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EMPLOYEE CREATIVITY: PERSONAL AND CONTEXTUAL FACTORS AT WORK

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This study examined the independent and joint contributions of employees' creativity-relevant personal characteristics and three characteristics of the organizational context—job complexity, supportive supervision, and controlling supervision—to three indicators of employees' creative performance: patent disclosures written, contributions to an organization suggestion program, and supervisory ratings of creativity. Participants (171 employees from two manufacturing facilities) produced the most creative work when they had appropriate creativity-relevant characteristics, worked on complex, challenging jobs, and were supervised in a supportive, noncontrolling fashion.

Numerous commentators have argued that enhancing the creative performance of employees is a necessary step if organizations are to achieve competitive advantage (Amabile, 1988; Devanna & Tichy, 1990; Kanter, 1983; Shalley, 1995). When employees perform creatively, they suggest novel and useful products, ideas, or procedures that provide an organization with important raw material for subsequent development and possible implementation (Amabile, 1988; Staw, 1990; Woodman, Sawyer, & Griffin, 1993). The initiation and implementation of these products enhance an organization's ability to respond to opportunities and, thereby, to adapt, grow, and compete (Kanter, 1983, 1988; March & Simon, 1958; Van de Ven, 1986; Van de Ven & Angle, 1989).

Unfortunately, little is known about the conditions that promote the creative performance of individual employees in organizations. Although numerous studies have attempted to identify the personal characteristics of individuals that predict creative accomplishment (Barron & Harrington, 1981), little of this research has focused on creative achievements in work settings. Moreover, little empirical work has systematically examined the possibility that characteristics of organizational contexts contribute significantly to employees' creative performance at work (Amabile, 1988; Shalley, 1991; Staw, 1990). Finally, although several theorists have called for research

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that addresses the joint or combined effects of personal and contextual factors on employee creativity (cf. Amabile, 1987; Staw, 1984; Woodman et al., 1993), very few empirical studies of this type have actually been conducted.

The purpose of the reported investigation was to address these issues. Specifically, we examined the independent and joint contributions of characteristics of individual employees and of their organizational contexts (i.e., job complexity and supervisory style) to three indicators of creativity in an organizational setting—patent disclosures written, contributions to an organization suggestion program, and supervisory ratings of creativity.

BACKGROUND

The study of creativity has generated a wide-ranging variety of definitions of the concept, some of which define it as a characteristic of a person and others as a process (Amabile, 1988). However, most contemporary researchers and theorists have adopted a definition that focuses on the product or outcome of a product development process (Amabile, 1983, 1988; Shalley, 1991; Woodman et al., 1993; Zaltman, Duncan, & Holbek, 1973). Following this earlier work, in the current study we defined creative performance as products, ideas, or procedures that satisfy two conditions: (1) they are novel or original and (2) they are potentially relevant for, or useful to, an organization. Further, we consider a product, idea, or procedure novel if it involves either a significant recombination of existing materials *or* an introduction of completely new materials.

Following the conceptualizations of Amabile (1988) and Staw (1990), in our definition we recognize the distinction between creative performance and organizational innovation. That is, creative performance refers to products, ideas, and so forth produced at the individual level, whereas innovation refers to the successful implementation of these products at the organizational level. In the current study, our focus was on the generation of creative outcomes by individual employees, not on the implementation of these outcomes.

Personal Characteristics and Creativity

As noted earlier, a large body of literature has focused on determining a set of personal characteristics and attributes associated with creative achievement (Barron & Harrington, 1981; Davis, 1989; Martindale, 1989). This research has examined personal characteristics ranging from biographical factors to measures of cognitive styles and intelligence (Amabile, 1983; Barron & Harrington, 1981; Davis, 1989; Hocevar & Bachelor, 1989; Woodman & Schoenfeldt, 1989). In general, these studies have demonstrated that a stable set of core personal characteristics, including broad interests, attraction to complexity, intuition, aesthetic sensitivity, toleration of ambiguity, and self-confidence, relate positively and consistently to measures of creative performance across a variety of domains (Barron & Harrington, 1981; Gough, 1979; Martindale, 1989).

A number of questionnaire measures have been developed that attempt to reliably assess these personal characteristics. One of the most widely used and respected of these measures is Gough's Creative Personality Scale (CPS; Gough, 1979; Hocevar & Bachelor, 1989; Kaduson & Schaefer, 1991; McCrae, 1987). The CPS includes 30 items empirically derived from the 300-item Adjective Check List (ACL; Gough & Heilbrun, 1965). In general, the items included are consistent with the core personal characteristics described above as correlates of creativity. For example, high CPS scorers endorse adjectives such as "self-confident," "interests wide," and "reflective" as self-descriptors; low scorers endorse words like "conventional" and "interests narrow."

In Gough's (1979) analysis of the CPS, ratings of creativity from expert judges, faculty members, assessment staff, and interviewers were examined for 12 groups of individuals from a variety of domains (e.g., mathematicians, architects, and research scientists) who had completed the ACL. Correlations of individual ACL items with the creativity ratings were used to select the 30 CPS items. The derived CPS correlated significantly with the creativity ratings in 10 of the 12 groups examined. Moreover, in two cross-validation samples, Gough reported that the CPS correlated significantly with ratings of creative performance. Subsequent research has also supported the validity of the CPS (Kaduson & Schaefer, 1991).

In the present investigation, we used the Creative Personality Scale to assess employees' creativity-relevant personal characteristics and examined the contribution of the CPS to employee creativity. On the basis of the evidence reviewed above, we predicted the following:

> *Hypothesis 1: An employee's score on the CPS will relate positively to employee creative performance.*

Organizational Context and Creativity

Although the search for personal characteristics predictive of creative performance dominated creativity research for several decades, recent research has begun to examine the effects of such contextual factors as goals, deadlines, and expected evaluations on individuals' creative performance (Amabile, 1979, 1982; Amabile, Goldfarb, & Brackfield, 1990; Amabile & Gryskiewicz, 1989; Amabile, Hennessey, & Grossman, 1986; Carson & Carson, 1993; Koestner, Ryan, Bernieri, & Holt, 1984; Kruglanski, Friedman, & Zeevi, 1971; Shalley, 1991, 1995). Most of this research has been conducted in behavioral laboratories and has followed an "intrinsic motivation" perspective. According to this perspective, the context in which an individual performs a task influences his or her intrinsic motivation, which in turn affects creative achievement (Amabile, 1988). Individuals are expected to be most creative when they experience a high level of intrinsic motivation—that is, when they are excited about a work activity and interested in engaging in it for the sake of the activity itself (Amabile, 1983, 1987; Shalley, 1991). Under these conditions, individuals are free of extraneous concerns and are likely to take risks, to explore new cognitive pathways, and to be playful with ideas

and materials (Amabile et al., 1990). They are also likely to stay focused on the internal nature of the task and to work longer on an idea or a problem. Situations that encourage this exploration and persistence should increase the likelihood of creative performance.

Previous research provides some direct support for the importance of intrinsic motivation for understanding creative responses. For example, studies by Amabile (1979) and Koestner and colleagues (1984) showed positive associations between measures of intrinsic motivation and individuals' creative performance on artistic tasks. Intrinsic motivation has been linked to creativity in work organizations as well. In an interview study, 120 scientists engaged in R&D mentioned intrinsic motivation as an important determinant of creative performance more frequently than any other characteristic (Amabile & Gryskiewicz, 1987).

