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Joint Impact of Interdependence and Group Diversity on Innovation☆

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This questionnaire study among 343 members of 41 work teams in a financial services organization examined the effects of individual team members' perceived task interdependence and perceived goal interdependence on innovative behavior in teams characterized by different levels of group diversity. Multilevel analyses revealed that individual's perceived task and goal interdependence were not related to innovative behavior in homogeneous teams. In heterogeneous teams, however, task interdependence was strongly and positively related to innovative behavior for individuals who perceived high levels of goal interdependence, and unrelated to innovative behavior for those who perceived low levels of goal interdependence.

Members of organizational work groups necessarily find themselves in a situation characterized by some form of interdependence (Sundstrom, DeMeuse & Futrell, 1990). The degree and type of interdependence in work groups stems from several sources including role differentiation, the distribution of skills and resources, the manner in which goals are defined and achieved, and the manner in which performance is rewarded and feedback is given (Wageman, 1995). Educational (e.g., Johnson & Johnson, 1989), organizational (e.g., Saavedra, Earley & Van Dyne, 1993; Shea & Guzzo, 1987; Wageman, 1995, 2001), sociological (e.g., Lindenberg, 1997), and social psychological (e.g., Rosenbaum et al., 1980)

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research has shown that how this social interdependence is structured largely determines interpersonal interactions and productivity.

Although much is known about the effects of interdependence on several elements of group process and effectiveness, there is a paucity of studies devoted to the relationship between interdependence and innovative behavior. This is surprising, given the importance of creativity and innovativeness for most modern work organizations. To cope with global competition and environmental uncertainty, organizations need employees who not only fulfill their formal job requirements, but also exceed their standard work behaviors by engaging in innovative behavior (Janssen, 2001). As such, innovative behavior in the workplace is widely claimed to be crucial for the effective functioning of work teams and organizations (e.g., Amabile, 1988; Kanter, 1988; Katz & Kahn, 1966; Oldham & Cummings, 1996). Since innovation often is an interactive process in the sense that groups of individuals develop, promote, discuss, modify, and realize new ideas (Kanter, 1988; West & Farr, 1989), intrateam interdependencies may play an important role in predicting individual team members' innovative behavior.

Moreover, because work teams are becoming more diverse (Bowers, Pharmer & Salas, 2000; Jackson & Ruderman, 1995; Webber & Donahue, 2001; Williams & O'Reilly, 1998) it is important to investigate the effects of interdependence in more and less diverse groups. Research examining the relationship between group diversity and several elements of individual and team functioning has found that, although group diversity has a number of negative effects, it may also provide the cognitive resources and different perspectives that are necessary to produce innovative behavior (for reviews, see Jackson, 1992; Milliken & Martins, 1996; Williams & O'Reilly, 1998).

This study combines and integrates theory and research on intrateam interdependence and group diversity. Consistent with the current interactionist models of creativity and innovation, we suggest that an individual's innovative behavior is the complex product of a person's relationships with fellow team members and the team context (Woodman, Sawyer & Griffin, 1993; Woodman & Schoenfeldt, 1990). More specifically, we will argue that an individual team member's interdependence with other team members will be an important predictor of individual innovative behavior, and that the degree of work group diversity will attenuate the strength of this relationship. In the following, we begin with a definition of the concept of innovative behavior. Next, we discuss some general findings from the interdependence and diversity literatures, respectively. Finally, we develop an integrative cross-level model in which individual interdependence and group diversity jointly affect individual team members' innovative behavior. A subsequently reported multilevel survey study tests this model in real-life organizational teams.

Individual Innovative Behavior

Based on West and Farr (1989), an individual's innovative behavior is defined here as the intentional generation, promotion, and realization of new ideas within a work role, group or organization, in order to benefit role performance, the group, or the organization. Following Janssen (2000, 2001) and Scott and Bruce (1994), we conceive individual innovative work behavior in the workplace as complex behavior consisting of a set of three different

behavioral tasks: idea generation, idea promotion, and idea realization. Individual innovation begins with idea generation, that is, the production of novel and useful ideas in any domain (Amabile, Conti, Coon, Lazenby & Herron, 1996; Kanter, 1988; Woodman et al., 1993). Perceived work-related problems, incongruities, discontinuities, and emerging trends are often instigators of the generation of novel ideas (Drucker, 1985). The next task of the innovation process consists of idea promotion to potential allies. That is, once a worker has generated an idea, he or she has to engage in social activities to find friends, backers, and sponsors surrounding an idea, or to build a coalition of supporters who provide the necessary power behind it (Galbraith, 1982; Kanter, 1988). The final task of the innovation process concerns idea realization by producing a prototype or model of the innovation that can be experienced and ultimately applied within a work role, a group or the total organization (Kanter, 1988).

Individual innovative behavior is a broader and more complex concept than creative behavior. While creativity refers to the generation of novel and useful ideas, innovation also encompasses the successful promotion and implementation of creative ideas (Amabile et al., 1996; Woodman et al., 1993). As such, creativity by individuals is a starting point of innovation (Amabile et al., 1996). Since innovation processes are often characterized by discontinuous activities (Kanter, 1988; Schroeder, Van de Ven, Scudder & Polley, 1989), individuals can be expected to be involved in any combination of idea generation, idea promotion, and idea realization at any time (Scott & Bruce, 1994).

Finally, the scope of innovations ranges from the development and implementation of new ideas that innovate theories, practices, or products across the whole organization, to much smaller-scale ideas that are related to improvements in daily work processes and work designs (Axtel, Holman, Unsworth, Wall & Waterson, 2000). This study focuses on the innovative behavior of individual lower-level employees who are primarily able to contribute to smaller-scale innovations in the domain of their own work roles and work groups (cf. Axtel et al., 2000), albeit that these innovations often cross group boundaries and may therefore have repercussions for intersecting territories (Kanter, 1988).

General Findings from the Interdependence Literature

Generating, promoting, and implementing ideas by definition imply a social element. Almost all models addressing the issue of promoting innovation have therefore emphasized the important role of interpersonal interaction as a key antecedent variable (Hackman, 1990; Tannenbaum, Salas & Cannon-Bowers, 1996). Because the degree and type of interdependence between a team member and the other team members is generally seen as an important determinant of the quality of interpersonal interaction (Johnson & Johnson, 1989), it seems reasonable to posit a relationship between interdependence and innovative behavior. In order to better understand the possible relationship between interdependence and innovative behavior, a distinction will be made between perceived task and goal interdependence (cf. Mitchell & Silver, 1990).

Perceived task interdependence is the extent to which an individual team member believes that he or she depends on other members of the team for being able to carry out his or her job

(Brass, 1985; Kiggundu, 1983; Van der Vegt, Emans & Van de Vliert, 2000, 2001). It results from the work that organizations divide among work teams, that is further divided among individuals occupying different jobs or roles within their teams. As Brass (1985) and Pearce and Gregersen (1991) have pointed out, this division of labor results in different patterns of task interdependence among individual group members occupying different jobs and performing differentiated tasks. Thus, although the degree of perceived task interdependence of individuals within a work group may sometimes be similar, normally it will vary a great deal (Van der Vegt et al., 2000, 2001).

Perceived goal interdependence is defined as the extent to which an individual team member believes that his or her goals can be achieved only when the goals of other team members are also met (Weldon & Weingart, 1993). It is similar to the concepts of cooperation (Deutsch, 1949, 1973) and positive goal interdependence (Johnson & Johnson, 1989) in social interdependence theory. In laboratory studies, these perceptions of goal interdependence are usually induced by providing team members with group goals and group feedback or with rewards for collective performance (Weldon & Weingart, 1993). In field settings, however, individual perceptions of goal interdependence not only vary as a result of goal, feedback, and reward systems, but also as a result of numerous other factors including one's personality and other group members' behavior (Deutsch, 1973). Consequently, the level of perceived goal interdependence is also likely to vary substantially within work teams.

