Motivated Information Processing, Social Tuning, and Group Creativity

Myriam N. Bechtoldt, Carsten K. W. De Dreu,
and Bernard A. Nijstad
University of Amsterdam

Hoon-Seok Choi
Sungkyunkwan University

The extent to which groups are creative has wide implications for their overall performance, including the quality of their problem solutions, judgments, and decisions. To further understanding of group creativity, we integrate the motivated information processing in groups model (De Dreu, Nijstad, & Van Knippenberg, 2008) with work on epistemic social tuning (Lunn, Sinclair, Whitchurch, & Glenn, 2007). Three propositions were advanced: (a) Groups produce more ideas when members have high rather than low epistemic motivation, especially when members also have a prosocial rather than pro-self motivation; (b) these ideas are more original, appropriate, or feasible when a group norm favors originality, appropriateness, or feasibility; and (c) originality is valued more in individualistic cultures (e.g., the Netherlands), whereas appropriateness is valued more in collectivist cultures (e.g., Korea). Four studies involving 3-person groups generating ideas supported these propositions: Epistemic motivation (mild vs. intense time pressure; presence vs. absence of process accountability) stimulated production and originality, especially when prosocial rather than pro-self motives were present and participants were Dutch or originality norms were experimentally primed. When appropriateness norms were primed or participants were Korean, epistemic motivation stimulated production and appropriateness, especially when prosocial rather than pro-self motives were present. We discuss implications for research on group processes and for work on culture and creativity.

Keywords: creativity, groups, information processing, motivation, innovation

Much creative work is done in groups: For example, groups of scientists generate research hypotheses (Dunbar, 1995), teams of managers generate ideas on how to improve the functioning of their organization (West & Anderson, 1996), and teams of designers generate ideas about new products (Sutton & Hargadon, 1996). Indeed, to solve problems, to adapt to their changing environments, and to innovate, both groups and their individual members need creativity—they need to generate insights, ideas, problem solutions, products, or services that are new and useful (Amabile, 1996).

Most research studying group creativity has focused on the factors differentiating creativity by individuals working in groups from creativity by individuals working alone (e.g., Diehl & Stroebe, 1987; Karau & Williams, 1993; Mullen, Johnson, & Salas, 1991; Nijstad & Stroebe, 2006; Paulus, Dzindolet, Poletes, & Camacho, 1993). This work reveals why individuals brainstorming alone tend to be more creative than individuals brainstorming in groups, but it scarcely illuminates the group processes underlying group creativity. Studies that specifically focused on group creativity produced a great number of findings on such diverse variables as time pressure (Kelly & Karau, 1993), mood states (e.g., Grawitch, Munz, Elliott, & Mathis, 2003), changes in group composition (e.g., Choi & Thompson, 2005), and dissent (Gruenfeld, Thomas-Hunt, & Kim, 1998; Nemeth, Personnaz, Personnaz, & Goncalo, 2004; Van Dyne & Saavreda, 1996). Unfortunately, however, these and other studies on group creativity did not always produce consistent results. Moreover, an overarching theoretical framework from which these and other findings can be understood is sorely missing.

To redress this state of affairs, in the current research, we used the motivated information processing in groups model (MIP-G; De Dreu, Nijstad, & Van Knippenberg, 2008). MIP-G allows one to understand the influence of many seemingly different antecedent conditions in terms of a parsimonious set of core motives that individual group members have or adopt and that drive group information search, processing, and dissemination. Although

MIP-G has not been tested in the realm of group creativity, it allows predictions regarding the ways group members generate and integrate new ideas and problem solutions. However, as is elaborated on below, additional theorizing is needed to understand which facets of creative production in groups are driven by the core motivational factors identified in MIP-G. Specific predictions were tested in four experiments. Experiments 1–3 were carried out in a Western context (the Netherlands) and provided good support for our key hypotheses. Experiment 4 was conducted in an Eastern context (Korea) to test specific hypotheses about the ways cultural differences may interact with the core motives identified within MIP-G.

MIP-G

MIP-G (De Dreu, Nijstad, & Van Knippenberg, 2008) is applicable to groups working on nonroutine, cognitive tasks (including creativity tasks) and builds on the view of groups as information processors (e.g., Hinsz, Tindale, & Vollrath, 1997). It assumes that group members search and process information and that through communication, individual-level information processing becomes integrated at the group level, where it affects other individuals in the group, gets distorted and ignored, or is analyzed deliberately. This cycling between individual-level and group-level information processing continues until creative ideas have been developed, a decision is reached, or some judgment is rendered. However, according to MIP-G, information processing at both the individual and the group levels can be more or less shallow and heuristic, or it can be deliberate and systematic (see also Chaiken & Trope, 1999; Stasser & Birchmeier, 2003). Under systematic information processing, more attention is given to available and new information, additional information is searched for, and information is communicated and integrated in a deliberate manner.

The extent to which information is processed systematically depends, according to MIP-G, on group members' epistemic motivation—their willingness to expend effort to achieve a thorough and rich understanding of the world, including the group task or decision problem at hand (De Dreu, Nijstad, & Van Knippenberg, 2008; also see Lundgren & Prislin, 1998; Lunn, Sinclair, Whitchurch, & Glenn, 2007). Whereas epistemic motivation partially depends on dispositional tendencies such as need for cognition (Petty & Cacioppo, 1986) and need for nonspecific closure (Webster & Kruglanski, 1994), it can also be activated by situational cues. Preference diversity within the group, for example, lowers group members' confidence in the adequacy of their initial judgments, raises epistemic motivation, and induces more systematic information processing (Nijstad & Kaps, 2008; Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2006). Likewise, making people accountable for the decision-making process—asking them to give reasons for their way of handling a task—raises epistemic motivation and the tendency to engage in systematic and effortful information processing (De Dreu, Koole, & Steinel, 2000; Lerner & Tetlock, 1999; Scholten, Van Knippenberg, Nijstad, & De Dreu, 2007). And, to look at it from the other way around, time pressure increases people's need for quick solutions and therefore decreases epistemic motivation (De Dreu, 2003; De Grada, Kruglanski, Mannetti, & Pierro, 1999).

Whereas epistemic motivation promotes the depth and care with which information is searched for, processed, communicated, and integrated, MIP-G postulates that the kind of information that is searched for, processed, and communicated depends on group members' social motivation—their preference for outcome distributions between oneself and other group members (e.g., De Dreu, Nijstad, & Van Knippenberg, 2008). Social motivation can be pro-self (i.e., the individual is concerned with his or her own outcomes only) or prosocial (i.e., the individual is concerned with joint outcomes and fairness). As with epistemic motivation, social motivation can be trait based or state based. For example, people scoring high on agreeableness are cooperative and empathic (Feist, 1998), and they are more likely to adopt a prosocial rather than pro-self motivation (Barry & Friedman, 1998). Alternatively, a prosocial motivation can be induced by situational cues. Under positive moods, people tend to adopt more cooperative attitudes and have a more prosocial motivation (Carnevale & Isen, 1986). And financial incentive schemes rewarding collective rather than individual performance induce prosocial versus pro-self motivation, respectively (De Dreu, Weingart, & Kwon, 2000).[1]

According to MIP-G, group members with prosocial motivation are more likely to search for, attend to, and communicate information that is conducive to group goals such as preserving and boosting harmony and achieving collectively beneficial, high-quality agreements. Group members with a pro-self motivation, in contrast, are more likely to search for, attend to, and communicate information that is conducive to personal goals such as preserving or boosting their personal status and power position within the group, defending themselves against possible exploitation and abuse by others, and achieving personal success. It is important to note that these differences between prosocial and pro-self individuals have different effects under low versus high levels of epistemic motivation. Low epistemic motivation leads pro-self group members to operate on an "everything you say may be used against you" heuristic: To safeguard their personal interests, they engage in as little information exchange as possible. Prosocial group members under low epistemic motivation operate on a "consensus implies correctness" heuristic: To preserve harmony and cohesion, they quickly seek to establish and converge on consensus. In contrast, high epistemic motivation leads pro-self group members to engage in debate and argument, effortful deception, and selective provision of information in a self-serving way, and it leads prosocial group members to engage in problem-solving behavior to uncover or design the best possible outcome for the entire group.

Thus far, MIP-G has received good empirical support. Cooperative groups make better decisions when members are process accountable (Kerschreiter, Schulz-Hardt, Mojzisch, & Frey, 2008; Scholten et al., 2007; also see Postmes, Spears, & Cihangir, 2001). Members of work teams exchange information better, learn more, and perform more effectively, especially when prosocial, cooperative outcome interdependence combines with high rather than low

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[1] Although epistemic motivation in principle is orthogonal to social motivation, some variables may influence both epistemic and social motivation. For example, positive mood states have been proposed to trigger prosocial motivation (Carnevale & Isen, 1986) as well as reduce motivation to engage in deep and deliberate information processing (Baas, De Dreu, & Nijstad, 2008). In the current research, we thus took care to select triggers of epistemic motivation that are known to have little influence on social motivation and vice versa.

task reflexivity (a proxy to epistemic motivation; De Dreu, 2007). And in negotiation, individuals engage in more problem solving and reach more integrative agreements when they have prosocial rather than selfish goals, but, again, this is the case only when epistemic motivation is high rather than low (De Dreu, Beersma, Stroebe, & Euwema, 2006; Halevy, 2008).

Group Creativity

Core principles identified within MIP-G can be used to understand the conditions under which groups become more or less creative and may help integrate previous work. Creativity can be defined as the generation of ideas, problem solutions, or insights that are novel and appropriate (Amabile, 1996; Runco, 2004). Thus, creativity requires something to be new and original in terms of (in)frequency—not many others have or have had that same idea, insight, or solution. In addition, creativity requires something to be appropriate, which is defined as fitting the problem— somehow, the idea, insight, or solution has to make sense and be feasible. Ideas that are new and original but not appropriate are bizarre rather than creative.

To assess creative performance in groups, researchers often consider fluency—the number of nonredundant ideas, problem solutions, and insights generated by the individual or the group. Among other things, this work reveals a positive correlation between fluency and originality: Sheer production appears to predict originality of ideas and problem solutions (De Dreu, Baas, & Nijstad, 2008; De Dreu & Nijstad, 2008; Diehl & Stroebe, 1987; Osborn, 1953). The strength of this correlation varies with the operationalization of originality. Research shows very strong correlations between fluency and the number of ideas that are rated to be highly original (e.g., $r = .81$ in Diehl & Stroebe, 1987; $r = .69$ in Parnes & Meadow, 1959). The correlation between fluency and the average originality of ideas is weaker and not significant in every study. However, a recent meta-analysis of 13 independent studies revealed a positive and significant correlation ($\rho = .22$; 95% CI [0.07, 0.37]) between fluency and average originality of ideas (Nijstad, De Dreu, Rietzschel, & Baas, 2010). Two compatible explanations have been offered for this pattern. First, Nijstad and Stroebe (2006) have argued and shown that with each new idea that is being generated within a particular cognitive category, the probability that something is novel and infrequent increases. For example, in the early phase of brainstorming, people tend to mention the most accessible ideas that are unlikely to be original; yet, when they continue and accessible ideas are depleted, there is more and more room for novel and uncommon ideas to come out (see also Rietzschel, Nijstad, & Stroebe, 2007). Second, Simonton (1997, 2003) has argued and shown that production increases the probability that some ideas and insights get noticed by others and are picked up and pursued: These are the insights, ideas, and solutions deemed to be groundbreaking and that provide disproportionate influence on subsequent artistic or scientific developments.