We therefore expected characteristics of an organizational context that promote or support intrinsic motivation to enhance creative achievement. In contrast, characteristics of the context that restrict or constrain an individual's excitement in his or her work activities should reduce creativity (Amabile, 1983; Deci & Ryan, 1985; Koestner et al., 1984). In the current study, we focused on two contextual characteristics suggested by previous research and theory as important determinants of intrinsic motivation and creative performance at work: job complexity and supervisory style. Each of these contextual conditions is reviewed separately below.

Job complexity. The design of jobs has long been considered an important contributor to employees' intrinsic motivation and creative performance at work (Amabile, 1988; Hackman & Oldham, 1980; Kanter, 1988; West & Farr, 1989). Specifically, complex, challenging jobs (i.e., those characterized by high levels of autonomy, skill variety, identity, significance, and feedback) are expected to support and encourage higher levels of motivation and creativity than are relatively simple, routine jobs (Deci, Connell, & Ryan, 1989; Hackman & Oldham, 1980). When jobs are complex and challenging, individuals are likely to be excited about their work activities and interested in completing these activities in the absence of external controls or constraints. The level of interest and excitement produced by a job's design is then expected to foster creative achievements at work. In addition, complex jobs may actually *demand* creative outcomes by encouraging employees to focus simultaneously on multiple dimensions of their work, whereas highly simple or routine jobs may inhibit such a focus.

Previous research suggests that complex jobs can have a positive and substantial impact on a variety of work-related outcomes (Cotton, 1993; Fried & Ferris, 1987; Kopelman, 1985). For example, numerous field studies have relied on measures of the five job characteristics identified in the previous paragraph and have demonstrated that an overall index of these characteristics, the Motivating Potential Score (MPS; Hackman & Oldham, 1980), explains substantial amounts of variance in measures of internal motivation (the extent to which employees experience positive feelings when they perform well and negative feelings when they perform poorly), job satisfaction,

and overall performance (Fried & Ferris, 1987). In addition, a few studies have provided some support for the link between the complexity of employees' jobs and their creative responses at work. Hatcher, Ross, and Collins (1989) created a job complexity index by averaging employee reports of three job characteristics: autonomy, variety, and feedback. Their results showed positive, significant relations between this index and the number of new ideas employees submitted to an organization suggestion program. And a study by Amabile and Gryskiewicz (1989) demonstrated significant relations between employee self-reports of creativity and of "freedom" and "challenging work."

The current study used the MPS index to assess job complexity and examined the contribution of this index to employee creative achievement. On the basis of the aforementioned arguments, we predicted

> *Hypothesis 2: A job's score on the MPS index will relate positively to employee creative performance.*

Supervisory style. A second salient characteristic of the organizational context that is often considered a potent determinant of employee creativity at work is style of supervision (Amabile & Gryskiewicz, 1987, 1989; Deci & Ryan, 1987; West & Farr, 1989). In particular, supervision that is supportive of employees is expected to enhance creative achievement; supervision that is controlling or limiting is expected to diminish creative performance (Deci et al., 1989; Deci & Ryan, 1985, 1987). When supervisors are supportive, they show concern for employees' feelings and needs, encourage them to voice their own concerns, provide positive, chiefly informational feedback, and facilitate employee skill development (Deci & Ryan, 1987). These actions on the part of a supervisor are expected to promote employees' feelings of self-determination and personal initiative at work, which should then boost levels of interest in work activities and enhance creative achievement.

In contrast, when supervisors are controlling, they closely monitor employee behavior, make decisions without employee involvement, provide feedback in a controlling manner, and generally pressure employees to think, feel, or behave in certain ways (Deci et al., 1989). Supervision that is experienced as controlling undermines intrinsic motivation and shifts an employee's focus of attention away from work activities and toward external concerns (Deci et al., 1989; Deci & Ryan, 1987). This reduction in intrinsic motivation is then expected to lower creative performance.

A few studies provide some support for the proposed effects of supportive behavior on intrinsic motivation (e.g., Deci, Schwarz, Sheinman, & Ryan, 1981; Ryan & Grolnick, 1986; Zuckerman, Porac, Lathin, Smith, & Deci, 1978). For example, Zuckerman and colleagues (1978) found that when individuals were given choices about which tasks to complete and how much time to allot to each, they were significantly more intrinsically motivated than individuals who were not offered choices. In addition, Harackiewicz (1979) demonstrated that individuals who were given positive informational feedback about their task performance (i.e., "you performed better on these puz-

zles than the average participant") exhibited higher levels of intrinsic motivation than individuals who were given no feedback.[1]

Previous research also supports the proposed association between supportive supervision and employee creativity. For example, Stahl and Koser (1978) demonstrated that R&D scientists' creative output was significantly related to the extent to which supervisors were empathic and attempted to understand employees' feelings. West (1989) demonstrated that health care professionals were most creative when their supervisors provided high levels of social support. Carson and Carson (1993) showed that individuals who were given informational feedback about their creativity on the first trial of a task exhibited higher creativity on subsequent trials than individuals who were given no feedback. Andrews and Farris (1967) showed that teams of scientists produced the most creative outcomes when their supervisors provided substantial freedom at work and many opportunities to influence important decisions. Amabile and Gryskiewicz (1989) found significant relations between employee ratings of supervisory encouragement and of creativity. Lastly, Scott and Bruce (1994) demonstrated that professional employees who reported high-quality relationships with their supervisors (relationships characterized by support, trust, and autonomy) were described by those supervisors as more likely to generate creative ideas.

Previous research also provides some support for the association between controlling supervision and lowered intrinsic motivation and creativity. Several studies (e.g., Pittman, Davey, Alafat, Wetherill, & Kramer, 1980; Ryan, 1982; Ryan, Mims, & Koestner, 1983) showed that when performance feedback was offered in a controlling fashion (e.g., "You performed well, just as you should"), participants' intrinsic motivation was adversely affected. Similarly, Lepper and Greene (1975) found that children placed under surveillance exhibited lower intrinsic motivation than those who were not monitored. Regarding creative outcomes, a field experiment by Koestner and his associates (1984) examined the effects of "controlling-limits" on the creativity of children's artwork. The experimenter set limits about being neat while painting a picture. Results demonstrated that children in the controlling-limits condition exhibited significantly lower levels of creativity than children in a no-limits condition. Finally, Stahl and Koser (1978) showed negative relations between employee reports of supervisory control and objective indicators of creative output.

The current study specifically examined associations between the supportive and controlling aspects of supervision and several indicators of employee creative performance. On the basis of the intrinsic motivation perspective and the evidence reviewed above, we predicted the following:

[1] In general, this body of theory and literature focuses on comparisons between no feedback and positive informational feedback. It is also possible that negative informational feedback (feedback that focuses on specific problems with work while providing guidance for future employee behavior) might enhance individuals' intrinsic motivation and subsequent creativity.

Hypothesis 3: Supportive supervision will relate positively to employee creative performance.

Hypothesis 4: Controlling supervision will relate negatively to employee creative performance.

