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RESEARCH REPORT

Bright Sparks and Enquiring Minds: Differential Effects of Goal Orientation on the Creativity Trajectory

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Why are some employees better than others at improving and maintaining their creativity over time? Despite decades of empirical study and theory on employee creativity, the temporal and developmental aspects of creativity are far from being fully understood. Emphasizing the dynamic nature of creativity, we propose that creativity trajectories are nonmonotonic, and that goal orientations explain individual variations in the ability to improve and sustain the productivity (number) and quality (novelty and usefulness) of ideas over time. Our findings from a longitudinal study at a manufacturing company suggest that employees with a learning orientation strive to develop their skills and thus improve the quality of their ideas at a faster rate and maintain it over time. Those with a performance orientation seek to demonstrate their skills, relying on existing frameworks that enable a larger number of ideas initially, yet ultimately undermine their creativity in the long term. We discuss the theoretical and practical implications for fueling creativity over time.

Keywords: creativity trajectory, learning, innovation, goal orientation

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To produce new products and improve work processes, organizations need a continual stream of new ideas from their employees (Deichmann & van den Ende, 2014). Organizational scholars are thus increasingly interested in understanding whether an individual's creativity can be improved and sustained over time (Mannucci & Yong, 2018). Traditionally, research on creativity trajectories, a change in creative performance over time, documented the careers of eminent artists and scientists, showing that their creativity fluctuates over the years. The number of ideas they generated and the quality of those ideas followed a curvilinear trajectory, starting with an initial improvement followed by a gradual decline (e.g., Lehman, 1953; Levin & Stephan, 1989; Mainemelis et al., 2016; Simonton, 1991, 1997, 2007a, 2007b; Sinatra et al., 2016). The few studies that examined how workplace creativity changes in a given period of time showed that employees improve their creativity with relevant experience (Deichmann & van den Ende, 2014). Yet, these studies also show that over time and unless there are opportunities for knowledge to be expanded into new domains, the employees' creative experience leads them to narrowly focus on familiar heuristics that worked in the past instead of exploring new approaches (Audia & Goncalo, 2007; Bayus, 2013).

Although informative, prior research is silent about *why* some individuals improve their creativity and maintain it over time, whereas others do not. In part, this is because scholars have largely attributed trends in creativity to prior experience in generating ideas (Audia & Goncalo, 2007; Bayus, 2013; Mannucci & Yong, 2018), overlooking individual differences in the motivation to learn from creative activities and to develop creativity skills. Given that creativity is vital for sustainability and that poor-quality ideas may fail and are costly to administer and to review (Baer, 2012; Deichmann & van den Ende, 2014), the faster employees learn and improve their creativity, the greater the value to be gained from their ideas.

To address this gap, we developed a theory on how goal orientations (Gong et al., 2009; Hirst et al., 2009, 2011) explain individual variation in the creativity trajectory. Goal orientations reflect the framework within which individuals interpret and react to achievement situations such as engaging in a creative endeavor (Dweck & Leggett, 1988). Two primary orientations have been identified in the literature: a *learning orientation,* where individuals view their capabilities as malleable and are thus intent on acquiring new skills and expanding their abilities by mastering challenging situations, and a *performance orientation*, where they conceive their capabilities as fixed and thus focus on demonstrating their competence relative to

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others. Previous research has combined these orientations with approach and avoidance goals (Elliot & McGregor, 2001). Given that creativity is inherently risky, avoidance goals can inhibit the willingness to engage in creative endeavors (Janssen & Van Yperen, 2004). In contrast, many studies have documented a positive relationship between a learning *approach* orientation and creativity (Choi et al., 2018; Gong et al., 2013; Huang & Luthans, 2015; Lee & Yang, 2015; Liu et al., 2015). Although less consistent, a performance *approach* orientation was found to drive employees to demonstrate their creativity as a means of gaining favorable judgments from others (Hirst et al., 2009). However, research on goal orientation and creativity has predominantly examined creativity in a single task or at a given time without considering whether goal orientations shape the creativity trajectory.

Given the centrality of these two areas of inquiry—the changing nature of creativity over time and the nature of the relationships between goal orientations and creativity—we address recent calls to take a dynamic approach in exploring the antecedents of creativity (Amabile & Pratt, 2016; Anderson et al., 2014). We do so by integrating these streams of research with the aim of testing the notion that goal orientations explain individual variations in the *creativity trajectory*, that is, the change in production and quality of ideas across a series of performance observations in a specified period of time (Judge & Hurst, 2008; Thoresen et al., 2004). To achieve this goal, we studied the creativity trajectories of employees in a manufacturing company that implemented an innovation program from the outset (Oldham & Cummings, 1996). This context was particularly suitable because it enabled us to examine the effect of goal orientations on creative performance in a period in which all employees were encouraged to generate new ideas and their creative suggestions were systematically evaluated by the organization.