The preceding discussion reveals that creativity is, to a large extent, socially defined: Whether an idea or insight is deemed original and/or appropriate is an evaluation made by an audience of fellow group members (Csikszentmihalyi, 1996; Farrell, 2001; Simonton, 1997). As we show below, there is reason to believe that the group setting within which creative tasks are performed oper-

ates as a double-edged sword. First, the group setting brings about group processes that are more or less conducive to productivity in general and creative performance in particular. This process is captured by MIP-G and is the one we turn to first. Second, the group setting creates norms that steer group members toward originality rather than appropriateness or, alternatively, toward appropriateness rather than originality. This process is captured in the epistemic social tuning hypothesis to which we turn subsequently.

Motivated Information Processing and Creative Fluency

There is reason to believe that creative fluency is higher among group members under high rather than low epistemic motivation. On the one hand, stressful conditions likely to lower epistemic motivation, such as time pressure and conflict-related threat, reduce individual creative problem solving (Schultz & Searleman, 1998), lower cognitive complexity and flexibility (Carnevale & Probst, 1998; De Dreu & Nijstad, 2008; Van Hiel & Mervielde, 2003), and result in less creative task performance (Baer & Oldham, 2006). On the other hand, trait-based openness to experience, which is associated with higher levels of epistemic motivation, correlates positively with a variety of creativity indicators assessed at the individual level of analysis (McCrae, 1987; Wolfradt & Pretz, 2001). At the group level, similar results have been reported. For example, Chirumbolo, Mannetti, Pierro, Areni, and Kruglanski (2005) and Kelly and Karau (1993) found that group members working on a joint task displayed greater levels of creativity when they had low rather than high need for nonspecific closure or when time pressure was mild rather than acute.

It is interesting that these positive effects of higher epistemic motivation are mitigated by factors that increase group members' anxiety about making errors (Rietzschel, De Dreu, & Nijstad, 2007) or their concerns about social face and reputation (Camacho & Paulus, 1995). In terms of MIP-G, when group members have a pro-self motive and value power and personal success, group climate and interaction processes may be characterized by undue criticism and fear of being ridiculed, downplayed, or derogated. This impairs constructive controversy and, ultimately, group creativity (e.g., Shin & Zhou, 2007; Taggar, 2002). In contrast, when group members have a prosocial motive, the group climate becomes positive and psychologically safe, so that individuals perceive few reality constraints and neither expect nor experience person-oriented criticism of their ideas. They engage in more constructive controversy, openly expressing their ideas, exploring opposing perspectives, and allowing others to build on these ideas (e.g., Tjosvold, 1998). Such a constructively critical climate should facilitate group creativity. In short, we expect greater constructive controversy (Hypothesis 1) and greater creative fluency (Hypothesis 2) under high rather than low epistemic motivation, but only when group members are prosocially rather than pro-self motivated.

Epistemic Social Tuning and Group Norms About Originality and Appropriateness

Creative fluency is a measure of cognitive productivity irrespective of idea quality. However, ideas can be more or less original

and novel, as well as more or less appropriate and useful. In principle, originality and appropriateness are unrelated, but quite a number of studies observed negative correlations between these two dimensions (e.g., Beersma & De Dreu, 2005; Nijstad et al., 2010). Especially in Western cultures that putatively value independence, autonomy, and uniqueness (e.g., Brewer & Chen, 2007; Hofstede, 1980), creative fluency positively associates with originality and originality negatively associates with appropriateness of ideas. People, alone and in groups, appear to trade off originality for appropriateness and vice versa (Rietzschel, Nijstad, & Stroebe, 2010). This suggests that, at least to some extent, implicit cultural norms drive the content of group members' cognitive performance (also see Adarves-Yorno, Postmes, & Haslam, 2007).

That implicit norms steer groups toward a focus on originality and novelty or on appropriateness and usefulness is captured by the epistemic social tuning hypothesis (Lunn et al., 2007). The idea is that people who lack confidence in their own understanding of the world—who have high epistemic motivation—turn to others in their immediate social environment for additional views and information. This tendency to seek social consensus and validation is stronger among group members with a prosocial rather than a pro-self motivation (or affiliative needs, in terms of shared reality theory; Hardin & Conley, 2001; Hardin & Higgins, 1996). Consequently, groups under high epistemic motivation are more likely to develop a shared reality and understanding of what the purpose of their task is and how to achieve it best (Echterhoff, Higgins, & Levine, 2009), especially when group members have a prosocial rather than a pro-self motivation.

Lunn et al. (2007) provided initial evidence for their epistemic social tuning hypothesis in the context of implicit prejudice: Only individuals under high epistemic motivation turned to the beliefs endorsed by others and adapted toward these other views. But the idea can also be applied to group creativity. When the implicit norm is to be original (appropriate), this more quickly and more profoundly becomes the shared reality in groups with high epistemic motivation and a prosocial orientation. This implies that originality should be higher among groups with high rather than low epistemic motivation, but only when group members have a prosocial rather than pro-self motivation (Hypothesis 3A). In turn, when the implicit norm is to be appropriate and feasible, this also more quickly and more profoundly becomes the shared reality in groups with high epistemic motivation and a prosocial orientation. This would then imply that appropriateness and feasibility are higher among groups with high rather than low epistemic motivation, but only when group members have a prosocial rather than pro-self motivation (Hypothesis 3B).

Study Overview

On the basis of MIP-G and the work on epistemic social tuning, we predicted that under high rather than low epistemic motivation, groups with a prosocial rather than pro-self motivation engage in more constructive controversy (Hypothesis 1), produce more ideas and insights (Hypothesis 2) that are original when originality is the norm (Hypothesis 3A) or are more appropriate when appropriateness is the norm (Hypothesis 3B). In Studies 1 and 2, we tested Hypotheses 1 and 2. We conducted these experiments within the Dutch culture, which values independence, autonomy, and uniqueness (Hofstede, 1980). Accordingly, we expected support for Hy-

pothesis 3A (about originality) more than for Hypothesis 3B (about appropriateness). Note that this hypothesis is consistent with findings showing higher levels of originality when independence is experimentally primed (Goncalo & Staw, 2006).

Study 3 was designed to more directly test the epistemic social tuning hypothesis that, depending on what is made the implicit norm, drives groups to be either fluent and original (cf. Hypothesis 3A) or fluent and appropriate (cf. Hypothesis 3B). In Study 4, we tested Hypothesis 2 in a Korean sample. Korea represents a collectivist culture known to value appropriateness and convergence more than originality and deviance (Bond & Smith, 1996; Hofstede, 1980). In this context, we expected evidence for Hypothesis 3B and not for Hypothesis 3A.

In keeping with our previous work on MIP-G, we used, across studies, different manipulations of epistemic and social motivation. Thus, to avoid monomethod and mono-operation bias, we manipulated epistemic motivation either through time pressure (Studies 1 and 4; also see De Dreu, 2003; De Grada et al., 1999; Kruglanski & Freund, 1983) or process accountability (Studies 2 and 3; also see De Dreu et al., 2006; Lerner & Tetlock, 1999; Scholten et al., 2007). We manipulated social motivation through incentives (Studies 2–4; also see Weingart, Brett, Olekalns, & Smith, 2007), or we measured agreeableness as a dispositional proxy (Study 1; also see Barry & Friedman, 1998).

Study 1

Method

Participants and design. One hundred eight students (mean age = 22.53 years; 68 women) participated for course credit or payment (€7, i.e., approximately \$10.80). Participants were randomly assigned to three-person groups, and groups were randomly assigned to the high or low epistemic motivation condition. Thus, the one-factorial design had two levels of epistemic motivation.[2] Agreeableness was measured and constituted a second (continuous) independent variable. Dependent variables were fluency, originality, appropriateness, constructive controversy, and group cohesiveness.

Procedure. Participants reported to the lab individually and were told that they would form triads for a brainstorming task. While brainstorming, they would be videotaped. Subsequently, the experimenter asked three participants to take a seat in a private room where they were given written information about the upcoming brainstorming task. They learned that they as a group were supposed to generate ideas about how to improve teaching at their university, a topic we have used before and is involving to this subject population (De Dreu, Baas, & Nijstad, 2008). Each group member was handed several lined sheets of paper on which they could note their own ideas. The instructions read that group members should not replicate ideas that had already been suggested by another group member and that only nonredundant ideas would contribute to their performance. Our instructions were explicitly

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[2] We examined whether gender composition of the groups (all male, all female, mixed) influenced our results. In neither this nor any of the subsequent experiments we report did we find any effects for gender composition; therefore, this variable is not discussed further.

neutral as to what ideas and solutions people should generate and only referred to number of ideas (i.e., we never asked ask for "creative," "original," or "appropriate" ideas, nor did we use words related to these terms).[3] Along with the task description, participants' epistemic motivation was manipulated (see the following section). Thereafter, groups brainstormed by taking private notes and voicing their ideas and insights. Finally, group members individually filled out a short questionnaire assessing group cohesion, constructive controversy, and manipulation checks. On completing the questionnaire, participants were paid, debriefed, and dismissed.

Manipulation of epistemic motivation.   We used a time pressure manipulation to create differences in epistemic motivation (De Dreu, 2003; De Grada et al., 1999; Kruglanski & Freund, 1983). In the low epistemic motivation condition, the written instructions stated that the group had no more than 5 min to generate ideas and that previous research had shown that this was very little time. In the high epistemic motivation condition, the instruction read that the group would have 15 min to generate ideas, which previous research had shown to be ample time.[4]

Measures.   At the outset of the study and prior to task instructions, participants filled out a personality questionnaire to assess their dispositional agreeableness (Saucier, 1994). Participants judged the degree to which eight different adjectives (i.e., *sympathetic*, *warm*, *kind*, *cooperative*, *cold* [reversed], *unsympathetic* [reversed], *rude* [reversed], *harsh* [reversed]) were representative of their personality (on a scale of 1 = *does not apply at all* to 5 = *applies completely*). For each individual, we aggregated the ratings into a single index of agreeableness (Cronbach's α = .74) and aggregated across the three group members within each group to obtain an index of group-level agreeableness.[5]

Video recordings were transcribed to derive indicators of fluency, originality, and appropriateness. *Fluency* was defined as the total number of nonredundant ideas generated in the group. Originality and appropriateness were evaluated by two pairs of trained students. A pair judged either originality or appropriateness. Originality was rated on a 5-point scale ranging from *not original* (1) to *highly original* (5). To enhance the raters' shared understanding of originality, we provided them with a detailed description for each point of the response scale (Rietzschel, De Dreu, & Nijstad, 2007). We assessed interrater reliability by computing intraclass correlations (ICC[3, 2]; Shrout & Fleiss, 1979) after the two raters had judged 60 of the overall 667 ideas. ICC(3, 2) was .77, indicating good interrater agreement, and raters continued to judge the remaining ideas. We averaged originality ratings across ideas, thus correcting for possible differences in fluency. Appropriateness was judged on a 5-point scale ranging from *not feasible* (1) to *highly feasible* (5). As with originality, raters were provided with a detailed description for each point of the response scale (Rietzschel, De Dreu, & Nijstad, 2007). After two raters had judged about 10% of all ideas (60 out of 667), ICC(3, 2) was .73, indicating good interrater agreement. Therefore, no further instructions were necessary before the two raters continued to judge the remaining ideas. We averaged appropriateness ratings across ideas, thus correcting for possible differences in fluency.[6]

Constructive controversy was measured with three items designed for this study: "While brainstorming, (1) group members voiced disagreements; (2) we openly discussed alternatives; and (3) we challenged each other's ideas and insights." Items were

answered on 5-point scales ranging from 1 = *not at all* to 5 = *very much*. Group cohesion was measured with four items (e.g., "I enjoyed interacting with this group very much") derived from Barry and Stewart (1997). Both scales were measured reliably (Cronbach's αs = .91 and .71, respectively). The ICC(1, 1) was .31 for cohesion and .35 for constructive controversy. This exceeds the minimum of .20, which indicates that for each scale, a considerable part of the variance in participants' judgments was determined by group membership (Bliese, 2000; Kenny, Kashy, & Bolger, 1998). Accordingly, we averaged ratings across individuals in each group.