Joint Contributions of Personal and Contextual Characteristics

To this point we have discussed the possible independent contributions of employees' creativity-relevant personal characteristics, job complexity, and supervisory style to creative performance. In addition to examining these independent contributions, we also examined the possibility that these personal and contextual factors combine and interact with one another to influence employee creativity at work.

As noted earlier, commentators have long suggested that personal and contextual factors interact to affect creativity (i.e., Amabile, 1983, 1987; Woodman et al., 1993). Although very few empirical studies have directly examined the joint effects of personal and contextual factors on employee creative performance, previous research has shown that personal, job, and supervisory variables do combine to influence other employee work responses. In particular, studies have established that measures of employees' personal, job, and supervisory characteristics are generally independent of one another (cf. Abdel-Halim, 1981, 1983; Ferris, 1983; Griffin, 1980) and that they often interact to affect such outcomes as satisfaction and work performance (Abdel-Halim, 1981, 1983; Greene, 1979; Griffin, 1980; Johns, 1978). For example, Abdel-Halim (1981) demonstrated that employees experienced high levels of job satisfaction when they worked on complex jobs and were supervised in a considerate, supportive fashion. Other studies have found interactions among supervisory style and employees' personal characteristics (cf. Abdel-Halim, 1981; Keller, 1989; Weed, Mitchell, & Moffitt, 1976). For example, Weed and colleagues (1976) showed that employees low in dogmatism exhibited the highest levels of performance when supervisors were supportive. Finally, a few studies have demonstrated that measures of job complexity, supervision, and employees' personal characteristics jointly combined to affect employees' work responses (cf. Abdel-Halim, 1983; Griffin, 1980; Zierden, 1980). For example, Griffin (1980) found significant relations between employee job satisfaction and a measure of supervisory participative behavior for employees who strongly desired growth and development at work and worked on complex jobs.

In the present investigation, we built upon this earlier literature and posited a multiplicative model of creative performance involving employees' creativity-relevant personal characteristics, job complexity, and supervisory style. In essence, this model suggests that employee creativity is maximized when high levels of all the aforementioned conditions (Creative Personality Scale, Motivating Potential Score, and supportive and noncontrolling supervision) are present, because a high level of any one condition enhances an employee's ability to respond positively to the other conditions. For example, an employee with a high score on the CPS should exhibit higher creativity

in response to a complex job than an employee with a low CPS score, and this response should be further enhanced when levels of supportive and noncontrolling supervision are also high.

On the basis of the aforementioned arguments, we predicted the following four-way interaction:

> *Hypothesis 5: Creativity-relevant personal characteristics and contextual conditions will interact in such a way that creative performance will be highest when employees score high on the CPS index, work on high-MPS jobs, and are supervised in both a supportive and noncontrolling fashion.*

Finally, in addition to examining the associations between employees' personal and contextual characteristics and creative performance, this study also explored the contributions of these characteristics to two traditional outcomes: overall work performance and intentions to quit (turnover intentions). Since little research has examined employee creativity in the context of more traditionally studied outcomes, the possible effects of combinations of creativity-relevant personal and contextual factors on outcomes such as work performance and intentions to quit remain unknown. This is a potentially significant issue if certain personal and contextual conditions combine to enhance creative achievement while contributing to lowered effectiveness on more traditional dimensions. For example, employees with high scores on the CPS index (high-CPS employees) may respond to noncontrolling supervision by producing more creative work but in the process may also lower their overall work performance. By focusing their energy and attention to produce creative outcomes, high-CPS employees may devote less effort to more traditional dimensions of work, and overall effectiveness may suffer. The current study addresses this possibility by simultaneously exploring the contributions of creativity-relevant personal characteristics, job complexity, and supervisory style to employees' overall work performance and intentions to quit as well as to indicators of creative achievement.

METHODS

Research Setting and Participants

The research was conducted in two manufacturing facilities that produced component parts for technical equipment. Each employee in the two facilities held 1 of 18 different jobs (e.g., design engineer, manufacturing engineer, design drafter, toolmaker, and technician).

Human resources managers from each of the facilities were contacted by the authors and asked to identify individual work units within the facilities for possible participation in the research. Managers were told that the research involved the possible effects of individual and contextual conditions on employees' work-related responses and were asked to identify units that were representative of the organization as a whole. At no time did we express

a particular interest in work units where high creative performance was present or expected.

All employees in the identified units were then contacted and asked to participate. We told employees that the study was designed to assess their responses to their work environments; we did not indicate that creative performance was the focus of the research. A total of 171 employees (118 from facility A; 53 from facility B) agreed to participate in the study. This number reflects a response rate of 87 percent of those originally contacted in facility A and of 75 percent of those in facility B, an overall participation rate of 83 percent. Thirty-seven percent of the participants were women. The mean age was 41 years, and the mean organizational tenure level was 12.75 years. The modal education level was "business college or technical school degree." Interviews with human resources managers indicated that the demographic and job profiles of the respondents were typical of the general population in the participating work units.

Procedures

Three types of data were collected on site. First, employees completed questionnaires at their desks or in a conference room. These questionnaires included items that measured personal characteristics, job complexity, supervisory style, and intentions to quit. Before they completed the questionnaires, employees were told that it was desirable to have their names on the questionnaires for research purposes and were assured that all provided information would be kept completely confidential.

After employee questionnaires were administered, the direct supervisors of the participating employees completed questionnaires that included items measuring each employee's creative and overall performance. Finally, human resource managers provided data on two additional measures of creative performance: patent disclosures written and contributions to an organization suggestion program.

Measures

Creativity-relevant personal characteristics. The 30-item Creative Personality Scale (CPS; Gough, 1979) of the ACL (Gough & Heilbrun, 1965) was used to assess employees' creativity-relevant personal characteristics. Employees were asked to "place a check mark next to each adjective that you think describes you." Of the 30 adjectives, 18 describe highly creative people: capable, clever, confident, egotistical, humorous, informal, individualistic, insightful, intelligent, interests wide, inventive, original, reflective, resourceful, self-confident, sexy, snobbish, and unconventional. Each of these checked adjectives was given a value of +1. The remaining 12 adjectives describe less creative people: cautious, commonplace, conservative, conventional, dissatisfied, honest, interests narrow, mannerly, sincere, submissive, suspicious, and phony.[2] Each of these checked adjectives was assigned a value of −1. The values were then summed to form a CPS index.

[2] After pretests, we selected "phony" to replace the original item, "affected."

Reliability of the CPS index was calculated via a weighted composite technique (Lord & Novick, 1968). We generated a positive subscale including the 18 adjectives that describe highly creative people and a negative subscale including the 12 adjectives associated with less creative individuals. A separate Cronbach's reliability coefficient was calculated for each of these subscales (alpha+ and alpha−). We then calculated the reliability of the total CPS index using a linear combination weighted for the number of items on each subscale and the correlation between the subscales.[3] The reliability of the CPS index was .70.