Outcomes of several laboratory experiments (Johnson, Johnson & Stanne, 1990; Miller & Hamblin, 1963; Rosenbaum et al., 1980; Saavedra et al., 1993), field studies (Van der Vegt et al., 2000, 2001; Wageman, 1995), and a meta-analysis (Stanne, Johnson & Johnson, 1999) revealed that the effects of task interdependence depends on the level of goal interdependence created by different goal, feedback, and reward systems. The more interaction required to complete the job (i.e., the higher the task interdependence), the more team members have the opportunity to either promote or hinder each other's performance (Stanne et al., 1999). Whether they will do the former or the latter will depend on the degree of perceived goal interdependence that is established within the team. With high levels of perceived goal interdependence, task interdependence is positively related to interpersonal helping and coordination because the more colleagues are enabled to perform well, the more they can contribute to the attainment of shared goals. With low levels of perceived goal interdependence, task interdependence is negatively related to interpersonal helping and coordination because individuals are tempted to use their power to behave competitively toward each other since individual interests prevail over collective interests (e.g., Mitchell & Silver, 1990; Saavedra et al., 1993).

General Findings from the Group Diversity Literature

Employees not only work under different interdependence conditions, but also with other individuals who may differ from themselves. Due to the changing demographics of the labor force, teams are becoming more diverse on a large number of demographic attributes (Webber & Donahue, 2001; Williams & O'Reilly, 1998). Moreover, work teams are

increasingly assembled from individuals varying in knowledge, skills, abilities, and attitudes (Bowers et al., 2000). As a result, the past decades have shown an increasing research interest in the effects of work group diversity.

Two different approaches have been distinguished in this group diversity literature: the demographic and the cognitive approach (cf. Kilduff, Angelmar & Mehra, 2000). The demographic approach emphasizes differences in directly measurable demographic attributes of individuals, such as gender, age, and tenure as determinants of attitudes, group process and effectiveness. The cognitive approach, in contrast, studies differences among team members through direct questionnaire measures of perceived differences in knowledge, values, and skills between individual team members who may be homogeneous or heterogeneous on demographic indicators (e.g., Kilduff et al., 2000; Nemeth, 1986).Research has shown that both types of group diversity may have both beneficial and detrimental effects on team functioning. On the one hand, demographic diversity may offer some advantages, including an increase in creativity, innovation, and the quality of performance (e.g., Drach-Zahavy & Somech, 2001; Watson, Kumar & Michaelsen, 1993). Discussion of diverse opinions allows diverse individuals to pool information and combine ideas which may stimulate synthetic solutions to work-related problems, thereby providing innovative performance benefits (e.g., Amabile, 1983; Jehn, Northcraft & Neale, 1999; Kickul & Gundry, 2001; Northcraft, Polzer, Neale & Kramer, 1995; Schwenk & Cosier, 1980). In the literature on innovation, combining or rearranging existing but different pieces of reality is considered as a key element of generating innovative ideas (for a review, see Kanter, 1988). In addition, research in the field of group decision making suggests that cognitive diversity may produce high-quality innovative decisions through "critical and investigative interaction processes in which team members identify, extract, and synthesize their different perspectives" (Amason, 1996: 124; see also Cosier & Schwenk, 1990; Schweiger, Sandberg & Ragan, 1986; Schweiger, Sandberg & Rechner, 1989; Schwenk, 1990). On the other hand, demographic and cognitive group diversity could have detrimental effects. Demographic and cognitive diversity in work teams may result in increased communication problems, conflict, and turnover (e.g., Jehn et al., 1999; Pelled, 1996), in decreased interpersonal attraction and cohesion (e.g., Harrison, Price & Bell, 1998; Terborg, Castore & DeNino, 1976), and in reduced team effectiveness (for reviews, see Jackson & Ruderman, 1995; Milliken & Martins, 1996; Williams & O'Reilly, 1998).

Much group diversity research usually presumes that diversity on demographic characteristics implies cognitive diversity with regard to such aspects as task-related knowledge, skills, and abilities, as well as values, beliefs, and attitudes (McGrath, Berdahl & Arrow, 1995). According to this perspective, as demographic diversity increases so do the group's cognitive resources and the ability to engage in more complex and innovative problem-solving (Bantel & Jackson, 1989; Jackson & Ruderman, 1995; Watson et al., 1993). However, other researchers have noted that demographic characteristics do not covary perfectly with these underlying psychological attributes (Bantel & Jackson, 1989; Hambrick & Mason, 1984), and that the link between demographic and cognitive diversity may be more complex than generally assumed (Kilduff et al., 2000; Lawrence, 1997). For this reason, this study tested the possible effects of both cognitive and demographic diversity in work teams simultaneously.

Joint Effects of Interdependence and Group Diversity on Innovative Behavior

The present study is an attempt to link previous theoretical and empirical research on interdependence, group diversity and innovative behavior. The proposed integrative cross-level model is depicted in Figure 1.

In this model, perceived task interdependence, perceived goal interdependence and innovative behavior are conceptualized as individual-level variables, whereas group diversity is considered to act as a contextual group-level variable. Because we have no theoretical reason to expect differential effects for cognitive and demographic group diversity, the relationships between perceived task interdependence, perceived goal interdependence and innovative behavior will be described for homogeneous and heterogeneous groups in general.

We propose that in homogeneous groups perceived task and goal interdependence may have few implications for innovative behavior because research has suggested that homogeneous teams tend to be far less innovative than heterogeneous teams (Hambrick, Cho & Chen, 1996; Hambrick & Mason, 1984; Watson et al., 1993). Due to the similarities between group members, the diversity in opinions, perspectives, and cognitive and informational resources in the group is low, and creative potential is relatively small. Therefore, it is unlikely that either the interpersonal contacts resulting from task interdependence, or perceptions of goal interdependence will lead to innovative behavior.

A different picture may emerge in groups characterized by high levels of diversity. A high level of group diversity brings more perspectives and ideas to groups and is a source of creativity and innovation. In such diverse groups, the interpersonal contacts among team members, resulting from higher levels of task interdependence, may have the potential to increase individual innovative behavior. However, based on the findings from the interdependence literature, we propose that the direction of the relationship between perceived task interdependence and innovative behavior will depend on the degree of perceived goal interdependence.

If a group member works under conditions of high task interdependence and perceives low levels of goal interdependence, he or she will develop less willingness to allow other

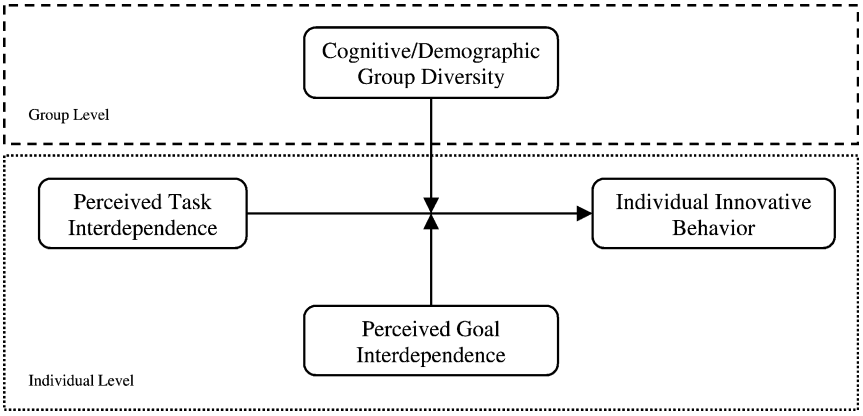

Figure 1. Cross-level research model for the joint effects of interdependence and group diversity on innovative behavior.

team members' actions to be substitutable for his or her own actions, few positive attitudes toward the interdependent others, and less readiness to be influenced by information, suggestions, and ideas provided by other interdependent members (cf. Deutsch, 1973). In such a work situation, diversity in perspectives and opinions may trigger the negative effects of mismatched task and goal interdependence, documented in the interdependence literature. That is, cooperation problems, distrust, and stereotyping among team members will inhibit a team member's willingness to combine and integrate diverse perspectives into innovative ideas. Moreover, the lack of cooperative interpersonal interactions make it unlikely that team members receive the necessary support to promote and realize novel and useful ideas. As a result, in diverse groups and for individuals who perceive low levels of goal interdependence, the relationship between task interdependence and innovative behavior will be absent or even negative.

