

The Curvilinear Relation Between Experienced Creative Time Pressure and Creativity: Moderating Effects of Openness to Experience and Support for Creativity

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This study examined the possibility of a curvilinear relation between the creative time pressure employees experience at work and their creativity. The authors also examined whether this curvilinear relation was moderated by employees' scores on the openness to experience personality dimension and by the support for creativity employees received from supervisors and coworkers. Data were obtained from 170 employees and 10 supervisors of a manufacturing organization. Results showed an inverted U-shaped creative time pressure-creativity relation for employees who scored high on openness to experience while simultaneously receiving support for creativity. The authors discussed the implications of these results for future research and practice.

Keywords: creativity, time pressure, openness to experience, support

Substantial evidence now suggests that employee creativity makes an important contribution to organizational innovation, competitiveness, and survival (Nonaka, 1991). As a consequence, there has been increasing interest in identifying the contextual conditions that influence such creativity (see Shalley, Zhou, & Oldham, 2004). One condition that is frequently mentioned in this literature is the time pressure employees experience at work (see Amabile, 1996). Specifically, commentators suggest that the experience of high time pressure stifles creativity by reducing the extent to which employees engage in exploratory thinking and by causing them to rely on familiar algorithms when approaching problems (see Andrews & Smith, 1996).

Unfortunately, the few studies that have tested this idea have produced results that are generally weak and inconclusive (e.g., Amabile, Conti, Coon, Lazenby, & Herron, 1996; Madjar & Oldham, 2006). For example, Andrews and Smith (1996) showed that product managers who experienced high time pressure developed marketing programs low in creativity. However, Andrews and Farris (1972) found positive relations between scientists' perceived time pressure to complete their work and the "innovativeness" of that work. But Amabile and Gryskiewicz (1989) found a nonsignificant relation between experienced time pressure and the creativity of employees from five different groups (e.g., government lab, educational institution).

One factor that may have contributed to the pattern of results obtained in these earlier studies involves the way time pressure was measured. Most previous research assessed the *overall* amount

of time pressure employees experienced at work, which may or may not have captured the extent to which they experienced pressure with respect to creativity. Specifically, while a measure of overall time pressure may reflect employees' perceptions regarding pressure for creative pursuits in cases where creativity is an essential component of employees' jobs, this may not be the case in situations where creativity is less central to employees' daily routines. In such circumstances, overall and creative pressures may capture different aspects of experienced time pressure at work—employees may not necessarily feel high levels of overall time pressure in their jobs, but may still feel that they have little time available to pursue creative activities. This ambiguity with respect to the specific aspect of pressure being measured may have contributed to the pattern of inconsistent results obtained in previous studies examining the time pressure-creativity relation.

Our study addresses this issue by examining the relation between employee creativity and a specific form of time pressure that should be particularly relevant to creativity: *experienced creative time pressure* (i.e., the extent to which employees feel they have insufficient time to develop creative ideas at work). In addition, we examine the possibility that the relation between creative time pressure and creativity is curvilinear in nature—not linear as suggested by previous research. Activation theory (Gardner & Cummings, 1988) and earlier research on constructs related to time pressure (e.g., job tension and job demands; Janssen, 2001; Zivnuska, Kiewitz, Hochwater, Perrewe, & Zellars, 2002) suggest that the shape of an inverted U might best characterize the time pressure-creativity relation. Finally, based on an interactionist perspective (Woodman & Schoenfeldt, 1989, 1990), we also examine the possibility that dimensions of employee personality and the social environment (i.e., openness to experience and support for creativity) moderate the curvilinear creative time pressure-creativity relation.