Our theoretical perspective and empirical findings make important contributions to knowledge about creativity in organizations. Our research is the first to suggest and show that employee creativity in organizations is nonmonotonic and that creative trajectories vary: Some employees improve their creativity at a faster rate and sustain it over time, whereas others do not. Our contribution lies in going beyond prior research that documented the careers of eminent creators (e.g., Simonton, 1997), or explained creativity in a specific task or time (e.g., Hirst et al., 2009; Miron-Spektor & Beenen, 2015), and showing that goal orientations play an important role in individual variations in the creativity trajectories. Given that the most creative employees generate many ideas that are judged as novel and useful (Oldham & Cummings, 1996; Shin & Grant, in press), we examine the change in the number of ideas produced over time (*idea productivity trajectory*) and the change in idea quality, that is, novelty and usefulness over time (*idea quality trajectory*; Mannucci & Yong, 2018). By showing that learning and performance orientations distinctly impact the idea quality and productivity trajectories, and that the benefits of performance orientation do not span over time, we also reconcile inconsistent findings in prior research (Porter et al., 2010). Overall, we offer novel theoretical, empirical, and practical insights into *why* some individuals improve their creativity and sustain it over time more than others.

Creativity Trajectories at Work

Workplace creativity refers to the generation of ideas, solutions, and products that are judged novel and useful by the organization (Amabile, 1997; Oldham & Cummings, 1996). It often involves employees identifying a problem and actively searching for new information that enables them to generate possible solutions, from which they select the best one(s). As organizations need to maintain a full pipeline of high-quality ideas to succeed (Deichmann & van den Ende, 2014), we seek to explore the creativity trajectory—whether employees improve and sustain their creativity over time.

Research on creativity trajectories suggests that the ability of employees to continuously produce creative solutions depends on (a) knowledge elements that are available for combination into new variations, (b) whether they are regarded as relevant to the problem at hand, and (c) the heuristics used when combining those elements (Simonton, 1999). When creativity is not an explicit component of the job description, being productive will also depend on the motivation to engage in creativity, that is, investing in surfacing organizational problems and developing novel and useful solutions (Amabile, 1997; Montag et al., 2012). Employees are motivated to invest in creativity when they find the problem at hand interesting, enjoyable, and challenging (*intrinsic motivators*), and when their creativity is appreciated by the organization without undermining their sense of self-determination (*synergetic extrinsic motivators*; Amabile & Pratt, 2016).

Thus, in an attempt to achieve sustainable improvement in employee creativity, many organizations launch innovation programs whereby employees are encouraged to propose new and useful solutions to everyday problems, learn from the feedback they receive, and thus improve their creativity (e.g., Carrier, 1998; Deichmann & van den Ende, 2014; Fuchs et al., 2019). Treating all employees as valued contributors, these programs remove bureaucratic barriers for innovation by establishing a platform through which ideas can be easily submitted and monitored and a system or process through which all ideas are evaluated by the managers who provide feedback and select novel and useful ideas for implementation (Oldham & Cummings, 1996). Most programs also use synergetic motivators and recognize the creative contributions from employees (Holzmann & Golan, 2016).

Utilizing an exceptional opportunity to explore the relationship between goal orientation and creativity trajectories in a natural work setting, we collected data in a manufacturing company that implemented such a program from the outset. Our first goal was to understand whether and how voluntary creativity changes over time. Building on the research on creativity trajectories and motivation described above, we expect the program to enhance employee creativity at first. By stressing that creativity is important for the organization, providing feedback on ideas, and recognizing creative contributions, the program encourages engagement and motivates employees to improve their creative performance, in terms of both the quantity of suggested ideas and their quality (Byron & Khazanchi, 2012; Shin & Grant, in press). Assuming that employees already have a "backlog" of ideas, the new platform makes it easier for them to submit their suggestions. In addition, the appreciation and developmental feedback they receive on their ideas, even if not implemented (Deichmann & van den Ende, 2014; Piezunka & Dahlander, 2019), increase their sense of competence and motivates them to gain deeper involvement in work-related activities that they find intrinsically interesting (Amabile & Pratt, 2016; Zhou, 2003). This deeper task engagement will in turn boost the intrinsic motivation to continuously face problems and strive to acquire the necessary knowledge to solve them. Employees' experience in

generating and submitting ideas—as well as utilizing insights from the feedback provided—is likely to improve the quality of the solutions (Zhou, 2003). Indeed, research suggests that learning from creative activities helps to identify superior heuristics for detecting important problems, gathering information, and generating and evaluating ideas (for a meta-analysis, see Scott et al., 2004), as well as improving the ability to differentiate promising ideas from those that might fail (Berg, 2016) and developing new ideas into accepted solutions (Audia & Goncalo, 2007).

