

**THREE ESSAYS ON POWER DYNAMICS AND GROUP
CREATIVITY**

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This dissertation is dedicated to my beloved mother. May her soul rest in peace in heaven.

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ABSTRACT

Creativity is critical to the success of individuals, groups, and organizations. The prevalence of groups as work units in modern organizations has inspired plenty of research to identify the facilitators and inhibitors of group creativity. Despite the extensive research on the benefits and costs of power on individual creativity, previous research has remained silent on how power influences group creativity performance. Besides, idea generation and idea selection are two qualitatively distinct stages of creativity with different task goals and cognitive requirements. Idea generation is defined as a task to produce as many creative ideas as possible and idea selection aims at choosing the best idea(s) for further development and commercialization. Despite these differences in the two stages of creativity, power equality, by facilitating open expression and enhancing information exchange, may have positive effects on the production of creative outputs at both two stages. Nonetheless, no known research has empirically examined the roles power distribution plays at the idea generation and selection stages of creativity. Furthermore, the presence of inconsistent findings pertinent to cross-cultural differences in creativity highlights the need for a theoretical framework that organizes existing findings and explicates the underlying mechanisms of these cultural differences. This dissertation aims to fill in the research gaps mentioned above through two empirical studies and the proposal of a theoretical model.

The present dissertation consists of three interrelated essays on power and group creativity. In the first essay, I examined how equal power distribution within the group, an important aspect of power dynamics in teams, predicts creativity performance through the mediation of constructive controversy in student teams. I hypothesized that equal power distribution facilitates creative performance through supporting open-minded discussion of

diverse opinions within the group. Aside from power distribution, the study also explored whether empowerment and collaboration also promote constructive controversy, which in turn enhances group creativity. The research further examined whether empowerment and collaboration can further strengthen the relationship between equal power distribution and constructive controversy. I conducted a survey study with student project teams to test my hypotheses. The results showed that equal power distribution, together with group empowerment and collaboration, positively predict group creativity through the mediation of constructive controversy. The interaction effects of empowerment and collaboration with equal power distribution on constructive controversy were not significant.

The focus of the second essay is on the role of equal power distribution in the idea generation and selection stages of team creativity. I hypothesize that equal power distribution predicts higher group originality at both idea generation and idea selection stages, but through different mechanisms. These hypotheses received partial support from a lab experiment, in which college students worked together in teams to generate or select ideas in a design task. Egalitarian groups tended to select more original ideas. However, both the facilitative (indirect effect through the mediation of information volume) and inhibitive effects of power equality on originality were found at the idea generation stage. Equal power distribution enhances group originality of ideas generated by licensing free expression; but also dilutes the average level of originality in the ideas generated by the group, possibly because equal power distribution encourages ideational explorations without due consideration for the originality of ideas generated.

In the third essay, I reviewed the pertinent literature on culture and team creativity and proposed a framework to unpack the effects of culture on group creativity. I argue that cultural

differences in creative performance arise from adherence to perceived norms of creativity in the presence of the group. People from different cultures hold different shared beliefs about what constitute creativity as well as how to achieve creativity in the group. I propose that the effects of these shared beliefs on group creativity are particularly pronounced in the idea selection stage because people are more likely to tune behaviors toward perceived norms when members of the culture are required to reach consensus on what ideas will be selected for further development. General discussion on how to manage group creativity is offered in the final chapter of the dissertation.

Contributions of this dissertation are multifold. First, this dissertation demonstrates the effects of equal power distribution on group creativity as well as their roles at the stages of idea generation and selection. The findings add to the literature on constructive controversy by examining several of its group level antecedents. My study also provides directions for future research on creativity as a multiple stage process. Finally, the framework of cultural effects on group creativity provides new insights into the normative processes underlying cultural differences in creativity performance. Future empirical investigation into the interplay of culture, power and creativity is strongly encouraged.

CHAPTER 1 INTRODUCTION AND THE OVERVIEW

Creativity is critical to the success of individuals, groups, and organizations. The prevalence of groups as work units in modern organizations has inspired plenty of research to identify the facilitators and inhibitors of group creativity. The effect of power on creativity gain and loss has been extensively studied at the individual level. Nevertheless, there is surprisingly little research on how power influences group creativity performance. Besides, idea generation and idea selection are two qualitatively distinct stages of creativity with different task goals. The goal of idea generation is to produce as many creative ideas as possible and that of idea selection is to choose the best idea(s) for further development and commercialization. Therefore, the effect of power on the quality of creative outputs may differ at these two stages of creativity. Furthermore, existing empirical investigations into the cross-cultural differences in creativity have yielded inconclusive findings. It remains unclear whether there are systematic differences in creativity performance across cultures and what the underlying mechanisms are if such differences exist. This dissertation aims to fill the research gaps mentioned above.

Creativity is both a quality attribute of a product / idea as well as a process. A creative product is one that embodies an original idea and has value to its users (Amabile, 1986). The process of producing a creative idea involves multiple stages including idea generation and idea selection (Chiu & Kwan, 2010). Idea generation is the stage in which knowledge workers generate and author new ideas. The primary goal at this stage is to generate potentially creative ideas. Idea selection is the stage in which a subset of new ideas is selected for further development and refinement. At this stage, the primary goal is to choose the best idea(s). This dissertation will investigate creativity as a quality attribute of product and as a process.

The potential impact of power on individual creativity has been examined in previous research. Powerful individuals, compared with less powerful ones, tend to show a reduced tendency to take other people's perspectives (Galinsky, Magee, Inesi, & Gruenfeld, 2006), although perspective taking can facilitate creativity and innovation (Grant & Berry, 2011). However, power can boost creativity by increasing the flexibility in instrumental information search and sheltering the individual from conformity pressure (Galinsky, Magee, Gruenfeld, Whitson, & Liljenquist, 2008; Overbeck, & Park, 2006; Overbeck, Tiedens, & Brion, 2006). People who feel powerful are also more efficient in deploying pertinent cognitive resources to support the initiation and persistent pursuit of goals (Galinsky, Gruenfeld, & Magee, 2003; Guinote, 2007a, 2007b; Smith, Jostmann, Galinsky, & Van Dijk, 2008), which may facilitate performance in creativity tasks.

Compared with research on the role of power in individual creativity, research on the linkage between power and creativity at the group level is much less extensive. One potential mediator between power and group creativity is cognitive stimulation. Several categories of predictors of group creativity, such as leadership, coworker characteristics, group characteristics, task characteristics and group processes, have been considered in different organizational behavior literatures. A recurrent theme in these literatures is that group creativity can benefit from exposure to divergent opinions. For example, research has shown that intellectual stimulation often results from recruiting members with diverse backgrounds (Jackson, 1992; West, 2002), creating a psychologically safe work environment (Gilson & Shalley, 2004; Kark, & Carmeli, 2009), encouraging debate and expression of dissents (Nemeth & Owens, 1996; Tjosvold, 1998b), and providing constructive feedback (Shin & Zhou, 2003). Meanwhile, there is evidence that power distribution in team can affect knowledge exchange. For example, Huber

(1982) found that the relative power of the members in a communication dyad in the organization could affect information sharing. These findings suggest that the presence of theoretical connections between power distribution and group creativity, which will be examined more thoroughly in the following chapters of my dissertation.

This dissertation aims to answer the following research questions: (1) What is the relationship between power distribution and group creativity? (2) How may the relationship between power distribution and group creativity differ at different stages of creativity? (3) How does culture influence group creativity performance at different stages of creativity? To answer these questions, I will report two empirical studies and propose a theoretical framework for understanding culture and creativity in the present dissertation.

The dissertation is organized as follows. Chapter 2 examines the effect of equal power distribution on creativity as well as the underlying mechanism of this relationship. In this chapter, I explored a possible channel through which equal power distribution affects creativity. I argue that equal power distribution encourages constructive controversy, i.e., open-minded discussion of disagreements, which in turn enhances cognitive stimulation in the group. A secondary objective of this study is to further extend the literature of constructive controversy by considering the main effects of empowerment and collaboration quality as well as their interactions with equal power distribution on constructive controversy. Using survey data from student groups working on a research project, I conducted path analyses to test the effect of equal power distribution, empowerment, and collaboration quality on group creativity performance through the mediating mechanism of constructive controversy. The interaction effects of equal power distribution with empowerment and collaboration quality on creativity through constructive controversy were also tested.

The relationship between equal power distribution and creativity across the idea generation and selection stages are examined in chapter 3. Creativity involves qualitatively different stages. In chapter 3, I examine the role of equal power distribution in (a) generating and (b) selecting original ideas in a team creativity task. As mentioned above, the aim of idea generation is to produce multiple potentially creative ideas. In contrast, the major goal in the idea selection stage is to choose the most creative idea(s) for elaboration and commercialization. Due to the goal differences in the two stages of creative production, equal power distribution influences group creativity performance through different mechanisms at the two stages. Specifically, I hypothesize that egalitarian teams tend to generate more original ideas because power equality facilitates free expression. In contrast, equal power distribution helps groups select more original idea by supporting thorough evaluation of alternatives. To test this hypothesis, I have conducted a lab study, in which participants were assigned to accomplish either the idea generation task or the idea selection task in groups. The rationale and the results of this lab study will be presented in chapter 3.

A framework on how culture can influence group creativity at different stages of creative production will be presented in chapter 4, drawing on the findings of chapter 3. Prior studies (Liou & Nisbett, 2011; Nouri, Erez, Thomas, & Ng, 2008) found out that compared with groups composed of members from individualist cultures, groups composed of members from collectivist cultures choose less original ideas. Based on the effect of equal power distribution on group originality in the idea selection stage in chapter 3, I propose that the cultural differences in the originality of ideas selected originate from cultural differences in the preferred style of teamwork. To elaborate, egalitarianism rather than unequal power is more widely practiced in teams in individualist cultures, and the reverse is true in collectivist cultures. However, prior

research has failed to find the differences in the originality of ideas generated by individualist and collectivist groups (Liou & Nisbett, 2011). Thus, cross-cultural differences in group creativity merit a closer examination. In Chapter 4, I offer a theoretical framework that explicates the interplay of culture, group processes and group creativity. I argue that cultural differences in creative performance may arise from adherence to perceived norms of creativity in the presence of the group. People from different cultures have different shared beliefs about what constitute creativity. Although these shared beliefs may not affect performance in idea generation or when people work on creativity tasks alone, their effects on what ideas will be selected for further development are pronounced when members of the culture are required to reach consensus at the idea selection stage. This framework will be further elaborated in Chapter 4. General discussion on how to manage group creativity is offered in the final chapter of the dissertation.

This dissertation contributes to the literature in several ways. First, the two empirical studies shed light on how power distribution may influence group performance, particularly creativity performance, through encouraging cognitive stimulation and constructive discussion. In addition, considering the facilitative roles of empowerment and collaboration in constructive controversy offers a more comprehensive understanding of the conditions that would support employees' participation in open discussion of diverse opinions. Furthermore, identification of divergent mechanisms through which equal power distribution influences group originality in the idea generation and selection stages further highlights the importance of treating creativity as a multi-stage process in research and management of group dynamics in innovation teams. Finally, the theoretical framework of culture and creativity proposed in the present dissertation helps to understand the effects of culture on group creativity by explicating the interplay of culture and

group processes. This framework may inspire more in-depth conceptual and empirical investigations into this emerging field of research on culture and creativity.

CHAPTER 2 CREATIVITY PERFORMANCE OF EGALITARIAN GROUPS

The facilitative and inhibitive effects of power on creativity are widely studied at individual level (e.g., Galinsky et al., 2006; Guinote, 2007a, 2007b; Overbeck et al., 2006; Smith et al., 2008).

However, there is a dearth of research on how power can affect group creativity, which is a research oversight considering the significance of creativity for the survival and success of work units. The current chapter aims to fill this research gap by examining the role of equal power distribution in group creativity performance as well as constructive controversy as the underlying mechanism. As a secondary objective, the current study also examines empowerment and quality of collaboration as other possible antecedents of constructive controversy. Through this study, I seek to bring attention to the importance of group experience both as antecedents and the mediating process in the study of group creativity performance.

The present study empirically explored the relationship between equal power distribution and group creativity performance. Prior research has extensively studied the creativity gain and loss of power in individual creativity tasks (e.g., Galinsky et al., 2008; Galinsky et al., 2006). There is also evidence that power sharing at workplace, as manifested in employee participation in management and decision making, is a major predictor of employee creativity in organizations (e.g., De Dreu & West, 2001; Kimberley & Evanisko, 1981; West & Anderson, 1996). Nonetheless, the literature has remained silent on the association between power equality and group creativity. The present study seeks to deepen our understanding of the linkage between equal power distribution and group creativity by introducing an intervening variable - constructive controversy. Constructive controversy refers to the open-minded discussion of opposite opinions (Tjosvold, 1998a); it captures the process through which equal distribution of power in teams enhances creative team output.

As a secondary objective, the present study also examines other antecedents of constructive controversy following the Ability - Motivation - Opportunity (AMO) framework of behavior. The AMO framework argues that the ability, motivation and opportunity to carry out an intended behavior jointly determine actual execution of the behavior (Ölander & Thøgersen, 1995). In the present context, the intended behavior is the intention to engage in constructive controversy within the group. For constructive discussions on controversial issues to occur within the group, aside from having the pertinent motivation, members need to perceive that they have the competence and opportunity to do so. In the present study, I examined a couple of group experience variables that may be connected to the ability, motivation, and opportunity to engage in constructive controversy.

As mentioned above, this chapter seeks to illustrate the significant role of group experience in predicting group effectiveness through the mediating mechanism of constructive controversy. A group is a complex system. Hence, there is a research need to open the black box and reveal the group processes that mediate the input and output variables in group performance (Ilgen, Hollenbeck, Johnson, & Jundt, 2005). Building on but unlike the past research that has investigated the functional relationships between group characteristics and group performance (e.g., team diversity, Pelled, Eisenhardt, & Xin, 1999; Van Knippenberg, De Dreu, & Homan, 2004), in this chapter, I investigate how group experience of power equality, empowerment, and quality of collaboration influence group creativity performance through the mechanism of cognitive stimulation - constructive controversy.

In summary, given the possible linkage between equal power distribution and group creativity and the lack of research that directly tests this linkage, the present research seeks to make a contribution by establishing this relationship. In addition, I will also try to identify one

possible mediating mechanism through which groups experiencing higher levels of power equality can outperform those experiencing lower levels of power equality in creativity tasks. Besides, the present study will explore other antecedents of constructive controversy using the AMO framework.

To flesh out my arguments, I will begin with a brief review of the pertinent literature to establish the possible connections between power, constructive controversy and creativity. Next, I will elaborate on how power distribution, empowerment and quality of collaboration are possible antecedents of constructive controversy from the AMO framework. I hypothesize that the relationship between the three group experience variables and group creativity runs through the mediating mechanism of constructive controversy. Furthermore, I will explore whether empowerment and collaboration quality would interact with equal power distribution to predict constructive controversy. I will close this chapter by discussing the implications of the results and the directions for future research.

Power Distribution, Constructive Controversy and Creativity

Although equal power distribution has not been studied directly, prior research has documented the beneficiary effects of power sharing at the workplace. Power sharing practices, such as participative decision-making, encourage employees to exercise control over their work and work outcomes (Locke & Schweiger, 1979). As a consequence, employees gain autonomy and a sense of ownership, as well as experience more control at work. These perceptions do not only improve employee's well-being but also increase the level of job involvement and task commitment (e.g., Brown, 1996; Spector, 1986). Participative decision-making also facilitates job performance and satisfaction (e.g., Cotton, Vollrath, Froggatt, Lengnick-Hall, & Jennings,

1988; Miller & Monge, 1986). Following this line of argument, power equality among group members, an egalitarian form of power sharing experience, is expected to produce similar benefits of power-sharing practices. Thus, in groups with more even power distribution, members should have more positive attitudes toward the job. They should also be more willing to voice their opinions when performing group tasks and making group decisions.

I contend that constructive controversy is an intervening variable in the relationship between power equality and team creativity. Constructive controversy enhances creativity through cognitive stimulation while mitigating the potentially negative consequences of conflicts. An advantage of having groups rather individuals working on creativity task is the increased amount intellectual stimulation resulting from the exposure to different opinions and non-overlapping expertise of group members. There is consistent evidence that in diverse work teams, exposure to divergent ideas from different members often stimulates new, original ideas (Nijstad, Stroebe, & Lodewijckx, 2003). Conflicts, particularly cognitive conflicts, also invite team members to resolve seemingly incompatible, paradoxical ideas (Leung & Chiu, 2010; Miron-Spektor, Gino, & Argote, 2011). A study showed that when teams are encouraged to debate with each other and criticize each other's ideas, the teams generate more divergent thoughts, compared to teams that engage in traditional brainstorming (Nemeth, Personnaz, Personnaz, & Goncalo, 2004). However, these confrontations may also produce tension within the group and reduce satisfaction, distract group members from the task, and lower productivity (Gladstein, 1984; Saavedra, Earley, & Van Dyne, 1993; Wall & Nolan, 1986). To leverage on the diverse knowledge of members without jeopardizing group performance, Tjosvold (1998b) proposed constructive controversy as a cooperative conflict-resolution approach. Constructive controversy refers to open-minded discussion of disagreements. Constructive controversy allows groups that

are exposed to divergent opinions from members to reduce the risks and tension associated with expressions of dissents, and hence enhances the quality of decision-making and creativity performance (Alper, Tjosvold, & Law, 2000; Chen, Liu, & Tjosvold, 2005; Tjosvold, 1998b).