We propose that individuals who experience intermediate creative time pressure should be fully engaged in their activities at work (Freedman & Edwards, 1988), leading to greater exploration of ideas and experimentation with novel approaches to solving

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problems, ultimately resulting in high creativity (Zhou & Shalley, 2003). However, the degree to which individuals actually respond with high creativity to elevated engagement and intermediate pressure may depend upon two conditions. The first is the extent to which employees are able to draw upon a variety of perspectives and approaches. The larger the pool of perspectives available to individuals, the greater the likelihood that heightened exploration and experimentation will result in the generation of creative ideas. Previous research suggests that employees high on the openness to experience personality dimension have access to a variety of different approaches and perspectives (McCrae & Costa, 1997) and, therefore, should be more likely to exhibit high creativity in response to intermediate pressure. The second condition is the extent to which creativity is encouraged and valued by the organization. When employees receive assistance and encouragement for their creative efforts and perceive creativity to be valued by the organization, they should be more likely to persist in their idea generation efforts, resulting in further exploration and refinement of creative ideas. Earlier research suggests that support for creativity by supervisors and coworkers not only provides such assistance and encouragement but also signals that the organization values creativity (Scott & Bruce, 1994; Tierney & Farmer, 2004). Hence, we expect employees who experience intermediate creative time pressure to exhibit high creativity when support for creativity is high.

Experienced Creative Time Pressure and Creativity

Creativity refers to the production of ideas about products, practices, processes, or procedures that are (a) novel and (b) potentially useful to the organization (Amabile, 1996). Based on activation theory (Gardner & Cummings, 1988; Scott, 1966), the present study examines the possibility that both high and low levels of experienced creative time pressure restrict creativity, whereas intermediate pressure enhances it resulting in a curvilinear, inverted U-shaped function. Activation theory posits a linear relation between time pressure and experienced activation—that is, the greater the creative time pressure employees perceive, the higher their experienced activation (Gardner, 1990). When creative time pressure and activation are at intermediate levels, individuals are assumed to be “optimally stimulated” since such levels match their “characteristic” levels of activation (Gardner & Cummings, 1988). Further, when employees are optimally stimulated, they should be fully engaged in their activities at work (Freedman & Edwards, 1988). By contrast, low or high levels of creative time pressure and activation are assumed to deviate from employees’ characteristic levels, resulting in suboptimal stimulation and lower engagement (Singh, 1998; Zivnuska et al., 2002).

Employees’ engagement in their activities at work has important implications for their creativity. Previous research indicates that individuals who are engaged in what they do are not only more curious but also more willing to take risks, such as engaging in exploratory behaviors and experimentation—all of which should facilitate creativity (see Zhou & Shalley, 2003). Conversely, employees who are less engaged in their activities at work as a result of creative time pressure that is either too high or too low are expected to exhibit relatively low creativity.

Although previous research has not directly examined the possibility of a curvilinear creative time pressure-creativity relation, a number of studies have confirmed the existence of inverted

U-shaped relations between measures of overall time pressure (or related constructs) and a range of employee responses (e.g., Baschera & Grandjean, 1979; Janssen, 2001; Pepinsky, Pepinsky, & Pavlik, 1960). Zivnuska et al., (2002) found an inverted U-shaped relation between the job tension employees experienced and their job satisfaction. In a laboratory study involving anagram tasks, Freedman and Edwards (1988) showed that the highest performance occurred at intermediate levels of time pressure and that similar inverted U-shaped relations emerged for outcomes such as enjoyment and satisfaction. Thus,

Hypothesis 1. There will be an inverted U-shaped relation between experienced creative time pressure and creativity.

Openness to Experience Moderating the Curvilinear Creative Time Pressure-Creativity Relation

Based on early theory and research (e.g., Amabile, 1996; Woodman & Schoenfeldt, 1989, 1990), we investigate the possibility that the proposed curvilinear creative time pressure-creativity relation is moderated by the openness to experience personality dimension. Openness to experience is associated with the Five Factor Model (Costa & McCrae, 1992) and captures the extent to which individuals are broad-minded, curious, imaginative, and original (McCrae, 1987). According to McCrae and Costa (1997), open individuals are highly motivated to actively seek out new and varied experiences. Rather than being passive recipients of new experiences, open individuals are in a constant quest of unfamiliar situations characterized by a high degree of novelty, as a result of which, they have access to a variety of ideas and perspectives.