However, research suggests that it is difficult to maintain high levels of creativity over time. Research on cognitive fixation has taken the view that past creative experience is detrimental to future ideation efforts (Bayus, 2013). Both experimental and longitudinal studies have shown that over time individuals may exhaust the available recombinations and struggle to deviate from previously successful problem-solving heuristics to generate novel solutions (Bayus, 2013; Duncker, 1945; Smith, 2003). Also, assuming that the suggested ideas will be implemented, at some point the organization's processes will become more efficient, and there will be fewer problems to solve. What Fleming (2002) referred to as "combinatoric exhaustion" is more likely to happen in environments where the set of knowledge components available for recombination is relatively limited (such as in stable and stereotypically "uncreative" environments), and when employees have limited opportunities to acquire new knowledge beyond their domain of expertise (Teodoridis et al., 2019).

Based on the above reasoning, our first hypothesis states that there will be *a nonmonotonic relationship between time and creative performance: On average, employees' creativity will improve when initially encouraged, but after a time will decline* (Hypothesis 1). Given this nonmonotonic pattern, a key question, then, is what explains individual variations in the ability to improve and sustain creativity over time.

Goal Orientation and the Creativity Trajectory

Given that goal orientation has been found to impact creative behavior and skill acquisition (Dweck, 1999; Hirst et al., 2009, 2011; Janssen & Van Yperen, 2004), we consider the possibility that it may account for individual differences in creativity trajectory. A *learning orientation* implies an incremental approach to goal attainment, whereby skills and abilities are acquired or developed with effort through mastering challenging tasks. Because learning-oriented employees use deep processing strategies to increase the depth and breadth of their knowledge, they have a wider variety of elements that can be combined when generating new solutions (Choi et al., 2018; Hirst et al., 2009; Lee & Yang, 2015; Liu et al., 2015). Taking this a step further, we posit that a strong learning orientation not only makes employees more creative overall but also explains the rate at which they improve their creativity and their ability to sustain it over time.

When approaching an activity with a learning orientation, individuals strive to improve and develop their skills (Dweck & Leggett, 1988). Like other competencies, they will view creativity as a skill that can be improved with effort and seek to maximize their learning by solving complex, challenging problems despite the risk of failure (Barron & Harackiewicz, 2001; VandeWalle et al., 1999). This approach enables them to fail faster, learn from their experience, and master new tasks more quickly (Chen & Mathieu, 2008; Elliot & McGregor, 2001). Given that they use personal standards to evaluate their performance, they will tend to be less anxious and more efficacious when suggesting new ideas and benefit more from feedback on their initiatives (VandeWalle et al., 2001). In support of this premise, research has shown that employees who treated the failure of their ideas as an opportunity to learn became more determined to find a solution that gets around the problem and were more likely to submit another idea (Deichmann & van den Ende, 2014). Consequently, drawing on research showing their ability to quickly develop other competencies (Chen & Mathieu, 2008), we suggest that when encouraged to be creative, learning-oriented employees will improve their creativity at a faster rate than those less oriented toward learning.

However, at some point in time learning-oriented employees will have exhausted their ideas and find that it becomes harder to depart from prior solutions. They may attribute their difficulty to come up with new ideas to a lack of effort on their part and put more energy into expanding their knowledge of uncharted territories and experimenting with new heuristics for generating ideas (Barron & Harackiewicz, 2001). By persisting and investing more effort into developing their creative ideas and capabilities, they are likely to sustain their creative advantage relative to employees who lack such an orientation. We thus posit that a *learning orientation will moderate the nonmonotonic relationship between time and creative performance such that employees with high learning orientation will improve their creativity at a faster rate up to an inflection point from which their creativity will gradually decline at a slower rate relative to those less oriented toward learning* (Hypothesis 2).