To check the adequacy of our time pressure manipulation ("To what extent did you experience time pressure during the group task?" answered on a scale of 1 = *not at all* to 7 = *a great deal*), we verified whether time pressure influenced epistemic motivation. Specifically, we asked participants to rate their information processing motivation on five items derived from De Dreu, Koole, and Oldersma (1999; e.g., "During the group task I tried to think deeply/make thorough contributions"; all were answered on a scale of 1 = *not at all* to 5 = *very much*; Cronbach's α = .81).

Results

Analytic strategy and manipulation checks.   Because agreeableness, our proxy for prosocial motivation, was a continuous variable, we tested predictions using hierarchical multiple regressions. In the first step, we entered the main effects of epistemic motivation and agreeableness, followed by their two-way interaction in the second step. Predictors were standardized (Aiken & West, 1991). Because testing for interactions in multiple regression is rather conservative (McClelland & Judd, 1993), we used directional tests in those cases where we had a priori hypotheses.

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[3] We did not provide the Osborn rules for brainstorming (e.g., generate many ideas, do not self-censor or criticize others) because these rules in and of themselves interfere with certain group processes that were expected to become more or less prevalent as a function of social and epistemic motivation (e.g., criticizing and ridiculing others is expected more under pro-self rather than prosocial motivation).

[4] Our reference to 5 or 15 min being little or plenty of time, respectively, obscures whether it is objective or subjectively experienced time limits that drive results. However, our objective was not to test the effects of time pressure but rather the effects of epistemic motivation. As previous work (e.g., De Dreu, 2003; Kruglanski & Freund, 1983) and our manipulation check results attest, we achieved this goal.

[5] Barry and Stewart (1997) proposed that in additive tasks such as the brainstorming task used in our studies, the average of group members' personality is more predictive than, for example, the variance or the level of the highest (lowest) scoring member. These indices become more important when the task has conjunctive or disjunctive elements (Moynihan & Peterson, 2001). Exploratory analyses using variance or min-max indices did not yield any other insights beyond those reported here.

[6] By correcting for differences in fluency, we also took care of the fact that in the low epistemic motivation condition, fewer ideas could be generated (groups had 5 min for brainstorming) than in the high epistemic motivation condition (groups had 15 min for brainstorming). Apart from that, it should also be emphasized that these differences in objective time on task may account for main effects for epistemic motivation but not for our hypothesized interactions with social motivation.

Groups that had only 5 min for brainstorming reported stronger time pressure, $B = -0.30$, $t = -2.33$, $p < .020$. More important, higher time pressure produced lower ratings on the epistemic motivation scale, $B = -0.07$, $t = -2.66$, $p < .015$. Thus, time pressure–related epistemic motivation was manipulated successfully.

Constructive controversy (Hypothesis 1) and cohesion. Regression results for cohesion and constructive controversy are reported in Table 1. There were no effects on cohesion. But the analysis of constructive controversy yielded a significant overall model, $R^2 = .27$, $F(3, 32) = 3.97$, $p < .02$. Prosocial motivation reduced controversy but, as expected, this main effect was qualified by a significant two-way interaction of epistemic and prosocial motivation. Simple slope analyses revealed that stronger prosocial motivation tended to result in less controversy when epistemic motivation was low, $B = -0.20$, $t = -2.0$, $p < .03$, but not when epistemic motivation was high, $B = 0.03$, $t = 0.19$, $p > .45$.

Creative fluency (Hypothesis 2). For fluency, we found main effects of both epistemic motivation and prosocial motivation, $R^2 = .29$, $F(2, 33) = 6.92$, $p < .01$. Table 2 shows that higher epistemic motivation led to more nonredundant ideas than did low epistemic motivation; prosocial groups also produced more nonredundant ideas than did pro-self groups. However, both main effects were qualified by the significant interaction term entered in the second step, $\Delta R^2 = .12$, $F(1, 32) = 6.43$, $p < .015$. Decomposing this interaction showed that high epistemic motivation produced greater fluency only under prosocial motivation, $B = 6.29$, $t = 3.02$, $p < .005$, and not under pro-self motivation, $B = 1.09$, $t = 1.49$, $p > .25$. Thus, Hypothesis 2 was supported.

Originality (Hypothesis 3A) and appropriateness (Hypothesis 3B). For originality, neither the main effect of epistemic motivation nor the main effect of social motivation was significant, both ts < 1. However, the two-way interaction between epistemic and social motivation was significant, $\Delta R^2 = .13$, $F(1, 32) = 4.62$, $p < .025$. Effects were as predicted in Hypothesis 3A. Figure 1 shows that prosocial motivation was positively related to originality when epistemic motivation was high, $B = 0.23$, $t = 1.94$, $p < .03$. When epistemic motivation was low, prosocial motivation had no effect, $B = -0.06$, $t = -0.77$, $p > .22$.

For appropriateness, we found a trend for epistemic motivation, $B = 0.23$, $t = 1.82$, $p < .08$, and a significant Epistemic Motivation × Prosocial Motivation interaction, $\Delta R^2 = .13$, $F(1, 32) =$

5.48, $p < .03$. Prosocial motivation resulted in lower appropriateness when epistemic motivation was high rather than low, a finding opposite to what was predicted in Hypothesis 3B. However, we need to be cautious, because none of the simple slopes were significant, all ps $> .35$. If anything, these results do not support Hypothesis 3B. Note, however, that support for this hypothesis was only expected when implicit (cultural) norms favored appropriateness over originality, which is unlikely to be the case in a Western culture such as the Netherlands. We return to this issue in Studies 3 and 4.

Path analyses. Using the bootstrapping method for testing indirect effects (Preacher & Hayes, 2008), we examined whether the interaction effect of epistemic and social motivation on originality was mediated by constructive controversy. The interaction between epistemic motivation and social motivation predicted constructive controversy, $\beta = -.27$, $t = -2.59$, $p < .015$, and originality, $\beta = .34$, $t = 1.72$, $p < .05$ (one-tailed). However, constructive controversy did not predict originality, $\beta = .04$, $t < 1$, and the bootstrap result for the indirect effect of the interaction between epistemic motivation and social motivation on originality through constructive controversy failed to reach significance, 95% CI $[-0.02, 0.11]$. In this study, we did not find evidence that constructive controversy mediates the effects of epistemic and social motivation on originality.

Discussion and Introduction to Study 2

Results supported Hypothesis 1 (about constructive controversy), Hypothesis 2 (about creative fluency), and Hypothesis 3A (about originality). As expected, in a Western context, no support was obtained for Hypothesis 3B (about appropriateness). Further, no support for the mediating role of constructive controversy was obtained. A first objective of Study 2 was to test this mediation hypothesis again, to exclude a Type II error.

Study 1 findings may partly be due to the specific operationalizations of social motivation (agreeableness) and epistemic motivation (time pressure). For example, it could be that if agreeable people are sympathetic, like to make other people feel at ease and are good at it, and show positive support, the more time they have to express these tendencies (e.g., under high epistemic motivation = low time pressure), the more they engage in these behaviors. Put differently, our time pressure manipulation may have produced a differential impact of agreeableness on group processes

Table 1
Regression of Cohesion and Constructive Controversy on Epistemic and Social Motivation, Study 1

Predictor variable	Cohesion					Constructive controversy				
	B	SE	β	R^2	ΔR^2	B	SE	β	R^2	ΔR^2
Step 1					.02					.16[†]
Epistemic motivation (EM)[a]	−0.07	0.08	−.15			−0.05	0.09	−.05		
Social motivation (SM; agreeableness)	0.02	0.09	.04			−0.26	0.11	−.26*		
Step 2				.06	.04				.27*	.11*
EM	−0.06	0.08	−.12			−0.08	0.09	−.08		
SM	−0.01	0.10	−.01			−0.20	0.10	−.20*		
EM × SM	−0.11	0.10	−.21			0.23	0.10	.23*		

[a] 0 = low, 1 = high.
[†] $p < .10$.   * $p < .05$.

Table 2

Regression of Fluency, Originality, and Appropriateness on Epistemic Motivation and Social Motivation, Study 1

Predictor variable	Fluency				Originality				Appropriateness			
	B	SE	β	ΔR^2	B	SE	β	ΔR^2	B	SE	β	ΔR^2
Step 1				.29				.00				.14†
Epistemic motivation (EM)[a]	4.04	1.22	.48**		0.01	0.07	.02		0.12	0.06	.29†	
SM (agreeableness)	2.45	1.36	.26†		0.02	0.08	.04		0.11	0.07	.24	
Step 2				.12*				.13*				.13*
EM	3.59	1.15	.43**		−0.02	0.07	−.04		0.14	0.06	.35*	
SM	3.23	1.30	.35**		0.06	0.08	.12		0.07	0.07	.15	
EM × SM	3.33	1.32	.36**		0.17	0.08	.37*		−0.16	0.07	−.37*	

[a] 0 = low, 1 = high.
† $p < .10$.   * $p < .05$.   ** $p < .01$.

that somehow influenced task effort and productivity. However, if this reasoning holds, we should probably have found highest levels of cohesiveness under low time pressure and high agreeableness, and this is not what was observed. This notwithstanding, we felt it important to test our main hypotheses again with different manipulations of epistemic and social motivation, and this was our second objective with Study 2. Specifically, we manipulated epistemic motivation through the presence versus absence of process accountability, and we manipulated social motivation through incentives that emphasized individual versus group performance (see De Dreu et al., 2006).