Although openness has been found to be positively related to creativity across several domains (Feist, 1998), recent studies of organizational settings show rather weak relations and suggest that the effects of openness on creativity might vary by contextual condition (Andrews & Smith, 1996; Burke & Witt, 2002). For example, George and Zhou (2001) found a nonsignificant relation between openness and employee creativity, but demonstrated that it interacted with feedback valence and the nature of tasks to affect creativity. Findings from other studies provide additional support for such a moderating role of openness (see Shalley et al., 2004).

The current study extends this earlier work by examining whether openness moderates the curvilinear relation between creative time pressure and creativity. Based on activation theory, we argued that individuals who experience intermediate time pressure should be fully engaged in their work activities and, as a consequence, more likely to explore different ideas and experiment with novel approaches to solving problems. However, if this heightened exploration and experimentation is to result in elevated creativity, individuals need to be able to draw upon a wide array of perspectives and approaches. Access to a number of different perspectives provides individuals with the kind of raw material that is necessary to convert heightened exploration and experimentation into truly novel ideas. Due to their active motivation to seek out the unfamiliar and new, open individuals have access to a variety of experiences and perspectives (McCrae & Costa, 1997) and, therefore, should respond with elevated creativity to intermediate time pressure. By contrast, employees low on openness should be less likely to benefit from the heightened exploration and experimentation associated with intermediate creative time pressure.

No previous study has directly examined these arguments. However, earlier research does suggest that personal characteristics moderate curvilinear relations between job conditions related to overall time pressure and several employee responses (e.g., Champoux, 1980; Xie & Johns, 1995). Champoux (1992) showed that the curvilinear relation between job scope and job satisfaction was moderated by employees' growth need strength. Thus,

Hypothesis 2. Openness to experience will moderate the inverted U-shaped relation between experienced creative time pressure and creativity such that employees who score high on openness will exhibit higher creativity in response to intermediate pressure than those who score low on openness.

Support for Creativity Moderating the Curvilinear Creative Time Pressure-Creativity Relation

Based on earlier theory and research (Champoux, 1992; Woodman & Schoenfeldt, 1990), we also examine whether one dimension of the social environment, support for creativity, moderates the proposed curvilinear creative time pressure-creativity relation. Support for creativity refers to the extent to which supervisors and coworkers encourage employees to develop and refine creative ideas (Madjar, Oldham, & Pratt, 2002). Previous work suggests that such support not only provides employees with the encouragement and assistance necessary to engage the idea generation process, but also conveys expectations that creativity is expected and valued by the organization (Ford, 1996; Scott & Bruce, 1994). For example, Tierney and Farmer (2004) showed that employees who perceived their supervisors as supportive of their creative efforts came to believe that creativity was an expected and valued aspect of their performance.

Although most previous studies concerned with support for creativity have shown that it has positive relations to employee creativity, a few studies have failed to produce evidence supporting such a link (Shalley et al., 2004). For example, Zhou (2003) found a nonsignificant relation between employee creativity and supervisor developmental feedback, but demonstrated that feedback interacted with the presence of creative coworkers to affect creativity. This latter study, along with several others (see Shalley et al., 2004), suggests that support from supervisors and coworkers may serve to moderate the effects of contextual conditions on creativity.

Extending this line of research, the present study examines the moderating role of support for creativity on the proposed curvilinear creative time pressure-creativity relation. We argued earlier that employees who experience intermediate time pressure should be engaged in their activities at work and, as a result, explore and experiment with novel ideas and approaches to solving problems. The degree to which such exploration translates into elevated creativity, however, may depend upon the extent to which employees persist in their idea generation efforts. Exploring and experimenting with new and alternative routes to solving problems generally requires employees to refine and expand on their initial ideas or solutions to ensure that they adequately address a given problem and are suitable for later implementation. Support for creativity not only provides employees with the necessary encouragement and tangible assistance (e.g., opportunities to discuss ideas in order to refine them), but also conveys the expectation that the organization values creativity—all of which should facilitate

the extent to which employees persist in their creative endeavors (Zhou & George, 2001). Hence, we expect employees who receive substantial support for creativity to respond with relatively high creativity to intermediate creative time pressure. Conversely, without a supportive social environment, the ideas employees produce in response to moderate pressure may not be developed to their fullest potential because employees may not persist in their exploratory efforts, ultimately resulting in lower creativity.