Job complexity. Fifteen items from the Job Diagnostic Survey (Hackman & Oldham, 1980) were used to assess the challenge and complexity of employees' jobs. Three items for each of five job characteristics (autonomy, skill variety, task identity, task feedback, and task significance) were averaged to form a summary index for that characteristic. We then combined these indexes to form a Motivating Potential Score (MPS) for each job using the formula suggested by Hackman and Oldham (1980): MPS = (variety + identity + significance)/3 × autonomy × feedback.[4]

Internal consistency was assessed for each of the five job characteristics as well as for other measures in this study (supervisory style, creative performance, overall performance, and intentions to quit) in terms of Cronbach's reliability coefficient (alpha). The median alpha of the job characteristics measures was .68. Table 1 reports reliabilities for all measures.

Supervisory style. To measure supervisory support and control, we used 12 items. Some of these items were adapted from the Michigan Organizational Assessment Package (1975) and others were written specifically for this study. Items were rated on a seven-point Likert-type scale that ranged from "strongly disagree" (1) to "strongly agree" (7). All items appear in the Appendix.

Independence among the 12 supervision items was assessed with exploratory factor analysis using principal components analysis with varimax rota-

[3] The formula used to calculate the reliability of the CPS index was as follows:

$$\text{Total alpha} = \frac{[(n+/n)(\text{alpha}+) + (n-/n)(\text{alpha}-) + 2r(n+/n)(n-/n)]}{(n+/n) + (n-/n) + 2r(n+/n)(n-/n)},$$

where n = the total number of scale items, $n+$ = the number of positive subscale items, $n-$ = number of negative subscale items, and r = the correlation between positive and negative subscales.

[4] To supplement this measure, we assigned each of the 18 job classifications a substantive complexity score based on those Roos and Treiman (1980) derived from the *Dictionary of Occupational Titles* (U.S. Department of Labor, 1977). This measure has been used in recent studies (e.g., Arvey, Bouchard, Segal, & Abraham, 1989; Gerhart, 1987; Oldham, Kulik, & Stepina, 1991) as a non-self-report index of overall job complexity. When we conducted analyses using this measure in place of the MPS score, virtually identical results were obtained. These results are available from the authors on request.

TABLE 1
Means, Standard Deviations, and Correlations[a]

Variables	Mean	s.d.	Reliability	1	2	3	4	5	6	7	8
1. Creativity-relevant personal characteristics	4.26	3.55	.70								
2. Job complexity	143.82	65.39	.68[b]	.22*							
3. Noncontrolling supervision	4.91	1.09	.67	.12	.50*						
4. Supportive supervision	4.68	1.11	.86	.08	.37*	.38*					
5. Rated creativity	4.60	1.29	.90	.12	.24*	.28*	.14				
6. Patents	0.28	0.87		.27*	.16	.07	−.14	.23*			
7. Suggestions	0.31	0.47		.00	−.05	−.20	−.19	.01	.18		
8. Rated performance	5.19	1.09	.85	.05	.35*	.31*	.29*	.75*	.05	−.02	
9. Intentions to quit	2.52	1.37	.75	.00	−.33*	−.08	−.25*	.03	.12	.01	−.08

[a] $N = 171$.

[b] This value represents the median reliability of the five measures of job characteristics.

*$p < .05$, two-tailed test

tion. Two factors emerged from this analysis accounting for 52.9 percent of the variance. The first factor (eigenvalue = 4.57) was composed of the eight items with factor loadings ranging from .52 through .79 and reflected "supportive supervision." The second factor (eigenvalue = 1.78) was composed of the remaining four items (loadings .57–.78) and reflected "controlling supervision." We averaged item scores for both factors to form indexes. Certain items on each index were reverse-coded so that high scores on the indexes reflect supportive and noncontrolling supervision.

Creative performance ratings. Supervisors rated the extent to which each employee produced work that was novel and useful to the organization. Three items developed for this study were used to assess creativity and are reported in the Appendix. Ratings were made on seven-point Likert-type scales and were averaged to form a rated creativity index.

Patent disclosures written. When employees developed product or process ideas that were deemed by their supervisors to be very original and relevant to the organization or the industry in general, they were invited to write a patent disclosure. Patents and patent applications are commonly used measures of creative output (cf. Keller & Holland, 1983; Pelz & Andrews, 1966), and the patent disclosure measure used here reflects the first step in the patent application process. This measure specifically assesses the number of internal patent disclosures written by an employee over a two-year period. Ratings on this measure ranged from 0 through 2.

Contributions to a suggestion program. Employees were also invited to submit recommendations to a formal organization suggestion program. The suggestion program, which was separate from the patent disclosure process, usually involved ideas about procedural or process changes in work methods (e.g., changes in quality inspections or waste disposal techniques). A multifunctional committee regularly reviewed all submitted recommendations and accepted only those that were considered novel and appropriate for organizational implementation. This measure assesses whether an employee's recommendations were accepted (i.e., judged creative) by the review committee over the same two-year period. When an employee's suggestions were accepted, this measure was coded 1; when not accepted, the suggestions measure was coded 0.

Overall performance ratings. Using three items suggested by Hackman and Oldham (1976), supervisors of each employee rated his or her performance on three dimensions: work quantity, work quality, and amount of effort. Ratings were made on seven-point Likert-type scales and averaged to form a rated performance index.

Intentions to quit. We averaged three items suggested by Colarelli (1984) to form an index of intentions to quit. Items were measured on a seven-point Likert-type scale that ranged from "strongly disagree" (1) to "strongly agree" (7). Numerous studies have demonstrated that similar measures relate significantly to subsequent employee turnover (Hom, Griffith, & Sellaro, 1984; Rosse & Hulin, 1985).

RESULTS

Relations among the Measures

Table 1 presents correlations and descriptive statistics for all measures included in the research.[5] The measure of creativity-relevant personal characteristics (CPS) is positively and significantly related to the measure of job complexity (MPS). However, CPS does not relate significantly to the measures of supervision. The job and supervision measures are all positively and significantly related to one another.

The three measures of creativity are all positively related to one another, but only the relation between patents and rated creativity is statistically significant. Rated creativity also correlates positively and significantly with rated performance, demonstrating that individuals rated high on the traditional performance measure are also rated as highly creative. The last outcome measure, intentions to quit, does not correlate significantly with the other outcomes.

Correlations between CPS and the three creativity indicators are shown in Table 1 and provide only partial support for Hypothesis 1. Specifically, CPS correlates positively and significantly with one of the creativity indicators (patents) but not with the remaining two indicators (rated creativity and suggestions). In addition, the relations between CPS and the supplementary outcomes, performance and intentions to quit, are nonsignificant.

Results shown in Table 1 also provide partial support for Hypothesis 2. Job complexity (MPS) correlates positively and significantly with only one of the three creativity indicators: rated creativity. In addition, MPS relates positively and significantly to rated performance and negatively and significantly to intentions to quit.

The results shown in Table 1 provide no support for Hypothesis 3. There are no significant associations between supportive supervision (SS) and the creativity indicators. However, supportive supervision does relate significantly to both rated performance and intentions to quit. Finally, noncontrolling supervision (NS) correlates positively and significantly with one measure of creative performance (rated creativity), providing partial support for Hypothesis 4. Noncontrolling supervision also relates positively and significantly to rated performance.