Study 2

Method

Participants and design. One hundred seventeen students (mean age = 22.16 years; 74 women) participated in exchange for course credit or pay (€7, i.e., approximately $10.80). Participants were randomly assigned to three-person groups and groups were randomly assigned to the conditions of a 2 × 2 between-groups design with two levels of epistemic motivation (high or low) and two kinds of social motivation (pro-self or prosocial). Dependent variables were the same as in Study 1.
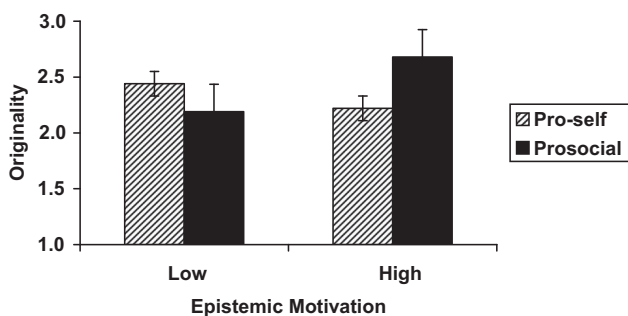

Figure 1. Originality as a function of social motivation and epistemic motivation (Study 1). The figure is based on a median split of group-level agreeableness, to facilitate comparison across studies. Error bars represent standard errors.

Procedure and tasks. These were the same as in Study 1, except that all groups were given 10 min for the brainstorming task and dispositional agreeableness was not assessed.

Manipulation of epistemic and social motivation. Motivations were manipulated through instructions delivered prior to the brainstorming task. To avoid potential order effects, we had half of the groups receive the manipulation of epistemic motivation first, whereas the others received the manipulation of social motivation first. Order had no effect and is not discussed further.

Epistemic motivation was manipulated by making some group members process accountable (De Dreu et al., 2006; Scholten et al., 2007). In the high epistemic motivation condition, participants read that the experimenters were especially interested in the strategies and tactics group members used for accomplishing their task. Therefore, the experimenters would like to interview them after the experiment. During this interview, participants would be able to see the videotaped brainstorming session and comment on their strategies at various stages of the task. On a calendar sheet attached to the instructions, participants were asked to mark at least two alternatives that would suit them for an appointment. In the low epistemic motivation condition, these process accountability instructions were not given.

Social motivation was manipulated by financial incentives (De Dreu, Giebels, & Van de Vliert, 1998; Weingart et al., 2007).[7] In the pro-self condition, the instructions read that each group member's contribution would be evaluated individually. Specifically, for each new idea that had not been mentioned by anyone else in the group, the participant would receive a lottery ticket. All lottery tickets would go into a lottery wheel. At the end of the study, three

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[7] Incentives are more removed from the motivational tendencies than, for example, need for affiliation, agreeableness, and social value orientations. However, incentives are powerful antecedents of social motives and, meta-analytically, different manipulations and measures of social motives appear functionally equivalent (De Dreu, Weingart, & Kwon, 2000). In addition, one may argue that individuals experience greater identifiability in the pro-self rather than prosocial motivation condition and that such greater identifiability reduces tendencies at social loafing. We note, however, that if such processes would emerge, they would run counter to the processes identified within MIP-G that suggest prosocial groups should generate more (rather than fewer, as suggested in the social loafing account) ideas, insights, and problem solutions than do pro-self groups.

lottery tickets would be drawn, and each of the three winners would get an extra €50 (approximately $75). Thus, an individual's odds of winning would grow depending on the number of nonrepetitive ideas he or she generated. In the prosocial condition, participants learned that their overall group performance would be evaluated. For each new idea the group produced, it would earn a lottery ticket that would go into a lottery wheel. At the end of the study, the winning group would be rewarded an extra €150 (approximately $225). Thus, a group's odds would grow depending on the number of nonrepetitive ideas it generated.[8]

Measures. We measured fluency, originality ($ICC[3, 2] = .77$), appropriateness ($ICC[3, 2] = .71$), group cohesion ($\alpha = .71$; $ICC[1, 1] = .34$), and constructive controversy ($\alpha = .64$; $ICC[1, 1] = .29$), as in Study 1. Ratings for cohesion and controversy were aggregated to the team level. To check the adequacy of our manipulations, we asked participants whether they were supposed to comment on and account for their strategies and decisions at some later point in time ($0 = no$, $1 = yes$, $2 = not\ sure$) and how motivated they felt to work in the interest of the group (rated on a scale of $1 = not\ at\ all\ motivated$ to $5 = very\ motivated$).

Results

Manipulation checks. Group members under high epistemic motivation all correctly indicated that they were process accountable; group members under low epistemic motivation overwhelmingly (98%) indicated they were not process accountable. There were no effects involving social motivation.

Group members under group incentives reported greater motivation to work for the group than did group members under individual incentives, $M = 3.95$ versus $M = 3.50$, $F(1, 34) = 4.60$, $p < .039$; no other effects were significant. In short, our manipulations of epistemic and social motivation appeared successful. In addition, they appeared orthogonal in that the manipulation of social motivation influenced ratings of social motivation but not epistemic motivation and vice versa (see also footnote 1).

Constructive controversy (Hypothesis 1) and group cohesion. As in Study 1, no effects were found for group cohesion, all $Fs(1, 34) < 1$. However, similar to Study 1, we found constructive controversy varied as a function of the interaction among epistemic motivation and social motivation, $F(1, 34) = 5.58$, $p < .024$, $\eta^2 = .13$. Cell means are given in Table 3. Under low epistemic motivation, there was less constructive controversy in prosocial groups than in pro-self groups, $F(1, 34) = 3.45$, $p < .07$, whereas under high epistemic motivation, a nonsignificant reversal emerged: Prosocial groups reported somewhat more constructive controversy than did pro-self groups, $F(1, 34) = 2.30$, $p < .14$. These results are in line with Hypothesis 1.

Creative fluency (Hypothesis 2). We expected more creativity fluency among prosocial rather than pro-self groups under high epistemic motivation. A 2 (high vs. low epistemic motivation) × 2 (pro-self vs. prosocial motivation) analysis of variance (ANOVA) only revealed the predicted interaction among epistemic motivation and social motivation, $F(1, 34) = 4.31$, $p < .045$, $\eta^2 = .11$. As predicted in Hypothesis 2, under low epistemic motivation, the effect for social motivation was not significant, $F(1, 34) < 1$, but under high epistemic motivation, prosocial

groups produced more ideas than did pro-self groups, $F(1, 34) = 7.35$, $p < .01$ (also see Table 3).

Originality (Hypothesis 3A) and appropriateness (Hypothesis 3B). A 2 × 2 ANOVA on originality revealed neither a main effect of epistemic motivation, $F(1, 34) = 2.51$, $p = .12$, $\eta^2 = .07$, nor an effect of social motivation, $F(1, 34) = 1.26$, $p = .29$, $\eta^2 = .03$. However, the predicted interaction between epistemic motivation and social motivation was significant, $F(1, 34) = 4.31$, $p < .032$, $\eta^2 = .12$. Figure 2 shows that under low epistemic motivation, social motivation had no effect on originality, $F(1, 34) < 1$, but that under high epistemic motivation, groups were more original when they had a prosocial rather than a pro-self motivation, $F(1, 34) = 6.24$, $p < .017$. This supports Hypothesis 3A.

A 2 × 2 ANOVA on appropriateness revealed no effects whatsoever, all $Fs(1, 34) < 1$ (see also Table 3). Hypothesis 3B thus is not supported.

Path analyses. As in Study 1, we explored whether constructive controversy mediated the effects of epistemic and social motivation on originality. The interaction between epistemic motivation and social motivation predicted constructive controversy, $\beta = .13$, $t = 2.39$, $p < .025$, and originality, $\beta = .10$, $t = 2.22$, $p < .05$. Furthermore, constructive controversy did predict originality, $\beta = .31$, $t = 2.21$, $p < .05$, and controlling for constructive controversy in predicting originality from the interaction between epistemic motivation and social motivation produced a nonsignificant equation, $\beta = .07$, $t = 1.34$, $p < .19$. Indeed, the bootstrap result for the indirect effect of the interaction between epistemic motivation and social motivation on originality through constructive controversy was significant, 95% CI [0.01, 0.13]. In short, constructive controversy mediates the effects of epistemic and social motivation on originality.

Discussion and Introduction to Study 3

Using different triggers of epistemic motivation (process accountability, time pressure) and different operationalizations of social motivation (mean agreeableness, incentive structures), we found support for the prediction that constructive controversy (Hypothesis 1), creative fluency (Hypothesis 2), and originality (Hypothesis 3A) are all a function of the combination of high epistemic motivation and prosocial orientation. We found no support for Hypothesis 3B that appropriateness is a function of the combination of high epistemic motivation and prosocial orientation.

The support for Hypothesis 3A (about originality) but not Hypothesis 3B (about appropriateness) is consistent with the assumption that our Dutch participants, coming from a culture valuing autonomy and independence, are more likely to focus on and value originality and uniqueness than appropriateness (also Goncalo & Staw, 2006; Smith, Peterson, & Schwartz, 2002). Through epistemic social tuning, this implicit norm is enhanced, validated, and anchored in a shared reality that steers group members' cognitive activity toward being original rather than being feasible. This

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[8] From these incentive manipulations, group members in both the pro-self and the prosocial motivation conditions may infer that it is in their best interest to generate many ideas. Nothing is said about these ideas needing to be original and novel or appropriate and feasible.

Table 3
Fluency, Appropriateness, and Constructive Controversy as a Function of Epistemic and Social Motivation (Study 2)

| | Epistemic motivation low | | | | Epistemic motivation high | | | |
| | Pro-self ($n = 9$) | | Prosocial ($n = 10$) | | Pro-self ($n = 10$) | | Prosocial ($n = 10$) | |
Dependent variable	M	SD	M	SD	M	SD	M	SD
Fluency	14.27	5.98	16.28	7.67	11.40	4.51	16.42	5.17
Appropriateness	3.43	0.19	3.49	0.36	3.34	0.28	3.41	0.26
Constructive controversy	3.38	0.38	3.07	0.31	3.09	0.28	3.32	0.41

process is stronger among group members with high rather than low epistemic motivation who have a prosocial rather than a pro-self orientation.

Whereas our findings so far are consistent with MIP-G and our reasoning based on epistemic social tuning, the latter remained untested. Accordingly, our key objective in Study 3 was to further substantiate this notion that implicit group norms account for the findings on originality and the lack of findings on appropriateness. In Study 3, we focused only on prosocial groups under high epistemic motivation but manipulated through instructions whether the group adopted a task focus or, instead, an interpersonal focus. We reasoned that under a task focus more than a relationship focus, groups are oriented toward group goals and joint performance and emerging controversies are task rather than person oriented (hence allowing them to be constructive; see, e.g., De Dreu, 2008; Tjosvold, 2008). In addition to focus, we induced, through a priming procedure prior to the group brainstorming, an implicit originality norm or, in the other condition, an implicit appropriateness norm. We predicted that groups that focused on their tasks would generate ideas that are more original when an originality norm has been primed (Hypothesis 4A) but more appropriate when an appropriateness norm has been primed (Hypothesis 4B).

