a better fit than models in which we regressed leader creative expectations (AIC = 1342.64, BIC = 1387.29, SSBIC = 1355.54) and job

autonomy (AIC = 1319.15, BIC = 1363.80, SSBIC = 1332.05) on the creative process and control variables. However, these analyses also revealed that models in which we regressed incremental creativity (AIC = 1327.37, BIC = 1372.02, SSBIC = 1340.27) and radical creativity (AIC = 1693.64, BIC = 1738.28, SSBIC = 1706.53) on the creative process and control variables had a worse fit than models in which we regressed problem construction (AIC = 986.65, BIC = 1026.83, SSBIC = 998.26), information search and encoding (AIC = 1099.96, BIC = 1140.14, SSBIC = 1111.57), or idea generation (AIC = 1193.80, BIC = 1233.98, SSBIC = 1205.41) on radical and incremental creativity and the control variables. These results suggest that the causal direction of the relationships between our study variables may be more dynamic than we theoretically envisioned.

Table 5 Exploring indirect relationships with Monte Carlo confidence intervals

	<i>b</i>	<i>LLCI</i> (95%)	<i>ULCI</i> (95%)
Leader creative expectations → problem construction → incremental creativity	0.003	-0.006	0.013
Leader creative expectations → problem construction → radical creativity	0.019*	0.002	0.042
Leader creative expectations → information search and encoding → incremental creativity	0.004	-0.012	0.019
Leader creative expectations → information search and encoding → radical creativity	-0.015	-0.037	0.002
Leader creative expectations → idea generation → incremental creativity	0.041*	0.016	0.071
Leader creative expectations → idea generation → radical creativity	0.055*	0.025	0.090
Job autonomy → problem construction → incremental creativity	0.003	-0.006	0.015
Job autonomy → problem construction → radical creativity	0.020*	0.003	0.047
Job autonomy → information search and encoding → incremental creativity	0.002	-0.006	0.013
Job autonomy → information search and encoding → radical creativity	-0.007	-0.026	0.002
Job autonomy → idea generation → incremental creativity	0.003	-0.012	0.018
Job autonomy → idea generation → radical creativity	0.004	-0.016	0.024

N = 642

LLCI lower-level confidence interval, *ULCI* upper-level confidence interval

**p* < .05

Discussion

While scholars acknowledge the importance of disentangling the creative process from creative output, there is scant empirical research that theoretically and empirically distinguished between different elements of the creative process and that examined their differential antecedents and consequences. In light of this, the aim of our study was threefold.

First, following Henker et al. (2015) and Caniëls (2019), we aimed to show empirically that problem construction, information search and encoding, and idea generation are in fact distinct elements of the creative process. Confirmatory factor analysis for a three-factor model separating these elements of the creative process indeed yielded better results than a model in which the elements of the creative process were collapsed into one factor.

Second, using a sensemaking perspective (Ford, 1996; Weick, 1995), we aimed to show that these distinct elements are differentially related to job autonomy and leader

creative expectations and found partial support. Specifically, we found that leader creative expectations were positively related to all elements of the creative process, but significantly stronger to idea generation than to problem construction and information search and encoding. Furthermore, we found that job autonomy was positively related to problem construction, but not to information search and encoding, or idea generation. Contrary to our predictions, we did not find a significant relationship between autonomy and information search and encoding. One explanation could be that the relationship between these two constructs is stronger for some individuals than others. Specifically, autonomy may facilitate or inhibit personal traits that are related to creative processes (cf. Tett & Burnett, 2003). For instance, workers high in creative personality may spend more time searching and analyzing new information when they have the opportunity (i.e., high autonomy) to do so (Zhou, 2003).

Third, we answered the call from Montag et al. (2012) who proposed that researchers should examine multiple categories of creative behaviors and their relationship with different types of creative outcomes. Specifically, we aimed to show that problem construction, information search and encoding, and idea generation differentially predict radical and incremental creativity. Again, we found (partial) support for our predictions. Consistent with our hypotheses, we found a positive relationship between idea generation and both radical and incremental creativities. Furthermore, problem construction was positively related to radical creativity but not to incremental creativity. In contrast to our hypotheses, however, we did not find a relationship between information search and encoding and radical creativity.