Hierarchical Regression Analyses

To examine the joint contributions of the CPS and the context measures to the explanation of the creativity and supplementary outcomes, we con-

[5] The low means of the patent and suggestion measures shown in Table 1 reflect the somewhat positively skewed distributions of these variables, which is not uncommon in field research on creativity and innovation (cf. Keller & Holland, 1983; Owens, 1969; Pelz & Andrews, 1966). Using both square root and logarithmic transformations of these two variables, we repeated all correlational and regression analyses reported below and obtained results virtually identical to those obtained using the original measures. Given these findings, and noting that regression analyses are generally robust even in the presence of departures from assumptions of normality (Pedhazur, 1982: 34), we report results using the original patent and suggestion measures.

ducted hierarchical regression analyses. Since our primary interest was the contribution of the four-way interaction involving CPS, MPS, and noncontrolling and supportive supervision (Hypothesis 5), it was necessary to control for the independent effects of these variables and the lower-order interactions among them (Aiken, West, & Reno, 1991; Cohen & Cohen, 1983; Peters, O'Connor, & Wise, 1984). Thus, we entered main effects into the equations first, followed by the 6 two-way interactions, the 4 three-way interactions and, finally, the 1 four-way interaction.[6] We emphasize interpretation of the increased squared multiple correlation (R^2) that results from including a particular predictor in a regression equation as an indication of its importance, because the multicollinearity present when both main effects and interaction terms are included in equations results in unstable and thus uninterpretable regression coefficients (Hom et al., 1984; Miller, Katerberg, & Hulin, 1979; Pedhazur, 1982). Table 2 summarizes results.

Results indicate that the independent effects of the CPS and organizational context measures together explained significant amounts of variance in two of the three creativity indicators: rated creativity and patents. Specifically, the main effects alone accounted for 10 percent of the variance in rated creativity and 12 percent of the variance in patents. The main effects also explained a significant amount of variance (16%) in the two supplementary outcomes: rated performance and intentions to quit.

The contributions of the interaction terms, however, differ substantially between the creative performance and the supplementary outcomes. As Table 2 shows, none of the two-, three-, or four-way interaction terms contribute significantly to the performance and intentions to quit measures. Indeed, the entire *set* of interaction terms explains only 4–6 percent of the variance in these supplementary outcomes. On the other hand, several of the interaction terms contribute significantly to the creativity measures, and the set of interaction terms explains 14–22 percent of the variance in these three indicators.[7]

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[6] We introduced the two- and three-way interaction terms into the equations in all possible orders, obtaining results virtually identical to those reported in Table 2.

[7] It is possible that the types of jobs employees hold may influence the contextual factors they experience and the creative outcomes they produce. For example, employees in professional or engineering jobs may receive more supportive supervision or have more opportunities to produce patents than employees in nonprofessional or technical jobs. To examine this possibility, we created a dummy variable representing this job type distinction. Employees holding professional/engineering jobs (e.g., design engineer and manufacturing engineer) were coded 1; those holding nonprofessional but technical jobs (e.g., toolmaker and quality control technician) were coded 0. Correlations between this dummy variable and all measures included in the research showed no significant associations (all p's $> .05$). Next, we repeated the regression analyses appearing in Table 2, after controlling for job type. In these analyses, the job-type variable was introduced first into the equations, followed by the steps as described above (i.e., CPS, MPS, etc.). Results showed that job type did not make significant contribution to any of the outcomes. Moreover, all of the significant main and interaction effects shown in Table 2 remained statistically significant ($p < .05$) after the introduction of the job-type variable. In total, these results suggest that job type does not affect the relations examined in this study. Details of these results are available on request.

TABLE 2
Summary of Results of Hierarchical Regression Analyses

Variables	Rated Creativity		Patents		Suggestions		Rated Performance		Intentions to Quit	
	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Creativity-relevant personal characteristics (CPS)	.01	.01	.07*	.07*	.03	.03	.00	.00	.00	.00
Job complexity (MPS)	.06*	.05*	.08*	.01	.04	.01	.12*	.12*	.12*	.12*
Noncontrolling supervision (NS)	.09*	.03*	.08*	.00	.06	.02	.14*	.02	.13*	.01
Supportive supervision (SS)	.10*	.01	.12*	.04*	.09	.03	.16*	.02	.16*	.03*
CPS × MPS	.17*	.07*	.12*	.00	.17*	.08*	.17*	.01	.16*	.00
CPS × NS	.18*	.01	.13*	.01	.21*	.04*	.18*	.01	.17*	.01
CPS × SS	.18*	.00	.14*	.01	.21*	.00	.18*	.00	.19*	.02
MPS × NS	.18*	.00	.20*	.06*	.21*	.00	.19*	.01	.19*	.00
MPS × SS	.18*	.00	.21*	.01	.22*	.01	.19*	.00	.19*	.00
NS × SS	.18*	.00	.22*	.01	.25*	.03	.20*	.01	.19*	.00
CPS × MPS × NS	.19*	.01	.24*	.02	.27*	.02	.20*	.00	.20*	.01
CPS × MPS × SS	.19*	.00	.24*	.00	.27*	.00	.20*	.00	.20*	.00
CPS × NS × SS	.19*	.00	.25*	.01	.28*	.01	.21*	.01	.20*	.00
MPS × NS × SS	.19*	.00	.30*	.05*	.28*	.00	.21*	.00	.20*	.00
CPS × MPS × NS × SS	.24*	.05*	.34*	.04*	.28*	.00	.22*	.01	.20*	.00

*$p < .05$

The contributions of the various interaction terms vary somewhat across the three creativity indicators. Specifically, results in Table 2 show a significant CPS-by-MPS interaction and a significant four-way interaction for rated creativity. Results for patents also show a significant four-way interaction, a significant three-way interaction of MPS, noncontrolling supervision, and supportive supervision, and a significant MPS-by-noncontrolling supervision interaction. Results for the third measure of creativity, suggestions, are slightly different. Here, the four-way interaction is not significant, but 2 two-way interactions make statistically significant contributions: CPS × MPS and CPS × NS.

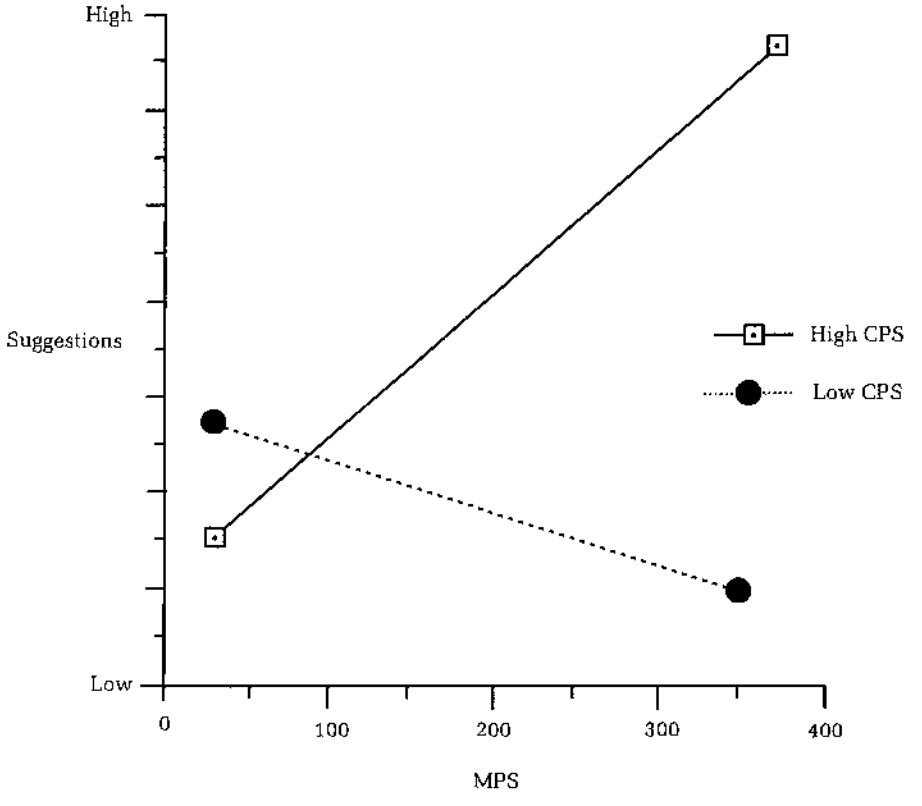
To interpret the interactions, we used procedures suggested by Peters and colleagues (1984) and conducted separate regression analyses for subgroups of the sample. For example, for the significant CPS-by-MPS interactions, we split the CPS measure at the median to form high and low CPS subgroups. We then regressed suggestions and rated creativity on MPS (job complexity) for each subgroup and plotted the within-subgroup regression equations using unstandardized regression coefficients. Figure 1 shows results for the suggestions measure. Results for the rated creativity measure, which are basically identical to those shown, are available on request from the authors.