What are the antecedents of constructive controversy? It is well documented in the behavioral science literature that ability, motivation and opportunity jointly predict people's behavior. Prior research suggests that the ability and the motivation to perform a certain behavior predict occurrence of the behavior better than using only one or none of these components (Batra & Ray, 1986; Moorman & Matulich, 1993). Aside from ability and motivation, opportunity as an antecedent of behavior is emphasized in Blumberg and Pringle's (1982) interactive model of performance. Likewise, Ölander and Thøgersen (1995) have proposed an Ability - Motivation - Opportunity (AMO) framework to understand consumer behavior. Ölander and Thøgersen (1995) demonstrated that the actor's intention (motivation), the actor's ability to carry out the intention, and opportunity to carry out the intended behavior jointly determine environmentally sustainable consumption behaviors. Thus, it seems reasonable to argue that competence, motivation and opportunity would also predict the likelihood of engaging in constructive controversy. Equal power distribution provides employees with the opportunity to express their opinions and impact group process and the outcome. Empowerment increases employees' confidence in their ability to engage in constructive debates, while having high quality collaborations with team members increases the motivation to voice dissent opinions for the collective good. Accordingly, I propose that power equality, empowerment and collaboration are group experiences that would increase the likelihood of employees participating in constructive controversy.

Research Hypotheses

I hypothesize that open-minded discussion of opposite opinions is an intervening mechanism that links group experience and group creativity. As discussed above, constructive controversy provides the group with cognitive stimulation that benefits creative problem solving. However, constructive controversy is more likely to emerge when the group is situated in a collaborative context in which group members can and are willing to discuss dissents openly (Tjosvold, 1998b; Tjosvold, Poon, & Yu, 2005). Equal power distribution readily provides employees with a controversy-friendly environment. Prior research has revealed an association between power sharing and constructive controversy by identifying the positive relationship between democratic leadership and the level of engagement in constructive discussion of disagreements (Tjosvold, Hui, & Law, 1998). Empowerment and collaborative experience also enable and motivate group members to engage in task-oriented debates, thus enhancing group creativity.

Equal power distribution provides a platform and opportunities for group members to contribute their expertise through active participation in constructive debate. One potential consequence of unequal power distribution within the group is the centralization of information exchange to the more powerful members (Brown & Miller, 2000; Pierro, Mannetti, De Grada, Livi, & Kruglanski, 2003). Conversational and influence asymmetries among group members can stifle employees' free expression of opinions and consequently decrease the group's awareness of divergent views. An egalitarian structure in the group offers members equal access to the power of discourse and creates an atmosphere that encourages constructive discussion of divergent opinions. To achieve group effectiveness, group members need to perceive that they have equal opportunity to engage in deliberation, to vote for or against any proposal, and to

express dissents (Abdel-Halim, 1983). Previous studies also found that participative structure can enhance performance and creativity (Woodman, Sawyer, & Griffin, 1993).

Hypothesis 1. Equal power distribution would positively predict group creativity, and the relationship is mediated by constructive controversy.

Empowering group experience enables group members to effectively participate in knowledge sharing and intellectual debate in a creativity task. Empowerment gives group members the perception of competence, autonomy, and influence in the process of task accomplishment (Spreitzer, 1995). Perceived efficacy and autonomy to accomplish the task encourages employees to express what they think would help the group to perform efficiently and effectively. Understanding that the group is receptive to their input and impact, group members are more likely to engage in constructive discussion. Besides, empowered group members are able to counteract the conformity pressures to express their genuine opinions and dissent (Galinsky et al., 2008).

Hypothesis 2. Group members' empowerment would positively predict group creativity, and the relationship is mediated by constructive controversy.

High quality collaboration within the group enhances group creativity by motivating group members to engage in constructive discussion of controversies. Coworkers tend to offer interpersonal help, be considerate to each other, work conscientiously as well as engage in other activities that may benefit their peers and the collective in cooperative groups (De Cremer & Van

Knippenberg, 2002). Group members are motivated to participate in the process of task accomplishment when they experience support and help within the group. As a result, they are more likely to take a cooperative conflict management approach - expressing ideas directly, tending to different opinions openly, and being willing to take each other's perspective accurately (Tjosvold, 1998b). Previous research findings support the conclusion that having cooperative goals is an important antecedent of constructive controversy (Tjosvold, 1998a; Tjosvold, Poon, & Yu, 2005). I posit that like having a cooperative goal, positive experience with collaboration with other team members also predicts constructive controversy. That is, high quality collaboration should support constructive controversy and enhance group creativity.

Hypothesis 3. Quality of group collaboration would positively predict group creativity, and the relationship is mediated by constructive controversy.

In addition to having main effects on constructive controversy and creativity outcome, empowerment and quality of collaboration may also moderate the effects of power equality on constructive controversy and creativity outcome. To elaborate, egalitarian groups with empowered members are more likely to engage in constructive discussion. Empowered employees perceive themselves to have the knowledge and skills to fulfill task requirements, possess control over how to complete the task, and be able to impact the group outcome and other group members (Spreitzer, 1995). In addition, employees who perceive low level of competence in participative decision-making tend to make poorer decisions when offered an opportunity for participative decision-making (Lam, Chen, & Schaubroeck, 2002). Therefore,

when members are delegated equal power within the group, those who feel more empowered are more likely to voice their opinions to deliver creative output.

Hypothesis 4. The interaction of empowerment and equal power distribution would have a positive effect on constructive controversy, which would in turn improve group creativity.

Positive collaborative experience may also strengthen the positive relationship between equal power distribution and constructive controversy. Members in cooperative groups are more motivated to share their knowledge when they are offered an opportunity to contribute to group performance. During a creativity task, egalitarian groups who experience more collegiality from team members will more freely express objections and dissents and be less concerned about negative sanctions from the group for making these expressions. Hence, employees who experience higher collaboration quality should be more motivated to engage in constructive controversy, particularly when power equality in the group is high.

Hypothesis 5. The interaction of collaboration and equal power distribution would have a positive effect on constructive controversy, which would in turn improve group creativity.

Method

Sample and procedure

A total of 224 college students from a large public university in Northern China participated in this study as members of project teams in an introductory social psychology class. They were randomly assigned to form forty-five 5-person groups (although one group had 4

members only) to accomplish a research project, which was an assignment of the course. A total of 172 (out of 224; 76.79%) participants returned their questionnaires. To produce reliable group level observations (Colquitt, Noe, & Jackson, 2002; Richardson & Vandenberg, 2005; Schneider, White, & Paul, 1998), I included only groups that had three or more members who had returned the questionnaire. Therefore, the final sample consisted of 40 groups.

Participants were randomly assigned to form teams one week after the semester started (Week 2). The survey was administered at Week 9, and it measured the three group experience variables: equal power distribution, empowerment, and collaboration quality; as well as constructive controversy. Participants submitted their final proposal at the end of Week 15. A more detailed description of the research project can be found in Appendix A.

Measures

Group experience. All participants rated the extent to which they felt that (a) all group members had equal power in the discussion and decision-making (equal power distribution), (b) they were empowered (empowerment), and (c) the group was supportive of collaboration (collaboration quality). I developed a 3-item measure ($\alpha = .93$) to assess perceived equality in the distribution of power in the team. An example item is: “Each member had equal opportunity to express his/her opinions during the discussion.” I assessed empowerment with three components of the Spreitzer (1995) measure: competence, self-determination, and impact. The dimension of meaning was excluded because I was primarily interested in empowerment as the perceived competence to engage in constructive controversy. Minor modifications to the some items were made to increase their applicability to the present context. An example item of the measure is “I have mastered the skills necessary for this task.” This 9-item measure had high reliability ($\alpha = .87$). Collaboration quality was measured with four items ($\alpha = .90$). A sample item is

“Members in my group helped each other to accomplish this task.” All three variables were measured in a 7-point Likert scale (1=strongly disagree, 7=strongly agree). The scales can be found in Appendix B.

Constructive controversy. I adopted Tjosvold’s scale (Alper, Tjosvold, & Law, 1998; Tjosvold, 1998b) to assess constructive controversy. Participants indicated on a 7-point scale (1=strongly disagree, 7=strongly agree) their extent of agreement with 6 items that depict constructive controversy within the group. A sample item is “Our group members showed mutual respect despite disagreements.” (The complete scale of 6 items is shown in Appendix B). The reliability of the scale was high ($\alpha = .93$).

Group creativity. Three experts used a 6-point Likert scale (1=very non-original/ very useless, 6=very original/very useful) to rate all group projects on the dimensions of originality and usefulness. For each project, I took the average of the originality and usefulness ratings by each

rater. Scores from the three raters showed high inter-rater agreement ¹ ($r_{wg}=0.85$) and inter-rater reliability² ($ICC(1)=0.22, p<0.001$). The average creativity scores of three raters were used as the measure of creativity of each group project. These values were adjusted to a 7-point scale in statistical analysis.

Calculation of group level variables. To generate group level variables, I calculated within-group agreement to determine the appropriateness of using group average as group level data. All three group experience variables in the study demonstrated high within-group agreement (equal power distribution: $r_{wg}=0.85$; empowerment: $r_{wg}=0.88$; collaboration quality: $r_{wg}=0.84$). Therefore, average scores of group members' ratings on equal power distribution, empowerment, and collaboration quality were used as team-level variables.

¹ r_{wg} was calculated for each group. The reported r_{wg} value of the variable is the average of the values of all groups. If the group value is negative, it was set to 0 based on James and his colleagues' (1984) recommendation. The

formula for calculating r_{wg} is $r_{wg} = 1 - \left(\frac{S^2}{\sigma_{EU}^2} \right)$; in which S^2 stands for the observed variance in group and σ_{EU}^2

stands for expected variance of this variable within the group, i.e. the variance when members responded randomly. The conventional cut-off point of r_{wg} is 0.70 (strong agreement), which means that only 30% of the variance in the data is attributed to random responding, i.e. error variance. Larger values of r_{wg} indicate higher agreement. For more details, see Bliese (2000) and LeBreton and Senter (2008).

² The formula for calculating $ICC(1)$ is $ICC(1) = \frac{MSB - MSW}{MSB + [(k - 1) * MSW]}$, where MSB refers to between-group

variance, MSW refers to within-group variance, and k indicates the group size (the number of members/raters in the group). A significant value of $ICC(1)$ indicates that the variance of creativity ratings is explained by group differences. The $ICC(1)$ value of 0.22 indicates that the effect size is sizable since the value of 0.25 is considered to be a large effect (Murphy & Myors, 1998).

Constructive controversy also achieved high within-group agreement on the ratings ($r_{wg}=0.89$). To show that the robust of the results across different operationalization of constructive controversy, two group-level measures of constructive controversy were constructed - the average of the group members' ratings (mean measure) and the lowest of the group members' ratings (minimal measure) (see Selected Score Model in Chen, Mathieu, & Bliese, 2003). The high level of within-group agreement of the ratings on constructive controversy indicates that the discrepancy between the lowest perception of constructive controversy and the group mean perception was not large. Indeed, the two measures were highly correlated ($r = .88$). In the following analyses, I tested my hypotheses with both measures of constructive controversy. If my hypotheses are true, the group mean measure and group minimal measure of constructive controversy shall yield the same patterns of results.

Analytical method

I used path analysis in LISREL 8.70 to test my model. Path analysis allows me to test all hypotheses and estimate error simultaneously. I adopted the bootstrapping method to obtain an appropriate sample size for path analysis using Structural Equation Modeling (SEM). I tested the hypothesized model with both the minimal measure and the mean measure of constructive controversy.

The fit of the model to the data was evaluated using the Root Mean Squared Error of Approximation (*RMSEA*), the Standardized Root Mean Squared Residual (*SRMR*), Goodness of Fit Index (*GFI*), and the Comparative Fit Index (*CFI*). *RMSEA* and *SRMR* are both absolute fit indices for testing the fit of the proposed model to a just-identified model. *SRMR* is based on the standardized residuals; smaller values indicate better fit of the model to the data. A *SRMR* value of 0.08 or lower indicates good model fit (Hu & Bentler, 1999). The calculation of *RMSEA* is

based on the non-centrality parameter. A *RMSEA* value of 0.05 or lower indicates very good fit, and values falling between 0.05 and 0.08 indicate good fit (Browne & Cudeck, 1993). Again, smaller values of *RMSEA* indicate better fit of the model. The *GFI*, also an absolute fit index, shows the proportion of the variances and covariances in data accounted for by the proposed model. The value of *GFI* should fall between 0.00 and 1.00; values greater than 0.90 are considered desirable (Byrne, 1994). Higher values of *GFI* indicate better fit of the model to the data. The *CFI* is an index of relative fit and measures the proportionate improvement in fit compared to the null baseline model. Its values range from 0.00 to 1.00, with higher values indicating better fit of the model to the data. *CFI* values exceeding 0.95 are accepted as evidence of good model fit (Hu & Bentler, 1999).

I also report the Chi-square statistic (χ^2). Chi-square is a global measure of model fit to data, with non-significant chi-square suggesting good fit. Chi-square is sensitive to sample size and degree of freedom (*df*); its values are inflated when sample size is large and degree of freedom is small. Thus, it is inappropriate to use it to judge model fit in the current study. Kenny (2012) mentioned that the chi-square is almost always significant for models with more than 400 cases. The bootstrapping sample used here is far larger than 400. So in this study, the significance of chi-square is reported but not used as a model fit indicator. However, chi-square is used to compare a series of nested models that specify model fitness change resulted from freeing pertinent paths. Comparison of the fitness of models mainly relies on whether the decrease in chi-square due to freeing additional paths is significant. A significant decrease in the chi-square indicates that freeing the pertinent paths improves the model fitness to the data, justifying the rejection of the more parsimonious model.

Results

Descriptive statistics and correlations are presented in Table 1. In line with my expectations, constructive controversy was positively correlated with group creativity: the group minimal measure of constructive controversy was significantly correlated with creativity ($r=0.33$, $p < 0.05$), while the correlation between the group mean of constructive controversy and group creativity was marginally significant ($r=0.29$, $p < 0.10$). The test for differences between the correlation coefficients of these two constructive controversy measures with group creativity was not significant ($t=0.53$, *ns*). Furthermore, the correlation coefficients between the three group experience variables (equal power distribution, empowerment, and collaboration quality) and constructive controversy were all positive.

I used bootstrapping method provided by LIRSEL 8.70 to generate a dataset with a large enough sample size for SEM analysis. To test for the interacting effects of Equal Power Distribution \times Empowerment and Equal Power Distribution \times Collaboration Quality on constructive controversy, I compared the fit indices of the model without interaction terms to those of the models with the interaction term(s) added. As shown in Figure 1, the baseline model is the model with the main effects of equal power distribution, empowerment, and collaboration quality on creativity through the mediation of constructive controversy only, testing Hypothesis 1-3. The interaction effect of Equal Power Distribution \times Empowerment on constructive controversy is added in Model 1. In Model 2, the path linking the interaction term of Equal Power Distribution \times Collaboration Quality with constructive controversy to the baseline model is freed. The last model (Model 3) included the effects of both interaction terms on constructive controversy as well as the main effects of equal power distribution, empowerment, and collaboration quality on creativity through the mediation of constructive controversy.

Table 1

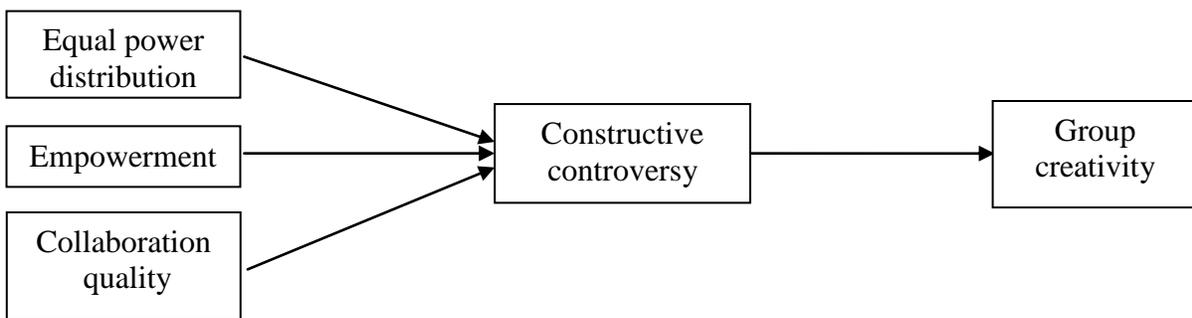
Summary of Correlations, Means, and Standard Deviations for Group-level Variables.