There are three explanations for the absence of the relationship between information search and encoding and creative outcomes. First, Henker et al. (2015), who found a similar result, suggested that it may be hard to differentiate information search and encoding from problem construction and idea generation. That is, information search and encoding may serve as a process to better understand a problem, or alternatively, might serve as a process to trigger inspiration for idea generation. The positive zero-order correlations of information search and encoding with problem construction and idea generation (Table 2) provide an indication that the former might impact creativity through facilitation of the latter processes. Second, an alternative explanation is that individuals differ in the type of information they select during information search and encoding, which our methodology did not account for. Specifically, Mumford et al. (1996) found that individuals who spent more time on processing factual and inconsistent information while discounting irrelevant information, produced more feasible and original problem solutions. Thus, it might be that radical creativity depends more on the *type* rather than amount of information that is processed during information search and encoding. Third, it must be noted that the items related to the measurement of information search and encoding do not specify the search of information with the aim of being creative. That is, some non-creative tasks might also require a large amount of information search and encoding. This potentially creates noise in the measurement, which may deflate the relationship of information search and

encoding with radical creativity. The first explanation for the insignificant effect of information search and encoding suggests a potential conceptual issue with this construct, whereas the latter two explanations suggest a measurement issue.

In addition to the primary aims of the study, we examined in an exploratory way the indirect relationship between leader creative expectations and job autonomy and radical and incremental creativity. These exploratory findings tentatively suggest that leader creative expectations may impact radical creativity through both problem construction and idea generation, while they may impact incremental creativity only through idea generation. Furthermore, job autonomy only had a significant indirect relationship with radical creativity through problem construction. It must be noted, however, that job autonomy still had a strong significant main effect on radical creativity that was not explained through the creative process. A potential explanation for this could be that the creative process is an internal process, whereas leaders' ratings of radical creativity are based on the ideas that employees actually voice to their leader. Thus, it might be the case that autonomy is important in later stages of the creative process, such as idea championing, where ideas are communicated to others. It should be again noted that the cross-sectional nature of our data precludes a strong test of indirect effects and mediation. Results with regard to the potential mediating role of creative process engagement should be seen as explorative and as input for future research.

Implications for Theory and Practice

Taken together, these results have various theoretical and practical implications. First, this study showed that the distinct elements of the creative process have differential antecedents and differential consequences in terms of creative outcomes. Hence, our findings empirically support other scholars' (largely theoretical) claims about the importance of disentangling the creative process (e.g., Mumford et al., 1991, 2012; Unsworth, 2001). Our theory and findings show that differences in individuals' creative process engagement are not only influenced by context variables (creative expectations and job autonomy), but also that these differences have important consequences with regard to creative outcomes. Thus, our results signal that scholars who are interested in explaining how different types of creativity come about should focus on the creative processes leading up to these types of creativity.

Second, this study suggests that the sensemaking theory of creative action (Ford, 1996) is a constructive framework for understanding how individuals decide to engage in specific elements of the creative process. More importantly, we have further developed the sensemaking perspective on creative action by predicting not only whether individuals engage in creative action, but also in what creative actions they will engage. Specifically, we proposed that the way in which creative action unfolds not only depends on whether creative outcomes are desired (prognostic framing), but also depends on the extent to which the individual is involved in the framing of the problem situation (diagnostic framing). The results indicate that this extension of the theory of

creative action (Ford, 1996) provides a useful framework of understanding what drives individuals to engage in specific elements of the creative process.

Finally, our study has some important implications for practitioners. Depending on the type of creativity that is required within an organization, managers should motivate their employees to engage in specific creative processes. That is, we found that idea generation is important for both radical and incremental creativity, while problem construction is only important for radical creativity. Managers could communicate a preferred emphasis on these creative processes directly to increase radical vs. incremental creativity (Reiter-Palmon & Robinson, 2009). In addition, although our cross-sectional methods preclude strong conclusions about mediation, we did find that autonomy seems more strongly related to problem construction, while leader creative expectations are more strongly related to idea generation. As such, our explorative findings suggest that managers can, perhaps unknowingly, influence the radicalness of creativity by (de)emphasizing creative expectations or providing higher (or lower) levels of autonomy.