Although no previous study has directly examined these ideas, earlier research does suggest that environmental characteristics moderate curvilinear relations between job conditions related to time pressure and several employee responses (e.g., Champoux, 1981, 1992). Janssen (2001) found that effort-reward fairness moderated curvilinear relations between perceived job demands and both standard and innovative performance. Thus,

Hypothesis 3. Support for creativity will moderate the inverted U-shaped relation between experienced creative time pressure and creativity such that employees who receive high levels of support will exhibit higher creativity in response to intermediate pressure than those who receive low levels of support.

Method

Research Setting and Participants

The research was conducted in two departments of an organization that produced cereals. A manager gave us permission to conduct a study concerning the effects of personal and contextual conditions on employee creativity and indicated that all employees in the organization had the opportunity to exhibit creativity in the workplace. Employees were allowed to participate as long as participation was voluntary. We contacted the employees of both departments ($N = 211$); 170 agreed to participate (81% response rate). Participants held 1 of 20 different jobs (e.g., process and packaging operator and business unit advisor). The average age was 42 years, the modal education level was "high school degree," and 20% were women.

Procedure

Employees completed questionnaires in groups of 5–15 in a room with the first author present. The questionnaires included items assessing education, experienced creative time pressure, openness to experience, and support for creativity. Before completing questionnaires, employees were assigned code numbers and were assured that all information provided would be kept confidential. Information about employees' age, sex, and job was collected from archival records. Primary supervisors ($N = 10$) in a position to observe the creativity of their employees completed a questionnaire assessing the creativity of each employee supervised. Additionally, the organization's manager indicated that seven of the supervisors were in a position to observe and judge the creativity of certain participating employees they did not directly supervise. These supervisors provided a second creativity rating for 35 participants.

Measures

Experienced Creative Time Pressure. This was measured using five items derived from the Innovation Climate Questionnaire (Innovation Centre Europe, 2000) and from those suggested by Basadur, Taggar, and Pringle (1999). Sample items include: Thinking of new ideas takes time I don't have; I don't have much time for thinking up wild ideas—I am too busy just getting my job done. Items were rated on a scale that ranged from

“strongly disagree” (1) to “strongly agree” (7) and were averaged to form an index.

Openness to Experience. This was measured with eight items derived from the “openness to experience” scale from the International Personality Item Pool, a broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models (Goldberg, 1999). Items were rated on a scale that ranged from “very inaccurate” (1) to “very accurate” (7) and were averaged to form an index. Sample items include: I get excited by new ideas; I am not interested in abstract ideas (reverse scored).

Support for Creativity. Ten items derived from those developed by Madjar et al. (2002) were averaged to create a measure of supervisor or coworker support for creativity. Items were rated on a scale that ranged from “strongly disagree” (1) to “strongly agree” (7). Sample items include: My [supervisors] support experimentation with new methods and ways of doing things; My coworkers discuss my work-related ideas with me in order to improve them.

Creativity. Supervisors assessed each employee’s creativity using four items derived from those developed by Zhou and George (2001): Suggests many creative ideas that might improve working conditions at [organization]; Often comes up with creative solutions to problems at work; Suggests new ways of performing work tasks; Is a good source of creative ideas. Items were rated on a scale that ranged from “strongly disagree” (1) to “strongly agree” (7) and were averaged to form an index for each employee.

Using the same four items, each of the seven *secondary supervisors* evaluated the creativity of one or more participants from a set of 35. We used these ratings to establish interrater reliability, which has seldom been examined in studies of creativity in organizations (see Shalley et al., 2004). We first averaged the secondary supervisor’s responses to the items ($\alpha = .98$) and then calculated the intraclass correlation coefficient, which is equivalent to Cronbach’s alpha (Shrout & Fleiss, 1979). The coefficient was .71, indicating that supervisors were generally consistent in their ratings. For the 35 employees for whom we had multiple ratings, we averaged the two ratings and used this index in all analyses. For the remaining 135 employees, we used the primary supervisor creativity rating.