Variables	Mean (SD)	1	2	3	4	5
1. Equal power distribution	5.95(0.48)					
2. Empowerment	5.40(0.48)	.42**				
3. Collaboration quality	5.94(0.47)	.76***	.50**			
4. Constructive controversy (group minimal)	5.17(0.94)	.57***	.33*	.52***		
5. Constructive controversy (group mean)	5.95(0.48)	.66**	.47***	.63***	.88***	
6. Creativity	4.72(0.71)	.01	.02	.10	.33*	.29 ⁺

Notes: $N = 39 \sim 44$.

⁺ $p < .10$. * $p < .05$. ** $p \leq .01$. *** $p \leq .001$.

Figure 1. The Baseline Model



Main effect hypothesis tests with the group minimal measure of constructive controversy

Hypotheses 1-3 stated that constructive controversy would mediate the relationship between the group experience variables and group creativity. The group minimal measure of constructive controversy was used in the analysis first. The path analysis with the bootstrapping sample confirmed the proposed mediational model with small residuals and large fit indices ($RMSEA=0.08$; $SRMR=0.05$; $GFI=0.95$; $CFI=0.96$; $\chi^2=233.83$ [$df=30$; $p<0.001$]). Constructive controversy positively predicted group creativity ($\beta=0.36$, $p<.0001$). Besides, the paths between equal power distribution ($\beta=0.47$, $p<.0001$), empowerment ($\beta=0.07$, $p<.05$), collaboration quality ($\beta=0.12$, $p<.01$) and the mediator - constructive controversy - were all positive and significant. Indirect effects of these variables on creativity were also significant (equal power distribution: 0.25 , $p<0.0001$; empowerment: 0.05 , $p<.05$; collaboration quality: 0.07 , $p<0.01$). These results suggested that equal power distribution, empowerment, and collaboration quality all positively predict group creativity through nurturing constructive controversy within the group, supporting Hypotheses 1-3. The summary of path coefficients and fit indices are shown in the column of Baseline Model in Table 2.

Interaction effect hypothesis tests with the group minimal measure of constructive controversy

To test the interaction effects on constructive controversy, I added each of two interaction terms to the baseline model (Model 1 and 2), and then added both interaction terms in the model (Model 3). Adding the interaction effect of Equal Power Distribution \times Empowerment on constructive controversy to the baseline model did not change the direction or significance of path coefficients in the baseline model, as shown in the column summarizing Model 1 in Table 2. More importantly, the Equal Power Distribution \times Empowerment interaction was not significant ($\beta=0.03$, ns). Besides, the decrease in the chi-square was not significant ($\Delta\chi^2=1.12$, $\Delta df=4$, ns),

indicating that freeing one more path did not significantly improve model fit. Therefore, Hypothesis 4 is not supported.

Next, I tested the model with the interaction effect of Equal Power Distribution \times Collaboration Quality on constructive controversy added to the baseline model (Model 2). Again, freeing the path linking the Equal Power Distribution \times Collaboration Quality interaction to constructive controversy did not significantly improve model fit ($\Delta\chi^2=1.22$, $\Delta df=4$, *ns*). In addition, the coefficient of Equal Power Distribution \times Collaboration interaction was not significant ($\beta=-0.03$, *ns*). Hypothesis 5 is rejected.

To further control the covariance between the two interaction terms, both interactions were included in Model 3. Although the Equal Power Distribution \times Empowerment interaction positively predicted constructive controversy ($\beta=0.05$, $p<0.05$), contrary to Hypothesis 5, the Equal Power Distribution \times Collaboration interaction had a negative effect on constructive controversy ($\beta=-0.08$, $p<0.05$). More importantly, freeing and fixing the paths linking the interaction terms and constructive controversy explained the data equally well ($\Delta\chi^2=5.90$, $\Delta df=9$, *ns*). Therefore, the path analysis results rejected Model 1- 3 and supported the more parsimonious baseline model.

To summarize, the results supported Hypothesis 1-3 and rejected Hypothesis 4 and 5. A full mediation model in which equal power distribution, empowerment, and collaboration quality positively predicted group creativity through constructive controversy had the best fit with the data.³ Given these results, I excluded the interaction terms and ran the path analysis again. The

³ I also checked the modification indices (*MI*) and expected parameter change (*EPC*) of the paths directly linking the group experience variables to group creativity for the partial mediation effect in the model. The modification index is calculated on one path and estimates the decrease in model chi-square if the current path is freed to be estimated.

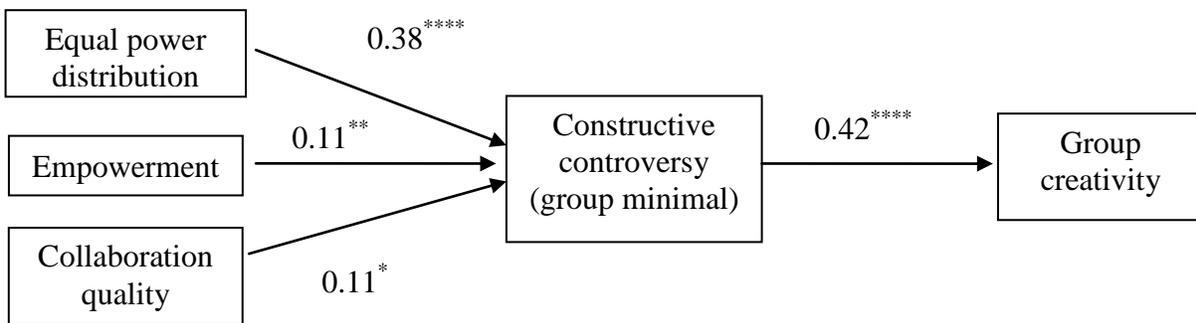
model with equal power distribution, empowerment, and collaboration quality affecting creativity through the mediating mechanism of constructive controversy fitted the data well ($RMSEA=0.05$; $SRMR=0.04$; $GFI=0.99$; $CFI=0.99$; $\chi^2=34.02[df=9; p<0.001]$). Constructive controversy positively predicted group creativity ($\beta=0.42, p<.0001$). Besides, the paths

Simultaneously, expected parameter change is also calculated for the path and approximates the expected size of the parameter estimate when the path parameter is freed. MI of values larger than 3.84 should call for a check on whether it is necessary to free the path since the expected change in model chi-square ($df=1$) due to freeing the path is significant. Large EPC values would raise similar concerns. However, although these two indices provide diagnostic statistical information, they do not determine model modification. The final decision of whether to add the path in the model depends on whether there is theoretical justification for the change (Byrne, 1998). Changes based on the modification indices alone may not identify the “true” model (MacCallum, 1986; MacCallum, Roznowski, & Necowitz, 1992).

In the present study, among three partial mediational paths (i.e. the path directly linking each of the three group experience variables to group creativity), only the path linking empowerment to creativity showed high MI (28.13). However, a closer look at the EPC revealed that the new path linking empowerment and creativity is negative, which is inconsistent with the existing literature and my hypothesis. Furthermore, after adding both paths linking the direct effects of empowerment and collaboration quality to group creativity, the model achieved almost perfect fit with the data ($RMSEA=0.00$; $GFI=1.00$; $CFI=1.00$; $SRMR=0.02$; $\chi^2=5.97[df=8; p=0.65, ns]$). Thus, the improvement in the model fit resulted from adding the two partial mediation paths may be spurious. There are two reasons why a perfect model-data fit is not desirable. First, there are random errors in data and a perfect fit may indicate that the model fits sample error well. In addition, as the just-identified model (in which the number of known values or the number of variances and covariances equals the number of parameters that needs to be estimated in the model ($df=0$)) always produces a perfect fit with the data, researchers should be cautious when interpreting a perfect fit of the model with very small degree of freedom (Lei & Wu, 2007). Therefore, I conclude that the results supported a full mediation model with constructive controversy mediating the relationship between the group experience variables and creativity.

connecting equal power distribution ($\beta=0.38, p<.0001$), empowerment ($\beta=0.11, p<.01$), and collaboration quality ($\beta=0.11, p<.05$) to constructive controversy were all positive and significant. The indirect effects of these group experience variables on creativity were also significant (equal power distribution: $0.23, p<.0001$; empowerment: $0.09, p<.001$; collaboration quality: $0.07, p<.05$). The model with path coefficients is depicted in Figure 2.

Figure 2. Final Path Model with the Group Minimal Measure of Constructive Controversy



Note. $N=1100$. * $p<0.05$. ** $p < .01$. **** $p < .0001$.

Main effect hypothesis tests with the group mean measure of constructive controversy

Replacing the group minimal measure of constructive controversy with the group mean measure produced identical results. The model with group experience variables affecting creativity through the mediating mechanism of constructive controversy fitted the data well ($RMSEA=0.05$; $SRMR=0.04$; $GFI=0.99$; $CFI=0.99$; $\chi^2=37.86[df=9; p<0.001]$). The paths linking equal power distribution ($\beta=0.36, p<.0001$), empowerment ($\beta=0.15, p<.0001$), collaboration quality ($\beta=0.25, p<.0001$) to constructive controversy were all positive and significant. Besides, constructive controversy positively predicted group creativity ($\beta=0.34, p<.0001$). The indirect effects of these group experience variables on creativity were also significant (equal power

distribution: 0.17, $p < .001$; empowerment: 0.10, $p < .001$; collaboration quality: 0.12, $p < .001$). The model with path coefficients is depicted in Figure 3.

Interaction effect hypothesis tests with the group mean measure of constructive controversy

Interaction effects on constructive controversy were also tested with the group mean measure of constructive controversy, again by comparing models with the interactions terms to the baseline model without the interaction terms. Although the interaction term of Equality \times Empowerment was significant ($\beta = 0.05$, $p < 0.5$) in Model 1 in Table 3, the decrease in the chi-square was not significant ($\Delta \chi^2 = 5.24$, $\Delta df = 4$, *ns*). Similarly, in Model 2 in Table 3, the interaction of equality with collaboration positively predicted constructive controversy ($\beta = 0.08$, $p < 0.5$). However, adding this interaction term did not significantly improve the model-data fit ($\Delta \chi^2 = 9.24$, $\Delta df = 4$, *ns*). Adding both interactions (Equality \times Empowerment and Equality \times Collaboration) to the model did not improve the fit either ($\Delta \chi^2 = 9.53$, $\Delta df = 9$, *ns*), although the path linking Equality \times Collaboration and Constructive Controversy was significant ($\beta = 0.07$, $p < 0.5$). To summarize, using the group mean measure of constructive controversy also yielded results that rejected hypothesis 4 and 5. Model details are shown in Table 3.

Alternative model with the group minimal measure of constructive controversy

A possible alternative explanation of the relationship between the group experience variables and creativity is that constructive controversy within the group empowers group members, improves the quality collaboration, and also makes members perceive power to be equally distributed, and hence increases group creativity. To rule out this alternative explanation, I tested whether the group experience variables (equal power distribution, empowerment, and

collaboration quality) mediated the linkage between constructive controversy and group creativity. This alternative model (shown in Figure 4) had poor fit to the data, as evident by large residuals and low fit indices ($RMSEA=0.48$; $SRMR=0.21$; $GFI=0.68$; $CFI=0.41$; $\chi^2=1268.78[df=5$; $p<0.01$]). Besides, although constructive controversy positively predicted all three group experience variables (equal power distribution: $\beta=0.48$, $p<.001$; empowerment: $\beta=0.37$, $p<.001$; collaboration quality: $\beta=0.53$, $p<.001$), the relationship between empowerment and group creativity was negative ($\beta=-0.13$, $p<.001$) while the path linking collaboration quality to group creativity was not significant ($\beta=0.03$, ns). These results rejected the alternative model.

Table 2

Model Summaries: Path Coefficients and Fitness Indices with the Group Minimal Measure of Constructive Controversy

Path	Baseline	Model 1	Model 2	Model 3
	Model			
Equality - Constructive controversy	0.47****	0.45****	0.45****	0.44****
Empowerment - Constructive controversy	0.07*	0.07*	0.07*	0.07*
Collaboration - Constructive controversy	0.12**	0.13**	0.11*	0.12**
Constructive controversy - Creativity	0.36****	0.36****	0.36****	0.36****
Equality × Empowerment - Constructive controversy		0.03		-0.08*
Equality × Collaboration - Constructive controversy			-0.03	0.05*
χ^2 (df)	233.83(30)	232.71(26)	232.61(26)	228.13(21)
RMSEA	0.08	0.08	0.08	0.09
$\Delta \chi^2$ (Δ df)		1.12(4)	1.22(4)	5.70(9)
SRMR	0.05	0.05	0.05	0.05
GFI	0.95	0.95	0.95	0.95
CFI	0.96	0.96	0.95	0.95

Note. * $p < 0.05$; ** $p < .01$; *** $p < .001$; **** $p < .0001$.

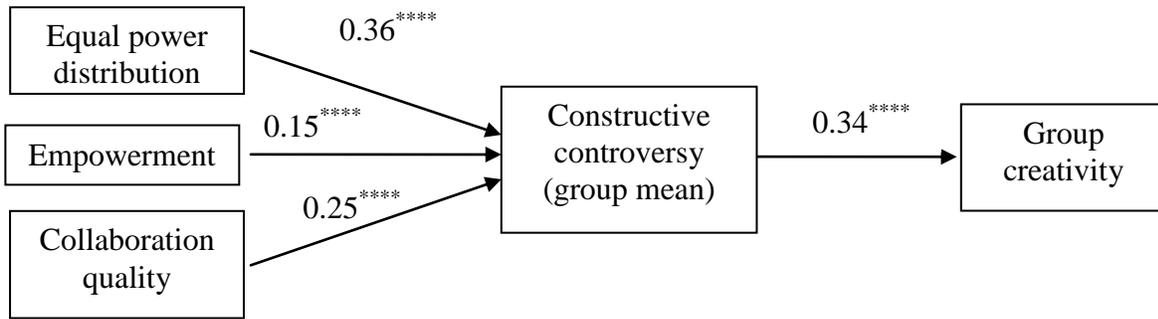
Table 3

Model Summaries: Path Coefficients and Fitness Indices with the Group Mean Measure of Constructive Controversy

Path	Baseline	Model 1	Model 2	Model 3
	Model			
Equality – Constructive controversy	0.42 ^{****}	0.45 ^{****}	0.44 ^{****}	0.45 ^{****}
Empowerment – Constructive controversy	0.14 ^{***}	0.13 ^{***}	0.14 ^{***}	0.13 ^{***}
Collaboration – Constructive controversy	0.24 ^{***}	0.22 ^{***}	0.27 ^{***}	0.26 ^{***}
Constructive controversy – Creativity	0.27 ^{****}	0.27 ^{****}	0.27 ^{****}	0.27 ^{****}
Equality × Empowerment – Constructive controversy		0.05 [*]		0.02
Equality × Collaboration – Constructive controversy			0.08 [*]	0.07 [*]
χ^2 (df)	165.20(30)	159.96(26)	155.96(26)	155.67(21)
RMSEA	0.06	0.07	0.07	0.08
$\Delta \chi^2$ (Δ df)		5.24(4)	9.24(4)	9.53(9)
SRMR	0.05	0.05	0.05	0.05
GFI	0.96	0.97	0.97	0.95
CFI	0.97	0.96	0.97	0.95

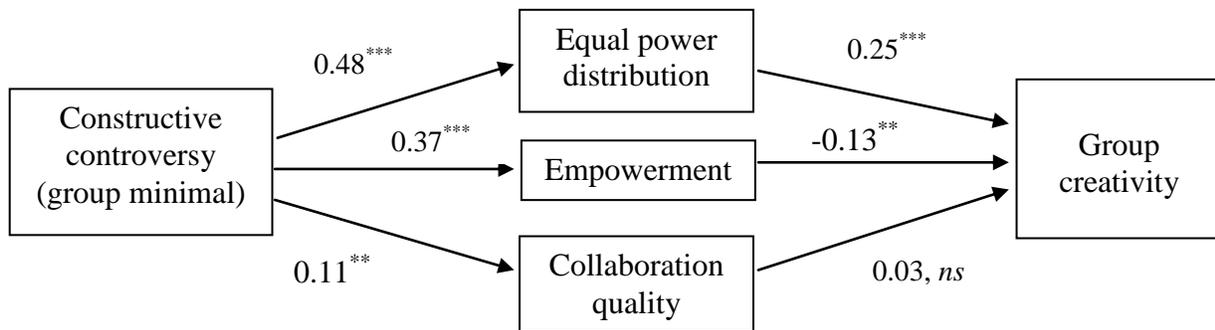
Note. * $p < 0.05$; ** $p < .01$; *** $p < .001$; **** $p < .0001$.