Limitations and Future Directions

As with any study, there are theoretical and empirical limitations that need to be noted. First, while we disentangle the creative processes, we disregarded the notion that the creative process can also be dynamic in nature (e.g., Beghetto & Corazza, 2019; Mumford et al., 2012). Specifically, individuals who attempt to be creative may cycle back and forth through the processes of problem construction, information search and encoding, and idea generation. It is possible that dispositional and contextual variables not only influence the extent to which individuals engage in specific elements of the creative process, but also influence the dynamics of the creative process (Botella & Lubart, 2019). This dynamic nature of processes may also affect creative outcomes. Although empirically challenging, future studies should therefore try to capture the creative process as it unfolds over time and examine antecedents of specific dynamics as well as their consequences on different types of creative outcomes.

A second limitation is that the present study is limited to contextual variables influencing whether individuals expend effort developing their own diagnostic frames and prognostic frames. However, research suggests that sensemaking processes are also influenced by dispositional variables (e.g., Drazin et al., 1999). For example, individuals who have a high need for cognition (Cacioppo et al., 1996) might be more interested in engaging in developing their own diagnostic frames regardless of the situation, since diagnostic framing may satisfy this need. In contrast, individuals with a high personal need for structure (Neuberg & Newsom, 1993) might be more inclined to adopt diagnostic frames from their leaders regardless of the amount of autonomy they have, since they feel more at ease in situation that are predictable. Overall, future research should examine how individual differences influence employees' inclination to develop their own diagnostic and prognostic frames and, as such, influence their engagement in stages of the creative process.

Third, although we have gathered our data from different sources (i.e., employees and their direct supervisors), another limitation lies in the fact that we have used surveys as a common method to gather the data for our study (Podsakoff et al., 2012). Following procedures as outlined by Williams and McGonagle (2016), we found that 12.56% of the variance in our substantive indicators can be attributed to a common method, which is lower than percentages reported elsewhere (Malhotra et al., 2006; Podsakoff et al., 2012). Given this relatively small percentage of common method variance and the fact that we are testing differential predictions that are unlikely to be caused by a common method, we argue that common method variance should have little to no effect on the conclusions of our hypotheses testing. Notwithstanding this, future research could employ different methods to verify and expand on our hypotheses, including observation studies and objective measures for creative output.

Finally, although the way in which we have theorized and hypothesized the relationships between our study variables may suggest specific causal relationships between our study variables, our cross-sectional design precludes us from making such causal claims (Spector, 2019). On the one hand, our supplementary analyses suggest that the different creative process variables may play a key role in facilitating distinct and unique relationships between leader creative expectations and job autonomy and radical and incremental creativity. Whereas job autonomy may result in more radical creativity (through increased problem construction), for instance, leader creative expectations may result in more radical (through increased problem construction and idea generation) as well as incremental creativity (through increased idea generation). On the other hand, at the same time, our supplementary analyses suggest that alternative causal pathways may also be possible. Whereas we have suggested that leader creative expectations and job autonomy may motivate employees to engage in creative processes, for instance, engaging in these creative processes may also spark a sensemaking process where employees perceive their creative engagement as indications of perceived leader creative expectations and job autonomy (Liu et al., 2019; Weick, 1995). Similarly, individuals that have previously generated radical and incremental creative ideas may be subsequently motivated to engage in creative actions in the future (Goncalo et al., 2010), be bestowed with further expectations to generate such ideas, and even be provided with (or claim) the autonomy to do so. Additional research is needed to empirically examine the causality of these effects. Future research could employ longitudinal or (field) experimental methods to provide stronger tests of the causal chain from contextual antecedents to creative outcomes, through differences in creative processes. For instance, in a lab setting, researchers could manipulate creative expectations and/or autonomy and observe their effect on different elements of the creative process and subsequently measure the radicalness of a creative solution. It would be interesting and important to observe whether the differential antecedental and consequential effects of the creative processes argued in our study would hold in such future research.