In contrast, *performance-oriented employees* find it difficult to develop their creative skills since they regard them largely as a matter of innate ability (Elliot & McGregor, 1999, 2001). Thus, when encouraged to be creative, they will seek to demonstrate their creativity and be mainly concerned with how they are doing relative to others (Barron & Harackiewicz, 2001). Given their focus on external outcomes associated with their performance, they find the recognition and rewards for creative ideas particularly motivating (Hirst et al., 2009) and suggest as many ideas as they can. However, after an initial spike in creativity, their tendency to rely on familiar knowledge domains will limit their ability to identify new problems and solutions (Bayus, 2013; Janssen & Van Yperen, 2004). Given that relative to less performance-driven individuals they see the need to make an additional effort as a signal that they lack the ability to continuously be creative, they are likely to withdraw rather than risk continued failure (Elliot & McGregor, 2001), leading to a steeper decline in their creativity from that point. Thus, we posit that *a performance orientation will moderate the nonmonotonic relationship between time and creative performance such that employees with high performance orientation will improve their creativity at a faster rate up to an inflection point from which their creativity will decline at a faster rate relative to those who are less performance oriented* (Hypothesis 3).

Methods

Sample and Settings

To study individual variations in creativity trajectories, we needed data on employees working in the same setting, within a defined period of time, and with a starting point from which they

were encouraged to suggest new ideas that were systematically evaluated (Thoresen et al., 2004). For this reason, we collected data from a company that manufactures advanced electro-optic technologies that implemented an innovation program in 2007. As in other such programs (Deichmann & van den Ende, 2014; Fuchs et al., 2019), ideas were submitted by the employees via an intranet platform. Each idea was then evaluated by the direct manager, who provided developmental feedback, and by a panel of experts (about ten members) from different units in the organization (Fairbank & Williams, 2001), on a scale of 1–10, reflecting the quality of the creative idea, with a higher score given to ideas considered novel and useful (Amabile, 1982). All employees were recognized for their creativity at an annual event through symbolic rewards (e.g., a certificate or a pen). The most creative employees were invited to meet the senior management and were featured on posters in central buildings (Holzmann & Golan, 2016; Miron-Spektor et al., 2018).

We measured creative performance from the program's outset in 2007 for seven years until 2013, in which the company's leadership changed. We collected data on 1,178 ideas proposed by 125 employees (21 females; age $M = 50$ years, $SD = 11$; tenure: $M = 22$ years, $SD = 13$) in 16 divisions. For each employee, we had data regarding the number of suggested ideas, the year in which each idea was suggested, and the score each idea received from the panel. We measured the employees' goal orientations and demographics with a survey, as described below. Additional information about the program and the organization appears in the supplemental materials. We obtained institutional review board (IRB) approval from the Technion-Israel Institute of Technology (IRB-2017-09), protocol title: "Creativity Momentum at Work."

Measures

We measured *learning and performance orientations* with eight items from VandeWalle et al. (2001), with a 7-point Likert response scale (1 = *strongly disagree*; 7= *strongly agree*; e.g., learning orientation: "I prefer challenging and difficult tasks so that I'll learn a great deal," $\alpha = .88$; and performance orientation: "It is important for me to prove that I am better than my coworkers on a given task," $\alpha = .84$). To measure the employee's *creativity trajectory*, we followed prior studies that divided the total time period into performance blocks, with each year representing one block (e.g., seven blocks for 7 years; Chen & Mathieu, 2008, Mannucci & Yong, 2018). *Idea productivity* was indexed as the number of suggested ideas (i.e., a count measure) in each of the seven performance blocks. *Idea quality* was indexed as the mean creativity score given by the panel across all suggested ideas in a given year for each of the seven performance blocks.

To ensure that goal orientation explained the trajectories above and beyond other variables that might explain trends in creativity, we controlled for gender, tenure, creative self-efficacy, and perceived fairness in evaluating creative ideas. Studies have found that people tend to consistently rate women's creativity lower than men's (e.g., Miron et al., 2004); that tenure increases idea quality as the employee understands the context better (Godart et al., 2014); that one's ability to improve creativity is dependent on one's creative self-efficacy (Tierney & Farmer, 2002, e.g., "I have confidence in my ability to solve problems creatively," $a = .85$), and on the perceived fairness of the way managers evaluate new ideas (Niehoff & Moorman, 1993; Streicher et al., 2012; e.g., "Decisions regarding ideas are made by my managers in an unbiased manner," $a = .90$).

Results

Table 1 includes descriptive statistics for all research variables. Given that idea productivity is a count variable (i.e., nonnegative integer), the use of linear regression would result in biased estimators. Thus, we started with a Poisson estimation and then reran all our analyses with a negative binomial distribution assumption, as recommended (Cameron & Trivedi, 1998). As the creativity quality variable measures individual creativity by computing yearly mean creativity scores, there was no reason to suspect bias in the estimation of this variable. To test our hypotheses, we followed the procedures used by Chen and Mathieu (2008). Using the growth modeling analytic framework delineated by Bliese and Ployhart (2002), data were analyzed using random coefficient modeling with the Proc Mixed program in SAS when the dependent variable was continuous (i.e., quality of creative ideas) and Proc Glimmix in SAS with a Poisson distribution when the dependent variable was a count variable (i.e., idea productivity). As such, the intercepts captured the initial creative performance in 2007 (Bliese & Ployhart, 2002). Given that our tests involved interaction terms, we entered the main (or linear) effects in initial models and the interaction terms in subsequent models (see Aiken & West, 1991). In addition, we used the "two-lines" test to prove the nonmonotonic effects (Simonsohn, 2018).