Figure 1 shows that relations between MPS and the suggestions outcome vary as a function of employees' creativity-relevant personal characteristics. For employees with high CPS scores, the more complex their jobs, the more they produced novel and useful suggestions. But for employees with relatively low CPS scores, the more complex their jobs, the less they produced creative suggestions.

The same procedure was used to illustrate the significant interactive effect of CPS and noncontrolling supervision (NS) on suggestions and the effect of the MPS-by-NS interaction on patents. Both interactions are very similar in form to that shown in Figure 1 and are not displayed here. Specifically, the CPS-by-NS interaction shows that for employees with high CPS scores, noncontrolling supervision has a strong, positive association to the production of novel suggestions. However, for employees in the low CPS group, noncontrolling supervision is very weakly associated with the suggestions measure. Similarly, the significant MPS-by-NS interaction for patents shows that individuals who perform highly complex jobs respond more positively to noncontrolling supervision than employees working on relatively simple jobs. Figures illustrating these interactions are available on request from the authors.

Table 2 also shows a significant effect of the interaction of MPS, noncontrolling supervision, and supportive supervision on patents. To interpret this interaction, we split each of the supervision measures at the median to form subgroups and regressed patents on MPS for each combination of these subgroups (e.g., high NS and low SS, and low NS and low SS). Results were generally consistent with the argument that when all three contextual conditions support intrinsic motivation, creativity is higher than when any

FIGURE 1
Interaction of Creativity-Relevant Personal Characteristics and Job Complexity for Suggestions

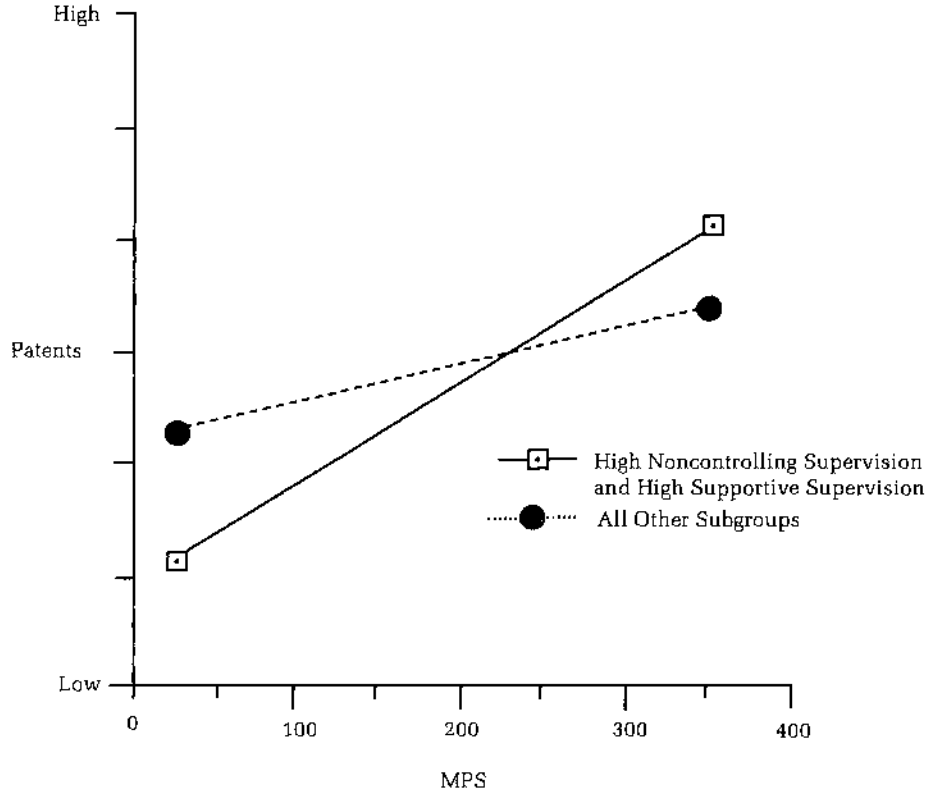


one condition is low. Specifically, results showed that the job complexity measure was more strongly associated with patents when supervision was both supportive and noncontrolling than when one or both of these supervision measures were low. Therefore, to illustrate the interaction, we regressed the patents measure on MPS for the high NS–high SS subgroup and for a new category consisting of employees in the remaining three subgroups: low NS–low SS, low NS–high SS, and high NS–low SS. Figure 2 shows results.

As suggested above, the figure shows a positive relation between MPS and patents when supervisors are both supportive and noncontrolling. However, when supervisors are controlling, nonsupportive, or both, the challenge and complexity of employees' jobs has little relation to number of patent disclosures written.

Interpretation of the two significant four-way interactions (see Table 2) allows us to address Hypothesis 5. This hypothesis predicts that the highest levels of creative performance occur when employees score high on all four

FIGURE 2
Interaction of Job Complexity, Noncontrolling Supervision, and Supportive Supervision for Patents