Study 3

Method

Participants and design. One hundred five Dutch students (mean age = 21.34 years; 93 women) participated in exchange for either course credit or payment (€7, approximately $10.80). Par-
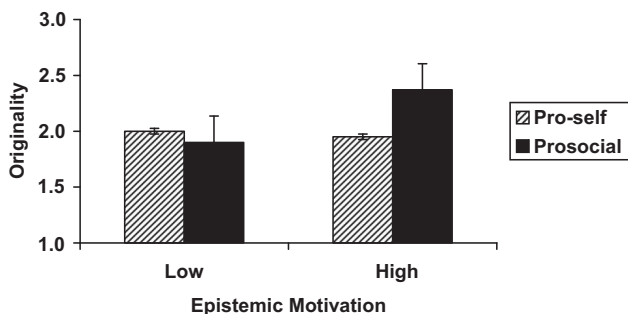
ticipants were grouped into triads, and groups were randomly assigned to a 2 (creativity norm: originality vs. appropriateness) × 2 (attentional focus: task vs. interpersonal) between-groups design (i.e., eight or nine groups per condition). Dependent variables were creative fluency, originality, appropriateness, and manipulation checks.

Procedure and manipulation of independent variables. The procedures and experimental tasks were identical to those in the previous two studies. All groups worked under a group-based incentives scheme (thus inducing prosocial motivation), and all groups were process accountable (thus inducing high epistemic motivation). Groups were provided with 15 min for the brainstorming task.

We manipulated participants' focus on either the task or interpersonal relations through instructions delivered prior to the brainstorming task. In the task focus condition, instructions read that the follow-up interview would concentrate on how participants maintained and improved task execution. In the interpersonal relations condition, instructions read that the follow-up interview would concentrate on how participants maintained and improved interpersonal relations and group harmony.

To manipulate creativity norms, we used a scrambled sentences task (Bargh, Chen, & Burrows, 1996) to prime the concepts of either originality or appropriateness. The scrambled sentences were presented as a pilot for an unrelated study on linguistic capabilities. Participants received eight scrambled sentences (i.e., lists of words arranged in a scrambled order) and were instructed to construct a grammatically correct sentence out of each list of words, for example, "do not like to common sense in contrary to be cats (alone) (original)". However, not only did participants have to find a grammatically sound order for the words (i.e., "Contrary to common sense, cats do not like to be alone."), they also had to choose one of two adjectives presented in parentheses (i.e., *alone*, *original*) at the end of each scrambled sentence. The correct adjective (*alone*) had a neutral connotation in terms of creativity, whereas the distracter adjective (*original*) activated the concept of either originality or appropriateness. The distracter adjectives used in the originality condition were *unique*, *creative*, *new*, *extraordinary*, *different*, *original*, *exceptional*, and *innovative*. The distracter items for appropriateness were *average*, *useful*, *workable*, *feasible*, *efficient*, *common*, *reasonable*, and *practical*. Thus, across conditions, the scrambled sentences were identical except for one distracting adjective per sentence, which primed either originality or appropriateness.

Dependent variables. Fluency, originality, and appropriateness of ideas were assessed as before; $ICC(3, 2) = .76$ and .94 for

Figure 2. Originality as a function of social motivation and epistemic motivation (Study 2). Error bars represent standard errors.

originality and appropriateness, respectively. We included several items to check the adequacy of our manipulations. We included the measure of epistemic motivation and prosocial motivation also used before. We asked group members whether they felt the dominant norm in their group was to produce new and original ideas (rated on a scale of $1 = $ *not at all* to $5 = $ *certainly*) and whether they were told to consider interpersonal relations or their group task progress (rated on a scale of $1 = $ *mostly task issues* to $5 = $ *mostly interpersonal issues*).

Results

Manipulation checks. As expected, groups reported relatively high levels of epistemic motivation, $M = 3.93$ (with 5 being very high); no effects for the independent variables were found, all $Fs(1, 33) < 1$. Likewise, groups reported relatively high levels of prosocial motivation, $M = 3.81$ (with 5 being very high); no effects for the independent variables were found, all $Fs(1, 33) < 1$. We conclude that we successfully created a high epistemic–high prosocial baseline.

A 2 (originality vs. appropriateness norm) $\times$ 2 (task vs. interpersonal focus) ANOVA on the creativity norm ratings only revealed a main effect for norm, showing that groups under an appropriateness norm gave lower ratings than did those under an originality norm, $M = 3.85$ vs. $M = 4.15$, respectively; $F(1, 33) = 4.60$, $p < .039$, $\eta^2 = .09$. A 2×2 ANOVA on attentional focus ratings only revealed a main effect for focus, showing that groups under interpersonal focus reported a stronger orientation on interpersonal issues than did groups under a task focus, $M = 3.88$ vs. $M = 3.75$, respectively; $F(1, 33) = 5.27$, $p < .028$, $\eta^2 = .10$. Together, our manipulations appear successful.

Fluency, originality (Hypothesis 4A) and appropriateness (Hypothesis 4B). We did not expect creativity norm or focus to influence creative fluency and, indeed, a 2×2 ANOVA on creative fluency showed no effects, all $Fs(1, 33) < 1$ ($M_{grand} = 8.03$, $SD = 4.66$). For originality, however, we predicted higher originality scores when originality rather than appropriateness norms were primed, especially when group members focused on their task rather than on interpersonal relations. A 2 (norm: originality vs. appropriateness) $\times$ 2 (focus: task vs. interpersonal relations) ANOVA on originality showed that task focus resulted in greater originality than did interpersonal focus, $F(1, 33) = 6.48$, $p < .02$, $\eta^2 = .12$. This main effect was, however, qualified by the predicted interaction between creativity norm and focus, $F(1, 33) = 5.09$, $p < .03$, $\eta^2 = .09$. Figure 3 (top panel) shows greater originality when participants focused on the task and had been primed with originality rather than appropriateness, $F(1, 33) = 4.18$, $p < .05$. When participants focused on interpersonal relations, originality did not differ as a function of norm, $F(1, 33) = 2.19$, $p < .15$. Also, within a task focus, an originality norm produced greater originality than did an appropriateness norm, $F(1, 33) = 18.25$, $p < .01$. This result supports Hypothesis 4A.

We predicted higher appropriateness scores when appropriateness rather than originality was primed, especially when group members focused on their task rather than on interpersonal relations. A 2×2 ANOVA on appropriateness only revealed an interaction between creativity norm and focus, $F(1, 33) = 4.26$, $p < .05$, $\eta^2 = .10$. Figure 3 (bottom panel) shows greater appropriateness when participants under task focus had been primed
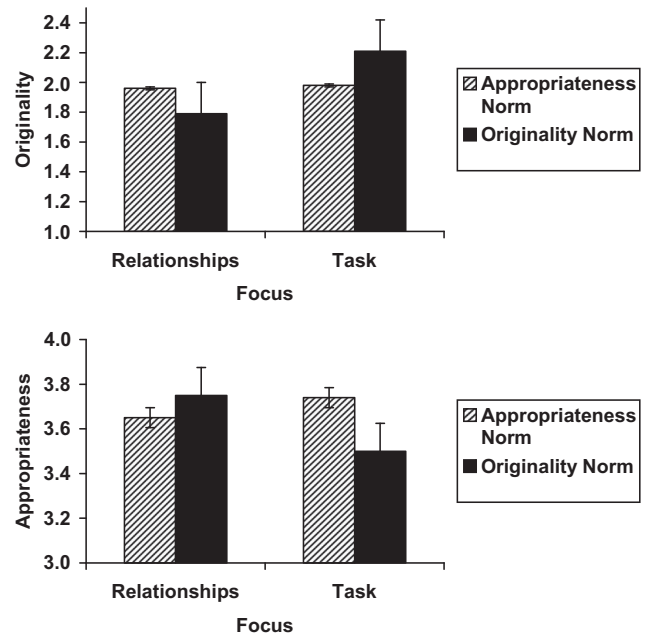

Figure 3. Originality (top panel) and appropriateness (bottom panel) as a function of norm and focus (Study 3). Error bars represent standard errors.

with appropriateness rather than originality, $F(1, 33) = 4.16$, $p < .05$. When participants focus on interpersonal relations, appropriateness did not differ as a function of norm, $F(1, 33) = 2.11$, $p < .18$. This result supports Hypothesis 4B.

Discussion and Introduction to Study 4

The three studies together support most of our predictions and underlying assumptions. Study 3 in particular adds that, as predicted on the basis of the epistemic social tuning hypothesis (Lunn et al., 2007), implicit group norms drive behavior when prosocial group members are epistemically motivated and focus on their tasks (rather than interpersonal relations). These implicit norms about originality versus appropriateness subsequently turn creative fluency into originality or, alternatively, into appropriate and feasible ideas and insights.

The results of Study 3 corroborate and further substantiate the fact that, in the first two studies, effects emerged on originality but not on appropriateness. We reasoned this to be in part because in Western culture, brainstorming and instructions to generate new ideas and insights are more quickly associated with a quest for being divergent and original than with convergence and appropriateness, and epistemic social tuning turns these implicit norms into a shared reality. Resonating with this idea is the meta-analytic finding that organizational cultures that value autonomy, flexibility, and risk taking engender greater creativity among their employees (Hunter, Bedell, & Mumford, 2007). However, if this explanation holds, we should find joint effects of epistemic and social motivation on appropriateness (Hypothesis 3B) rather than originality (Hypothesis 3A) in cultural contexts that implicitly value conformity, convergence, and usefulness. Indeed, whereas individualistic cultures like those found in the Netherlands and the

United States value independence, uniqueness, and autonomy, collectivistic cultures like those found in China and Korea more strongly emphasize group affiliation, conformity, and convergence (Bond & Smith, 1996; Goncalo & Staw, 2006; Niu & Sternberg, 2001). For example, East Asians prefer abstract figures, pens, and magazine ads that represent conformity, whereas European Americans prefer targets that represent uniqueness (Kim & Markus, 1999), and American students score higher on both individualism and creative potential than do Chinese students, who score higher on collectivism and skill mastery (Zha, Walezyk, Griffith-Ross, Tobacyk, & Walczyk, 2006).

The preceding discussion provides no reason to assume that epistemic and social motivation influence creative fluency differently in Korea as opposed to the Netherlands (Studies 1 and 2), and we expected new support for Hypotheses 1 and 2. However, the discussion also suggests that in Korean culture, there is a tendency toward appropriateness rather than originality and that the combination of epistemic and social motivation brings out this tendency. Put differently, rather than support for Hypothesis 3A (about originality), we now expected support for Hypothesis 3B that epistemic motivation and social motivation interact to predict appropriateness.

Study 4

Method

Participants and design. One hundred thirty-eight Korean students at Sungkyuankwan University (mean age = 23.95 years; 41 women) participated in exchange for course credit. Participants were randomly assigned to triads, which were randomly assigned to the conditions of a 2×2 between-groups design with two levels of epistemic motivation (high or low) and two kinds of social motivation (prosocial or pro-self).