Table 1
Descriptive Statistics

Variable	Mean	*SD*	1	2	3	4	5	6	7
1. Tenure	22.08	13.28							
2. Gender[a]	.18	.38	.16						
3. Creative self-efficacy	5.41	.89	.14	−.06					
4. Leadership fairness	4.58	1.19	.12	.00	.01				
5. Idea productivity[b]	9.36	11.28	−.17	−.07	.17	−.08			
6. Idea quality[c]	3.17	.93	.08	−.04	.03	−.01	−.29**		
7. Learning goal orientation	5.91	.80	−.01	.10	.44***	.21*	.09	.13	
8. Performance goal orientation	5.01	1.14	.03	.16	.18*	.01	.06	−.01	.04

Note. [a] Dummy variable in which male = 0 and female = 1; [b] Total number of generated ideas between 2007 and 2013; [c] Average quality of generated ideas between 2007 and 2013.
* $p < .05$. ** $p < .01$. *** $p < .001$.

In line with the four-step growth model (Bliese & Ployhart, 2002), we first examined the extent of between- versus within-employee variance ICC (1). As we expected to see variability in creativity over time for each employee, the within-employee variability in creativity was relatively large compared to the variability in average creativity between employees (productivity: ICC (1) = .34; quality ICC (1) = .02). We then examined the creativity trajectory trends, which were fixed across the 125 participants. In support of Hypothesis 1, we found a nonmonotonic relationship between time and creativity. Specifically, the idea productivity trajectory exhibited an inverted-J-shaped relationship with a significant positive linear trend ($\pi = .13$, $p < .05$) and a significant negative quadratic trend ($\pi = -.05$, $p < .0001$), indicating a slight initial improvement, followed by a systematic decrease in the number of suggested ideas over time. The idea quality trajectory exhibited an inverted-U-shaped relationship with significant positive linear trend ($\pi = .94$, $p < .0001$) and a significant negative quadratic trend ($\pi = -.16$, $p < .0001$).

It has recently been posited that when examining nonmonotonic relationships, significant quadratic effects are necessary but not sufficient to prove such relationships (Shin & Grant, in press). The analysis should show that the slopes are significantly positive on the left side of the curve and significantly negative on the right side of the curve, or vice versa, and that the inflection point is within the range of the data. These conditions can be examined with the two-lines test (Simonsohn, 2018). The relationship between time and idea quality revealed a significant and positive relationship in years 0–3, before the inflection point (in year 3; $\gamma = .40$, $p < .001$), and a significant and negative relationship in years 4–7 ($\gamma = -.68$, $p < .001$) after that point, confirming the inverted-U-shaped relationship between time and idea quality. A similar test for the relationship between time and idea productivity revealed that the relationship was not significant in years 0 to 3 ($\gamma = .02$, *n.s.*) but significant and negative in years 4–7 ($\gamma = -.60$, $p < .001$). As we show below, the relationship in years 0–3 was significant only for highly performance-oriented employees. Moreover, for both tests, the inflection points were within the range of the data, thus partially supporting Hypothesis 1.

We next tested whether individuals' intercepts and their linear and quadratic trends varied significantly by comparing (a) the growth model with no variance in the linear or quadratic growth parameters with (b) models that allow variance in these parameters (i.e., likelihood ratio [LR]; Bliese & Ployhart, 2002). LR tests comparing a model where only the linear slope was allowed to vary with a model in which both linear and quadratic terms were allowed to vary were significant for creativity productivity ($LR = 26.4$, $p < .001$) and quality ($LR = 20.2$, $p < .001$). These results support our premise that creativity trajectories are nonmonotonic and vary among individuals. We then examined the effects of the variables on the creativity intercept. As shown in Table 2, for each dependent variable, we tested a model in which the main (or linear) cross-level effects of Level 2 predictors (i.e., individual differences in goal orientations) were entered as predictors of the Level 1 random creativity intercepts. This strategy essentially parallels what is done in traditional regression analyses but using time-sensitive criteria. In this model, the within-person (Level 1) linear (time) and quadratic ($time^2$) creativity trends were fixed across individuals. Neither learning orientation nor performance orientation was related to any of the initial creativity measures.