Conclusion

In this paper, we theoretically articulated and empirically examined the multidimensional nature of the creative process. We presented evidence that problem construction, information search and encoding, and idea generation are distinct from each other and have different antecedents and consequences. We empirically disentangled the elements of the creative process and showed that they explain why individuals differ in radical and incremental creativity and how leader and context variables impact this. We encourage scholars to focus more on the creative process, rather than solely on creative outcomes.

Appendix. Data transparency table and statements

The data collected were part of a larger study on creativity and innovation at multiple levels of analysis and consist of cross-sectional survey data. Three other projects use the same dataset; two are currently in the process of “revise and resubmit” at a different journal, and the other one has just been submitted. Two of these projects, however, focus on the team level of analysis and overlap with used variables is mainly the use of control variables. The third paper focuses on predictors of managerial exploration and exploitation. Please find a more detailed explanation of each of these projects and a data-transparency table below.

Paper 1. The current submission focuses on individual employees and on antecedents and consequences of creative process engagement.

Paper 2. It has just been submitted and focuses on moderators of the relation between team-level creativity and team-level innovation. Overlap with the current paper is minimal (only leader creative expectations are used as a control variable in that paper).

Paper 3. It is currently in the R&R stage and focuses on predictors of team level creativity. Creative process engagement is considered in this paper as an IV at the team level. Specifically, it looks at role differentiation at the team level (i.e., whether different team members specialize in different creative processes) as a predictor of team creativity.

Paper 4. It focuses on the predictors of managerial exploration-exploitation.

Note: in the table, X denotes focal variable of the model and C denotes use as control variable.

Variables included in the analyses	Current submission (paper 1)	Under review (paper 2)	R&R (paper 3)	R&R (paper 4)
<i>Employee-rated variables</i>				
Leader creative expectations	X	C		
Autonomy	X			
Creative process engagement	X (individual level)		X (team level)	
Resources for creativity (in team)			X	
Centralization of decision making			X	
Standardization of work		X		C
Organizational support for creativity		C		
Managerial openness to ideas				X
Tenure	C			C
Age	C			
Gender	C			
Education	C			C
<i>Team leader (supervisor) rated variables</i>				
Employee incremental creativity	X			
Employee radical creativity	X			
Team creativity		X	X	
Perceived rewards for innovation		X		
Managerial exploration and exploitation				X

Variables included in the analyses	Current submission (paper 1)	Under review (paper 2)	R&R (paper 3)	R&R (paper 4)
Networking ability				X
Shared organizational vision				X
Team workload				C
Gender		C		
Tenure		C		
<i>Higher manager rated variables</i>				
Team innovation		X		
Company slack resources		C		
Norms for innovation				C
Environmental dynamism				C
<i>From company records</i>				
Team size		C	C	
Firm size		C		

X denotes focal variable of the model, and C denotes use as control variable

Author contribution

All authors contributed to the study conception and design. Material preparation and data collection were performed by Bart Verwaeren, Bernard Nijstad, and Gerben Tolkamp. Analyses were performed by Gerben Tolkamp and Tim Vriend. The first draft of the manuscript was written by Gerben Tolkamp, and all other authors (Tim Vriend, Bart Verwaeren, Roni Reiter-Palmon and Bernard Nijstad) commented on all previous versions of the manuscript. All authors read and approved the final manuscript.

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Data and code availability

The datasets generated during and analyzed during the current study are not publicly available due to nondisclosure obligations in terms of privacy agreements with participating companies. For transparency reasons, all codes used to analyze the data as well as the variance and covariance matrices, on which the analyses are based, are available from the corresponding author upon reasonable request.

Declarations

Ethics approval The questionnaire and methodology for this study was approved by the Human Research Ethics committee of the Faculty of Economics and Business of the University of Groningen, (Ethics approval number: FEB-20200805-11641)

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Conflict of interest

The authors declare no competing interests.

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