Conversely, if a group member works under conditions of high task interdependence and perceives high levels of goal interdependence, he or she will experience high-quality social processes and extensive mutual learning, use the knowledge and skills of interdependent members to solve problems, and will be receptive to information and suggestions from interdependent others. In such a work situation, group diversity may provide the latent positive outcomes described in the group diversity and innovation literatures. That is, the facilitative and cooperative interactions with dissimilar group members, resulting from high task interdependence and high levels of perceived goal interdependence, will enhance the generation of creative thoughts, and stimulate and enable a team member to promote and implement useful ideas. Thus, in diverse groups and for individuals who perceive high levels of goal interdependence, task interdependence is likely to be positively related to innovative behavior.

Hypothesis 1: There will be a three-way interaction of perceived task interdependence, perceived goal interdependence and diversity (both cognitive and demographic) on individual innovative behavior.

Hypothesis 1a: Perceived task interdependence will be unrelated to innovative behavior among homogeneous groups regardless of the level of perceived goal interdependence.

Hypothesis 1b: The relationship between perceived task interdependence and individual innovative behavior will be absent or negative for individuals who perceive low levels of goal interdependence in heterogeneous teams.

Hypothesis 1c: The relationship between perceived task interdependence and individual innovative behavior will be positive for individuals who perceive low levels of goal interdependence in heterogeneous teams.

Method

Sample and Procedure

In order to test the hypothesis, a survey study was conducted in a Dutch multinational in the financial services sector. The sample consisted of individuals who worked in primary work

teams ranging in size from 4 to 18 members. A work team was defined as a group of personnel who (1) formed the smallest functional unit in the organization, (2) reported directly to the same supervisor, and (3) worked together on a permanent basis. All work teams were well-delineated; the members identified themselves with the team, and the management identified the members with the team. The activities of the teams were very diverse and varied from data entry activities and providing telephone services for customers, to conducting information technology projects and maintaining business contacts with other organizations.

The human resources department, in conjunction with the researchers, contacted the potential work teams and their members who might be included in the study. Only work teams located in The Netherlands and conforming to the above definition of a team were approached. An introduction letter and subsequent presentation for each of the teams during a team meeting informed the potential respondents about the nature of the study. It was explained that data would be collected from subordinates and their supervisors, that for data matching procedures each questionnaire contained a unique identification number, and that all information that could link respondents' names to identification numbers would be destroyed after the subordinate and supervisor data were successfully linked. Thus, complete confidentiality was guaranteed. Participation was voluntary. The researchers distributed questionnaires among the members of the work teams who had agreed to participate. The questionnaire included measures of task interdependence, goal interdependence, group diversity, and a number of control variables. A total of 535 questionnaires were distributed and 433 completed questionnaires were returned for a response rate of 81%. The response rate in each team was 65% or higher ($M = 79$, $SD = 12$).Team members' immediate supervisor received a rating form for each of their subordinates. The supervisor filled out the questionnaire and returned it directly to the researchers. Supervisor ratings were obtained for 396 of the 535 employees in the sample (74%). Because of missing data (e.g., incompletely answered questionnaires, receipt of a subordinate's questionnaire but no corresponding rating form from the subordinate's supervisor and vice versa), the final sample consisted of 343 respondents distributed across 41 work teams. The mean age was 36.85 years ($SD = 9.88$), 46% of the respondents were men, 78% were Dutch, 5% were Asians, 9% were African Americans, and 8% were Hispanics.

Measures

Perceived task interdependence. Five items based on previous research were used to measure individual team members' task interdependence (Van der Vegt et al., 2000, 2001). These items were: "I need information and advice from my colleagues to perform my job well"; "I have a one-person job; it is not necessary for me to coordinate or cooperate with others"; "I need to collaborate with my colleagues to perform my job well"; "My colleagues need information and advice from me to perform their jobs well"; "I regularly have to communicate with colleagues about work-related issues." Items were scored on seven-point Likert scales ranging from 'Completely disagree' (1) to 'Completely agree' (7). Scale reliability was .68.

Perceived goal interdependence. Three items adapted from previous research tapped individual team members' perception of goal interdependence (Tjosvold, 1984; Van der

Vegt, Emans & Van de Vliert, 1999). Respondents were asked to indicate to what extent each of the following statements described their relationship with the other team members: "Goal attainment for one team member facilitates goal attainment for the other team members"; "Gain for one team member means gain for the other team members"; "Success for one team member implies success for the other team members." Items were scored on seven-point Likert scales ranging from 'Completely disagree' (1) to 'Completely agree' (7). Scale reliability was .83.

Group diversity. We measured demographic diversity as well as the extent to which group members themselves believed that the members of their team differed in perspectives, attitudes, and skills. Cognitive group diversity was measured by asking employees to report on characteristics of their groups and aggregating those reports for each group. Aggregating employee perceptions is a common and valid means by which to assess group-level variables. Respondents indicated to what extent the members of the work group differed in their way of thinking, in their knowledge and skills, in how they viewed the world, and in their beliefs about what is right and wrong. Items were scored on seven-point Likert scales ranging from 'to a very small extent' (1) to 'to a very large extent' (7). Cronbach's alpha of the summative scale was .81. The appropriateness of aggregating cognitive diversity to the group level was assessed using r_{wg}, discussed by James, Demaree and Wolf (1984). This within-group agreement analysis yielded a median value of .84, and led us to conclude that the group members' scores on cognitive diversity were sufficiently homogeneous to warrant aggregation. Demographic group diversity was measured along three dimensions. We used the coefficient of variation (i.e., the standard deviation divided by the mean) to calculate age diversity, which was the only continuous diversity dimension. Scores for sex and ethnicity were computed using the entropy-based index (Teachman, 1980). This index is calculated with the formula

$$-\sum p_i(\ln p_i)$$

where p is the proportion of the group in the ith category. A higher index score indicates greater group diversity among team members along the particular dimension. Like Jehn et al. (1999), and Polzer, Milton and Swann (2001), we averaged the age, sex, and ethnicity diversity scores to produce one demographic group diversity measure.

Innovative behavior. This variable was assessed by using Janssen's (2001) nine-item scale of individual innovative behavior in the workplace. Drawing on Kanter's (1988) work on the stages of innovation, three items refer to idea generation ("Creating new ideas for improvements"; "Searching out new working methods, techniques, or instruments"; "Generating original solutions to problems"), three items refer to idea promotion ("Mobilizing support for innovative ideas"; "Acquiring approval for innovative ideas"; "Making important organizational members enthusiastic for innovative ideas"), and three items refer to idea realization ("Transforming innovative ideas into useful applications"; "Introducing innovative ideas into the work environment in a systematic way"; "Evaluating the utility of innovate ideas"). Immediate supervisors rated how often each individual team member performed the nine innovative work behaviors in the workplace. The response format was a seven-point scale ranging from 'never' (1) to 'always' (7). Scale reliability was .96.