To test Hypotheses 2 and 3, we analyzed models in which the linear and quadratic within-person creativity trajectories are allowed to vary freely across individuals. Participants' creativity trajectories were operationalized as individual differences in the creativity–linear time trend slope (i.e., individual differences in the π_{1j} term) and in the quadratic time trend (individual differences in the π_{2j} term). Hence, the effects shown in the model at the bottom of Table 2 represent two-way cross-level interactions between the Level 2 predictors and the Level 1 linear and quadratic time factors. Our analysis indicated that a learning orientation was not related to the productivity trajectory. However, in support of Hypothesis 2, learning orientation moderated the inverted-U-shaped relationship between time and idea quality ($\gamma = -.05$, $p < .05$). Over time, participants with a strong learning orientation improved the quality of their ideas at a faster rate, and idea quality remained relatively high in the long term (see Figure 1). When probing the nature of this interaction using the two-lines test, we found that the shape of the trajectory varied at different levels of learning orientation. At low levels of learning orientation, the relationship between time and idea quality was not significant both before ($\gamma = .43$, *n.s.*) and after ($\gamma = -.37$, *n.s.*) the inflection point, suggesting employees low on learning orientation did not significantly improve the quality of their ideas over time. In contrast, at moderate levels of learning orientation, the relationship between time and idea quality was significant and positive before the inflection point ($\gamma = .90$, $p < .0001$) and significant and negative after the inflection point ($\gamma = -.24$, $p < .01$), suggesting that these employees initially improved the quality of their ideas, but their creativity declined after three years. Lastly, at high levels of learning orientation, the relationship was significant and positive ($\gamma = .88$, $p < .01$) before the inflection point, yet it was not significant after that point ($\gamma = -.49$, *n.s.*). Thus, employees with a strong learning orientation quickly improved their creativity and were able to maintain it over time relative to those with lower levels of learning orientation.

Our analysis then indicated that performance orientation shaped the idea productivity trajectory (Figure 2), but not the idea quality trajectory. More specifically, performance orientation moderated the inverse quadratic influence of time on creative productivity ($\gamma = -.03$, $p < .01$). When probing the nature of this interaction using the two-lines test, we found that at low levels of performance orientation the relationship between time and idea productivity was not significant both before ($\gamma = .06$, *n.s.*) and after ($\gamma = -.13$, *n.s.*) the inflection point, suggesting that employees low on performance orientation did not change the number of their suggested ideas over time. In contrast, at moderate levels of performance orientation, the relationship between time and idea quality was not significant before the inflection point ($\gamma = .08$, *n.s.*) but was significant and negative after the inflection point ($\gamma = -1.01$, $p < .01$). Lastly, at high performance orientation levels the relationship was significant and positive before the inflection point ($\gamma = .46$, $p < .05$) yet significant and negative after that point ($\gamma = -1.54$, $p < .01$). Thus, in support of Hypothesis 3, performance orientation moderated the inverted-J-shaped relationship between time and creative performance. Performance-orientated employees improved their idea productivity in the first three years, but after the inflection point, their productivity declined at a faster rate than those with lower levels of such orientation.

Demonstrating the robustness of our findings, in Table 2, our results remain consistent when controlling for gender, tenure, creative self-efficacy, and fairness in evaluating creative ideas. We also tested (a) whether these variables moderated the effect of the goal orientation