Procedure and variables. The procedures were the same as before, except that instructions were delivered in Korean. We used the time pressure manipulation of Study 1 to create different levels of epistemic motivation. We manipulated social motivation using the individual versus collective incentive scheme for contributing ideas used in Study 2. We assessed fluency, originality ($ICC[3, 2] = .66$), and appropriateness ($ICC[3, 2] = .71$) as before, and cohesion ($\alpha = .94$; $ICC[1, 1] = .31$), constructive controversy ($\alpha = .79$; $ICC[1, 1] = .25$), and manipulation checks for epistemic and social motivation ($\alpha = .74$ and .78, respectively) with Korean translations of the items used before in Studies 1 and 2. Ratings were aggregated to the group level.

Results and Discussion

Manipulation checks. A 2 (high vs. low epistemic motivation) $\times$ 2 (pro-self vs. prosocial motivation) ANOVA on the ratings for time pressure only revealed an effect for epistemic motivation. Groups under high epistemic motivation reported lower time pressure than did those under low epistemic motivation, $M = 2.25$ versus $M = 2.72$, respectively; $F(1, 42) = 5.30$, $p < .025$. A 2×2 ANOVA on the ratings for social motivation only revealed a main effect for social motivation: Groups working under a group-based reward reported stronger prosocial motivation than did those working for an individual-based reward, $M = 3.82$ versus $M = 3.20$, respectively; $F(1, 42) = 10.26$, $p < .003$. We conclude that epistemic motivation and social motivation were induced as intended.

Constructive controversy (Hypothesis 1) and group cohesion. Hypothesis 1 is not supported: We did not find any effects on constructive controversy, all Fs < 1. A 2×2 ANOVA on cohesion revealed a main effect for social motivation, showing that prosocial groups reported stronger cohesion than did pro-self groups, $F(1, 42) = 4.86$, $p < .03$, $\eta^2 = .10$. This main effect was qualified by a significant two-way interaction between epistemic and prosocial motivation, $F(1, 42) = 5.01$, $p < .03$, $\eta^2 = .11$. Prosocial groups reported stronger cohesion than did pro-self groups under high epistemic motivation, $M = 3.93$ versus $M = 3.26$, respectively; $F(1, 42) = 10.57$, $p < .01$. When epistemic motivation was low, no effect for social motivation was found, $M = 3.54$ for prosocial groups versus $M = 3.53$ for pro-self groups, $F(1, 42) < 1$, ns.

Taken together, we found a pattern of results exactly opposite to what we found earlier, in that epistemic and social motivation do not affect constructive controversy (as they did in Studies 1 and 2), but they do conspire to promote group cohesiveness (as they did not in Studies 1 and 2). This set of findings is, however, consistent with the idea that prosocial motivation in collectivist culture leads people to emphasize and focus on interpersonal relations and harmony rather than task-related aspects such as joint performance.

Fluency (Hypothesis 2). A 2×2 ANOVA only revealed a significant interaction between epistemic motivation and social motivation, $F(1, 42) = 4.23$, $p < .05$, $\eta^2 = .10$. Simple main effect analyses indicated that, as expected, groups in the prosocial condition generated significantly more ideas than did groups in the pro-self condition when epistemic motivation was high, $F(1, 42) = 4.99$, $p < .05$. When epistemic motivation was low, fluency did not differ between the prosocial and pro-self conditions, $F < 1$ (see also Table 4).

Table 4

Fluency, Originality, and Appropriateness as a Function of Epistemic and Social Motivation (Study 4)

| Dependent variable | Epistemic motivation low | | | | Epistemic motivation high | | | |
| | Pro-self ($n = 10$) | | Prosocial ($n = 10$) | | Pro-self ($n = 11$) | | Prosocial ($n = 11$) | |
	M	SD	M	SD	M	SD	M	SD
Fluency	10.58	4.44	8.80	2.44	13.75	4.92	19.08	9.04
Originality	2.50	0.55	2.64	0.51	2.52	0.33	2.27	0.46
Appropriateness	3.61	0.25	3.55	0.56	3.51	0.35	3.91	0.25

Originality (Hypothesis 3A) and appropriateness (Hypothesis 3B). A 2×2 ANOVA on originality revealed no effects, all Fs < 1, and the means pattern opposite to what we found in studies conducted in an individualistic culture with their putative valuation of originality rather than appropriateness (see Table 4). Thus, as could have been expected on the basis of Study 3, Hypothesis 3A received no support in this more collectivist sample.

For appropriateness, there was a significant interaction between epistemic motivation and social motivation, $F(1, 42) = 4.56$, $p < .04$, $\eta^2 = .10$. Table 4 shows that when epistemic motivation was high, appropriateness was significantly higher in the prosocial than in the pro-self condition, $F(1, 42) = 6.96$, $p < .03$. But when epistemic motivation was low, appropriateness did not differ as a function of social motivation, $F < 1$. Thus, as predicted, Hypothesis 3B was supported in this collectivist sample that supposedly values appropriateness more than originality.

Conclusions and General Discussion

Viewing groups as motivated information processors, we proposed that group creativity improves when members have high rather than low epistemic motivation, but especially when they also have or adopt a prosocial rather than selfish orientation. With regard to creative fluency—the number of nonredundant ideas and insights generated by the group—our hypothesis was supported in all three tests (i.e., Studies 1, 2, and 4). In line with the epistemic social tuning hypothesis (Lunn et al., 2007), results further showed that epistemic and social motivation codetermine originality when uniqueness and independence are culturally valued or experimentally primed; further, they relate to higher appropriateness when convergence and conformity are culturally valued or experimentally primed. Finally, and especially with regard to originality, we obtained some evidence that group creativity benefits from constructive controversy, which, in turn, benefits from high epistemic motivation paired with a prosocial orientation.

Our results thus largely confirm derivations from MIP-G (De Dreu, Nijstad, & Van Knippenberg, 2008) and the epistemic social tuning hypothesis (Lunn et al., 2007). They bear implications for these two interrelated theoretical perspectives on group processes and performance and for work on cross-cultural differences in creativity. These implications, along with some methodological concerns, are elaborated on in the remainder of this section.

Theoretical Implications

MIP-G predicted greater creative fluency when group members combine high epistemic motivation with a prosocial rather than a pro-self motivation. This general hypothesis was well-supported across a number of studies and across a number of operationalizations of social motivation (i.e., incentive structures, dispositional agreeableness) and epistemic motivation (i.e., time pressure, process accountability). This pattern of results lends further confidence in the predictive validity and generality of MIP-G. Social and epistemic motivation alone and in combination predict information processing and dissemination in group judgment and decision making (e.g., Scholten et al., 2007; Toma & Butera, 2009), in negotiation (De Dreu et al., 2006; Halevy, 2008), and in work teams (De Dreu, 2007). In these prior works, however, there was always a relatively limited set of decision options or possibilities

for agreement, and some options were clearly better than others. As such, the present support for MIP-G in the realm of group creativity reveals that motivated information processing in groups also directs performance in ill-defined situations.

Our findings are consistent with past work on group creativity, showing higher levels of creativity when time pressure is mild rather than acute (Chirumbolo et al., 2005; Kelly & Karau, 1993) or when group members have a low rather than a high need for closure (Chirumbolo et al., 2005; Rietzschel, De Dreu, & Nijstad, 2007). Our work not only connects these previous findings by proposing that both time pressure and need for closure can be understood in terms of epistemic motivation; it also clarifies that these variables will have their effects especially when group members have a prosocial rather than pro-self motivation. Current findings are also consistent with past work showing that group creativity increases when group members are in a positive rather than neutral mood (Grawitch et al., 2003) or when group members score high rather than low on dispositional agreeableness (Taggar, 2002). We propose that positive moods and dispositional agreeableness associate with prosocial motivation and cooperation, which stimulates creativity given sufficient epistemic motivation. As such, MIP-G provides a coherent framework to understand various effects of situational and dispositional variables on group creativity.

To understand when and how creative fluency translates into highly original and/or highly appropriate and feasible ideas and insights, we invoked the epistemic social tuning hypothesis (Lunn et al., 2007). The idea is that especially under high epistemic motivation, group members turn to others to create a shared reality and understanding of their task. What is implicitly valued and validated by others develops into a group norm, which subsequently drives further focus and effort. Thus, when the group values uniqueness, independence, and originality, these are what group members seek to achieve, especially when they have high epistemic motivation. But when the group values convergence and conformity, these are what group members seek to achieve, especially when they have high epistemic motivation. Direct evidence for this hypothesis that implicit norms drive groups toward originality or appropriateness was obtained in Study 3. Indirect evidence was obtained by comparing the results in Studies 1 and 2, conducted in an individualistic setting valuing independence and originality, with those obtained in Study 4, conducted in a collectivist setting valuing convergence and conformity.

The work on epistemic social tuning and the current evidence in the context of group creativity bears some resemblance to earlier studies on the role of social comparison processes in group ideation. For example, Dugosh and Paulus (2005) exposed participants to either a high or a low number of either common or unique ideas and induced (or not) participants to engage in social comparison. Results showed that exposure to a high number of ideas enhanced the generation of additional ideas, especially when participants engaged in social comparison. Along similar lines, Michinov and Primois (2005) showed that in electronic brainstorming, group creativity improved when group members were provided with online feedback about others' performance. In these studies, the putative norm was to generate original (rather than appropriate) ideas and insights, and social comparison may induce an upward trajectory in which individual group members benefit from others' inputs. Future work could integrate these findings with the epis-

temic social tuning hypothesis that when the norm is appropriateness rather than originality, social comparison processes should lead to more appropriate but less original ideas.

MIP-G is not the first account of group creativity. In fact, MIP-G is an attempt to provide a broader theoretical perspective, generating predictions about group creativity, group negotiation, group decision making, and team performance. When we focused on group creativity, our theorizing benefited from adding the epistemic social tuning hypothesis. The resulting MIP-G perspective on group creativity can be compared with other models specifically designed to understand group creativity, including the social–cognitive influence model of group brainstorming (Paulus, Dugosh, Dzindolet, Putnam, & Coskun, 2002). The social aspect of this model assumes that there is a reciprocal influence process during group brainstorming in which the productivity of one brainstormer affects that of another. Although there is a trend to perform less than one's fellow group members (e.g., through free riding and social loafing; see, e.g., Karau & Williams, 1993), exposure to productive brainstormers may, in fact, raise group creative performance. The cognitive aspect of the model asserts that exposure to ideas from others can stimulate associations that lead to additional ideas (Brown & Paulus, 2002; Nijstad & Stroebe, 2006). The model further assumes that the stimulating impact of others' ideas depends on the extent to which people attend to these ideas and retain them in memory during task performance (Dugosh & Paulus, 2005).

This social–cognitive influence model developed by Paulus et al. (2002) is grounded in a long tradition of research on brainstorming and has important parallels with MIP-G. In terms of MIP-G, one would expect higher epistemic motivation to stimulate individuals to attend to others' ideas and to work hard to keep them in memory for future use. Put differently, the cognitive stimulation provided by others has more effect under high rather than low epistemic motivation. Furthermore, MIP-G adds that these stimulation processes emerge especially under prosocial rather than pro-self motivation, the latter orientation being more likely to induce social loafing. Future research on group brainstorming could pursue these ideas and test specific hypotheses about the interplay between social and epistemic motivation on the one hand and social and cognitive influence processes on the other.