Control Variables. To reduce the likelihood that other variables likely to affect creativity would confound the relations examined in this research, our analyses controlled for employee education and job complexity. Previous research suggests that education has positive effects on creativity (Farmer, Tierney, & Kung-McIntyre, 2003; Mumford & Gustafson, 1988; Zhou, 2003). Therefore, we measured education on a scale that ranged from “grade school” (0) to “master’s or higher degree” (8). Also, since complex jobs might provide more opportunities to exhibit creativity than simple jobs (Tierney & Farmer, 2002), two managers rated each of the 20 jobs on two items suggested by Oldham, Cummings, Mischel, Schmidtke, and Zhou (1995): Overall, how complex is this job?; Overall, how much training is required for a person to successfully complete this job? Scale anchors were “not at all complex” (1) and “very complex” (7) for the first item and “very little training required” (1) and “a great deal of training

required” (7) for the second. Cronbach’s alphas for the managers were .98 and .97. The intraclass correlation coefficient was .95, and the ratings were averaged to form a job complexity index.

Results

As shown in Table 1, experienced creative time pressure was negatively related to openness to experience ($r = -.27, p < .01$) and support for creativity ($r = -.24, p < .01$). Openness correlated positively with support ($r = .31, p < .01$). Finally, creativity was related positively to job complexity ($r = .17, p < .05$) and negatively to time pressure ($r = -.24, p < .01$).

Table 2 presents the results of the moderated hierarchical regression analysis used to test our hypotheses. After centering our independent variables (Aiken & West, 1991), we introduced into a regression equation the control variables (step 1), the main effect variables (step 2), and to control for potential linear trends, the linear two-way and three-way interactions (step 3). Next, to test our prediction that experienced creative time pressure would have a curvilinear relation to creativity (Hypothesis 1), we introduced the quadratic experienced creative time pressure term in step 4 of the regression equation. As shown in Table 2, the coefficient associated with this term was statistically nonsignificant ($\beta = -.04, p > .05$), and Hypothesis 1 is rejected.

We hypothesized that openness to experience would moderate the inverted U-shaped experienced creative time pressure-creativity relation (Hypothesis 2). To test this hypothesis we introduced the relevant quadratic-by-linear interaction (experienced creative time pressure² \times openness to experience) in step 5 of the regression equation. The coefficient associated with this interaction term was statistically nonsignificant ($\beta = -.07, p > .05$), and Hypothesis 2 is rejected.

Finally, we predicted that support for creativity would moderate the inverted U-shaped relation between experienced creative time pressure and creativity (Hypothesis 3). To test this hypothesis we introduced the relevant interaction term (experienced creative time pressure² \times support for creativity) in step 6 of the equation shown in Table 2. Consistent with Hypothesis 3, the coefficient associated with this term was statistically significant ($\beta = -.28, p < .05$).

An inspection of the interaction plot (see Figure 1) revealed that the relation between creative time pressure and creativity followed an inverted U-shaped function for employees receiving high support for creativity. In addition, under conditions of intermediate time pressure, employees reporting high support exhibited higher creativity than those receiving less support.

Table 1
Means, Standard Deviations, and Correlations Among All Variables

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. Education	3.73	0.98	—					
2. Job complexity	4.60	1.72	.15	—				
3. Experienced creative time pressure	3.58	1.16	-.04	-.05	(.76)			
4. Openness to experience	5.18	0.90	.34**	.05	-.27**	(.72)		
5. Support for creativity	4.14	1.07	.03	.01	-.24**	.31**	(.86)	
6. Creativity	4.23	1.40	-.05	.17*	-.24**	.00	.02	(.98)

Note. *N* ranges between 161 and 170 due to missing data. Values in parentheses along the diagonal are reliability estimates (Cronbach’s alpha).

* $p < .05$. ** $p < .01$ (two-tailed).