Figure 3. Final Path Model with the Group Mean Measure of Constructive Controversy



Note. $N=1100$. **** $p < .0001$.

Figure 4. Test of the Alternative Model with the Group Minimal Measure of Constructive Controversy



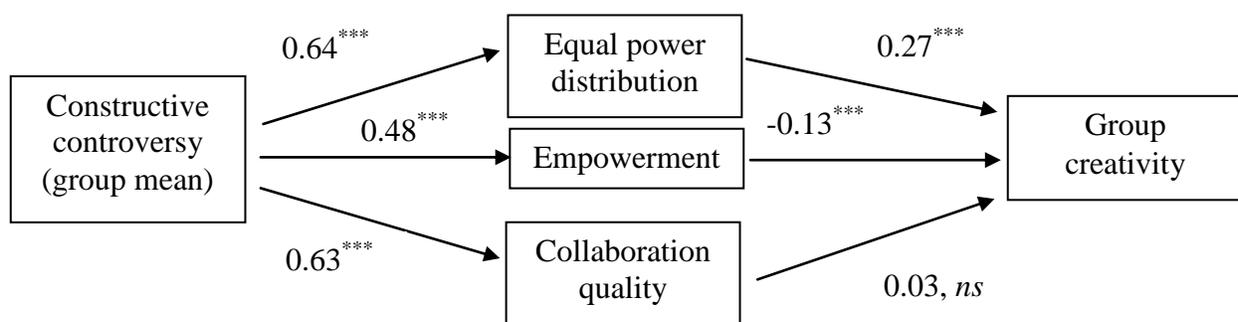
Note. $N=1100$. ** $p < .01$; *** $p < .001$.

Alternative model with the group mean measure of constructive controversy

I also tested the alternative model with the group mean measure of constructive controversy, replacing the group minimal measure of constructive controversy with the group mean measure. Again, the alternative model had poor model fit ($RMSEA=0.41$; $SRMR=0.15$;

$GFI=0.75$; $CFI=0.63$; $\chi^2=1001.70[df=5; p<0.01]$). As shown in Figure 5, constructive controversy positively predicted three group experience variables (equal power distribution: $\beta=0.64, p<.001$; empowerment: $\beta=0.48, p<.001$; collaboration quality: $\beta=0.63, p<.001$). However, there was a negative relationship between empowerment and group creativity ($\beta=-0.13, p<.001$), and the path linking collaboration quality to group creativity was not significant ($\beta=0.03, ns$).

Figure 5. Test of the Alternative Model with the Group Mean Measure of Constructive Controversy



Note. $N=1100$. *** $p < .001$.

DISCUSSION

My research findings highlight the importance of equal power distribution as well as empowerment and collaboration quality in predicting group creative outcome. The beneficial effect of these group experience variables on creativity ensues from their facilitative roles in nurturing constructive controversy - open-minded discussion of divergent opinions within the group. Group experience that offers members the opportunity to participate in constructive

discussion and simultaneously makes members feel enabled and motivated to engage in open discussion of opposite ideas could enhance group creative performance.

Results of the current study failed to support the interaction effects of equal power distribution with empowerment and collaboration quality on creativity through constructive controversy. There is no significant interaction effect of equal power distribution with empowerment on constructive controversy. Although the path linking the interaction of equal power distribution and collaboration quality was significant, adding this interaction term to the model did not significantly improve the model fit (the group minimal measure of constructive controversy: $b=0.05$, $p<0.05$, $\Delta \chi^2=5.70$, $\Delta df=9$, *ns*; the group mean measure of constructive controversy: $b=0.07$, $p<0.05$, $\Delta \chi^2=9.53$, $\Delta df=9$, *ns*). There are several possible reasons for this result. First, there might be a lack of statistical power to detect the interaction effects. However, in the current study, I used bootstrapping to generate a sample of 1100. With this large sample, there were enough degree of freedom ($df=21$) for parameter estimation in the model that included both interaction terms. This rules out lack of sufficient statistical power as an alternative explanation for the null effects of the interactions.

Second, multicollinearity could have also obscured the effects of the interactions because the interaction terms might be highly correlated with the two independent variables used to construct the interaction term. However, both independent variables were mean-centered before they were used to generate the interaction term. In addition, I also controlled the covariances between the interaction terms and the two independent variables in the model. For example, for the interaction of power equality with empowerment, I multiplied the mean-centered value of power equality by the mean-centered value of empowerment to form the interaction term. I also freed the parameters estimating the covariance of this interaction term with power equality and

empowerment in the model. Therefore, multicollinearity is not a plausible alternative explanation for the null effects of the interactions.

There are possible theoretical explanations for the null effects of the interactions. Although more empowered members may better engage in constructive controversy when perceiving power equality within the group, they may also be more likely to insist on own opinions and refuse to accept other people's ideas. Since power is equally distributed among members within egalitarian group, each empowered member may not be motivated to take other members' perspective and attend to other members' opinions. Therefore, egalitarian groups with empowered members may not necessarily engage in constructive debate actively. Likewise, as my results showed, collaboration quality does not always strengthen the relationship between power equality and constructive controversy. Positive collaboration experience may lead egalitarian groups to avoid conflicts and to maintain the harmony within the group. The more group members enjoy each other's support and help, the less likely they would utilize the opportunity of power equality to express own dissents. Because of co-existence of the facilitative and the inhibitive effects on constructive controversy, I did not find a significant path linking the interaction term of equal power distribution with collaboration quality and constructive controversy.

The theoretical explanations I propose for the null effects of the interaction are post hoc and speculative. They may also be other explanations for the null interaction effects. Future research is needed to test my proposed explanations and explore other possible explanations..

Theoretical and practical implications

This present study makes several theoretical contributions. First, the results of the present study confirmed the predicted relationship between equal power distribution and group creativity.

Groups that experience high levels of power equality are more likely to engage in constructive discussion of opposite opinions, and therefore produce more creative outcomes.

The present study also extends the literature of constructive controversy. Past studies have examined leadership (e.g., leader-member exchange and Guanxi) and several group characteristics (e.g., cooperative goal, competitive goal, goal interdependence) as antecedents of constructive controversy (e.g., Chen & Tjosvold, 2006; Tjosvold, 1998a, 1998b). The present research extends this literature by showing how group experience can nurture constructive controversy within the group, offering another approach to predicting open-minded discussion of intellectual disagreements. From the opportunity, ability and motivation perspective, the ability, motivation and opportunity to carry out a behavioral intention jointly determine actual execution of the behavior (Ölander & Thøgersen, 1995). Power equality provides group members the opportunity to engage in constructive debates. Empowerment enables employees to openly express disagreement, while collaborative experience motivates members to voice dissenting opinions to improve group performance. Group members' experiences of power equality, empowerment and collaboration quality together predict their engagement in constructive controversy.

The identification of constructive controversy as the intervening mechanism between group experience and group creativity is another contribution of the present study. Previous investigations on the effects of group characteristics on group performance have yielded mixed findings. For example, the evidence for the argument that group diversity, especially functional diversity and knowledge diversity, positively predict group creativity is mixed (e.g., Hülsheger, Anderson, & Salgado, 2009; Jackson & Joshi, 2011). Constructive controversy could be a missing link between diversity and creativity. Diverse composition of a group can contribute to

group creativity when the group experiences encourage group members from different backgrounds to freely express their views and actively participate in constructive debates. In this sense, power equality, empowerment and collaboration quality help to unlock the creativity potential of diverse groups.

The current study offers insights into managerial practices as well. As shown in the present study, empowerment and collaboration quality work in concert with equal power distribution to improve creativity. Therefore, managers should critically evaluate whether the employees are prepared (feel competent and motivated) to engage in constructive controversy. Training programs and guidance can be offered when necessary to assure effective participation of open-minded discussion. Organizations also need to strengthen a collaborative climate and create opportunities for constructive debates to occur.

Limitations and future research

The present study is not without limitations. One concern is that the empirical investigation was conducted with self-management teams accomplishing a highly interdependent task. The facilitative effect of power equality, empowerment and collaboration quality on group creativity may be particularly pronounced in this setting because of the high level of task and outcome interdependence in self-management teams. Hence, it remains to be shown whether the effect of equal power distribution on creative performance can be replicated with independent teams. My belief, which needs to be tested in future research, is that when motivated and empowered, employees will actively engage in constructive discussion of divergent opinions with other members of the group. As long as group members can benefit from exposure to divergent opinions, the group can enjoy the creative benefits of power equality.

Another limitation with the current study lies in the conceptualization of power equality. Equal power distribution in this study is defined as the equality of amount in decision-making power among team members. This definition focuses on the relative decision control in power distribution: Can some team members dominate the team's decisions? However, people may also experience power equality when they experience psychological equality, feeling that they have a voice and their opinions are appreciated even when they do not have the same amount of decision control as other team members. It is possible that group members experiencing psychological equality are also willing to actively engage in constructive debates, which in turn enhance group creativity. This possibility is consistent with the finding that the nature of social relations (cooperative vs. competitive) contributes to equality experience and practices (e.g., Deutsch, 1975; 1985; Kabanoff, 1991). Not including psychological equality in my measure of power equality could have contributed to the failure to detect a significant direct effect of power equality on group creativity in the current study ($b=0.10$, *ns*). Future research should examine the facilitative role of psychological power equality in group creativity through constructive controversy.

Besides, the present study examined only the cognitive mechanism through which power equality facilitates group creativity. Despite the popularity of the cognitive emphasis in creativity research, an increasing amount of research now focuses on the role of affect in enhancing creativity (e.g., Amabile, Barsade, Mueller, & Staw, 2005; Baas, De Dreu, & Nijstad, 2008). Since participation at workplace through influence sharing also enhances satisfaction (Wagner, 1994; Wagner, Parker, & Christiansen, 2003), future research can examine the affective mechanisms underlying the relationship between group experience and group creativity.

CHAPTER 3 IDEA GENERATION AND IDEA SELECTION

Creativity is *the* factor that drives advances in art, science, culture, business, and the national economy. In innovation management, companies are consistently challenged to come up with the next best idea, and develop it into something applicable and marketable (Amabile, 1996). Not surprisingly, group creativity research has sought to identify factors that facilitate or hinder the generation of original ideas. Comparatively less attention has been given to the processes that promote or hinder the selection of original ideas for further elaboration and marketing. Because groups rarely select ideas with the highest quality (Faure, 2004; Putman & Paulus, 2009; Rietzschel, Nijstad, & Stroebe, 2006), in this chapter, I investigate the group experience that is associated with generating and retaining original ideas. Specifically, I am interested in the role of equal power distribution in group creative performance in the idea generation and selection stages. Power at the workplace has attracted an increasing amount of research attention. There is yet a dearth of research on the role of power equality in group creativity. My study aims to fill this research gap. The present chapter seeks to provide answers to the following research question: how does equal power distribution in a group influence the originality of ideas generated and selected by the group?

Contributions of the current study are twofold. First, I will provide further evidence for the theoretical distinctions between idea generation and selection. Second, the study seeks to identify the different mechanisms that equal power distribution influences the generation of original ideas and their retention in idea selection. These qualitatively different processes are equally important for the eventual success of a creativity project. These findings will extend empirical investigations of the effects of power on group creativity. They will also help deepen

the understanding of the conditions that enhance the quality of creative ideas at the generation and selection stages.

In the present chapter, I will first discuss the conceptual distinction between idea generation and selection, followed by a review of the research on how creativity performance can be improved at these two stages. The association between power equality and group creativity will be discussed briefly before I develop my hypotheses and present a study that tested the proposal.

Differences between Idea Generation and Idea Selection Stages

Idea generation and idea selection are two qualitatively different processes involved in knowledge creation. In the idea generation stage, otherwise known as brainstorming, people aim to come up with as many potentially good ideas as possible. In the idea selection stage, people select the best idea(s) for further development and improvement. The output of idea generation serves as the input of idea selection. The selected idea(s) may then enter the stage of manufacturing and commercialization. Now, let me elaborate on the distinction between the idea generation and selection stages.

First, different criteria of evaluation are used at the idea generation and idea selection stages (Chiu & Kwan, 2010). At the idea generation stage, the primary criteria for evaluation are the novelty of the idea and the idea's personal utility to the knowledge creator. Ideas that are novel, nonconventional, and counter-intuitive in relation to current knowledge are preferred at this stage. At the selection, editing, and marketing stage, the primary objectives are to select ideas based on their potential success in the market, modify and edit the selected idea to enhance its market value, and enhance the publicity of the idea in the target audiences. At this stage,

knowledge creators will consider the assumed attitudes, values, and beliefs of the gatekeepers and the end users.

Furthermore, success in idea generation and idea selection requires different skills. Success in idea generation requires the skills of an inventor, whose goal is to create new ideas. Inventors place high premium on novelty, originality, and technological perfection; take personal ownership of their inventions, and attach personal significance to their inventions. In contrast, success in idea selection requires the skills of a trader, whose goal is to create values for new ideas. Traders are motivated by the expected returns of their investments; they exploit innovative applications of new knowledge and package new ideas for different audiences. Traders do not attach emotional significance to their ideas and enjoy market ownership of their creations (Chiu & Kwan, 2010).

Scholars and practitioners acknowledge the distinction of idea generation and selection stages and realize the challenge of combining them effectively. For example, the quality of the selected idea relies upon accurate evaluation of the idea's market potentials during the idea selection stage, whereas deference of judgment and freedom from evaluation are key to generating original ideas (e.g., Amabile, 1979; Hennessey, 1989). Cumming and O'Connell (1978) suggested that the generation of creative solutions should be separated from the evaluation of the solutions. From the practitioner's perspective, the dissociation between idea generation and selection is embodied in the separation of these two functions in different departments in some large organizations, with idea generation housed in the R&D division and the selection and marketing of new creations housed in the marketing division (Griffin & Hauser, 1992).

Creative Performance in Idea Generation and Selection Stages

To achieve high-quality output that will finally be implemented, creative performance at the idea generation and idea selection stages are both important. Despite the qualitative differences of these two stages in many respects, both idea generation and idea selection are essential parts of the innovation process. The output of idea generation serves as the input for idea selection. Thus, the quality of ideas generated would limit creative performance at the idea selection stage.

Creative performance of idea generation can be evaluated in terms of both the quantity and the quality of ideas generated. As Osborn (1953) posits, quantity breeds quality. That is, there is a positive association between the number of ideas and the number of high-quality ideas available for subsequent selection (e.g., Diehl & Stroebe, 1987). However, generating a large number of ideas is never the ultimate goal of the creativity process. Eventually, the best idea(s) will be chosen from a list of candidate ideas for further development and subsequent implementation (Nijstad & De Dreu, 2002). Individuals making the selection need to differentiate creative ideas from mediocre ones to reach a high-quality decision. The quality of the selected idea is a major indicator of creative performance at the idea selection stage. In short, performance in idea generation and selection jointly determine the success of a creativity project.

Perceived ease of expression within the group is a key facilitator of productivity at the idea generation stage. Brainstorming groups are more productive when members feel free to express their ideas without worrying about being criticized or judged (Amabile, 1979; Hennessey, 1989; Mullen, Johnson, & Salas, 1991). Perceived psychological safety in work environment is also positively associated with creativity (Kark & Carmeli, 2009), whereas the fear of being negatively evaluated (i.e., evaluation apprehension) inhibits knowledge sharing and creative

ideation (Bordia, Irmer, & Abusah, 2006; Diehl & Stroebe, 1987). Process blocks to productivity of brainstorming in interactive groups compared with nominal groups have been widely examined (for more detailed discussion, see Mullen, Johnson, & Salas, 1991).

One may assume that an original idea is more likely than a non-original one to be selected for further development and commercialization. However, the evidence for this assumption is weak. Groups often do not choose the most original idea for further development. Rietzschel, Nijstad and Stroebe (2006) found that the idea selected is rarely the most novel one on the list of alternatives (see also Putman & Paulus, 2009). In fact, the idea(s) that groups selected are no more original than those selected by chance. That is, the originality of the idea selected is not different from the average originality of the ideas generated (Faure, 2004).

Different factors affect the quality of idea(s) generated and selected by groups. The best predictor of performance in idea generation is the amount of cognitive stimulation within the group. A prominent benefit of group work in brainstorming is the opportunity to establish associations between ideas through opinion sharing. There is consistent evidence that in diverse work groups, exposure to divergent ideas from different members often stimulates new and original ideas (e.g., Nijstad, Stroebe, & Lodewijkx 2003). Ideational groups can further enjoy the stimulation benefits from intellectual debates. A study showed that when groups are encouraged to debate among group members and criticize each other's ideas, the groups generate more divergent thoughts, compared to groups that engage in traditional brainstorming (Nemeth, Personnaz, Personnaz, & Goncalo, 2004). Therefore, groups generate more original ideas when members tend to comment and develop on each other's ideas.