Covariates. We controlled for several variables that were perceived to be common predictors of innovative behavior. First, past research has shown that group size may affect group dynamics (e.g., Pelled, 1996). Accordingly, we controlled for group size in all of our analyses. Information regarding this variable was obtained from company records. Second, we included a measure of task nonroutineness in our survey. Previous research has shown that people performing more nonroutine jobs are more likely to engage in innovative behavior (e.g., Oldham & Cummings, 1996). Six items adopted from Jehn et al. (1999) were used to measure this variable (e.g., "My job is very routine," "I feel like I am doing the same thing over and over again"). The response format was a seven-point scale ranging from 'completely disagree' (1) to 'completely agree' (7). Scale reliability was .86, with high scores reflecting nonroutineness. Finally, innovative behavior might be influenced by an individual's flexibility. Flexibility is defined as a personality variable reflecting an individual's capability to adjust oneself cognitively and behaviorally to new situations and experiences (Van der Zee & Van Oudenhoven, 2000). Twelve items were used to measure this variable (e.g., "Is looking for new experiences," "Switches easily from one activity to another"). Previous research has shown the validity of this scale and revealed positive relationships with both sensation seeking, need for change, and the openness to experience dimension of the Big Five, and a negative relationship with rigidity (Van der Zee & Van Oudenhoven, 2000). The response format was a five-point scale ranging from 'not at all applicable' (1) to 'totally applicable' (7). Scale reliability was .70.

Analysis

Given the hierarchical structure of our data, with individuals nested within groups, the factorial structure of the constructs under study was examined at both the individual and group level of analysis using exploratory multilevel factor analysis (Van de Vijver & Poortinga, 2002). When constructs are structurally equivalent at two levels of analysis, this forms important evidence that they have the same psychological meaning across these levels. If there is no close agreement between individual- and group-level factor structures, different constructs are needed to describe individual and group-level differences (Muthén, 1991). In the process of exploratory multilevel factor analysis, seperate factor analyses are carried out on the matrix of the sample means of the various items, and on the matrix of the individual deviation scores from the group mean (Van de Vijver & Poortinga, 2002). The factorial agreement of the factor structures is evaluated after target rotation has been carried out by means of Pearson correlation coefficients.

The predicted relationships between perceived interdependence and group diversity, on the one hand, and individual innovative behavior, on the other hand, were considered within a hierarchical linear model (Bryk & Raudenbush, 1992). This is a statistical model for hierarchically structured data which takes into account between-group variability as well as within-group variability in the variables of interest. Using ordinary regression analysis would possibly lead to unreliable results because individuals in the same group share common influences, so that the assumption of independent observations would be violated (cf. Bryk & Raudenbush, 1992). Data analysis was performed using the MLwiN computer package (Goldstein et al., 1998). Fitting a model in MLwiN decomposes the total observed variance into individual-level and group-level residual variances. We used

Snijders and Boskers (1994) formulae to compute the proportions of explained within- and between-group variance. These proportions of explained variance are comparable to the R^2 statistic in ordinary regression analysis. In addition to estimates of within-group and between-group residual variances, MLwiN produces a fixed effect coefficient for each predictor variable along with the associated standard error (*SE*). These fixed effect coefficients are comparable to the unstandardized regression coefficients in ordinary regression analysis and their significance level can be tested by using *t*-distribution tests (t = coefficient/*SE*). Finally, MLwiN produces a chi-square statistic, which indicates how well a given model fits the data. If two models are nested, the difference of the chi-squares for the two models can be used to perform a multivariate significance test of the effects.

Results

Response Bias

In order to test whether there were systematic differences between the respondents who were excluded as a result of missing supervisor ratings and those who were included in the final sample, we conducted a multivariate analysis of variance (MANOVA) using age, sex, ethnicity, task nonroutiness, flexibility, task interdependence, goal interdependence, and cognitive group diversity as the dependent variables, and whether or not they were included in the sample as the independent variable (dummy-coded). The results of the MANOVA were nonsignificant, indicating that there was no substantial response bias.

Exploratory Multilevel Factor Analysis

Before testing the hypothesized effects of perceived task interdependence, perceived goal interdependence and group diversity on innovative behavior, the pooled-within and the pooled-between matrices were factor analyzed, representing the individual and group level of analysis, respectively. Table 1 presents the pattern matrices for the individual- and group-level data obtained from the exploratory multilevel factor analyses with Oblimin rotation.

An inspection of Table 1 confirms the hypothesized four-factor structure at both the individual and group level of analysis: Each item showed high primary loadings on the intended factor, and lower loadings on the other factors. The correlations among the individual- and group-level factor patterns were .95, .91, .84, and .96 for perceived task interdependence, perceived goal interdependence, cognitive group diversity, and innovative behavior, respectively. The correspondence among the individual- and group-level factors was thus high, providing evidence for the invariance of the factor structure across levels of analysis.

Descriptive Statistics and Correlations

Table 2 presents means, standard deviations, and Pearson zero-order correlations among all variables. For the individual-level correlations, the scores for group size, and the cognitive and demographic group diversity measures were assigned to each individual. Group-level

Table 1
Results of exploratory multilevel factor analysis

Items	Individual-level factor loadings				Group-level factor loadings			
	I	II	III	IV	I	II	III	IV
1. Perceived task interdependence 1	.85	.20	.03	.16	.80	.05	.00	.03
2. Perceived task interdependence 2	.70	−.12	.20	.01	.70	−.02	−.07	.08
3. Perceived task interdependence 3	.80	.00	−.09	−.03	.82	.04	.12	−.11
4. Perceived task interdependence 4	.79	−.01	−.11	−.09	.86	−.01	−.06	−.02
5. Perceived task interdependence 5	.73	.10	.03	.07	.68	.09	.11	.06
6. Perceived goal interdependence 1	−.01	.72	.12	.09	.02	.83	−.02	−.07
7. Perceived goal interdependence 2	−.04	.86	.06	.06	.02	.91	−.02	.00
8. Perceived goal interdependence 3	−.15	.75	.16	.19	.01	.84	.05	.08
9. Cognitive group diversity 1	.07	−.10	.76	.16	.00	−.04	.65	−.18
10. Cognitive group diversity 2	−.05	−.34	.63	−.11	.02	.07	.81	−.06
11. Cognitive group diversity 3	−.04	.08	.65	.10	.22	−.08	.43	.18
12. Cognitive group diversity 4	.08	.04	.77	−.14	−.18	.08	.55	.16
13. Individual innovative behavior 1	.14	−.17	.14	.80	−.01	.00	.03	.87
14. Individual innovative behavior 2	.10	−.21	.07	.82	.03	−.03	.00	.85
15. Individual innovative behavior 3	.02	−.13	.11	.83	.03	.05	−.02	.90
16. Individual innovative behavior 4	.02	−.02	−.32	.86	.02	−.03	−.02	.84
17. Individual innovative behavior 5	−.04	−.10	−.13	.88	.03	.05	−.04	.85
18. Individual innovative behavior 6	−.04	.08	−.13	.96	−.01	.03	−.09	.88
19. Individual innovative behavior 7	.05	.01	.35	.84	−.03	.02	.02	.89
20. Individual innovative behavior 8	−.13	.07	.23	.78	−.05	−.03	.06	.87
21. Individual innovative behavior 9	−.09	.07	.25	.86	−.01	−.04	.02	.88
% explained variance	34.81	13.21	11.21	7.68	4.89	14.83	12.54	5.77
Eigenvalue	6.95	2.64	2.27	1.70	7.41	4.49	2.80	2.60

Table 2
Univariate statistics and Pearson correlations among the variables

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	*M*	*SD*
1. Group size	16.22	7.93	–	.06	.12	.17	−.13	.07	−.10	.10	14.23	7.58
2. Task nonroutineness	5.21	1.15	.07	–	.49***	.10	.13	.71***	.50***	.38*	5.16	.78
3. Flexibility	3.13	.45	.08	.14*	–	.23	.18	.44**	.42**	.31*	3.14	.20
4. Cognitive group diversity	3.98	.41	.06	.07	.09	–	.36*	.03	−.08	−.02	3.97	.42
5. Demographic group diversity	.39	.58	−.22***	.06	.08	.39***	–	−.02	.01	−.19	.40	.59
6. Perceived task interdependence	4.79	.95	.06	.43***	.19***	.06	.00	–	.56***	.24	4.80	.53
7. Perceived goal interdependence	4.10	1.37	.02	.16**	.12	−.04	.00	.14*	–	.43**	4.13	.67
8. Individual innovative behavior	2.82	1.11	.16**	.24***	.15**	−.04	−.14**	.15**	.13*	–	2.82	.70

Individual-level correlations are in the lower triangle ($N = 343$). Group-level correlations are in the upper triangle ($N = 41$).