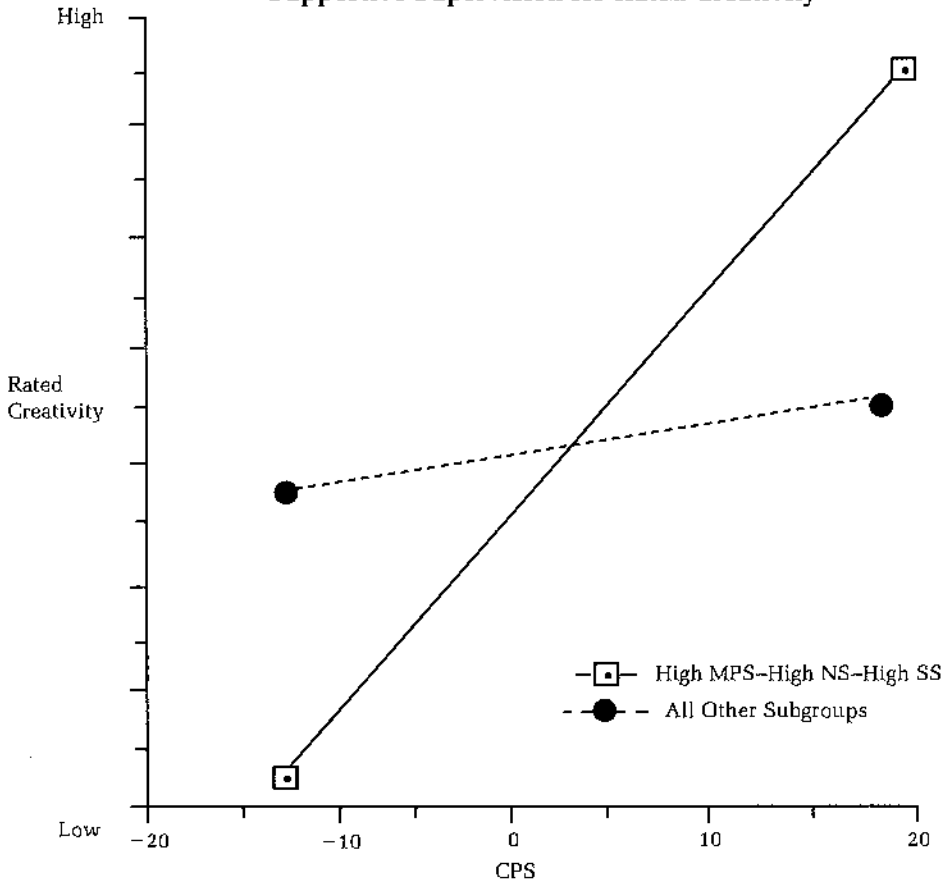


predictors: the CPS index, the MPS index, supportive supervision (SS), and noncontrolling supervision (NS). To examine this interaction, we again split each of the context measures (i.e., MPS, NS, SS) at the median to form subgroups. We then regressed the creativity outcomes (rated creativity and patents) on CPS for each of the eight combinations of these subgroups. As predicted, results showed that the more contextual conditions were high, the stronger the association between CPS and creativity.

Given this pattern of results and Hypothesis 5, we again contrasted regression results for two groups: the high MPS–high NS–high SS and a combination of the seven remaining subgroups (e.g., low MPS–low NS–high SS, high MPS–low NS–high SS, etc.). Figure 3 shows results for rated creativity. Results for patents were virtually identical to those shown in the figure and are available from the authors on request.

The results shown in Figure 3 provide support for Hypothesis 5: creative performance was highest when employees had appropriate creativity-

FIGURE 3
Interaction of Creativity-Relevant Personal Characteristics, Job Complexity, Noncontrolling Supervision, and Supportive Supervision for Rated Creativity



relevant personal characteristics and worked under conditions expected to foster intrinsic motivation. Specifically, when jobs were complex and supervisors supportive and noncontrolling, CPS was strongly and positively associated with rated creativity. However, when scores were low on one or more of the contextual conditions, CPS had little relation to creative achievement.

DISCUSSION

This study examined the independent and joint contributions of a measure of creativity-relevant personal characteristics (the CPS) and three measures of the organizational context—job complexity, supportive supervision, and noncontrolling supervision—to the explanation of three indicators of employee creativity: patents, contributions to a suggestion program, and

rated creativity. In addition, we examined the contributions of the personal and context measures to two traditional outcomes, overall work performance and intentions to quit (turnover intentions).

In general, results indicated that the contextual characteristics alone contributed independently to the performance and intentions to quit outcomes. Employees exhibited higher performance and lower intentions to quit when their jobs were complex and when their supervisors were described as supportive and noncontrolling.

But a completely different pattern of results emerged for the three creativity outcomes. In addition to the fact that two of the context measures (job complexity and noncontrolling supervision) and the CPS made independent contributions to one creativity indicator, interactive combinations of the CPS and the context measures contributed significantly to each of the creativity outcomes. Specifically, the interaction of the CPS and job complexity and that of the CPS and noncontrolling supervision contributed significantly to the suggestions outcome, and the four-way interaction term involving CPS, job complexity, noncontrolling supervision, and supportive supervision contributed significantly to the patents and rated creativity outcomes.

The direction of the results for patents and rated creativity was as hypothesized: employees produced the most creative work when they had appropriate creativity-relevant personal characteristics (high CPS), worked on complex, challenging jobs (high MPS), and were supervised in a supportive, noncontrolling fashion. The absence of any of these conditions adversely affected creative performance. For the suggestion outcome, results were nearly as expected. Production of novel and useful recommendations to a formal suggestion program was higher when individuals had high CPS scores, complex jobs, and noncontrolling managers. However, supervisory support had little role in predicting this particular indicator of creativity.

These results are generally consistent with earlier "interactionist" approaches to understanding creativity (Amabile, 1987; Woodman & Schoenfeldt, 1989) and suggest that managements should consider both personal and contextual factors to increase creativity in work organizations. Specifically, our results suggest that if creativity at work is to be enhanced, an individualized or selective approach to management may be warranted. For example, individuals with high levels of creativity-relevant personal characteristics might be identified through use of assessment instruments such as the CPS and the normative baselines that accompany these instruments (Gough, 1979). Individuals demonstrating high creative potential relative to these norms might then be surrounded with contextual conditions that support intrinsic motivation. That is, high-CPS employees might be placed in complex, enriched jobs and managed in a supportive, noncontrolling fashion. However, the same contextual conditions should be implemented cautiously, if at all, for individuals with few creativity-relevant personal characteristics. Our results suggest that for low-CPS employees, enriching jobs and managing in a supportive manner may have few beneficial effects *or* may actually have adverse effects on creative achievement (see Figures 1 and 3). Low-CPS

employees may be overstretched or irritated by certain contextual conditions (e.g., complex, challenging jobs), and respond by lowering their creative output.

In addition, although designing the context in the individualized manner described above appears to be an appropriate strategy if one is interested in maximizing creative achievement at work, our results also suggest that this strategy may complicate efforts to simultaneously maximize general performance effectiveness or to minimize turnover in a work unit. Results indicated that the context measures independently made strong positive contributions to these traditional outcomes, suggesting that performance might be enhanced and intentions to quit lowered if *all* employees were placed in highly complex jobs and managed in a supportive, noncontrolling manner. Thus, if the context is not designed in this fashion for some employees (e.g., if those with few creativity-relevant characteristics are placed on less complex jobs), their general performance and organizational longevity may suffer. This implies that managers may face a dilemma regarding some employees, a conflict between enhancing creative achievement and maximizing traditional outcomes. It also suggests that managers should consider which outcomes they value most before implementing an individualized or more general management strategy.

Although we have discussed several implications of our results for the management of creativity, the research reported here is not without its limitations. First, like the results of other field studies that include multiple measures of creative performance (cf. Pelz & Andrews, 1966), our results indicate relatively low convergence among creativity measures (i.e., ratings, patents, and suggestions; see Table 1). Although rated creativity and patents were positively and significantly correlated with one another, the suggestions measure was not significantly correlated with either other measure of creativity. In addition, as described above, the multiplicative effects of personal and contextual characteristics were similar for rated creativity and patents, but different for suggestions.