Table 2
Predicting Creativity Trajectories

Model[a]	Idea productivity Estimate (*SE*)	Idea quality Estimate (*SE*)
$Creativity_{ij} = \pi_{0j} + \pi_{1j}\,(time_{ij}) + \pi_{2j}\,(time^2_{ij}) + r_{ij}$		
$\pi_{0j+} = \beta_{000} + \beta_{001}$ (LO) + β_{002} (PO)		
$\pi_{1j} = \beta_{100}$		
$\pi_{2j} = \beta_{200}$		
Intercept	−1.38 (1.29)	1.70 (.67)*
Year	.19 (.14)	.97 (.14)***
$Year^2$	−.07 (.02)**	−.16 (.02)***
Learning orientation	.11 (.18)	.14 (.10)
Performance orientation	.07 (.12)	−.06 (.07)
$Creativity_{ij} = \pi_{0j} + \pi_{1j}\,(time_{ij}) + \pi_{2j}\,(time^2_{ij}) + r_{ij}$		
$\pi_{0j} = \beta_{000} + \beta_{001}$ (LO) + β_{002} (PO)		
$\pi_{1j} = \beta_{100} + \beta_{101}$ (LO) + β_{102} (PO)		
$\pi_{2j=} \beta_{200} + \beta_{201}$ (LO) + β_{202}(PO)		
Intercept	−.38 (1.14)	3.26* (1.46)
Year	−1.13 (.53)*	−.04 (1.15)
$Year^2$	.22 (.09)*	.03 (.17)
Learning orientation	.07 (.17)	−.29 (.22)
Performance orientation	−.02 (.12)	.13 (.015)
Year* Learning orientation	.09 (.08)	.39 (.17)*
Year* Performance orientation	.15 (.06)**	−.18 (.12)
$Year^{2}$* Learning orientation	−.02 (.01)	−.05 (.03)*
$Year^{2}$* Performance orientation	−.03 (.01)**	.03 (.02)
Intercept	−.38 (1.24)	3.04 (1.49)*
Year	−1.13 (.53)*	−.41 (1.15)
$Year^2$	.22 (.09)*	.03 (.17)
Gender	−.22 (.34)	−.23 (.23)
Tenure	−.01 (.01)	.01 (.006)*
Creative efficacy	.23 (.16)	−.04 (.11)
Leadership fairness	−.09 (.11)	.01 (.06)
Performance orientation	−.04 (.12)	.14 (.15)
Learning orientation	−.001 (.19)	−.27 (.23)
Year* performance orientation	.15 (.06)**	−.18 (.12)
Year* learning orientation	.09 (.08)	.39 (.17)*
$Year^{2}$* performance orientation	−.03 (.01)**	.03 (.02)
$Year^{2}$* learning orientation	−.02 (.01)	−.05 (.03)*

Note. [a]LO = Learning Orientation; PO = Performance Orientation.
* $p < .05$. ** $p < .01$.

on creativity over time; (b) whether creative self-efficiency mediated these relationships; and (c) the possibility that the effect of learning and performance orientations on creativity trajectories is interactive. The results of these analyses were not significant, whereas the results described above remained significant. We obtained similar results when running the analyses with a negative binomial distribution. For additional analyses, see the supplemental materials.

Discussion

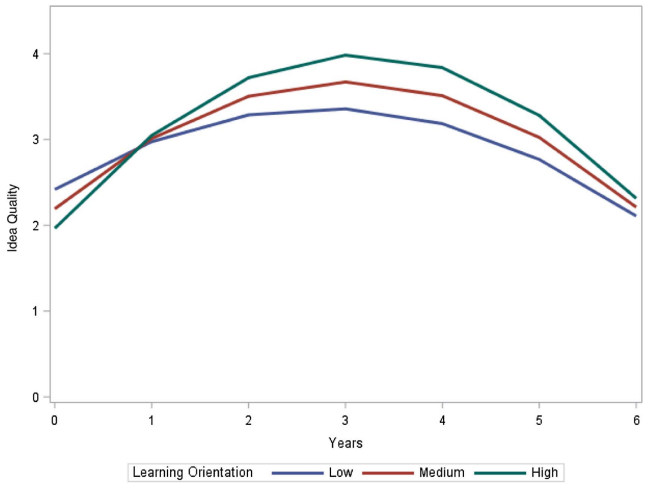
In seeking to advance our understanding of creativity trajectories at work, our research is the first to demonstrate that goal orientation explains variations in the way individual creativity unfolds over time. Our data on manufacturing employees participating in an innovation program reveal that the trajectory of idea quality had an inverted-U shape, and the idea productivity trajectory had an inverted-J shape. These patterns prove that both the quantity and the quality of generated ideas can be improved when encouraged and that the extent to which such improvement is achieved and sustained depends on the individual's goal orientation. A learning orientation drove a rapid improvement in the quality of generated ideas and maintained such quality over the years. In contrast, a performance orientation increased the number of suggested ideas, but the improvement was temporary and was followed by a rapid decline in idea productivity. These results have significant implications for research on creativity and goal orientations.

Our findings stress the importance of studying individual creativity over time. Given that individuals differ in their ability to improve and sustain their creativity, relying on cross-sectional studies to predict long-term creative performance might result in inaccurate conclusions, depending on the measurement time (Thoresen et al., 2004). Using our findings as an example, if managers promote employees based on how productive they are in generating ideas in the first few years after the program has been launched, they will favor performance-oriented employees, who are less likely to keep their creative momentum in the long term.