* $p < .05$.

** $p < .01$.

*** $p < .001$.

correlations are the correlations between group means. As expected, flexibility and task nonroutiness were positively related to innovative behavior at both the individual and group level of analysis. Interestingly, cognitive group diversity was found to be significantly related to demographic group diversity. This provides some empirical support for the notion in the diversity literature that objective demographic group diversity produces diversity in knowledge, skills, and attitudes. However, cognitive group diversity appeared to be unrelated to innovative behavior, whereas demographic group diversity was weakly and negatively related to individual innovative behavior. Most of these relationships are in the expected direction and, taken together, they provide additional evidence for the construct validity of the scales used.

Levels of Analysis

As a next step in our analyses, we decomposed the total observed variance for perceived task interdependence, perceived goal interdependence, cognitive group diversity, innovative behavior, task nonroutineness, and flexibility into within-group and between-group variance using the MLwiN multilevel software (Goldstein et al., 1998). On the basis of this information the intraclass correlation (ICC; defined as the between-group variance divided by the sum of the between-group and the within-group variance) could be computed. This measure reflects the percentage of the total variance that can be attributed to differences between groups. The results showed the intraclass correlations for goal interdependence and flexibility to be nonsignificant (ICCs were .02 and .05, respectively), indicating that these variables are not directly influenced by group-level predictors. For task interdependence, cognitive group diversity, innovative behavior, and task nonroutineness the ICCs were .17, .52, .31, and .29, respectively (p's $< .001$), indicating that the between-group differences were substantial for these variables. However, for task interdependence, innovative behavior, and task nonroutineness the differences within groups were larger than those between groups. Moreover, with regard to task interdependence the results are consistent with findings from previous research (e.g., Van der Vegt et al., 2000, 2001), and suggest that it is useful to examine the effects of task interdependence at the individual level of analysis. Finally, it should be noted that the significant between-group variance for innovative behavior could reflect either real between-group differences in innovative behavior or the fact that some supervisors tend to be more lenient in their ratings of subordinates than others. In any case, this violation of the requirement of statistical independence emphasizes the need for multilevel analyses in which such effects are controlled.

Test of Hypotheses

To test for possible main and interactive effects of perceived task interdependence, perceived goal interdependence, and group diversity on innovative behavior, we conducted two separate two-level analyses using MLwiN. In the first analysis (A) using innovative behavior as the dependent variable, task and goal interdependence (Step 2), and cognitive group diversity (Step 3A) were added to the model, respectively, followed by their interaction terms (Steps 4A and 5A). Steps 3B, 4B, and 5B in Table 3 reflect the results of a separate analysis in which we used demographic group diversity as the indicator of group diversity,

Table 3
Results of multilevel analysis for cognitive and demographic group diversity

Predictor variables	Coefficient	Standard error	Increase in model fit	Cumulative explained variance	
				Within groups	Between groups
Step 1 (control variables)			χ^2 (3) = 18.789***	.080	.190
Group size	.012	.013			
Task nonroutineness	.209**	.059			
Flexibility	.112*	.052			
Step 2 (main effects)			χ^2 (2) = 1.651	.090	.190
Perceived task interdependence (TI)	.061	.058			
Perceived goal interdependence (GI)	.039	.054			
Step 3A (main effect)			χ^2 (1) = .247	.090	.190
Cognitive group diversity (CD)	−.046	.113			
Step 4A (two-way interactions)			χ^2 (3) = 3.843	.110	.190
TI × GI	.023	.050			
TI × CD	.100	.061			
GI × CD	−.082	.062			
Step 5A (three-way interaction)			χ^2 (1) = 3.823*		
TI × GI × CD	.108*	.047		.130	.220
Step 3B (main effect)			χ^2 (1) = 2.298	.090	.230
Demographic group diversity (DD)	−.054	.100			
Step 4B (two-way interactions)			χ^2 (3) = 2.277	.110	.260
TI × GI	.014	.050			
TI × DD	.063	.056			
GI × DD	−.069	.060			
Step 5B (three-way interaction)			χ^2 (1) = 4.982*	.150	.260
TI × GI × DD	.132**	.049			

* $p < .05$.
** $p < .01$.
*** $p < .001$.

instead of cognitive group diversity. To aid interpretation, all of the continuous predictor variables were standardized before calculation of the interaction terms and regression statistics (Aiken & West, 1991).

Hypothesis 1 predicted a three-way interaction between task interdependence, goal interdependence, and group diversity on innovative behavior. Before testing this hypothesis, we first entered our control variables in the first step of the hierarchical linear model. The results presented in Table 3 show that task nonroutineness and flexibility were positively related to innovative behavior, and explained 8% of the within-group variance and 19% of the between-group variance. Recall, however, that the ICC for flexibility was nonsignificant, indicating that this variable varies within groups only. This implies that the explanation of the between-group variance in innovative behavior in this step of the analysis is solely attributable to between-group differences in the degree of task nonroutiness. In Step 2, the

main effects of task and goal interdependence were entered, none of which were predictive for innovative behavior. The main effect of cognitive group diversity, entered in Step 3A, also turned out to be nonsignificant. All the possible two-way interactions were entered in Step 4A. This block was not predictive for innovative behavior either. Finally, in Step 5A, the three-way interaction between task interdependence, goal interdependence, and cognitive group diversity was entered. As expected, this interaction reached significance, and explained 2% of the within-group variance and 3% of the between-group variance in innovative behavior.[1]

Similar effects were found when we used demographic group diversity as an indicator of group diversity. After adding the control variables and the two interdependence dimensions to the hierarchical linear model, the main effect of demographic group diversity, entered in Step 3B, and all the possible two-way interactions, entered in Step 4B, turned out to be nonsignificant. However, the three-way interaction between task interdependence, goal interdependence, and demographic group diversity, entered in Step 5B, reached significance and explained 4% of the within-group variance in innovative behavior.

In keeping with Hypothesis 1a, and following the procedures described by Aiken and West (1991), the simple slope tests conducted to interpret the interaction effects revealed that under conditions of either low cognitive or demographic group diversity, neither task interdependence nor goal interdependence was related to innovative behavior. In contrast, in groups characterized by either high cognitive or high demographic group diversity, task

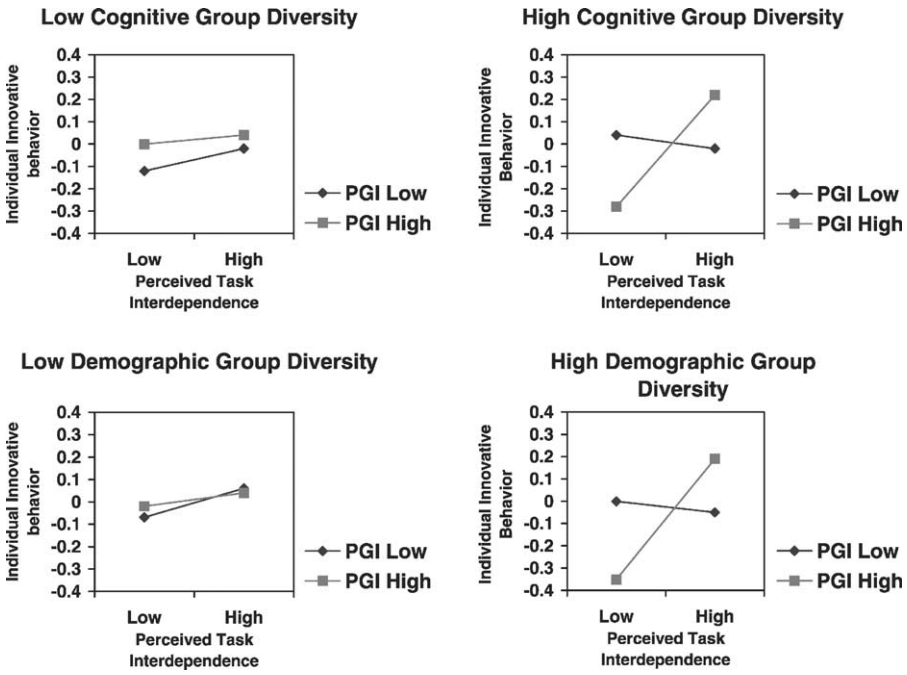

Figure 2. Three-way interaction between perceived task interdependence, perceived goal interdependence (PGI), and group diversity.

and goal interdependence interactively influenced innovative behavior. As expected, and consistent with Hypothesis 1b, for individual team members who perceived low levels of goal interdependence, individual task interdependence was not related to innovative behavior. For those who perceived high levels of goal interdependence, task interdependence was strongly and positively related to innovative behavior. This supported Hypothesis 1c. These effects are depicted in Figure 2.