Table 2
Results of Hierarchical Regression Analyses

Variable	β	ΔR^2	ΔF
Step 1		0.04	3.26*
Education	-0.08		
Job complexity	0.19*		
Step 2		0.05	3.01*
Experienced creative time pressure	-0.24**		
Openness to experience	-0.05		
Support for creativity	-0.03		
Step 3		0.01	0.28
Experienced creative time pressure \times Openness to experience	0.04		
Experienced creative time pressure \times Support for creativity	-0.07		
Openness to experience \times Support for creativity	0.02		
Experienced creative time pressure \times Openness to experience \times Support for creativity	0.08		
Step 4		0.00	0.16
Experienced creative time pressure ²	-0.04		
Step 5		0.00	0.22
Experienced creative time pressure ² \times Openness to experience	-0.07		
Step 6		0.03	4.33*
Experienced creative time pressure ² \times Support for creativity	-0.28*		
Step 7		0.03	5.86*
Experienced creative time pressure ² \times Openness to experience \times Support for creativity	-0.56*		

Note. $N = 161$ after listwise deletion. Standardized regression coefficients are reported for the step indicated. R^2 and F for the full model are 0.16 and 2.16*, respectively.

* $p < .05$. ** $p < .01$ (two-tailed).

We further analyzed this interaction by evaluating simple slopes. As suggested by Aiken and West (1991), we estimated simple slopes at three levels of experienced creative time pressure: low (one standard deviation below the maximum of the regression curve), intermediate (maximum of the regression curve), and high (one standard deviation above the maximum of the curve). Results indicated that when support for creativity was high, the simple slope of the regression curve had a positive, nonsignificant value for low creative time pressure ($b = .90, t = 1.28, p > .05$), did not differ significantly from zero at intermediate pressure ($b = -.14, t = -.41, p > .05$), and had a significant negative value for high pressure ($b = -1.18, t = -2.59, p < .05$). When support was low, the simple slopes of the regression line did not differ significantly from zero ($ps > .05$) at low, intermediate, or high levels of experienced creative time pressure. In total, these results provide support for Hypothesis 3.

Post hoc Analyses

Although our results failed to provide support for the moderating role of openness to experience on the curvilinear creative time pressure-creativity relation, previous research and theory (e.g., Champoux, 1992; Woodman & Schoenfeldt, 1989, 1990) suggest that dimensions of personality and the social environment might combine to moderate the effects of contextual factors such as time pressure. Therefore, we explored the possibility that openness to experience and support for creativity jointly moderate the curvilinear time pressure-creativity relation.

We tested this idea by introducing the relevant three-way quadratic interaction term (experienced creative time pressure² \times openness to experience \times support for creativity) in step 7 of the regression equation shown in Table 2. The coefficient associated with this term was statistically significant ($\beta = -.56, p < .05$).¹

Figure 2 shows that the relation between creative time pressure and creativity followed an inverted U-shaped function for employees who received substantial support for creativity and who were open to experience. The Figure also shows that under conditions of intermediate time pressure, employees scoring high on both support and openness exhibited higher creativity than those who received less support, were less open, or both. For these latter combinations, the time pressure-creativity relation did not follow the shape of an inverted U but was slightly negative.

Additional analyses revealed that in the case of high support for creativity and high openness to experience, the simple slope of the regression curve had a significant positive value for low experienced creative time pressure ($b = 1.90, t = 2.24, p < .05$), did not differ significantly from zero at intermediate pressure ($b = .24, t = .69, p > .05$), and showed a significant negative value for high pressure ($b = -1.44, t = -2.70, p < .01$). In all remaining cases, the simple slopes of the regression lines generally did not differ significantly from zero ($ps > .05$) at low, intermediate, or high levels of pressure.²

¹ We repeated all substantive analyses using the primary supervisor ratings only (rather than averaging the scores provided by both primary and secondary supervisors for the 35 employees). Results obtained in these analyses were virtually identical to those reported in Table 2.

² Additional tests of differences between predicted values on creativity (Aiken & West, 1991) revealed no significant differences between employees in the high openness/low support, low openness/high support, and low openness/low support conditions, indicating that individuals in these conditions exhibited similar levels of creativity in response to increasing levels of experienced creative time pressure.