In contrast, performance at the idea selection stage depends on whether the group can fully explore all alternative ideas. Decision-making research suggests that careful evaluation of

the quality of all alternatives created at the idea selection stage enables the group to choose the best alternative(s) from the candidate ideas. Cognitive biases, especially those associated with biased information search and exchange, can hinder the quality of decision-making (Kerr, MacCoun, & Kramer, 1996; Schulz-Hardt, Frey, Lüthgens, & Moscovici, 2000). For example, groupthink, a phenomenon in which group members avoid raising controversies to achieve consensus quickly and maintain harmony within the group, often leads to defective decisions (Janis, 1982). Without critical evaluation of alternatives and comprehensive information search, groups may make low-quality decisions (Janis, 1982; Postmes, Spears, & Cihangir, 2001). Pluralistic ignorance is another widely studied cognitive error in group decision-making. It refers to the phenomenon in which most group members disapprove an alternative privately while assuming all other members approve it (Krech & Crutchfield, 1948). Biases in decision-making caused by pluralistic ignorance have been studied in many disciplines (e.g., Schroeder & Prentice, 2006; Westphal, & Bednar, 2005). Exploration of all alternatives prevents premature agreement on an inferior choice (Janis, 1982; Nemeth & Nemeth-Brown, 2003). Therefore, deliberative exploration of all available ideas enhances creative performance at the idea selection stage.

Equal Power Distribution in Idea Generation and Idea Selection

Equal power distribution within the group encourages members to actively express their own opinions and participate in decision-making. Employees experiencing power equality actively engage in group decision-making process (Abdel-Halim, 1983), and active involvement in the decision-making process stimulates exchange and integration of information, reduces resistance to change, improves task satisfaction and facilitates team members' commitment to team decisions (e.g., Black & Gregersen, 1997; King, Anderson, & West, 1992). To sum up, in

an egalitarian group, members have more positive attitudes toward the task, and are more willing to voice their opinions through participating in various activities along the process to complete the task.

Equal power distribution may affect the quality of idea(s) generated and selected by groups through different mechanisms. Egalitarian groups generate more creative ideas because when group members feel that they have equal power as other group members, they would be more comfortable with freely sharing their opinions (Locke et al., 1997); they are willing to contribute ideas during discussion. As discussed above, the best predictor of creativity in idea generation is the amount of cognitive stimulation within the group (e.g., Brown et al., 1998; Dugosh et al., 2000; Rietzschel et al., 2007; Njstad et al., 2003). The large volume of information generated from free expression provides rich inputs for cognitive stimulation in the team. Thus, ideational groups can benefit from power equality through exposure to a large volume of information from different members.

In an idea selection task, a challenge is to ensure that the most original ideas will be retained following group discussion. As discussed above, if all group members are aware of the different opinions held by other group members, the team would engage in more thorough exploration of the available ideas, which would in turn lead to high-quality decisions. Thus, I propose that equal power distribution that encourages members to participate in decision-making would help attenuate the cognitive biases of individual members in idea selection. Group members experiencing power equality are more likely to engage in thorough exploration of all available ideas and openly express their own opinions on the quality of each idea. This proposal is consistent with the past finding that groups that privilege participative decision-making and

are receptive to dissident views have better innovation outcomes (De Dreu & West, 2001; West, 1990; West & Anderson, 1996).

Therefore, I make the following hypotheses:

Hypothesis 1. Groups experiencing higher levels of equal power distribution will have more creative outputs in an idea generation task, and this relationship is mediated by the amount of information volume during group discussion.

Hypothesis 2. Groups experiencing higher levels of equal power distribution will have more original outputs in an idea selection task.

To test these two hypotheses, I conducted a lab experiment in which functionally diverse groups were asked to perform either an idea generation task or an idea selection task. I measured the level of equal power distribution during group discussion. The dependent variable was the level of originality in the creative outputs.

Method

Participants

I collected data from 168 Chinese college students from a university in Beijing, China. Their average age was 21 ($SD=1.66$). Participants came from more than 40 different majors. The participants were randomly assigned to one of the 42 four-person gender-balanced groups, with 2 men and 2 women in each group. With the exception of one group with students from the same major and four groups composed of students from two majors, the remaining 37 groups had students from 3 different majors. Excluding the group with one major did not change the results.

To control for the effect of prior history of interaction with group members, in making the group assignment, I made sure that the group members did not know each other before the study.

Tasks and Procedures

The creativity tasks used here were similar to the design task used in the IDEO case of redesigning a shopping cart (ABC, 1999). The groups were asked to redesign a shopping cart. Upon arriving at the research laboratory in groups of four, the experimenter explained the task to the participants. At this point, half of the groups were assigned to perform the generation task; they were asked to work together to generate innovative designs for a shopping cart. They saw a picture of a typical shopping cart and the objective of the task was “to come up with as many innovative ideas as possible, bearing in mind that an innovative idea should be novel and workable.” The remaining groups were assigned to work on a selection task, they were asked to work together to select the most promising new design for a shopping cart. In this condition, the participants were presented with five new designs for the shopping cart and the objective of the task was “to select the most promising idea and elaborate how this idea can be further improved.” Participants in the idea selection task were also explicitly told that an innovative idea should be both novel and workable.

To make sure that each participant would have some initial ideas on how to accomplish the task, before teamwork began, I gave each participant ten minutes to think about the task alone and to jot down their ideas. Participants in the generation task were told to generate innovative designs and those in the selection task were asked to choose one design and elaborated on it in the selection task. Group discussions, which lasted for 20 minutes, followed the preparatory task. At the end of the 20-minute discussion, the experimenter collected the final design(s) from the group and administered task satisfaction measures to each participant. Upon

completion of these measures, the experimenter thanked and thoroughly debriefed the participants. The entire experimental session lasted for an hour. Details of the instructions for either task can be found in Appendix C & D.

Dependent Measures

The key dependent variable was the level of originality of the group output. To code the originality of the group output from the selection task, following Ward and his colleagues (2002), for each idea, I counted the number of groups that had selected it to form the *output dominance* score - ideas with higher output dominance scores were more popular or less original. Next, I took the inverse of the output dominance scores ($1/\text{output dominance}$) to form the originality scores. Using this procedure, I determined the level of originality of the idea selected by each group. If the group failed to reach an agreement and made a choice at the end of discussion, the group received an originality score of 0. Simultaneously, individual member's originality scores were also calculated with the same method.

I used a similar procedure to determine the originality score of the group output from the idea generation groups. First, I collated all the ideas generated by the 21 groups. For each idea, I used the number of groups that mentioned it to index its output dominance. Originality score of each idea was the inverse of the output dominance score. For each group, I then took the mean of the originality scores of the ideas the group had generated as a measure of the originality of the group output. The calculation of the originality of individual output, however, took several extra steps. After collecting all the ideas generated by 82 individual members, the output dominance scores were taken. I then recorded the order of each idea among all ideas that were generated by the same individual. Next, for each idea, the mean of the ordinal positions across all the individuals that listed the idea were calculated to determine the rank of the idea. Idea originality

referred to the quotient of rank/dominance. Each individual's originality score was the mean of the originality scores of the ideas the individual had generated⁴.

Equal Power Distribution

Equal power distribution was operationally defined as the extent to which members have equal power within the group along the process to complete the task. A limitation of the Chapter 2 is that I used self-reports to measure equal power distribution. In the current study, I developed a behavioral measure of equal power distribution by coding the transcripts of the group discussions. Based on previous research on power and conversational behaviors (see Krauss & Chiu, 1998), for the idea generation task, I coded power equality in a group by how evenly each member contributed information to the group output. Specifically, I first counted the number of characters that each member contributed to the discussion. Next, I computed the variance of the number of characters each member said during group discussion and used it as a proxy for equal power distribution within the group; a higher variance would indicate that some members in the group had dominated the conversation. For the ease of interpretation, I converted this measure into a measure of equal power distribution. I identified group with the largest variance value among all the groups, and for each group, subtracted the group's variance value from the largest

⁴The original measure was used to measure individual creativity (Ward et al., 2002). The assumption with the rank order is that a more original idea is less popular (has low dominance) and less likely to come to people's mind easily (has high rank). Therefore, the measure takes the mean of the ordinal positions across all individuals. However, in group idea generation, the order of an idea on the group's list may not correspond to the cognitive accessibility of the idea. Therefore, I did not use the rank/dominance score in the calculation of group originality here. For the purpose of exploration, I conducted statistical analysis with originality scores that used the rank/dominance formula. The results regarding the role of equal power distribution in idea generation remained unchanged.

variance value across all groups. The higher the reversed score was, the more evenly members of the group had contributed to the discussion. We refer to this power equality index as *power equality (information)*.

The power equality (information) was not suitable for measuring power distribution in the idea selection task, because most groups reached consensus on the idea they would select for the group. Therefore, a substantial proportion of the discussion concerned how the selected idea can be further improved. In addition, in the idea selection task, aside from contributing ideas to the task, group members actively sought to influence the decision of the group. To provide a more nuanced behavioral measure of equal power distribution in idea selection, for each group, I counted the number of speaking turns each member (a) challenged or disagreed with another member (challenge frequency), (b) defended his or her own opinion (defense frequency), and (c) yielded to other members' opinions (yielding frequency). For each group member, I created a power index by taking the sum of the challenge frequency and the defense frequency, and then subtracting from the sum the yielding frequency. To create a common metric for comparison across groups, I created a power ratio for each group member by dividing the power index of this member by the sum of the power indices of all group members in the group. Next, for each group, I computed the variance of the power ratios of its members, and identified the group with the largest variance. For the ease of interpretation, the final equal power distribution index based on social influence behaviors in the group was obtained for each group by subtracting the group's variance value from the largest variance value across all groups. I refer to this power equality index as *power equality (influence)*. The higher a group's power equality (influence) score was, the more evenly members of the group had attempted to exert mutual influence on each other during the discussion.

Task satisfaction

Task satisfaction was measured on a 7-point scale (1=*strongly disagree* and 7=*strongly agree*). Participants were asked to indicate their degree of agreement on five statements indicating how much they enjoyed the task. A sample item is “*I enjoyed doing the task.*” The scale had high reliability ($\alpha=0.78$). For each group, its mean task satisfaction was used as the measure of group-level task satisfaction ($r_{wg}=0.81$). The task satisfaction items can be found in Appendix E.

Information volume

I measured *information volume* by the total number of characters expressed during the group discussion in the idea generation stage.

Control variables

In the idea selection task, I included two control variables. First, for each group, the number of different options (out of 5) that the four individual members chose before group discussion was recorded. I refer to this variable as *initial opinion diversity*. Because there were four members in each group, if all four members chose a different option before discussion, initial opinion diversity would reach the maximum value of 4. If all 4 members chose the same option, initial opinion diversity would be the minimum value of 1.

In an idea selection task, the level of opinion diversity in the group and the level of consensus among group members before group discussion can influence the discussion process and the ultimate decision (Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2006; Schulz-Hardt et al., 2000). Therefore, I coded these two variables and included them as control variables in the idea selection task. Specifically, for each group in the idea selection task, I

measured the extent of support for the majority opinion before discussion as the variable of *majority support* using the following coding scheme:

Majority support = 1, if two members chose one option and the remaining two members chose another option, or each member chose a different option before group discussion.

Majority support = 2, if two group members selected one option and the remaining two members each selected a different option.

Majority support = 3, if three group members selected one option and the remaining member selected another option.

Majority support = 4, if all four group members selected the same option before group discussion.

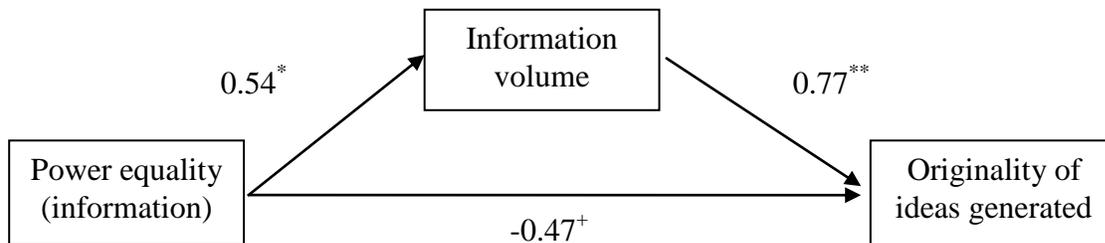
Results

The average originality of the individual group members did not differ among the groups assigned to the idea generation task and those assigned to the idea selection task, $F(20,83)=0.19$, *ns*. Furthermore, participants enjoyed the generation and selection tasks to the same extent, 5.87 vs. 5.80, $F(1,41)=0.64$, *ns*.

To examine the relationship between group creativity performance and power equality in the generation task, I conducted *Sobel* test to examine whether information volume mediates the positive effect of equal power distribution on group originality. As expected, I found out the equal power distribution indirectly facilitated the generation of original ideas through encouraging information exchange (indirect effect: 0.41, $Z=1.93$, $p=0.05$, 95% CI [.13, .90]). However, I also found a close-to-significant inhibitive effect of equal power distribution on the originality of ideas generated ($b=-0.47$, $p=0.07$): the *average* level of originality of the ideas

tended to be lower in more egalitarian groups. The lower level of originality in a more egalitarian group may result from the generation of a greater quantity of ideas in these groups. That is, when performing an idea generation task, group members in an egalitarian group might feel that they should contribute ideas freely regardless of how original these ideas were. This expectation resulted in the generation of some ideas that were not very original, and hence lowered the *average* level of originality of the ideas the group generated. The suppression effect of power equality on the average idea originality also explains the non-significant effect of power equality on average idea originality ($b=0.05, ns$) when information volume was not added to the model. Therefore, hypothesis 1 was partially supported. Details of the model and coefficients are shown in Figure 6.

Figure 6. The Model Testing Hypothesis 1 with Path Coefficients.



Note. $N=21$. All coefficients are based on standardized variable values.

Indirect effect=0.41, $Z=1.93, p=0.05, 95\% CI [0.13, 0.90]$.

⁺ $p<0.10$. * $p<.05$. ** $p<.01$.

Consistent with Hypothesis 2, power equality (influence) positively predicted group originality in idea selection ($b=0.69, p=.001$) (Model 1 in Table 4). As a robust test, I added Initial Opinion Diversity as a control variable ($b=-0.07, ns$) in analysis (Model 2, Table 4). The

coefficient of Power Equality (Influence) remained positive and significant ($b=0.68, p=.001$) after controlling for the effect of initial opinion diversity. Adding Majority Support ($b=-0.03, ns$) as a control variable in the regression did not change the results either (Model 3, Table 4); Power Equality (Influence) still positively predicted group originality ($b=0.69, p=.001$) (Model 3 in Table 4). Adding both Initial Opinion Diversity ($b=-0.16, ns$) and Majority Support ($b=-0.13, ns$) as control variables also did not attenuate the effect of Power Equality (Influence) on group originality ($b=0.65, p=.002$; Model 4 in Table 4). Therefore, Hypothesis 2 was supported.

Table 4

Regression Results of Equal Power Distribution on Group Originality in the Selection Task

	Originality of Ideas Selected			
	Model 1	Model 2	Model 3	Model 4
Power equality (influence)	.69***	.68***	.69***	.65**
Information volume				
Initial opinion influence		-.07		-.16
Majority support			-.03	-.13

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

I also examined the relationship between equal power distribution and group creativity in the idea selection stage with two alternative measures of originality. First, I used the data from the idea generation task as the idea pool to create an additional measure of originality. Specifically, the originality of each of the five ideas used in the idea selection task was indicated by how rarely each idea was mentioned during the idea generation task. Specifically,

each of the 5 ideas included in the idea selection task had an output dominance score depending on how many idea generation groups had generated this idea. Ideas with higher output dominance scores were more popular or less original. Next, I took the inverse of the output dominance scores (1/output dominance) to form the originality scores. This originality score (Alternative Measure 1) was highly correlated with the originality score used in the analysis reported above ($r=.75, p<.001$). I repeated the regression analysis reported above using this alternative measure of originality as the dependent measure. As shown in Table 5 (the column of Alternative Measure 1), the results did not change when the alternative measure was used as the dependent measure.

In addition, I had the originality of the 5 options ranked by three coders. Rankings from of three coders followed the same distribution (Kendall $W=0.56, ns$). Thus, I took the average of the rank orders of five ideas from the three coders, and reverse scored the ranks to create the second alternative measure of originality. This measure of originality (Alternative Measure 2) was positively correlated with the original measure ($r=.45, p<.05$) and Alternative Measure 1 ($r=.86, p<.001$). Replacing the dependent variable in the regression analyses reported above with Alternative Measure 2 yielded the same result (the column of Alternative Measure 2 in Table 5).