One explanation for the lack of convergence between the suggestions measures and the remaining creativity indicators involves the nature of the suggestions measure itself. As mentioned earlier, suggestions was a dichotomous measure. The resulting restricted range may have contributed to the relatively weak associations between this measure and the other indicators of creativity. Future research should examine suggestion measures with a wider range, such as the total number of suggestions accepted by a review committee.

The low convergence between suggestions and patents could also be explained by conceptual and empirical distinctions in the innovation literature. In particular, routine, incremental, or minor innovations have been distinguished from radical or major innovations (Dewar & Dutton, 1986; Ettlie, Bridges, & O'Keefe, 1984; Knight, 1967; Zaltman et al., 1973). Routine innovations represent relatively small changes in an organization's products, procedures, or services. They are new to the organization but reflect an

adaptation or simple adjustment of existing practices, and their implementation rarely requires major changes in organizational structures or processes (Dewar & Dutton, 1986; Knight, 1967). Radical innovations, in contrast, represent larger changes in organizational products, procedures, or services. They reflect broader shifts in perspective and reorientation of existing practices and often require major changes in organizational structures or processes to implement. This distinction is also consistent with the characterization of individuals' creativity styles as ranging from adaptive to innovative (Kirton, 1976, 1989). Employees with adaptive styles work within existing structures to make incremental changes and "do things better." In contrast, employees with innovative styles treat current structures as part of the problem and make more radical changes by "doing things differently" (Kirton, 1976: 622).

Thus, another possible explanation for the weak association involving the suggestions and patents measures is that they reflect different kinds of creative performance: suggestions reflects a routine or adaptive kind of creativity outcome, whereas patents represents a radical or innovative type of creative performance. Submissions to the formal suggestion program were usually detailed, specific suggestions that involved daily work practices. They were more often minor adjustments to existing practices than sources of major changes in product or procedures. Patent disclosures, on the other hand, represented ideas that could make a major change in a product or procedure—ideas the organization wanted to protect its rights in. They were characterized by distinctly different, not simply better, ways of going about the work.

Our results also indicated that supervisors' ratings of creativity are more closely aligned with patents than with suggestions. One possible explanation for this finding is that supervisors' ratings were influenced in one of two ways by their awareness of employees' patent and suggestion contributions. First, supervisors may have given stronger consideration in their ratings to the number of patents generated than to employee suggestions because patents were more highly visible organizational contributions. Second, supervisors may have considered suggestions and patents equally but judged patents as more creative than suggestions. Future research using ratings of creativity should systematically examine these possibilities by asking raters to describe the basis for their creativity ratings.

Future work is also needed to develop a refined and comprehensive set of objective creativity indicators that range from the routine or adaptive to the highly radical or innovative. In addition, work is needed that examines the contributions of personal and contextual characteristics to this set of creativity outcomes. For example, future research might examine the effects of other personal characteristics (e.g., technical skills and cognitive styles) and contextual conditions (e.g., goal-setting programs, financial incentive systems, and interpersonal competition) on various types of creative performance. In addition, research should continue to address the interactive effects of these personal and contextual characteristics on employee creativity.

A second limitation of this study involves the rather low internal consistency reliabilities for some of the measures included in the research. For example, the low reliabilities for job complexity and noncontrolling supervision (.68 and .67) may have reduced the effectiveness of these measures in explaining the creativity outcomes. Work is now needed to develop more reliable measures of these constructs and to investigate their relation to a variety of creativity indicators.

Finally, the results of this research have been discussed as though creativity-relevant personal and organizational characteristics caused employees' creative accomplishments. The current study was, however, cross-sectional, and these assumptions of causality are not technically justified. It is possible, for example, that highly creative performers were placed in more complex jobs and supervised in a more supportive manner in the work units investigated. Moreover, employees' recent creative accomplishments might have affected their responses to the CPS measure.

Longitudinal field studies and controlled field experiments that address the issue of causal direction are now needed. Specifically, longitudinal studies should follow individuals with different CPS scores and from different contexts for a period of time, assessing their creative performance at regular intervals. Field experiments might examine the effects on creative performance of (1) assigning employees with different scores on the CPS index to different positions within an organization and (2) manipulating specific characteristics of the organizational context.

In addition, research is needed that examines the effects of context manipulations on employees' creativity-relevant personal characteristics. Although we treated personal and contextual characteristics as independent constructs and our measures of these constructs made independent contributions to the three creativity indicators (Tables 1–2), our measures of personal characteristics (CPS) and job complexity (MPS) related significantly to one another (Table 1). It may be that employees who scored high on the CPS self-selected into complex jobs or were assigned to such jobs by supervisors. Alternatively, it may be that individuals' scores on the CPS were shaped by their job experiences. Early research by Kohn and Schooler (1978) demonstrated that certain job conditions could substantially influence personal characteristics such as intellectual flexibility. Studies are now needed to investigate whether characteristics of a job and an organizational context affect employees' creativity-relevant personal characteristics.

In conclusion, despite the limitations described in the paragraphs above, this study contributes to a growing literature on individual creativity in organizations and provides support for an interactionist approach. Future practice and research need to further unravel the complex relations among personal characteristics, contextual factors, and a variety of creative outcomes. As this unraveling occurs, organizations may be better able to appreciate their employees' creative potential and to benefit from the implementation of their novel and useful contributions.

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APPENDIX

The items measuring *supportive supervision* included (1) My supervisor helps me solve work-related problems, (2) My supervisor encourages me to develop new skills, (3) My supervisor keeps informed about how employees think and feel about things, (4) My supervisor encourages employees to participate in important decisions, (5) My supervisor praises good work, (6) My supervisor encourages employees to speak up when they disagree with a decision, (7) My supervisor refuses to explain his or her actions (reversed-coded), and (8) My supervisor rewards me for good performance.

The items measuring *noncontrolling supervision* included (1) My supervisor always seems to be around checking on my work (reverse-coded), (2) My supervisor tells me what shall be done and how it shall be done (reverse-coded), (3) My supervisor never gives me a chance to make important decisions on my own (reverse-coded), and (4) My supervisor leaves it up to me to decide how to go about doing my job.

The items measuring *creative performance* included (1) How ORIGINAL and PRACTICAL is this person's work? Original and practical work refers to developing ideas, methods, or products that are both totally unique and especially useful to the organization; (2) How ADAPTIVE and PRACTICAL is this person's work? Adaptive and practical work refers to using existing information or materials to develop ideas, methods, or products that are useful to the organization; and (3) How CREATIVE is this person's work? Creativity refers to the extent to which the employee develops ideas, methods, or products that are both original and useful to the organization.

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[Footnotes]

[4] **Physical Environments and Employee Reactions: Effects of Stimulus-Screening Skills and Job Complexity**

Greg R. Oldham; Carol T. Kulik; Lee P. Stepina

The Academy of Management Journal, Vol. 34, No. 4. (Dec., 1991), pp. 929-938.

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[5] **Communicators and Innovators in Research and Development Organizations**

Robert T. Keller; Winford E. Holland

The Academy of Management Journal, Vol. 26, No. 4. (Dec., 1983), pp. 742-749.

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