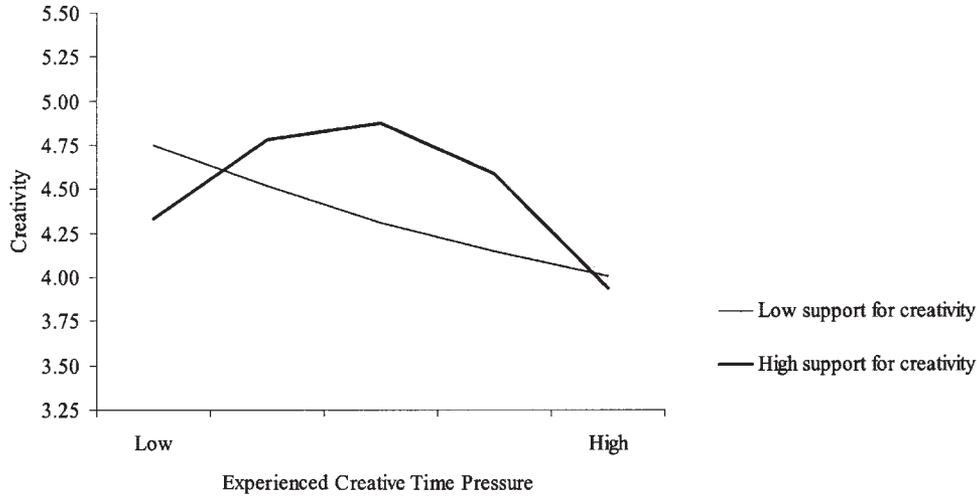


Figure 1. Curvilinear interaction of experienced creative time pressure and support for creativity on creativity.

Discussion

This study examined the possibility of an inverted U-shaped relation between experienced creative time pressure and creativity, and whether openness to experience and support for creativity moderated this relation. Although our results failed to show a simple curvilinear relation, or an independent moderating effect of openness, we did find that support for creativity moderated the inverted U-shaped relation between creative time pressure and creativity. Specifically, employees exhibited relatively high creativity when they experienced intermediate creative time pressure and received considerable support for creativity from supervisors and coworkers.

In addition to this independent moderating effect of support, we found that openness to experience combined with support to further modify the curvilinear creative time pressure-creativity relation. That is, our results showed an inverted U-shaped function between time pressure and creativity for employees receiving substantial support for creativity and scoring high on openness to

experience. By contrast, for individuals who received little support for creativity, were less open to experience, or both, increases in experienced creative time pressure generally had little effect on creativity. Although we hypothesized that open employees would be highly creative under conditions of intermediate pressure because they are able to draw upon a wide array of perspectives when engaging in exploratory behaviors and experimentation, this theorizing appears to be incomplete. Only when the social environment provides the support necessary for employees to persist in their creative efforts, did openness moderate the creative time pressure-creativity relation. Under conditions of low support, low openness, or both, it is likely that individuals either do not have access to the variety of perspectives necessary to exhibit creativity when experimenting with ideas or that they do not receive the support needed to further explore and refine their ideas.

Our results are consistent with those obtained in previous studies showing curvilinear relations between contextual variables

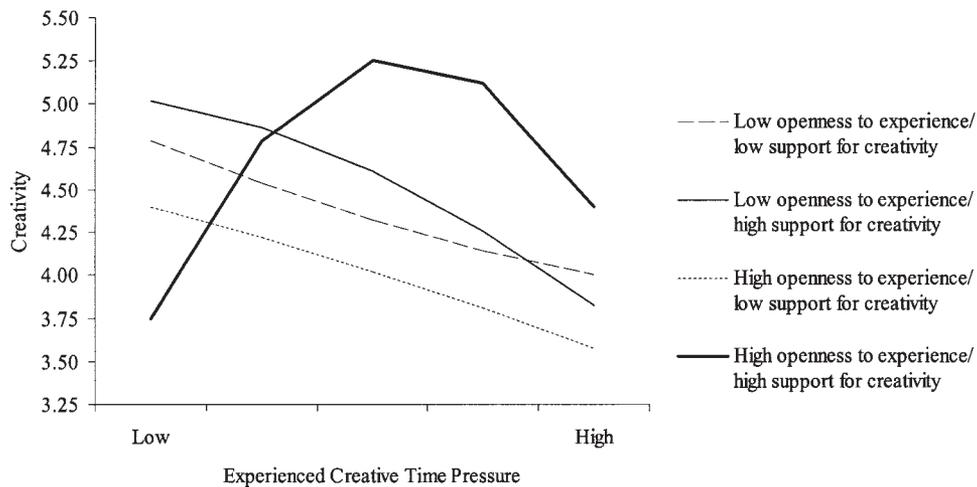


Figure 2. Curvilinear interaction of experienced creative time pressure, openness to experience, and support for creativity on creativity.