In summary, I replicated the positive association between power equality and group originality in the idea selection stage with two alternative measures of originality. This result attests to the robustness of the positive effect of equal power distribution on creativity in the idea selection stage.

Table 5
Regression Results Using Different Measures of Group Originality of the Idea Selected

Variables	DV=Originality											
	Original Measure				Alternative Measure 1				Alternative Measure 2			
	M 1	M 2	M 3	M 4	M 1	M 2	M 3	M 4	M 1	M 2	M 3	M 4
Power	.69***	.68***	.69***	.65**	.60**	.57**	.62**	.59**	.49*	.48*	.55*	.57*
equality												
(influence)												
Initial						-.21		-.15		-.14		.10
opinion												
diversity												
Majority		-.07		-.16			.18	.09			.31	.37
support												

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

Discussion

Generating and selecting original ideas in teamwork are equally important for the success of a creative project. The current study sheds light on the different effects of equal power distribution on the generation of original ideas and their retention in idea selection. The results show that groups experiencing higher level of power equality tend to retain more original ideas, because the egalitarian experience encourages group members to freely express dissident views and more thoroughly explore all alternatives to reach a high-quality decision. Besides, during idea generation stage, I found supportive evidence of the facilitative effect of power equality on

idea originality. However, equal power distribution could also negatively affect the average level of idea originality in the group when power equality licenses free expression of ideas irrespective of their quality, and hence dilutes the average level of originality in the ideas generated by the group. When performing an idea generation task, group members in an egalitarian group may feel that they should contribute ideas freely regardless of how original these ideas are. This expectation may result in the generation of ideas that are not necessarily original.

Connections to Chapter 2 Results

Results of Chapter 2 and 3 together deepen our understanding of the relationship between power and group creativity. In Study 1, participants did not receive clear instructions on how they should accomplish the creativity task. Groups formulated their own strategies to attain the task goal. Therefore, I could not separate the effects of power distribution on idea generation and idea selection on the final creative output. The lab experiment in Chapter 3 addressed this limitation by isolating the effects of power distribution in idea generation and selection.

Equal power distribution positively predicted group creativity in Chapter 2. In Chapter 3, equal power distribution was positively related to originality in idea selection, but had both facilitative and inhibitive effects on group originality in idea generation. The mixed effects of power equality on ideational originality in the generation task may also explain why in Chapter 2, the direct effect of equal power distribution on group creativity was not significant ($b=0.10, ns$).

A limitation of Study 2 is that I did not measure constructive controversy, which may play a role in facilitating the generation of original ideas. When teams are encouraged to debate with each other and criticize each other's ideas, the teams generate more divergent

thoughts, compared to teams that engage in traditional brainstorming (Nemeth et al., 2004). Therefore, the mechanism through which power equality enhances group originality through constructive controversy should apply in idea generation too.

Nonetheless, the results of the current study identify licensing of free expression as another possible mechanism through which power equality enhances group originality in idea generation. In traditional brainstorming, most groups are instructed to avoid criticizing others' ideas (e.g., Osborn, 1953) and not to express disagreements unless they are specifically instructed to. In the current study, when idea generation groups experienced equal power, they contributed a higher volume of ideas to the group and did not hold back ideas that were not highly original. This in turn improved creative performance of the group. Past research shows that including an idea exchange session in idea generation task can further enhance creativity benefit of mutual stimulation (e.g., Kohn, Paulus, & Choi, 2011; Paulus & Yang, 2000). There is room for future research to explore how brainstorming techniques can be further improved by encouraging both free expression ideas and cognitive debates.

Meanwhile, in an idea selection task, groups that have more equal power distribution tend to select more original ideas, probably because team members feel that they can openly defend their ideas and challenge other members' ideas. As shown in Chapter 2, constructive controversy mediates the effect of power equality on group creativity. Chapter 3 results further confirmed that the contribution of constructive controversy to group creativity is particularly important at the idea selection stage, when team members need to reach consensus on which idea will be selected for further development. In this situation, constructive controversy, supported by equal power distribution, engages team members in deliberative discussion and full exploration of all alternatives, which in turn lead to high

quality decisions. Unfortunately, we did not directly measure constructive controversy in Chapter 3, a shortcoming that needs to be addressed in future studies.

Implications

These findings have several practical implications. By identifying the specific roles of equal power distribution plays in generating and retaining original ideas, my results illustrate how organizations can increase creative performance of their groups by managing the pertinent group experience at different stages of creative production. For example, team leaders can promote retention of original ideas when the team decides which idea would be selected for commercialization by creating equality in decision-making power within the team. Similarly, team leaders can improve the originality of the ideas generated by the teams by promoting the egalitarian climate within the team while reminding members about the importance of information quality.

Limitations and Future Research

Nonetheless, the current study has limitations. One limitation is that I randomly assigned groups to work on either the idea generation or the idea selection task. R&D groups may need to accomplish both tasks for their projects: Group members come up with the ideas before proceeding to evaluate the ideas. It will be important and interesting to examine the potential carryover effects of equal power distribution from one stage to the other. As I have demonstrated in the current study, idea generation and selection are qualitatively different tasks. Power equality has different effects on group originality at these two stages. R&D group members may experience intrapersonal conflicts when they transit from one stage to the other. Future research is needed to examine the consequences of such conflicts and how they can be managed.

Another limitation is that only originality was examined in the study as the indicator of the quality of ideas. Usefulness is also a critical evaluation of criterion of the quality of creative output. Only ideas and products that can provide utilities to people are going to be implemented and turned into innovation. However, a novel idea may not always be useful. Rietzschel and his colleagues (2010) have examined the originality and the feasibility of idea(s) as separate indicators of quality. They also examined the context under which the creative output would have high scores on both quality indicators. Future creativity research can be conducted to extend my findings to the quality of the idea (s) or product(s) on both novelty and usefulness.

The current study also failed to consider the importance of leadership in idea generation and selection. There is consistent evidence that a competent leader equipped with domain-related knowledge and motivation skills can empower and motivate group members to achieve creative output (e.g., Gong, Huang, & Farh, 2009; Zhang & Bartol, 2010). A competent leadership can facilitate group creative performance by helping group members recognize and respect each other's expertise, despite their unequal power. Recognized expertise may be required for the emergence of the creative effects of power equality. If a group member without recognized expertise in the task domain tries to dominate other members, such behaviors may be frowned at even in an egalitarian group. Future research is needed to further explore the boundary conditions of the relationship between power equality and group creativity in organizational settings, particularly in contexts where power inequality can facilitate group creativity performance through effective coordination of group discussion and coordination of expertise.

Finally, although the experimental paradigm together with detailed analysis of the group discussion processes has shed some new light on the relationship between power and group creativity, more research is needed to fully unpack the effect of power on group creativity.

Future research may further examine how power equality impacts the micro behavioral processes involved in creative production. Additional measures can be included to reveal these processes. Some examples are self-ratings of the creativity of the ideas generated or selected before group discussion, and group ratings of the creativity of the group output at the completion of the task. With these measures, it may be possible to determine whether individual members and the group are able to distinguish creative ideas from ordinary ones or would purposefully withhold expression and submission of very novel ideas.

CHAPTER 4 THEORETICAL EXPANSION⁵

In the last two chapters, I examined the relationship between equal power distribution and group creativity, as well as the mediator and the moderator of the relationship. In Chapter 2, equality in power was found to facilitate group creative performance through the mediation effect of constructive controversy within the group. The moderating role of stages of creativity on the relationship between equal power distribution and team creativity was explored in Chapter 3, in which I found the different effects of power equality on the originality of ideas at the idea generation and selection stages. Whereas equal power distribution facilitated selection of original ideas through more thorough explorations of alternatives, it increased idea originality in generation through an increased volume of information individual members contributed to group discussion. This result highlights the utility of studying idea generation and selection separately.

Building on this distinction, in the present chapter, I will examine the role of group norms in explaining cultural differences in idea generation and selection when people work in groups to produce creative outcomes. The findings reported in chapters two and three offer some insights into the cultural differences in group creativity and the underlying mechanism. In Study 2, egalitarian groups tended to select more original ideas. Consistent with this finding, cross-cultural research has shown that groups from individualist cultures select more original ideas than do collectivist groups, assuming that power distribution is more equal in individualist than collectivist cultures (Liou & Nisbett, 2011; Nouri, Erez, Rockstuhl, & Ang, 2008). Thus, the greater emphasis on group egalitarianism in individualist versus collectivist cultures may explain

⁵ Part of this chapter is published in Li, C., Kwan, L., Y-Y., Liou, S., & Chiu, C-Y. (2013). Culture, group processes, and creativity. In M. Yuki, & M. Brewer (Eds.), *Culture and Group Process* (pp.143-165). New York: Oxford University Press.

why compared to collectivist cultures, groups in individualist cultures tend to choose more original ideas at the idea selection stage. To further exploit my research findings for the purpose of deepening the understanding of cultural differences in creativity, I will propose a conceptual model of the cultural effects on creativity. In this chapter, I will start by elaborating on what culture is and how creativity is conceptualized. Next, I will discuss how culture affects the group processes that underlie group creativity to illuminate the interplay of culture, group processes and creativity. I will close with a discussion on how cultural differences in the prevalent norms concerning group egalitarianism could affect group creativity across cultures.

Creativity and culture are intricately related. Humans are not the only species capable of engaging in social learning. Other primates are also capable of copying novel use of tools from their peers (Whiten et al., 1999). What distinguishes human culture from primate culture is that human culture is cumulative; only human beings build on the inventions of others, so that once somebody had invented the wheel, others do not have to reinvent it (Tomasello, 2001). Instead, others build on it to develop new applications (e.g., the wheels of a motor vehicle). This process, which has been referred to as *ratcheting*, illustrates the reciprocal influence of culture and creativity. On the one hand, creativity is *the* process that moves the evolution of culture forward. On the other hand, culture provides inspirations for new inventions. In addition, existing knowledge in the culture serves as a benchmark for evaluating the level of creativity of the new inventions: What is creative is something that is not already in the culture (Chiu & Kwan, 2010).

Nonetheless, what is creative does not have to be a new creation. An old idea in a certain cultural tradition may be perceived to be a creative idea in another cultural tradition (Niu & Sternberg, 2001). For example, the neurological effect of mindfulness (e.g, Zeidan, Martucco, Kraft, Gordon, McHaffie, & Goghil, 2011), an “established” knowledge in Zen Buddhism, is new knowledge in contemporary psychology. In addition, what is creative to an individual may not be seen as creative to the group or the larger culture. For example, Vincent Van Gogh, whose paintings opened the doors to modern art, was way ahead of his time. Intense negotiation of what constitutes a creative idea often takes place within a cultural community before a consensus can be reached on how creative an idea is. In short, creativity is an intrinsically cultural and social process (Chiu & Kwan, 2010).

Paradoxically, creativity is often studied as an intrapersonal cognitive process that occurs in a social and cultural vacuum. The study of creative personality as an individual difference

(e.g., Helson, 1996) and the study of creative cognition as intra-individual cognitive processes (e.g., Finke, Ward, & Smith, 1992; Mumford & Gustafson, 1988) have deepened the understanding of the intrapersonal factors that underlie individual creativity performance. What is relatively less thoroughly researched is the interplay of culture and group processes in both individual and group creativity. The objective of the present chapter is to fill this gap.

In this chapter, I will review the literature on how culture affects the group processes that underlie group creativity to illuminate the interplay of culture, group processes and creativity. Research on this topic has treated the heritage culture of the individual as an independent causal factor that shapes the creative outcomes of work teams through certain intervening group processes. A challenge of writing this review is the non-availability of an integrated theoretical framework in the literature to bring these three research traditions in culture and creativity together. In this chapter, I propose a preliminary framework to fill this theoretical void. Although I have tried to constrain my theoretical propositions with available empirical data, my analysis is severely limited by the dearth of research that has examined the interplay of culture, group processes and creativity. Nonetheless, I hope my preliminary framework would inspire more in-depth conceptual and empirical investigations into this emerging field. To provide an overarching framework to structure the discussion, I will begin this chapter with a discussion of (a) what culture is, and (b) what creativity is.

What Is Culture?

Psychological research on culture has traditionally focused on national cultures or the knowledge tradition of a national group (Lehman, Chiu, & Schaller, 2004). However, broadly speaking, a culture is any knowledge tradition that is widely shared in a community of

interdependent individuals and has a history (Chiu, Leung, & Hong, 2010). By this definition, a culture can be a shared knowledge tradition of a national, religious, political, or disciplinary group (Chiu, Kwan, & Liou, in press).

Every established human group has its culture, which serves important functions for the group and each of its individual members (Chiu & Hong, 2006). At the group level, culture prescribes desirable and acceptable behaviors or behaviors that would benefit not just the individual but also the group. Culture also proscribes behavioral expressions of selfish maximization that would hurt the welfare of the collective (Chiu & Chao, 2009; Chiu, Kim, & Chaturvedi, 2010). From this perspective, cultural prescriptions and proscriptions serve important regulatory functions of coordinating goal pursuits of multiple individuals in a complex system.

Culture also serves important functions for the individual (Chiu & Hong, 2006). First, individuals can rely on knowledge that is shared or widely accepted in a community when they need firm answers in uncertain situations (Chiu, Morris, Hong, & Menon, 2000; Konic, Kruglanski, Pierro, & Mannetti, 2004). That is, culture confers epistemic security when individuals are confronted with decisional uncertainty. Second, the continuity of one's cultural tradition also offers existential security to individuals (Greenberg, Solomon, & Pyszczynski, 1997). Individuals, when confronted with the inevitability of one's mortality, may question the purpose of life. Knowing that one belongs to a long lasting tradition provides the assurance that one lives on, albeit symbolically, as a contributing member of the tradition, and hence can assuage existential anxiety (Solomon, Greenberg, & Pyszczynski, 1991).

Finally, culture also addresses an individual's identity needs. The desire to be connected to others is a basic human need (Baumeister & Leary, 1995). Individuals can satisfy this need

through participating in a culture. When the need to belong is activated, individuals who strongly identify with their in-group are motivated to claim possession of the characteristic qualities of the group (Pickett, Bonner, & Coleman, 2002). Individuals who identify strongly with their culture are more motivated to adhere to and defend the perceived norms of their culture (Jetten, Postmes, & Mcauliffe, 2002).

As will be discussed later, the reliance on culture to satisfy one's identity needs and needs for epistemic and existential security is a primary driver of (a) motivated effort to protect the purity, integrity and vitality of one's culture, and (b) motivated adherence to cultural norms. These motivational processes have important implications for understanding the interplay of culture and group processes in creativity.

What Is Creativity?

Creativity is *the* factor that drives advances in art, science, culture, business, and the national economy. A creative product is one that embodies an original idea and has value to its users (Amabile, 1986). As noted, the originality of an idea is audience-dependent; it is defined in relation to what is already known in a certain human group. Thus, a well-established idea in a certain group could be an original idea in another group, and vice versa. For example, Niu and Sternberg (2001) noted that while Chinese reviewers did not regard the film *Crouching Tiger, Hidden Dragon* as a particularly novel film, Western reviewers acclaimed the film for its stylistic innovations.

A creative product is also a valuable product to its users. A creative product is valuable if it can help its users achieve their valued goals. For example, the goal of psychological science is to explain, predict and control human behaviors. A piece of creative research in the

psychological science contributes to new knowledge, affording better understanding, more accurate predictions, and more effective interventions of human behaviors (Sternberg, 2003). Likewise, in commercial product design, a creative product embodies a new design idea that can increase consumer satisfaction (Liou, 2009). According to this definition, the value of a creative product is relative to the goals of the creative activity, as well as the needs and expectations of the product's consumers.

The process of producing a creative idea involves three iterative stages (Chiu & Kwan, 2010). Idea generation is the stage in which knowledge workers generate and author new ideas. Idea editing and marketing is the stage in which a subset of new ideas is selected for further development and refinement. Idea acceptance is the stage in which potential users of the new idea choose to adopt or reject the idea.

The three stages are qualitatively different stages, each with its distinct performance expectations (Chiu & Kwan, 2010). For example, at the idea generation stage, the goal is to generate *novel* ideas. A primary driver of creative activities at this stage is the intrinsic satisfaction and projected extrinsic rewards (e.g., social recognition, patents) associated with creating something new and distinctive. Reality checks gain importance at the idea editing and marketing stage. At this stage, knowledge workers need to consider the perceived preferences of the potential users, assess the acceptance potential of each candidate idea, and select ideas with high acceptance potentials for further development. At the acceptance stage, ideas compete with each other in the marketplace and those that possess the highest collective utility or match the preferences of the audience are likely to be accepted. Ideas that have received endorsement from the pertinent authorities are also likely to be accepted. Given the different performance expectations at the three stages of creative production, it is not surprising that oftentimes, the

most novel idea may not be as successful in the marketplace as the minimally counter-intuitive ideas (Norenzayan, Atran, Faulkner, & Schaller, 2006). Because market acceptance of creative ideas involves complex interactions between historical, sociopolitical, economic and psychological processes that go beyond the scope of analysis in this chapter, I will focus on the cultural and group processes in the idea generation and editing stages.