Our findings resonate with comparative case studies on so-called *collaborative circles* (Farrell, 2001). Collaborative circles are primary groups consisting of peers who share similar occupational goals and who, through long periods of dialogue and collaboration, negotiate a common vision that guides their work. The vision consists of a shared set of assumptions about their discipline, including what constitutes good work, how to work, what subjects are worth working on, and how to think about them (Farrell, 2001). It stands to reason that epistemic social tuning provides the basis for such a shared vision to emerge. Farrell (2001) further noted that

> in a collaborative circle, . . . [group members work] side-by-side, they master new techniques. In backstage discussions, they fine-tune their understanding of concepts and hone their ability to speak the jargon of their discipline. They . . . act them out in their arguments with one another . . . [and] . . . the shared vision, style, or culture of the group shapes their work. (pp. 12–13)

In other words, epistemic social tuning directs epistemically motivated group members to develop a shared reality; the prosocial motivation furthers the climate within which constructive controversies can emerge to sharpen the wits and stimulate group creativity.

Directions for New Research

Comparing our laboratory studies with the comparative case studies on collaborative circles reveals several important issues for future research. First, much of the work on group creativity relies on a brainstorming task in which group members generate ideas or problem solutions. This renders the group product an additive function of individual performances (Steiner, 1972). But group creativity can also be disjunctive, where the group member who sees the solution or has the proper insight determines the group's creative performance. It would be interesting to examine how task characteristics interact with motivated information processing. Also, and more specifically, more needs to be known about the ways social and epistemic motivation drive creative performance in disjunctive creativity tasks. Second, group creativity can be conceived of as some combination (additive, disjunctive) of individual inputs or, alternatively, as the single product of a group process (e.g., one idea, one collective artwork). This distinction between individual-level versus group-level group creativity may be important to consider because different group processes may promote individual-level group creativity more than group-level group creativity (Sawyer & DeZutter, 2009).

Two other issues for future research are worth noting. In our search for the normative basis underlying group creativity, we highlighted that some cultures value originality more than they value appropriateness, whereas other cultures tend toward the reverse. Across studies, our findings were consistent with this general idea, showing that in Western cultures, appropriateness gives way to originality, whereas in Eastern cultures, originality is of secondary importance. However, and notwithstanding the fact that our methods and tasks were highly similar across studies, our studies were not designed to provide a direct cross-cultural comparison of group creativity. Although Dutch participants are, on average, more individualistic and less collectivistic than are Korean participants (e.g., Smith et al., 2002), we did not directly measure this in the current studies, and new research is needed to further specify possible cross-cultural differences in the ways groups work and create. Such new research should also remedy a weakness in the current study design, namely, that we did not test our assumption that Dutch participants in Study 1 and 2 were, on average, more individualistic and less collectivistic than their Korean counterparts in Study 4. Including measures of cultural value differences would allow researchers to confirm our assertion that these differences in cultural value account for the differential effects of epistemic and social motivation on originality and appropriateness.

Finally, our work speaks to the large literature considering the reasons why individuals working alone tend to be more fluent and original than those working in group settings (e.g., Diehl & Stroebe, 1987; Nijstad & Stroebe, 2006). An interesting issue for future research thus is whether the optimal conditions identified in the current work—high epistemic motivation combined with a prosocial orientation, a task focus, and normative context valuing orig-

inality rather than appropriateness—boosts creative performance in groups to a level similar or superior to that achieved by individuals working alone. To some extent, it could be argued that prosocial motivation reduces social anxiety and therefore helps creative ideas to come out (Camacho & Paulus, 1995). At the same time, however, it is difficult to see how the combination of creativity-enhancing conditions in our studies can counter production blocking and concomitant process losses (e.g., Diehl & Stroebe, 1987). Thus, we suspect that even if similar or superior levels of creativity are achieved, this is a result of psychological mechanisms different from those responsible for the classic individual–group effect identified in past work (Nijstad & Stroebe, 2006).

Conclusion

Taken together, the present studies provide good support for the MIP-G prediction that group members with high epistemic motivation are more fluent when they have a prosocial rather than pro-self motivation. Such creative fluency translates into highly original ideas when culture or context primes independence and originality or into highly appropriate and feasible ideas when culture or context primes conformity and convergence.

References

Adarves-Yorno, I., Postmes, T., & Haslam, S. A. (2007). Creative innovation or crazy irrelevance? The contribution of group norms and social identity to creative behavior. *Journal of Experimental Social Psychology, 43,* 410–416.

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Newbury Park, CA: Sage.

Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity.* Boulder, CO: Westview Press.

Baas, M., De Dreu, C. K. W., & Nijstad, B. A. (2008). A meta-analysis of 25 years of mood–creativity research: Hedonic tone, activation, or regulatory focus? *Psychological Bulletin, 134,* 779–806.

Baer, M., & Oldham, G. R. (2006). The curvilinear relation between experienced creative time pressure and creativity: Moderating effects of openness to experience and support for creativity. *Journal of Applied Psychology, 91,* 963–970.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology, 71,* 230–244.

Barry, B., & Friedman, R. A. (1998). Bargainer characteristics in distributive and integrative negotiation. *Journal of Personality and Social Psychology, 74,* 345–359.

Barry, B., & Stewart, G. L. (1997). Composition, process, and performance in self-managed groups: The role of personality. *Journal of Applied Psychology, 82,* 62–78.

Beersma, B., & De Dreu, C. K. W. (2005). Conflict's consequences: Effects of social motives on postnegotiation creative and convergent group functioning and performance. *Journal of Personality and Social Psychology, 89,* 358–374.

Bliese, P. D. (2000). Within-group agreement, non-independence, and reliability. Implications for data aggregation and analysis. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions* (pp. 349–381)*.* San Francisco, CA: Jossey-Bass.

Bond, R., & Smith, P. B. (1996). Culture and conformity: A meta-analysis of studies using Asch's (1952b, 1956) line judgment task. *Psychological Bulletin, 119,* 111–137.

Brewer, M. B., & Chen, Y.-R. (2007). Where (who) are the collectives in collectivism? Toward conceptual clarification of individualism and collectivism. *Psychological Review, 114,* 133–151.

Brown, V. R., & Paulus, P. B. (2002). Making brainstorming more effective: Recommendations from an associative memory perspective. *Current Directions in Psychological Science, 11,* 208–212.

Camacho, L. M., & Paulus, P. B. (1995). The role of social anxiousness in group brainstorming. *Journal of Personality and Social Psychology, 68,* 1071–1080.

Carnevale, P. J. D., & Isen, A. M. (1986). The influence of positive affect and visual access on the discovery of integrative solutions in bilateral negotiation. *Organizational Behavior and Human Decision Processes, 37,* 1–13.

Carnevale, P. J. D., & Probst, T. M. (1998). Social values and social conflict in creative problem solving and categorization. *Journal of Personality and Social Psychology, 74,* 1300–1309.

Chaiken, S., & Trope, Y. (Eds.). (1999). *Dual-process theories in social psychology.* New York, NY: Guilford Press.

Chirumbolo, A., Mannetti, L., Pierro, A., Areni, A., & Kruglanski, A. W. (2005). Motivated closed-mindedness and creativity in small groups. *Small Group Research, 36,* 59–82.

Choi, H.-S., & Thompson, L. (2005). Old wine in a new bottle: Impact of membership change on group creativity. *Organizational Behavior and Human Decision Processes, 96,* 121–132.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention.* Boston, MA: HarperCollins.

De Dreu, C. K. W. (2003). Time pressure and closing of the mind in negotiation. *Organizational Behavior and Human Decision Processes, 91,* 280–295.

De Dreu, C. K. W. (2007). Cooperative outcome interdependence, task reflexivity, and team effectiveness: A motivated information processing perspective. *Journal of Applied Psychology, 92,* 628–638.

De Dreu, C. K. W. (2008). The vice and virtue of workplace conflict: Food for (pessimistic) thought. *Journal of Organizational Behavior, 29,* 5–18.

De Dreu, C. K. W., Baas, M., & Nijstad, B. A. (2008). Hedonic tone and activation level in the mood–creativity link: Toward a dual pathway to creativity model. *Journal of Personality and Social Psychology, 94,* 739–756.

De Dreu, C. K. W., Beersma, B., Stroebe, K., & Euwema, M. C. (2006). Motivated information processing, strategic choice, and the quality of negotiated agreement. *Journal of Personality and Social Psychology, 90,* 927–943.

De Dreu, C. K. W., Giebels, E., & Van de Vliert, E. (1998). Social motives and trust in integrative negotiation: The disruptive effects of punitive capability. *Journal of Applied Psychology, 83,* 408–422.

De Dreu, C. K. W., Koole, S. L., & Oldersma, F. L. (1999). On the seizing and freezing of negotiator inferences: Need for closure moderates the use of heuristics in negotiation. *Personality and Social Psychology Bulletin, 25,* 348–362.

De Dreu, C. K. W., Koole, S. L., & Steinel, W. (2000). Unfixing the fixed pie: A motivated information-processing account of integrative negotiation. *Journal of Personality and Social Psychology, 79,* 975–987.

De Dreu, C. K. W., & Nijstad, B. A. (2008). Mental set and creative thought in social conflict: Threat rigidity versus motivated focus. *Journal of Personality and Social Psychology, 95,* 648–661.

De Dreu, C. K. W., Nijstad, B. A., & Van Knippenberg, D. (2008). Motivated information processing in group judgment and decision making. *Personality and Social Psychology Review, 12,* 22–49.

De Dreu, C. K. W., Weingart, L. R., & Kwon, S. (2000). The influence of social motives on integrative negotiation: A meta-analytic review and test of two theories. *Journal of Personality and Social Psychology, 78,* 889–905.

De Grada, E., Kruglanski, A. W., Mannetti, L., & Pierro, A. (1999). Motivated cognition and group interaction: Need for closure affects the

contents and processes of collective negotiations. *Journal of Experimental Social Psychology, 35,* 346–365.

Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Toward the solution of a riddle. *Journal of Personality and Social Psychology, 53,* 497–509.

Dugosh, K. L., & Paulus, P. B. (2005). Cognitive and social comparison processes in brainstorming. *Journal of Experimental Social Psychology, 41,* 313–320.

Dunbar, K. (1995). How scientists really reason: Scientific reasoning in real-world laboratories. In R. J. Sternberg & J. Davidson (Eds.), *Mechanisms of insight* (pp. 365–395). Cambridge, MA: MIT Press.

Echterhoff, G., Higgins, E. T., & Levine, J. M. (2009). Shared reality experiencing commonality with others' inner states about the world. *Perspectives on Psychological Science, 4,* 496–521.

Farrell, M. P. (2001). *Collaborative circles: Friendship dynamics and creative work.* Chicago, IL: Chicago University Press.

Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review, 2,* 290–309.

Goncalo, J. A., & Staw, B. M. (2006). Individualism–collectivism and group creativity. *Organizational Behavior and Human Decision Processes, 100,* 96–109.

Grawitch, M. J., Munz, D. C., Elliott, E. K., & Mathis, A. (2003). Promoting creativity in temporary problem-solving groups: The effects of positive mood and autonomy in problem definition on idea-generating performance. *Group Dynamics: Theory, Research, and Practice, 7,* 200–213.