Our research also offers a potential way to reconcile the mixed findings in the goal orientation and creativity literature (Porter et al., 2010). Some studies suggest that because performance-oriented employees are attuned to external expectations, in places where creativity is encouraged, they are extrinsically motivated to prove their creative capabilities to others (Hirst et al., 2009). Yet

Figure 1

The Effect of Learning Orientation on Idea Quality Trajectories



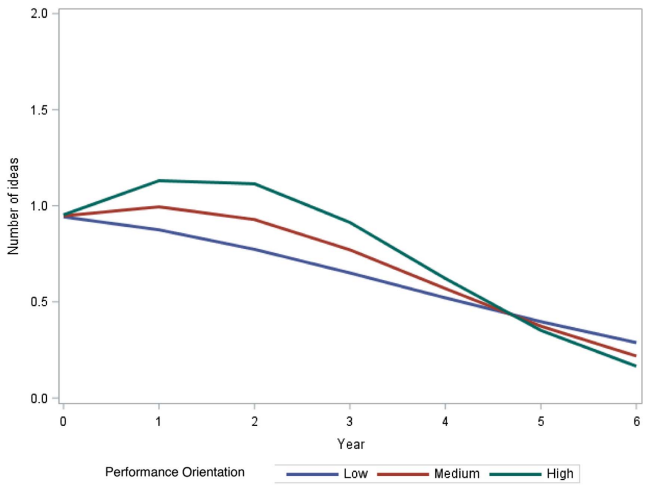
Note. See the online article for the color version of this figure.

others documented negative effects of a performance orientation on employee creativity, suggesting that the surface processing triggered by such orientation limits the ability to identify new solutions (e.g., Janssen & Van Yperen, 2004). By incorporating temporal effects and distinguishing the quality of generated ideas from their quantity, we show that when encouraged to be creative, at least in the short term, performance-oriented employees try to prove their creativity by suggesting a larger number of (but not better) ideas, yet they quickly lose this advantage in the longer term when more effort is required to surface new problems that go beyond well-known task boundaries and overcome obstructions.

Furthermore, by integrating research on goal orientation and creativity trajectories, we also shed light on the different processes leading to the generation of more (as opposed to better) ideas over time (Montag et al., 2012). An early assumption in creativity research was that the best way to generate high-quality ideas (that are novel and useful) is to generate as many as possible (Campbell, 1960). Yet recent studies have challenged this assumption, arguing that what matters to idea quality is the extent to which individuals draw from existing knowledge and the prior creative experiences they have had (e.g., failure/success, Audia & Goncalo, 2007; Bayus, 2013) rather than the accumulated number of ideas generated. We take this one step further by suggesting that individuals' ability to utilize their knowledge and leverage their creative experiences over time depends on whether they take a learning approach to creative tasks. Improving the quality of the generated ideas requires deep processing and the learning from prior failures and successes to identify superior strategies (Argyris, 1976), which is aided by a learning orientation.

Figure 2

The Effect of Performance Orientation on Idea Productivity Trajectories



Note. See the online article for the color version of this figure.

As always, our research has some strengths and limitations. Despite the clear advantages of our research setting, we cannot firmly establish causal relationships in our model or eliminate the possibility that creativity trajectories may have been influenced by experience accumulated prior to our study. Even so, the nature of our research design and supplementary analyses helps to rule out alternative explanations. Moreover, we measured only learning- and performance-approach goal orientations. Future studies that measure other orientations (e.g., avoid orientations, amity orientation, Levontin & Bardi, 2018) may add additional dimensions to our findings. Further, when assessing idea quality, we used the aggregated ratings of the panel, a method considered more accurate than count measures of "highly impactful ideas" (Mannucci & Yong, 2018). However, this method did not allow us to distinguish between the novelty and usefulness aspects of creativity, which have been shown to be differently related to learning and performance orientations (Miron-Spektor & Beenen, 2015). Additional research is needed to unpack these effects over time, as well as the effect of goal orientations on different types of creativity (Steele et al., 2019). Even though certain elements in our model are consistent with prior work on eminent creators (e.g., Simonton, 1997), future studies should examine the creativity trajectories of employees working in other environments. Our findings are particularly valuable because they show that even veteran manufacturing employees can improve their creativity with the right approach, when encouraged to do so.

Conclusions and Practical Implications

While organizations worldwide strive to promote creativity within the workforce, efforts to do so may be hard to sustain over time. To ensure a constant stream of high-quality ideas, managers need to help employees recognize that creativity is an acquired skill and provide opportunities for learning from creative experiences. Such opportunities include working in different environments and with new methods (Godart et al., 2015), collaborating with others (Audia & Goncalo, 2007; Gino et al., 2010), and providing developmental feedback and recognition for suggested ideas (Zhou, 2003). By suggesting that learning and performance orientations explain not just whether individuals engage in creativity but also the extent to which they leverage their creative experiences to improve the quality and quantity of their suggested ideas, we hope to fuel further investigation into why and how individuals' creativity develops and is sustained over time.

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