Different cognitive styles and motivational predilections are associated with successful performance in the idea generation and editing stages. For example, divergent or lateral thinking (thinking that aims to find diverse answers to the same problem) improves fluency in idea generation, whereas convergent thinking (thinking that aims to find the correct answer for a problem) hinders it (Milliken, Bartel, & Kurtzberg, 2003). Broadening the attention field and an expansive mental search for nonconventional exemplars of a semantic category facilitate performance at the creative idea generation stage only (Friedman, Fishbach, Förster, & Werth, 2003; Ip, Chen, & Chiu, 2007). Whereas a self-regulatory focus on maximizing gains facilitates fluency in ideas generation (Friedman & Forster, 2001; Herman & Reiter-P, 2011; Ip et al., 2007), a self-regulatory focus on avoiding failures promotes persistence in idea editing (Lam & Chiu, 2002).

When individuals work in teams, performance of the teams at idea generation and editing stages are related to different group processes. For example, to generate the most novel ideas, knowledge workers need to defy the crowd and explore uncharted intellectual territories (West & Wallace, 1991). Team members are prepared to suggest new ways to achieve task goals and generate new ideas to improve performance when the team climate promotes the creative self-efficacy of the individual team members and encourages expression of dissident views. The team leaders can also play an important role in facilitating creative idea generation in teamwork by

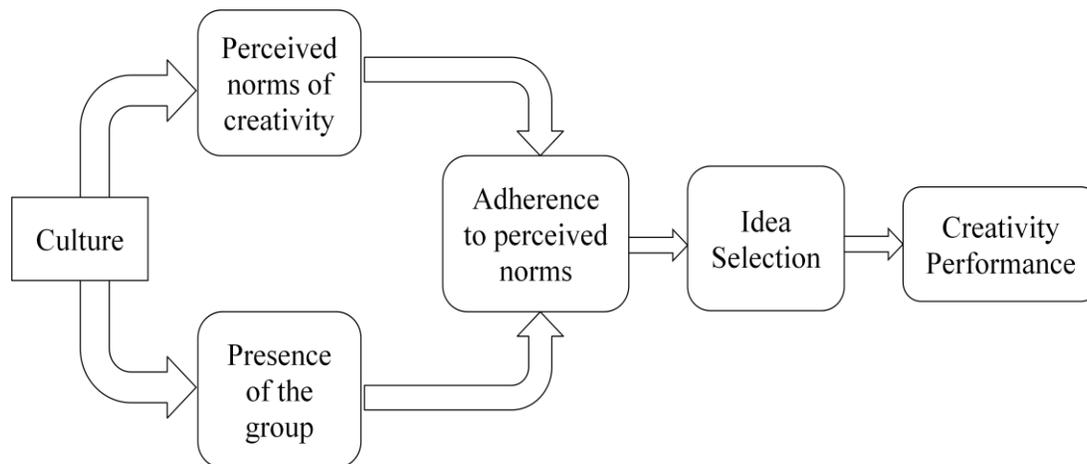
supporting mutual inspiration and intellectual stimulation (Shin, Kim, Lee, & Bian, 2012). In contrast, at the selection and editing stage, an overemphasis on conflict avoidance could lead team members to prioritize ideas that are likely to be accepted by all team members even when these ideas are not the most original and valuable ones the group has generated (Liou & Nisbett, 2011). Thus, a challenge in managing team performance is to minimize the group dynamics that would increase the likelihood of groupthink.

Culture → Group Processes → Group Creativity

How does culture affect group creativity? I seek to answer this question by examining how culture affects the group processes that are implicated in idea generation and selection in a group creativity task. My argument, as illustrated in Figure 5, is that the most pronounced cultural differences in team creativity performance occur at the idea selection stage, when members of the team deliberate to select ideas for further development. To elaborate, the tendency to adhere to cultural norms is most salient in the presence of a group. During the deliberation process, the need to reach consensus with other group members motivates the individual members to assess what the perceived creativity norms in the group are and tune their decisions toward the perceived norms. Perceived creativity norms vary across cultures. For example, novelty is perceived to be more valued in Western cultures whereas usefulness is perceived to be more valued in Asian cultures (see Morris & Leung, 2010; Paletz & Peng, 2008). Because of these cultural differences, different types of ideas tend to be selected in different cultures. Continuing with the example of East-West differences, novel ideas are more likely to be selected in Western cultures and useful ideas more likely to be selected in Asian cultures. In addition, culture also affects the relative importance of perceived norms and personal preferences

in idea selection, with perceived norms being a more important consideration in cultures that emphasize group conformity.

Figure 7. A model of cultural differences in creative idea selection and group creativity



Culture and Individual Differences in Creativity

As a straightforward answer to the question of how culture impacts group creativity, one may argue that some cultural processes support the development and expression of creativity, while others do not. For example, some writers (Nisbett, 2003) contend that people in individualist cultures are socialized to become analytical thinkers, whereas those in collectivist cultures are socialized to become holistic thinkers. Because only analytical thinking supports creative accomplishments in science, cultural differences in the preferred thinking styles may account for the superior creative scientific accomplishments in Western, individualist cultures.

Nevertheless, the empirical support for this contention is weak. Some studies (e.g., Niu, Zhang, & Yang, 2007) found that individuals from Western cultures (the US, Europe) outperformed individuals from Asian cultures (e.g., China, Japan) in creativity tests. These

results however are difficult to interpret because of the lack of evidence for the measurement equivalence of the tests used in the studies. Furthermore, most standard tests of creative performance were developed in the West and sometimes administered to the Asian participants (e.g., Hong Kong Chinese) in English (Zhou & Su, 2010). The lack of culture-fairness in assessment has compromised the validity of any conclusions drawn from earlier cross-cultural comparisons. Finally, other studies (Nouri et al., 2008) have failed to find consistent cross-cultural differences in individual performance on creativity tasks. For example, Saeki, Fan and Dusen (2001) compared the performance of Americans and the Japanese on the figural test of the Torrance Tests of Creative Thinking. Although Americans produced more abstract and elaborate ideas than did the Japanese, the two groups did not differ in the number of ideas generated, and the ideas generated by the two groups were equally original. Other studies (Zha, Walczyk, Griffith-Ross, Tobacyk, & Walczyk, 2006) showed that Americans outperformed Chinese on divergent thinking, but personal endorsement of individualism did not mediate the performance difference between the two cultures.

Culture and Group Differences in Creativity

Despite the lack of consistent support for differences in individual creative performance across cultures, recent studies have found robust differences in team creativity between individualist and collectivist cultures (Bechtoldt, De Dreu, Nijstad, & Choi, 2010; Liou & Nisbett, 2011; Nouri et al., 2008). For example, one study (Goncalo & Staw, 2006) found that compared to collectivist groups, individualist groups have higher creative performance, particularly when creativity is a salient task goal (e.g., when the groups are explicitly instructed to be creative).

However, it is unclear from these results how culture and group processes interact to affect creative performance in work teams. For example, it is unclear whether cultural differences occur at the idea generation or the idea selection stage. In addition, the mechanisms that underlie this cultural difference remain to be identified. One reason for the presence of this knowledge gap is the emphasis in past research on cultural differences in creative accomplishments rather than the group processes that give rise to cultural differences in creative performance (De Dreu, 2010).

Nonetheless, evidence from a few recent studies has suggested a possible explanation for the cultural differences in group creativity. First, a study (Liou & Nisbett, 2011) showed that cultural differences in team creativity emerge at the idea selection stage. In this study, Americans and Taiwan Chinese teams were instructed to generate new design ideas for a product. At the idea generation stage, team members were instructed to work alone. Consistent with past research that has failed to find cultural differences in individual creative performance, the ideas generated by the American and Chinese participants were equally original. Next, at the idea selection stage, team members were instructed to discuss the ideas generated by the individual team members and selected some ideas for further development. At this stage, cultural differences surfaced. The ideas selected by the American teams were more original than those selected by the Taiwanese teams, and the ideas discarded by the Taiwanese teams were more creative than those discarded by the American teams. This result shows that although both Americans and the Chinese are equally capable of generating original ideas, compared to the Chinese teams, American teams are more likely to select the relatively novel ideas for further development.

This cultural difference in idea selection seems to originate from the use of different criteria for idea selection. In a cross-cultural study, Nouri, Erez, Rockstuhl and Ang (2008) compared Singaporeans and Israelis on their performance on a creativity test performed individually and again found that the two groups performed equally well on this test. Interestingly, when the participants were asked to perform the task in groups, the Israeli teams were more original than the Singaporean teams. In contrast, the Singaporean teams elaborated more the appropriateness of each idea they selected. In another study (Bechtoldt et al., 2010), Dutch and Korean student teams were asked to generate new ideas to improve university teaching. When Dutch students were (vs. were not) instructed to do their best, they generated more original ideas. In contrast, when Korean student teams were asked to do their best, they generated more useful ideas. The situation-induced increase in task motivation did not impact the usefulness of the ideas generated by the Dutch teams or the originality of the ideas generated by the Korean teams. Together, these findings show that compared to Western teams, Asian teams put greater emphasis on idea usefulness and less emphasis on idea originality at the idea selection stage.

These cultural differences in idea selection seem to originate from the perceived norms of creativity rather personal preferences across cultures. In one study, Paletz and Peng (2008) compared the relative importance of novelty and usefulness in evaluating the creativity of new products among Americans, the Chinese and the Japanese. They found that the Chinese valued novelty more than Americans, whereas Americans and Japanese valued usefulness more than the Chinese. This result suggests that the East-West difference in the relative weights assigned to novelty and usefulness in idea selection does not reflect the actual personal importance of novelty or usefulness to Asians and Westerners.

Instead, as I mentioned earlier, at the idea selection stage, individuals are inclined to consider the *perceived preferences* of the audience when choosing ideas for further development. When deliberating on the choices of ideas, team members would consider the perceived preferences of other team members. When team members assume that other members in the team value novelty, they would express greater support for novel ideas. Likewise, when team members assume that others in the team value usefulness, they would show greater support for useful ideas. This contention is consistent with the intersubjective approach to cultural influence (Chiu, Gelfand, Yamagishi, Shteynberg, & Wan, 2010, Morris & Leung, 2010; Zou, Tam, Morris, Lee, Lau, & Chiu, 2011), which posits that culture impacts decisions not necessarily through internalized personal values, but through the perceived norms in the culture. In support of this contention, Bechtoldt and her colleagues (2010) reported that when Dutch teams were experimentally induced to perceive usefulness to be the prevalent norm of creativity in the group, motivating them to do their best in a team creativity task increased the usefulness but not the novelty of their ideas.

There are several implications of these findings. First, cross-cultural differences in team creativity do not always reflect group differences in the ability to generate novel or useful ideas, or group differences in what types of ideas are considered to be creative. Instead, cultural differences in team creativity may arise from the perceived norms of creativity in the culture, which may or may not correspond to the actual norms (Morris & Leung, 2010; Wan, Chiu, Tam, Lee, Lau, & Peng, 2007).

Although both Asian and Western teams would consider the perceived norms in the team when selecting ideas for further development, the impact of perceived norms on idea selection may be stronger in more collectivist culture. This is because the motivation to submit the self to

majority influence is stronger in collectivist versus individualist cultures (Zhang, Lowry, Zhou, & Fu, 2004). Indeed, priming the interdependent self would accentuate the influence of perceived norms in decision-making, whereas priming the independent self would attenuate it (Torelli, 2006). On the one hand, when making decisions in groups, the pressure to achieve early consensus could hurt the quality of the final decision. On the other hand, voicing one's disagreements with others despite the conformity pressure could enhance the quality of decisions made through cancellation of biases from individual members (Schulz-Hardt et al., 2006). Thus, the greater conformity pressure in collectivist groups may help these groups to reach consensus more quickly at the expense of decision quality.

Thus far, I have focused on how group processes contribute to cultural differences in idea selection. Group processes also contribute to cultural differences in idea generation, although the evidence for such contributions is still limited. As noted, a focus on gain maximization versus loss minimization is associated with greater fluency and originality in idea generation. Thus, one would expect that in cultures that emphasize gain maximization, having an incentive system that rewards novel ideas would encourage generation of original ideas. There is evidence that individualist cultures emphasize gain maximization more than do collectivist ones (Lee, Aaker, & Gardner, 2000). Accordingly, having an equitable reward system for original ideas should have greater facilitative effects on novel idea generation in individualist versus collectivist cultures. Consistent with this hypothesis, Goncalo and Kim (2010) found that after participants were primed with the independent self, an equitable reward system increases group productivity in idea generation more than an egalitarian reward system. In contrast, the reward system manipulation had no impact on idea generation following priming of the interdependent self. As another example, constructive controversy facilitates team creativity (Nemeth et al., 2004;

Reining & Mejias, 2004). Specifically, encouraging group members to debate among themselves (vs. encouraging group members to avoid criticizing others' ideas) during group brainstorming improves the fluency of idea generation. Accordingly, higher levels of team creativity are expected in cultures that promote constructive controversies (e.g., individualist cultures) rather than conflict avoidance (e.g., collectivist cultures) in teamwork.

Conclusions and Discussion

In summary, I have reviewed recent research evidence to illustrate how culture impacts group creativity at different stages of creative production through different group processes. This analysis highlights the importance of separating idea generation from idea selection, as well as the importance of considering normative process in idea selection for understanding cultural differences in team creativity.

Research on culture and creativity has focused on how cultures differ on various performance measures of individual creativity. Due to various conceptual and measurement problems, the available evidence has failed to reveal any systematic cultural differences on individual creativity. Against this backdrop, in this chapter, I attempt to focus on the relevance of group processes in the link between culture and creativity. Specifically, I argue that cultural differences in creative performance may arise from adherence to perceived norms of creativity. People from different cultural groups have different shared beliefs about what constitute creativity. Although these shared beliefs may not affect performance when individuals are required to generate new ideas by themselves, their effects on what ideas will be selected for further development are pronounced when members of the culture are required to reach

consensus on idea selection. This analysis also highlights the contribution of studying creativity as a multi-stage process.

The model proposed in this chapter can be applied to understand cross-cultural differences in group creativity. According to the results from Chapter 3, groups with more even distribution of power are more likely to select ideas that are original. Thus, the greater emphasis on group egalitarianism in individualist versus collectivist cultures may explain why compared with collectivist cultures, groups in individualist cultures tend to choose more original ideas at the idea selection stage.

To elaborate, there are cultural differences in the extent to which group egalitarianism is perceived to be the prevalent teamwork norm. Compared to groups in collectivist cultures, groups in individualist cultures perceive power equality to be more widely accepted in their cultures. In support of this argument, there is evidence that people in individualist cultures perceive a smaller power distance in their culture, compared with people in collectivist cultures. Power distance refers to the degree to which the less powerful members accept unequal distribution of power (Hofstede, 1980). High power distance is usually referred to as “hierarchy” and low power distance as “egalitarianism” (e.g., House, Hanges, Javidan, Dorfman, & Gupta, 2004). Individualist cultures score lower on power distance than collectivist cultures do. People from low power-distance cultures have weak tendency to rely on and refer to the authority. In addition, group members’ contributions as information sources are more comparable (Earley, 1999). In contrast, in high power distance cultures, high status members are more important sources of collective efficacy judgment (Earley, 1999) and governance (Smith, Peterson, & Schwartz, 2002). Comparing Japanese managers with their American counterparts, reference to authority has been found to be a more prevalent influence strategy in Japanese culture (Rao,

Hashimoto, & Rao, 1997). There are also consistent findings that paternalistic leadership is highly valued in collectivist cultures (Ayca, 2006; Ayca et al., 2000; Farh & Cheng, 2000; Pellegrini & Scandura 2006; Sinha, 1997; Westwood, 1997). Furthermore, House and his colleagues (2004) found that high power distance and collectivist values are negatively associated with the desirability of charismatic and participative leadership and positively correlated with a self-protective style of leadership that emphasizes status-conscious behaviors. Given these findings, it seems reasonable to assume that group egalitarianism is believed to be more valued and accepted in individualist versus collectivist cultures.

Acting on this perceived norm, groups in individualist cultures may more openly express their individual ideas and select the one that the group subsequently agree to be the most original idea. In contrast, groups in collectivist cultures may perceive group autocracy to be more widely practiced in their cultures, and may engage in self-censorship and do not express or defend their personal preferences. As a consequence, they select the less original ideas.

In addition, as shown in Chapter 3, equal power distribution within the group has mixed effect on group originality in idea generation. Thus, although groups in individualist cultures perceive power equality to be prevalent than do group in collectivist cultures, this perception has relatively little overall impact on the originality of ideas at the idea generation stage. This explanation is consistent with the findings that cultural differences in idea originality tend to surface at the idea selection stage only.