Gruenfeld, D. H., Thomas-Hunt, M. C., & Kim, P. H. (1998). Cognitive flexibility, communication strategy, and integrative complexity in groups: Public and private reactions to majority and minority status. *Journal of Experimental Social Psychology, 3,* 202–226.

Halevy, N. (2008). Team negotiation: Social, epistemic, economic, and psychological consequences of subgroup conflict. *Personality and Social Psychology Bulletin, 34,* 1687–1702.

Hardin, C. D., & Conley, T. D. (2001). A relational approach to cognition: Shared experience and relationship affirmation in social cognition. In G. Moskowitz (Ed.), *Cognitive social psychology: Princeton Symposium on the Legacy and Future of Social Cognition* (pp. 3–17). Mahwah, NJ: Erlbaum.

Hardin, C. D., & Higgins, E. T. (1996). Shared reality: How social verification makes the subjective experience. In R. M. Sorrentino & E. T. Higgins (Eds.), *Handbook of motivation and cognition* (Vol. 3, pp. 28–84). New York, NY: Guilford Press.

Hinsz, V. B., Tindale, R. S., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin, 121,* 43–64.

Hofstede, G. (1980). *Culture's consequences.* Beverly Hills, CA: Sage.

Hunter, S. T., Bedell, K. E., & Mumford, M. D. (2007). Climate for creativity: A quantitative review. *Creativity Research Journal, 19,* 69–90.

Karau, S. J., & Williams, K. D. (1993). Social loafing: A meta-analytic review and theoretical integration. *Journal of Personality and Social Psychology, 65,* 681–706.

Kelly, J. R., & Karau, S. J. (1993). Entrainment of creativity in small groups. *Small Group Research, 24,* 179–198.

Kenny, D. A., Kashy, D. A., & Bolger, N. (1998). Data analysis in social psychology. In D. Gilbert, S. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., Vol. 1, pp. 233–265). Boston, MA: McGraw-Hill.

Kerschreiter, R., Schulz-Hardt, S., Mojzisch, A., & Frey, D. (2008). Biased information search in homogeneous groups: Confidence as a moderator for the effect of anticipated task requirements. *Personality and Social Psychology Bulletin, 34,* 679–691.

Kim, H., & Markus, H. R. (1999). Deviance or uniqueness, harmony or conformity? A cultural analysis. *Journal of Personality and Social Psychology, 77,* 785–800.

Kruglanski, A. W., & Freund, T. (1983). The freezing and unfreezing of lay inferences: Effects of impressional primacy, ethnic stereotyping, and numerical anchoring. *Journal of Experimental Social Psychology, 19,* 448–468.

Lerner, J. S., & Tetlock, P. E. (1999). Accounting for the effects of accountability. *Psychological Bulletin, 125,* 255–275.

Lundgren, S. R., & Prislin, R. (1998). Motivated cognitive processing and attitude change. *Personality and Social Psychology Bulletin, 24,* 715–726.

Lunn, J., Sinclair, S., Whitchurch, E. R., & Glenn, C. (2007). (Why) do I think what you think? Epistemic social tuning and implicit prejudice. *Journal of Personality and Social Psychology, 93,* 957–972.

McClelland, G. H., & Judd, C. M. (1993). Statistical difficulties of detecting interactions and moderator effects. *Psychological Bulletin, 114,* 376–390.

McCrae, R. R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of Personality and Social Psychology, 52,* 1258–1265.

Michinov, N., & Primois, C. (2005). Improving productivity and creativity in online groups through social comparison process: New evidence for asynchronous electronic brainstorming. *Computers in Human Behavior, 21,* 11–28.

Moynihan, L. M., & Peterson, R. S. (2001). A contingent configuration approach to understanding the role of personality in organizational groups. In B. M. Staw & R. I. Sutton (Eds.), *Research in organizational behavior* (Vol. 23, pp. 327–378). London, United Kingdom: JAI Press.

Mullen, B., Johnson, C., & Salas, E. (1991). Productivity loss in brainstorming groups: A meta-analytic integration. *Basic and Applied Social Psychology, 12,* 3–23.

Nemeth, C. J., Personnaz, B., Personnaz, M., & Goncalo, J. A. (2004). The liberating role of conflict in group creativity: A study in two countries. *European Journal of Social Psychology, 34,* 365–374.

Nijstad, B. A., De Dreu, C. K. W., Rietzschel, E. F., & Baas, M. (2010). The dual pathway to creativity model: Creative ideation as a function of flexibility and persistence. *European Review of Social Psychology, 21,* 34–77.

Nijstad, B. A., & Kaps, S. C. (2008). Taking the easy way out: Preference diversity, decision strategies, and decision refusal in groups. *Journal of Personality and Social Psychology, 94,* 860–870.

Nijstad, B. A., & Stroebe, W. (2006). How the group affects the mind: A cognitive model of idea generation in groups. *Personality and Social Psychology Review, 10,* 186–213.

Niu, W., & Sternberg, R. J. (2001). Cultural influences on artistic creativity and its evaluation. *International Journal of Psychology, 36,* 225–241.

Osborn, A. F. (1953). *Applied imagination.* New York, NY: Scribner.

Parnes, S. J., & Meadow, A. (1959). Effects of "brainstorming" instructions on creative problem solving by trained and untrained subjects. *Journal of Educational Psychology, 50,* 171–176.

Paulus, P. B., Dugosh, K. L., Dzindolet, M. T., Putnam, V. L., & Coskun, H. (2002). Social and cognitive influences in group brainstorming: Predicting gains and losses. *European Review of Social Psychology, 12,* 200–235.

Paulus, P. B., Dzindolet, M. T., Poletes, G., & Camacho, L. M. (1993). Perception of performance in group brainstorming: The illusion of group creativity. *Personality and Social Psychology Bulletin, 19,* 73–89.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 19, pp. 123–205). New York, NY: Academic Press.

Postmes, T., Spears, R., & Cihangir, S. (2001). Quality of decision making and group norms. *Journal of Personality and Social Psychology, 80,* 918–930.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling

strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879–891.

Rietzschel, E. F., De Dreu, C. K. W., & Nijstad, B. A. (2007). Need for structure and creative performance: The moderating role of fear of invalidity. *Personality and Social Psychology Bulletin, 33,* 855–866.

Rietzschel, E. F., Nijstad, B. A., & Stroebe, W. (2007). Relative accessibility of domain knowledge and creativity: The effects of knowledge activation on the quantity and quality of ideas. *Journal of Experimental Social Psychology, 43,* 933–946.

Rietzschel, E. F., Nijstad, B. A., & Stroebe, W. (2010). The selection of creative ideas after individual idea generation: Choosing between creativity and impact. *British Journal of Psychology, 101,* 47–68.

Runco, M. A. (2004). Creativity. *Annual Review of Psychology, 55,* 657–687.

Saucier, G. (1994). Mini-markers: A brief version of Goldberg's unipolar Big Five markers. *Journal of Personality Assessment, 63,* 506–516.

Sawyer, R. K., & DeZutter, S. (2009). Distributed creativity: How collective creations emerge from collaboration. *Psychology of Aesthetics, Creativity, and the Arts, 3,* 81–92.

Scholten, L., Van Knippenberg, D., Nijstad, B. A., & De Dreu, C. K. W. (2007). Motivated information processing and group decision making: Effects of process accountability on information processing and decision quality. *Journal of Experimental Social Psychology, 43,* 539–552.

Schultz, P. W., & Searleman, A. (1998). Personal need for structure, the Einstellung task, and the effects of stress. *Personality and Individual Differences, 24,* 305–310.

Schulz-Hardt, S., Brodbeck, F. C., Mojzisch, A., Kerschreiter, R., & Frey, D. (2006). Group decision making in hidden profile situations: Dissent as a facilitator for decision quality. *Journal of Personality and Social Psychology, 91,* 1080–1093.

Shin, S. J., & Zhou, J. (2007). When is educational specialization heterogeneity related to creativity in research and development? Transformational leadership as a moderator. *Journal of Applied Psychology, 92,* 1709–1721.

Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin, 86,* 420–428.

Simonton, D. K. (1997). Creative productivity: A predictive and explanatory model of career trajectories and landmarks. *Psychological Review, 104,* 66–89.

Simonton, D. K. (2003). Scientific creativity as stochastic behavior: The integration of product, person, and process perspectives. *Psychological Bulletin, 129,* 475–494.

Smith, P. H., Peterson, M. F., & Schwartz, S. H. (2002). Cultural values, sources of guidance, and their relevance to managerial behavior: A 47-nation study. *Journal of Cross-Cultural Psychology, 33,* 188–208.

Stasser, G., & Birchmeier, Z. (2003). Group creativity and collective choice. In P. B. Paulus & B. A. Nijstad (Eds.), *Group creativity: Innovation through collaboration* (pp. 85–109). New York, NY: Oxford University Press.

Steiner, I. D. (1972). *Group process and productivity.* New York, NY: Academic Press.

Sutton, R. I., & Hargadon, A. (1996). Brainstorming groups in context: Effectiveness in a product design firm. *Administrative Science Quarterly, 41,* 685–718.

Taggar, S. (2002). Individual creativity and group ability to utilize individual creative resources: A multilevel model. *Academy of Management Journal, 45,* 315–330.

Tjosvold, D. (1998). Cooperative and competitive goal approach to conflict: Accomplishments and challenges. *Applied Psychology: An International Review, 47,* 285–342.

Tjosvold, D. (2008). Conflicts in the study of conflict in organizations. In C. K. W. De Dreu & M. J. Gelfand (Eds.), *The psychology of conflict and conflict management in organizations* (pp. 445–454). New York, NY: Erlbaum.

Toma, C., & Butera, F. (2009). Hidden profiles and concealed information: Strategic information sharing and use in group decision making. *Personality and Social Psychology Bulletin, 35,* 793–806.

Van Dyne, L., & Saavedra, R. (1996). A naturalistic minority influence experiment: Effects on divergent thinking, conflict, and originality in work-groups. *British Journal of Social Psychology, 35,* 151–167.

Van Hiel, A., & Mervielde, I. (2003). The need for structure and the spontaneous use of complex and simple cognitive structures. *Journal of Social Psychology, 14,* 559–568.

Webster, D. M., & Kruglanski, A. W. (1994). Individual differences in need for cognitive closure. *Journal of Personality and Social Psychology, 67,* 1049–1062.

Weingart, L. R., Brett, J. M., Olekalns, M., & Smith, P. L. (2007). Conflicting social motives in negotiating groups. *Journal of Personality and Social Psychology, 93,* 994–1009.

West, M. A., & Anderson, N. R. (1996). Innovation in top management teams. *Journal of Applied Psychology, 81,* 680–693.

Wolfradt, U., & Pretz, J. E. (2001). Individual differences in creativity: Personality, story writing and hobbies. *European Journal of Personality, 15,* 297–310.

Zha, P., Walezyk, J. J., Griffith-Ross, D. A., Tobacyk, D. T., & Walczyk, J. (2006). The impact of culture and individualism-collectivism on the creative potential and achievement of American and Chinese adults. *Creativity Research Journal, 18,* 355–366.