(e.g., overall time pressure and job demands) and different attitudinal and behavioral outcomes (Champoux, 1992; Freedman & Edwards, 1988; Janssen, 2001). Like these earlier studies, we too found that certain circumstances influenced the likelihood with which inverted U-shaped relations occurred. Intermediate creative time pressure might not be sufficient to elicit creative responses. These findings underscore the need for researchers to identify the personal and social characteristics that moderate curvilinear relations between job conditions and work outcomes.

Similar to earlier research concerned with creativity in the workplace and the possible role of openness to experience and support (e.g., George & Zhou, 2001; Zhou, 2003), our results indicated that both openness to experience and support for creativity had only weak, direct relations to employee creativity but served to jointly interact with a contextual condition—creative time pressure—to multiplicatively affect such creativity. Our results, along with those obtained in earlier investigations, emphasize the importance of considering the interactive effects of contextual, social, and personality variables when examining creativity at work. Although earlier theory had alluded to the possibility of openness, support, and time pressure interacting to jointly affect creativity (Woodman & Schoenfeldt, 1989; Woodman, Sawyer, & Griffin, 1993), and each characteristic had been investigated separately in previous investigations (e.g., Amabile & Grysiewicz, 1989; George & Zhou, 2001; Madjar et al., 2002), our study was the first to address how these characteristics fit together to shape creativity at work.

Our study has a few limitations. First, our sample included manufacturing employees only and it is not clear that our results generalize to other populations. Future research might attempt to test the ideas developed in this study across different samples and settings. Another limitation of our study is its correlational design, which precludes a clear determination of the direction of causality. Although results were consistent with many of our arguments, it is possible that creative employees simply described their contextual, social, and personal characteristics differently than employees who were less creative. Finally, in contrast to previous research that generally focused on experienced overall time pressure (see Amabile, 1996), we focused on the experience of a specific type of pressure—creative time pressure. Although our measure eliminated some of the vagueness associated with earlier measures, it is not clear whether our results generalize to overall time pressure or to other types of pressure (i.e., pressure to complete standard job responsibilities). Future research may address this issue by examining relations between creativity and measures of several types of time pressure.

Future research is also needed that explores whether other individual differences (e.g., extraversion) and social (e.g., organizational support) characteristics might also moderate the curvilinear relations involving experienced creative time pressure and creativity. In addition, previous researchers have assumed that the effects of time pressure on creativity are negative and linear (e.g., Andrews & Smith, 1996). Applying principles of activation theory, we found that when employees who were open to experience worked in a supportive environment, intermediate creative pressure was necessary for creativity to peak—little pressure seemed to be as harmful to creativity as too much pressure. Future researchers may want to examine whether an activation framework is also helpful in understanding the effects of other contextual conditions

(e.g., the physical environment; Woodman & Schoenfeldt, 1990) on individuals' creativity.

Our results have some interesting practical implications. First, previous research indicates that objective conditions in the workplace (e.g., tight deadlines and high workloads) are substantially related to the experience of overall time pressure (e.g., Durham, Locke, Poon, & McLeod, 2000; Maule, Hockey, & Bdzola, 2000). Thus, if management is interested in boosting creativity, supervisors might first identify the objective conditions that produce the experience of creative time pressure and alter those conditions so employees experience intermediate pressure with respect to creative pursuits. Next, management should consider assigning employees who are open to experience to these conditions, and encouraging supervisors and coworkers to support the creative efforts of such employees. If it is not possible to assign employees with the appropriate personality profiles to intermediate pressure conditions and to offer support in these circumstances, somewhat lower creativity might be expected.

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