In conclusion, I am aware of the dearth of empirical evidence that directly addresses the interrelations of culture, group processes, and creativity. Nonetheless I have made a reasonable attempt to construct a broad theoretical framework to bring together the scattered research findings on culture, group processes and group creativity. I hope that my attempts will inspire

new systematic research that will eventually deepen the understanding of the interplay of culture, group processes and creative performance.

The framework proposed here is also applicable with an expanded conceptualization of culture. Culture may also refer to professional culture, disciplinary culture, even organizational culture. Here I use disciplinary culture as an example to elaborate on how my proposed framework could help understand disciplinary differences in group creativity. There are different perceived norms of creativity across disciplines. For example, artists tend to weigh novelty heavily when designing a piece, while engineers also emphasize the usefulness of an idea or product when they design it. Therefore, working as groups, engineers are likely to follow “the engineer culture” and are relatively inclined to select ideas that have the potential to satisfy instrumental functions. In contrast, a team of artists may tend to favor ideas of high originality and uniqueness.

The normative approach to culture and creativity also deepens our understanding of how to manage interdisciplinary work teams. First, differences in perceived norms of creativity may explain group processes when diverse groups work on a creativity task. When people work together in a group, they would assess what the prevalent norms are and have a tendency to adhere to the perceived norms. However, people from different disciplines may disagree on what constitutes creativity and how to achieve creativity. Group members are likely to adhere to their own disciplinary norms of creativity, and the ensuing conflicts may jeopardize group creativity performance. Prior research has shown that people tend to regard their own disciplinary approach as the more applicable one in solving an interdisciplinary problem (Banerjee & Chiu, 2008; Kruglanski, Pierro, Mannetti, & De Grada, 2006). This expression of intellectual centrism hinders interdisciplinary collaboration and lowers the

quality of creative outputs (Chiu, Kwan & Liou, in press). Future research can further explore the role of disciplinary culture in the creativity performance of interdisciplinary groups and suggest strategies to maximize creativity gains in these groups.

The normative approach to culture and creativity also offers an alternative to operationalize group diversity when investigating creativity performance. That is, group diversity can be measured in terms of the level of disagreement on perceived norms of creativity within the group. Group diversity research has used background diversity as a proxy to measure group diversity. But this measure may fail to capture other aspects of cognitive diversity that contribute to varying levels of group performance. Because team members select ideas based on the perceived relative importance of different performance criteria to other team members, disagreement versus consensus in such perceptions is an aspect of the cognitive diversity that importantly influences creativity performance.

CHAPTER 5 GENERAL DISCUSSION

Summary of Findings

This dissertation aims to investigate the relationship between power, group creativity, and culture. Plenty of research has been done on the facilitators and inhibitors of group creativity. Despite the extensive research effort spent on revealing the benefits and costs of power on individual creativity, there is a dearth of research on how power can affect group creative performance. In the present dissertation, I focused on one aspect of power - equal power distribution. I am interested in the relationship between equal power distribution and group creative performance, as well as the mechanism that mediates this relationship. Besides, idea generation and idea selection are two qualitatively distinct stages of creativity with different task goals and cognitive requirements. Therefore, I further examined the potential implications of equal power distribution for managing the tension between these two stages for the goal of enhancing creative performance. Furthermore, I discussed the relationship between power and group creativity at different stages in broader cultural contexts and developed a theoretical framework to understand how culture affects group creativity at the idea generation and selection stages. Details of my findings are as follows.

In Chapter 2, I examined the effect of equal power distribution on group creative performance and the underlying mechanism. The study also adopted an expanded conceptualization of the antecedents of constructive controversy, incorporating empowerment and the quality of collaboration as contributing factors to engagement in open-minded discussion of diverse opinions, in addition to the opportunity (equal power distribution) to realize constructive controversy. Using survey data collected from student groups who worked on a research project, I conducted path analyses to confirm the facilitative role of all three variables

(equal power distribution, empowerment, and collaboration) in group creative performance. The relationship between equal power distribution, empowerment, collaboration, and group creativity was found to be mediated by constructive controversy within the group.

The influence of equal power distribution on creativity was further explored in Chapter 3 by introducing different stages of creativity process. I examined the role of equal power distribution in (a) generating and (b) selecting original ideas in a team creativity task. The idea generation and selection stages are two qualitative different stages of the creativity process. Idea generation aims to produce as many potentially good ideas as possible. In contrast, during idea selection, people select the best idea(s) for further development and refinement. Supporting the conceptual distinction between idea generation and selection, the results showed that teams with higher level of group power equality - a facilitator of broad exploration of alternatives - have more original outputs in an idea selection task. In contrast, equal power distribution has mixed effects on group originality in an idea generation task. A closer look at the relationship between power equality and group originality in idea generation indicated that equal power distribution enhances group originality of ideas generated by licensing free expression; but also dilutes the average level of originality in the ideas generated by the group. The dilution effect is possibly because in an idea generation task, free expression of opinions supported by equal power distribution encourages expression of ideas that are not necessarily very original or stimulating.

Chapter 4 situates my theory of the relationship between power and group creativity in a broader cultural context. An expanded model is proposed to unpack the effects of culture on group creativity. I argue that the most pronounced cultural differences in team creativity performance occur at the idea selection stage, when members of the team deliberate to select ideas for further development. To elaborate, the tendency to adhere to cultural norms is most

salient in the presence of a group. During the deliberation process, the need to reach consensus with other group members motivates the individual members to assess what the perceived creativity norms in the group are and tune their decisions toward the perceived norms. Perceived creativity norms vary across cultures. Because of these cultural differences, different types of ideas tend to be selected in different cultures.

Implications and Future Directions

The present dissertation has theoretical and practical implications on how to improve group creativity. Past research has identified the performance benefits of open-minded discussion of opposite opinions in the organization. My study reveals the importance of empowering employees and offering them opportunities to engage in constructive controversy. In this regard, managers can design influence-sharing policies and structures that facilitate employees' participation in constructive discussions and incentivize employees to engage in such discussions. Training programs and guidance can be designed and introduced to strengthen employees' motivation and ability to practice constructive discussion at work.

The current study highlights the importance of managing group dynamics for creativity. Idea generation and idea selection are two qualitatively distinct stages. Equal power distribution helps retain the original idea but has mixed effects in idea originality in idea generation tasks. The presence of the different effects of equal power distribution on group creativity in idea generation and selection suggest that it may be challenging to combine idea generation and idea selection effectively (e.g., Cumming & O'Connell, 1978; Rietzschel et al., 2006). Therefore, careful management of group processes and experience at the two stages is required to improve the quality of the final creative output. If the group needs to accomplish both tasks, managers

should pay attention to the transition between the two stages because of their distinct cognitive requirements and the involvement of different group dynamics at the two stages. I welcome future research into other group process facilitators and inhibitors of creativity that could impact creative performance at the idea generation and selection stages.

There are also implications of my research for the management of multicultural teams. As a result of globalization, multicultural teams are found in many work units nowadays. Managing team members from multiple cultures is challenging given the presence of dissimilar culturally characteristic values and beliefs, working styles, and other differences in the team. Cultural differences within a team can create an obstacle for effective teamwork and consequently compromise creativity and team performance. To improve team creative performance, leaders of multicultural teams may want to create a controversy-friendly environment to facilitate adoption of a cooperative approach to resolving intellectual disagreement. Team leaders may also strike promote group egalitarianism as a shared norm among team members. To mitigate the effects of pluralistic ignorance and groupthink in idea selection, team leaders could help team members develop accurate perceptions of the shared norms regarding power distribution in different cultures. Instead of being culture-blind, managers need to attend to cultural differences and understand how culture impacts creative performance through different group dynamics at different stages of creative production.

Cultures that promote constructive controversy rather than conflict avoidance can facilitate group creative performance. Cultures here could refer to national cultures, professional cultures, organizational cultures, or at the team level, team climate. Creativity originates in part from the cross-fertilization of divergent ideas and critical debate over disagreement. When people experience a climate that encourages free expression of one's own opinions and open

discussion of opposing ideas, the collective could benefit from the cognitive stimulation and select more creative ideas for refinement and implementation. Conflict avoidance, on the other hand, extinguishes the creative sparks despite its beneficiary effects on interpersonal relationship. To achieve innovative outcome, it is desirable to have a culture that encourages resolving conflicts with cooperative intentions rather than confrontation avoidance (Zhang, Zhang, & Wang, 2011).

To close, I encourage further research on the relationship between power and creativity as well as other types of team performance. Power plays an important role in organizational behavior as well as social life. The current dissertation makes a preliminary attempt to investigate the effect of power distribution on group creativity. Besides group equal power distribution, other types of power relations and dynamics also deserve research attention. For example, within a department /division, the existence of subgroups and the relative power of subgroups could be one interesting aspect of power relations that merits future research. The field also needs further research into other aspects of power dynamics to illuminate how they can influence creativity and performance at group and organizational levels.

Appendix A: Course Syllabus

课程大纲

课程编号: 02830140

课程名称: 社会心理学

周学时/总学时: 3/48

授课对象: 本科生

英文名称: Social Psychology

学 分: 3

一、课程概述

社会心理学包括个人如何与个人、与群体进行互动,以及群体之间如何互动。这种互动是双向、复杂的相互影响。社会心理学将基本的心理系原理系统地应用到人类行为。本课程将涵盖主流社会心理学中的重要理论和概念,包括:个人如何看待自己和他人,如何看待思考社会现象,态度的形成及其对行为的影响,态度怎样发生改变,个人为什么会受到他人的影响,人们在群体情境中的行为表现和特征等。此外,本课程将分析社会心理学的知识在社会生活中的应用,包括人际关系的形成与维持,人际沟通的原理与冲突化解,从事通畅的团队合作,以及进行有效的谈判等。并且,本课程也将介绍目前国际上前沿的心理学研究进展,如关于幸福的研究探索。本课程的最大特色将以组织的观点和文化的观点为核心,阐述社会心理学的理论在组织当中的应用,并关注当代学者对于不同文化背景下人类心理与行为的深入研究。

二、课程目标

- 1、全面理解和掌握社会心理学中的概念、理论
- 2、提高学生认识和解释个体、群体行为的能力
- 3、将社会心理学知识应用到个人的社会生活中,解决现实中的问题。

三、内容提要及学时分配

日期	题目	内容
第1周, 2.21	我和社会心理学有个约会	课程安排以及社会心理学的概况及内容。
第2周, 2.28	兵器谱—社会心理学的研究方法	社会心理学中常用的科学研究方法、以及如何运用这些方法来创造知识。
第3周, 3.7	横看成岭侧成峰—社会认知和判断	信息加工过程、认知策略以及归因等。
第4周, 3.14	Say you, Say me—认识自己	自我知识、自我概念、社会身份、

	和他人	性别差异、个体特性。
第5周, 3.21	我的态度谁做主?	个体态度的形成机制及其对行为的影响。
第6周, 3.28	“磁场”—人际吸引与人际关系	人际关系建立的过程与机理。
第7周, 4.2 (周六)	冲突猛于虎? —沟通与冲突	社会生活以及组织情境下的沟通; 冲突产生的原因及其解决方法
第8周, 4.11	Know the Game, Play the Game—谈判的过程与技巧	分配性和整合性谈判的理论和技巧。
第9周, 4.18	“天使”vs.“恶魔”—利他行为与攻击行为	人在什么情况下会做出利他的行为? 人为什么会对他人有攻击行为?
第10周, 4.25	近朱者必赤? ——社会影响	从众与独立、遵从与服从
第12周, 5.9	三个和尚没水喝—群体行为	群体规范、群体压力、社会懈怠, 群体思维, 群体决策。
第13周, 5.16	展开创新的双翼	在问题解决的过程中体现出的创造力
第14周, 5.23	幸福在哪里?	什么是幸福; 幸福的分类及来源; 如何提升幸福感
第15周, 5.30	透过社会心理学看世界	以社会心理学的视角去理解人、社会和组织中的种种现象。
第16周, 6.9	温故知新	总揽已经涉及到的社会心理学的知识、理论和概念。

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十、学生成绩评定办法

本课程进行闭卷考试。学生的成绩将根据以下几个方面进行评估。其中第四项的评估将由教师和每个小组的学生代表组成的评委联合进行。

- 课堂参与: 10%
- 访谈实习: 10%
- 个人日记: 15%
- 期末考试: 45%
- 小组书面报告: 20%

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期末小组作业

在本次课程学习过程中, 要求五位同学组成一个学习小组, 完成从课程之初就开始的小组作业。小组作业分三部分三个阶段进行, 提出研究问题, 提出理论和假设, 研究设计, 最后综合成一个小组作业。

小组作业的报告分成两部分。一部分是课程最后的课堂报告, 由小组派代表进行课堂演讲。另一部分是书面报告的提交, 小四号字, 1.5行距, 10页。

The research project

This course requires five students to form a group to accomplish a project starting at the beginning of the semester. The group project will be accomplished in three stages, proposing the research question, generating hypotheses, and research design. A final version for submission will include all three components.

The project requires a presentation before the class and a written report. The report will be 10 page long, with the font size of 12, 1.5 lines spacing.

Appendix B: Study 2 Survey Items

Instructions: Please indicate the degree to which you agree or disagree with the following statements.

[1= strongly disagree, 2=disagree, 3=slightly disagree, 4=neutral, 5=slightly agree, 6=agree, 7=strongly agree]

Equal power distribution scale

1. Each member had equal opportunity to express his/her opinions during the discussion.
2. Decision in my team was made via agreement among members.
3. Each member had equal say in final decision of my team.

Empowerment scale

1. I am confident about my ability to accomplish this task.
2. I am self-assured about my capabilities to perform activities incorporated in this task.
3. I have mastered the skills necessary for this task.
4. I felt free to express my opinions and ideas on the task during the discussion.
5. Members in my team listened to how I would like to do things in this exercise.
6. I had freedom to adopt my own approach in this task.
7. My impact on what happened in my team was large.
8. I had a great deal of control over what happened in my team.
9. I had significant influence over what happened in my team.

Collaboration quality scale

1. Members in my team helped each other to accomplish this task.
2. Members in my team were supportive when we encountered problems when completing the task.
3. Communication and coordination within my team was effective and efficient.
4. Members in my team were cooperative.

Constructive controversy scale

1. Our group members expressed own opinions directly to each other.
2. Our group members attended to other's ideas.
3. Our group members tried to understand other members in the discussion.
4. Our group members tried to integrate other members' opinions.
5. Our group members showed mutual respect despite disagreements.
6. Our group members worked for decisions that we agreed upon.

Appendix C: Instruction for the Idea Generation Task

In this study, we want to understand how people work with others to accomplish an innovation task. In this study, you will be a part of a 4-person innovation team and work with three other team members to accomplish an innovation task.

The task of your team is to come up with workable ideas to improve an ordinary shopping cart, like the one shown in the picture below. A promising innovative product would be a shopping cart with some novel features that would improve the satisfaction of the customers and the store owners. **Specifically, your task is to come up with as many innovative ideas as possible, bearing in mind that an innovative idea is one that is novel and workable.**

Before interacting with other team members, I will give you 10 minutes of private time to generate some innovative ideas by yourself. During the group discussion, you will share ideas with other team members. Now, please proceed to one of the small rooms and start to generate your ideas and write them down in the booklet provided. After 10 minutes, I will come and collect your booklet.



Appendix D: Instruction for the Idea Selection Task

In this study, we want to understand how people work with others to accomplish an innovation task. In this study, you will be a part of a 4-person innovation team and work with three other team members to accomplish an innovation task.

The task of your team is to select a promising innovative idea to improve an ordinary shopping cart, like the one shown in the picture below. A promising innovative product would be a shopping cart with some novel features that would improve the satisfaction of the customers and the store owners. Specifically, you will receive a collection of innovative ideas generated by several innovative teams. **Your task is to select the most promising idea and elaborate how this idea can be further improved, bearing in mind that an innovative idea is one that is novel and workable.**

Before interacting with other team members, I will give you 10 minutes of private time to review, and select on the most promising idea by yourself. During the group discussion, you will share ideas with other team members. Now, please proceed to one of the small rooms and start to review, select and edit the ideas presented in booklet. Please write down in the answer space which idea you have selected. After 10 minutes, I will come and collect your booklet.

1. Adding brakes
2. Adding foldable partitions
3. Installing a price-reading device
4. Installing a few hooks
5. Adding a stand to hold bottle



Appendix E: Task Satisfaction Items

Instructions: Please indicate the degree to which you agree or disagree with the following statements.

[1= strongly disagree, 2=disagree, 3=slightly disagree, 4=neutral, 5=slightly agree, 6=agree, 7=strongly agree]

1. This task was very interesting.
2. I enjoyed doing this innovation task.
3. I'm satisfied with what I did to accomplish of this task.
4. I would like to participate in similar study next time if I'm offered an opportunity.
5. I regret that I came and spent one hour doing this task.

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