Discussion

In line with the current interactionist models of organizational creativity and innovation (Woodman & Schoenfeldt, 1990; Woodman et al., 1993), we proposed that individual interdependence and group diversity would interactively affect the innovative behavior of individual team members. We distinguished between task interdependence and goal interdependence as possible relational determinants of innovative behavior, and between cognitive and demographic group diversity as possible contextual moderator variables.

Consistent with previous research on innovation (e.g., Oldham & Cummings, 1996), task nonroutineness and flexibility were found to be positively related to innovative behavior. In comparison to simplified work, nonroutine jobs are more challenging and require more thinking, which in turn promotes innovation. Additionally, flexible persons are more capable to adjust themselves cognitively and behaviorally to new situations and experiences, which stimulates innovative behavior (Van der Zee & Van Oudenhoven, 2000). In contrast to many findings in the group diversity literature (e.g., Bantel & Jackson, 1989; Drach-Zahavy & Somech, 2001; Hambrick et al., 1996), our results did not indicate a direct relationship between group diversity and innovative behavior. Although there was a significant zero-order correlation between demographic diversity and innovative behavior, this relationship disappeared after we controlled for group size, flexibility, task nonroutineness, and the interdependence dimensions in the multilevel analyses. Nevertheless, group diversity turned out to be important for innovative behavior because the hypothesized cross-level interaction between individual interdependence and group diversity reached significance. As expected, in homogeneous groups neither perceived task interdependence nor perceived goal interdependence were related to innovative behavior. Cross-level analyses revealed that task and goal interdependence interactively affected innovative behavior in heterogeneous groups only. That is, in heterogeneous groups and for team members who perceived low levels of goal interdependence, task interdependence was unrelated to innovative behavior. However, in heterogeneous groups and for team members who perceived high levels of goal interdependence, task interdependence was positively related to innovative behavior.

It is interesting to note that Figure 2 also revealed that the lowest level of innovative behavior appeared under conditions of low task interdependence and high perceived goal interdependence, whereas the highest level of innovative behavior occurred under conditions of high perceived task and goal interdependence. Under conditions of high goal interdependence combined with low levels of task interdependence team members work relatively independently, and yet the collective performance depends on each of them doing their job effectively. Under these conditions, the focus for many people may simply be to do their job the way they are supposed to, with little incentive to “rock the boat” by trying to change

things. Additionally, these individuals may be less motivated to contribute to the group product (Miller & Hamblin, 1963; Stanne et al., 1999). Such free-riding or social loafing effects may be especially strong in diverse groups that are known to reduce cohesiveness and interpersonal attraction (Jackson & Ruderman, 1995; Webber & Donahue, 2001; Williams & O'Reilly, 1998). By contrast, high levels of perceived goal interdependence combined with high levels of task interdependence stimulate learning and information exchange in heterogeneous groups, thereby resulting in more innovative behavior. This is in line with research in educational psychology showing that providing heterogeneous and task interdependent student groups with cooperative rewards stimulates cooperative learning and integration of perspectives (Maruyama, Knecxhel & Petersen, 1992).

Our findings are of theoretical interest for several reasons. First, our results support a social psychological perspective on individual innovation. Although several researchers in the field of creative and innovative behavior already suggested the importance of good interpersonal relationships for innovative behavior (e.g., Johnson, Donahue, Atkin & Johnson, 2001; Kanter, 1988; Scott & Bruce, 1994), few studies have empirically examined this relationship. A notable exception is a study by Scott and Bruce (1994) which looked at the quality of team member exchange (TMX) in research and development groups as one of several determinants of individual innovative behavior. However, they did not find a significant relationship between TMX and individual innovative behavior. They suggested that a plausible explanation for these findings is that intragroup task interdependence influences the relationship between TMX and innovative behavior. In a similar vein, we proposed and found that task interdependence and perceived goal interdependence would interactively influence innovative behavior in heterogeneous teams. In line with Scott and Bruce's (1994) suggestion our findings indeed suggest that cooperative interpersonal relationships, that are known to be the result of high task interdependence combined with high goal interdependence, may result in higher levels of innovative behavior, but in heterogeneous groups only.

Second, our findings are important for group diversity researchers. The mixed findings of work group diversity research have triggered a search for moderators of group diversity effects (e.g., Webber & Donahue, 2001). Although several possible moderators have been proposed in the literature (see e.g., Milliken & Martins, 1996; Williams & O'Reilly, 1998), the present study highlights the importance of the degree and type of individual team members' interdependence as major conditions under which they are able to benefit from group diversity. Our findings also provide an empirical base for the theoretical proposition in the diversity literature that the degree to which an individual's task structure encourages cooperation is likely to be relevant for understanding the consequences of diversity in work groups (e.g., Northcraft et al., 1995; Triandis, 1994).

Third, our results showed cognitive and demographic group diversity to be significantly interrelated. This provides some initial empirical support for a "trait-approach" to group diversity in which objective demographic differences are presumed to affect interaction and performance only in so far as such diversity is directly linked to differences in such underlying attributes as knowledge, skills, values, and beliefs (McGrath et al., 1995). Nevertheless, the modest relationship between demographic and cognitive group diversity found in this research suggests that we must be careful in equating both types of group diversity. Apparently, team members' perceptions of cognitive diversity are influenced by other

factors as well. More research that examines the exact relationships between demographic and cognitive group diversity as well as the antecedents and consequences of cognitive group diversity is clearly needed. Nevertheless, although cognitive and demographic group diversity were only modestly related, they were found to have similar moderating effects on the relationship between interdependence and innovative behavior. This does suggest that it is indeed the diversity in knowledge, values, and skills, resulting from demographic differences, that potentially promotes individual innovative behavior in work teams.

Fourth, the exploratory multilevel factor analysis revealed that the factor structure of the concepts of task interdependence, goal interdependence, and innovative behavior were invariant across levels of analysis. The use of a hierarchical linear model therefore allowed us to examine the individual- and group-level effects of our predictor variables simultaneously. Interestingly, the results of these multilevel analyses showed that individual task interdependence, perceived goal interdependence, and innovative behavior varied more within than between groups. If this pattern of results is replicated in future research, it may be worthwile for researchers to focus more on individual-level instead of group-level explanatory variables in their research because these explain the largest part of the variance in innovative behavior. In addition, the cross-level interactions were found to explain especially within-group variance in innovative behavior. These effects suggest that the interplay of individuals within the context of groups may be as interesting to study as individuals or groups *per se*.

The results of this study are, of course, limited by its operations. First, although the use of supervisor ratings of innovative behavior avoided mono-method bias, our study did not answer any questions associated with the direction of causality. Are more innovative people, for example, also more innovative in managing mismatched task and goal interdependencies in heterogeneous groups? Because our dependent variable was innovative behavior rather than innovative outcomes, and because the interdependence measures were self-report causality was difficult to tease apart. Longitudinal research assessing the influence of interdependence and group diversity over time would provide additional and even stronger support for the effects reported here. Such designs may also help to clarify the direction of causality between interdependence, group diversity, and innovative behavior. Second, although the diverse activities of the work groups included in our sample seems to support a cautious generalization of the results to other settings, replications and extensions are needed. Future research might try to replicate our findings in teams and organizations operating in other domains than the financial services industry.

Finally, the ICCs demonstrated that the degree of intrateam interdependence varied considerably. Although our multilevel analyses enabled us to examine the individual- and group-level effects of perceived interdependence simultaneously, we did not examine the possible effects of the dispersion in the degree of interdependence within groups because this variable was not included in our theoretical model. It is nevertheless possible that in groups in which the level of interdependence varies, the dynamics may be different than in groups that are homogeneous with regard to the degree of intrateam interdependence. Future research may develop a theoretical rationale.

Despite possible limitations, our findings may have some implications on an applied level. They show innovative behavior to strongly depend on the work environment, including job design, interdependence characteristics, and group composition. This suggests that these

task characteristics may be straightforward variables to address in intervention efforts. Changes in the work environment could make possible substantial increases in individual innovative behavior (Amabile, 1988). The results of this study suggest that, if management wants to stimulate innovative work performance, it is best to create diverse work teams in which members perceive high task and goal interdependence. When group members are task interdependent and have dissimilar values, beliefs and knowledge, they need to perceive goal interdependence in order to gain the benefits from group diversity. Management could induce perceptions of goal interdependence by formulating group goals, rewarding the group as a whole for collective performance, and providing group feedback (cf. Tjosvold, 1984). However, before conclusive recommendations can be offered regarding how to stimulate the positive effects of diversity in ongoing work teams, more research is clearly needed.

In conclusion, the results of the present study show that interdependence can be beneficial to individual team members' innovative behavior. More specifically, it is the cooperative interdependence resulting from high task and goal interdependence that enables individual team members to exploit the benefits of diverse values, skills, and perspectives in diverse groups at work.

Note

1. Tests of our hypothesis using ordinary multiple regression analysis resulted in stronger effects, suggesting that ordinary regression models indeed overestimated effect sizes as a result of statistical dependence in the data.

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References

Aiken, L. S., & West, S. G. 1991. *Multiple regression: Testing and interpreting interactions*. California: Sage Publications.

Amabile, T. M. 1983. The social psychology of creativity. *Journal of Personality and Social Psychology*, 45: 357–376.

Amabile, T. M. 1988. A model of creativity and innovation in organizations. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior*: Vol. 10, 123–167.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. 1996. Assessing the work environment for creativity. *Academy of Management Journal*, 39: 1154–1184.

Amason, A. C. 1996. Distinguishing the effects of functional and dysfunctional conflict on strategic decision making: Resolving a paradox for top management teams. *Academy of Management Journal*, 39: 123–148.

Axtel, C. M., Holman, D. J., Unsworth, K. L., Wall, T. D., & Waterson, P. E. 2000. Shopfloor innovation: Facilitating the suggestion and implementation of ideas. *Journal of Occupational and Organizational Psychology*, 73: 265–285.

Bantel, K. A., & Jackson, S. E. 1989. Top management and innovations in banking: Does the composition of the top team make a difference? *Strategic Management Journal*, 10: 107–124.

Bowers, C. A., Pharmer, J. A., & Salas, E. 2000. When member homogeneity is needed in work teams: A meta-analysis. *Small Group Research*, 31: 305–327.

Brass, D. J. 1985. Technology and the structuring of jobs: Employee satisfaction, performance, and influence. *Organizational Behavior and Human Decision Processes*, 35: 216–240.

Bryk, A. S., & Raudenbush, S. W. 1992. *Hierarchical linear models: Applications and data analysis methods*. California: Sage Publications.

Cosier, R. A., & Schwenk, C. R. 1990. Agreement and thinking alike: Ingredients for poor decisions. *Academy of Management Executive*, 4: 69–74.

Deutsch, M. 1949. An experimental study of the effects of cooperation and competition upon group process. *Human Relations*, 2: 199–231.

Deutsch, M. 1973. *The resolution of conflict*. New Haven: Yale University Press.

Drach-Zahavy, A., & Somech, A. 2001. Understanding team innovation: The role of team processes and structures. *Group Dynamics: Theory, Research, and Practice*, 5: 111–123.

Drucker, P. F. 1985. *Innovation and entrepreneurship: Practice and principles*. London: Heinemann.

Galbraith, J. R. 1982. Designing the innovating organization. *Organizational Dynamics*, 10: 5–25.

Goldstein, H., Rasbash, J., Plewis, I., Draper, D., Browne, W., Yang, M., Woodhouse, G., & Healy, M. 1998. *A user's guide to MLwiN*. University of London.

Hackman, J. R. 1990. *Groups that work (and those that don't)*. San Francisco: Jossey-Bass.

Hambrick, D., Cho, T., & Chen, M. J. 1996. The influence of top management team heterogeneity on firms' competitive moves. *Administrative Science Quarterly*, 41: 659–684.

Hambrick, D., & Mason, P. M. 1984. Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9: 193–206.

Harrison, D. A., Price, K. H., & Bell, M. P. 1998. Beyond relational demography: Time and the effects of surface- and deep-level diversity on work group cohesion. *Academy of Management Journal*, 41: 96–107.

Jackson, S. E. 1992. Team composition in organizations. In S. Worchel, W. Wood, & J. Simpson (Eds.), *Group process and productivity*: 1–12. California: Sage Publications.

Jackson, S. E., & Ruderman, M. N. 1995. *Diversity in work teams: Research paradigms for a changing workplace*. Washington, DC: American Psychological Association.

James, L. R., Demaree, R. G., & Wolf, G. 1984. Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology*, 69: 85–98.

Janssen, O. 2000. Job demands, perceptions of effort-reward fairness, and innovative work behavior. *Journal of Occupational and Organizational Psychology*, 73: 287–302.

Janssen, O. 2001. Fairness perceptions as a moderator in the curvilinear relationships between job demands, and job performance and job satisfaction. *Academy of Management Journal*, 44: 1039–1050.

Jehn, K. E., Northcraft, G. B., & Neale, M. A. 1999. Why differences make a difference: A field study of diversity, conflict, and performance in work groups. *Administrative Science Quarterly*, 44: 741–763.

Johnson, J. D., Donahue, W. A., Atkin, C. K., & Johnson, S. 2001. Communication, involvement, and perceived innovativeness. *Group and Organization Management*, 26: 24–52.

Johnson, D. W., & Johnson, R. T. 1989. *Cooperation and competition: Theory and research*. Edina, MN: Interaction Book Company.

Johnson, D. W., Johnson, R. T., & Stanne, M. B. 1990. Impact of group processing on achievement in cooperative groups. *Journal of Social Psychology*, 130: 507–516.

Kanter, R. M. 1988. When a thousand flowers bloom: Structural, collective, and social conditions for innovation in organizations. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior*: Vol. 10, 169–211.

Katz, D., & Kahn, R. L. 1966. *The social psychology of organizations*. New York: Wiley.

Kickul, J., & Gundry, L. K. 2001. Breaking through boundaries for organizational innovation: New managerial roles and practices in e-commerce firms. *Journal of Management*, 27: 347–361.

Kiggundu, M. N. 1983. Task interdependence and job design: Test of a theory. *Organizational Behavior and Human Performance*, 31: 145–172.

Kilduff, M., Angelmar, R., & Mehra, A. 2000. Top management-team diversity and firm performance: Examining the role of cognitions. *Organization Science*, 11: 21–34.

Lawrence, B. S. 1997. The black box of organizational demography. *Organization Science*, 8: 1–22.

Lindenberg, S. M. 1997. Grounding groups in theory: Functional, cognitive, and structural interdependencies. *Advances in Group Processes*, 14: 281–331.

Maruyama, G. M., Knecxhel, S., & Petersen, P. 1992. The impacts of role reversal and minority empowerment strategies on decision making in numerically unblanced cooperative groups. In R. Hertz-Lazarowitz & N. Miller (Eds.), *Interaction in cooperative groups*. Cambridge: Cambridge University Press.

McGrath, J. E., Berdahl, J. L., & Arrow, H. 1995. Traits, expectations, culture, and clout: The dynamics of diversity in work groups. In S. E. Jackson & M. N. Ruderman (Eds.), *Diversity in work teams: Research paradigms for a changing workplace*: 17–46. Washington, DC: American Psychological Association.

Miller, L. K., & Hamblin, R. L. 1963. Interdependence, differential rewarding, and productivity. *American Sociological Review*, 28: 768–777.

Milliken, J. F., & Martins, L. L. 1996. Searching for common threads: Understanding the multiple effects of diversity in organizational groups. *Academy of Management Review*, 21: 402–433.

Mitchell, T. R., & Silver, W. S. 1990. Individual and group goals when workers are interdependent: Effects on task strategies and performance. *Journal of Applied Psychology*, 75: 185–193.

Muthén, B. O. 1991. Multilevel factor analysis of class and student achievement components. *Journal of Educational Measurement*, 28: 338–354.

Nemeth, C. J. 1986. Differential contributions of majority and minority influence. *Psychological Review*, 93: 23–32.

Northcraft, G. B., Polzer, J. T., Neale, M. A., & Kramer, R. M. 1995. Diversity, social identity, and performance: Emergent social dynamics in cross-functional teams. In S. E. Jackson & M. N. Ruderman (Eds.), *Diversity in work teams: Research paradigms for a changing workplace*: 69–97. Washington, DC: American Psychological Association.

Oldham, G. R., & Cummings, A. 1996. Employee creativity: Personal and ontextual factors at work. *Academy of Management Journal*, 39: 607–634.

Pearce, J. L., & Gregersen, H. B. 1991. Task interdependence and extrarole behavior: A test of the mediating effects of felt responsibility. *Journal of Applied Psychology*, 76: 838–844.

Pelled, L. H. 1996. Demographic diversity, conflict, and work group outcomes: An intervening process theory. *Organization Science*, 7: 615–631.

Polzer, J. T., Milton, L. P., & Swann, W. B. 2001. *Capitalizing on diversity: Interpersonal congruence in small work groups*. Best Paper Proceedings, Academy of Management, Washington, DC.

Rosenbaum, M. E., Moore, D. L., Cotton, J. L., Cook, M. S., Hieser, R. A., Shovar, M. N., & Gray, M. J. 1980. Group productivity and process: Pure and mixed reward structures and task interdependence. *Journal of Personality and Social Psychology*, 39: 626–642.

Saavedra, R., Earley, P. C., & Van Dyne, L. 1993. Complex interdependence in task-performing groups. *Journal of Applied Psychology*, 78: 61–72.

Schroeder, R., Van de Ven, A., Scudder, G., & Polley, D. 1989. The development of innovation ideas. In A. Van de Ven, H. Angle, & M. Poole (Eds.), *Research on the management of innovation: The Minnesota studies*: 107–134. New York: Harper & Row.

Schweiger, D. M., Sandberg, W. R., & Ragan, J. W. 1986. Group approaches for improving strategic decision making: A comparative analysis of dialectical inquiry, devil's advocacy and consensus. *Academy of Management Journal*, 29: 51–71.

Schweiger, D. M., Sandberg, W. R., & Rechner, P. L. 1989. Experiental effects of dialectical inquiry, devil's advocacy and consensus approaches to strategic decision making. *Academy of Management Journal*, 32: 745–772.

Schwenk, C. R. 1990. Conflict in organizational decision making: An exploratory study of its effects in for-profit and not-for-profit organizations. *Management Science*, 36: 436–448.

Schwenk, C. R., & Cosier, R. A. 1980. Effects of the expert, devil's advocate, and dialectical inquiry methods on prediction performance. *Organizational Behavior and Human Performance*, 26: 409–424.

Scott, W. E., & Bruce, R. A. 1994. Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal*, 37: 580–607.

Shea, G. P., & Guzzo, R. A. 1987. Groups as human resources. In G. R. Ferris & K. M. Rowland (Eds.), *Research in personnel and human resources management*: Vol. 5, 323–356. Greenwich, CT: JAI Press.

Snijders, T. A. B., & Bosker, R. J. 1994. Modeled variance in two-level models. *Sociological Methods and Research*, 22: 342–363.

Stanne, M. B., Johnson, D. W., & Johnson, R. T. 1999. Does competition enhance or inhibit motor performance: A meta-analysis. *Psychological Bulletin*, 125: 133–154.

Sundstrom, E., De Meuse, K. P., & Futrell, D. 1990. Work teams: Applications and effectiveness. *American Psychologist*, 45: 120–133.

Tannenbaum, S. I., Salas, E., & Cannon-Bowers, J. A. 1996. Promoting team effectiveness. In M. West (Ed.), *Handbook of work group psychology*: 503–520. New York: Wiley.

Teachman, J. D. 1980. Analysis of population diversity. *Sociological Methods*, 8: 341–362.

Terborg, J. R., Castore, C., & DeNinno, J. A. 1976. A longitudinal field investigation of the impact of group composition on group performance and cohesion. *Journal of Personality and Social Psychology*, 34: 782–790.

Tjosvold, D. 1984. Cooperation theory and organizations. *Human relations*, 37: 743–767.

Triandis, H. 1994. *Culture and social behavior*. New York: McGraw-Hill.

Van de Vijver, F. J. R., & Poortinga, Y. H. 2002. Structural equivalence in multilevel research. *Journal of Cross-Cultural Psychology*, 33: 141–156.

Van der Vegt, G. S., Emans, B. J. M., & Van de Vliert, E. 1999. Interdependence in project teams. *Journal of Social Psychology*, 139: 202–214.

Van der Vegt, G. S., Emans, B. J. M., & Van de Vliert, E. 2000. Affective responses to intragroup interdependence and job complexity. *Journal of Management*, 26: 633–655.

Van der Vegt, G. S., Emans, B. J. M., & Van de Vliert, E. 2001. Patterns of interdependence in work teams: A two-level investigation of the relations with job and team satisfaction. *Personnel Psychology*, 54: 51–69.

Van der Zee, K. I., & Van Oudenhoven, J. P. 2000. The multicultural personality questionnaire: A multidimensional instrument of multicultural effectiveness. *European Journal of Personality*, 14.: 291–309.

Wageman, R. 1995. Interdependence and group effectiveness. *Administrative Science Quarterly*, 40: 145–180.

Wageman, R. 2001. The meaning of interdependence. In M. E. Turner (Ed.), *Groups at work: Theory and research*: 197–217. Mahwah, NJ: LEA.

Watson, W. E., Kumar, K., & Michaelsen, L. K. 1993. Cultural diversity's impact on interaction process and performance: Comparing homogeneous and diverse task groups. *Academy of Management Journal*, 36: 590–602.

Webber, S. S., & Donahue, L. M. 2001. Impact of highly and less job-related diversity on work group cohesion and performance: A meta-analysis. *Journal of Management*, 27: 141–162.

Weldon, E., & Weingart, L. R. 1993. Group goals and group performance. *British Journal of Social Psychology*, 32: 307–334.

West, M. A., & Farr, J. L. 1989. Innovation at work: Psychological perspectives. *Social Behavior*, 4: 15–30.

Williams, K., & O'Reilly, C. 1998. The complexity of diversity: A review of forty years of research. *Research in Organizational Behavior*, 20: 77–140.

Woodman, R. W., Sawyer, J. E., & Griffin, R. W. 1993. Toward a theory of organizational creativity. *Academy of Management Review*, 18: 293–321.

Woodman, R. W., & Schoenfeldt, L. F. 1990. An interactionist model of creative behavior. *Journal of Creative Behavior*, 24: 279–290.

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