

How Diversity Amplifies Uncertainty and Reduces Group Preference for Novelty

ABSTRACT

How does diversity produce a bias against novel ideas? We hypothesized groups with informational and functional diversity prefer less novel ideas because the diversity created uncertainty. Through an experimental study with 62 groups, we found informational, but not functional diversity, made groups experience more uncertainty and select less novel ideas.

Keywords: Informational diversity; Functional diversity; Uncertainty; Preference of novelty; Creativity

Improving creative idea generation in groups has been the focus of a large body of research over the past few decades (e.g. Paulus, 2000; Nijstad & Stroebe, 2006; Goncalo & Staw, 2006; Gilson & Shalley, 2004; Nemeth & Ormiston, 2007). The focus is compelling: groups with more novel ideas are more likely to find fundamentally new solutions to problems previously believed to be difficult or impossible to solve. However, the link between generating creative ideas and the processes involved in determining which of those ideas to retain in group discussions, value, develop, adopt, and resource, has been relatively unexplored. That oversight is problematic for building an understanding of group creativity because generating more and better quality creative ideas does not necessarily result in the best ideas being selected (Payne, 1982; Timmermans, 1993; Wright, 1975). In fact, some research suggests that groups are in general no better than chance at identifying their best creative ideas (Putman & Paulus, 2009; Rietzschel, Nijstad, & Stroebe, 2006). Groups, like individuals, may exhibit a bias against novelty (Mueller et al., 2012).

At the heart of the bias against novelty is uncertainty. When uncertainty is salient, people tend to prefer ideas that are lower in novelty, even when claiming to desire creative ideas (Mueller et al., 2012). Instead, people tend to prefer ideas that are relatively familiar and provide the greatest value for the greatest number of people (Blair & Mumford, 2007). Uncertainty is an inherent feature of novel ideas. Because novel ideas diverge from what already exists, their feasibility, resource requirements, and likelihood of success cannot be known (Lampel, Shamsie, & Shapira, 2009; Shapira, 1995; Mueller, Wakslak, & Krishnan, 2014; Klein & Knight, 2005). Some scholars argue that the quality of a novel idea is fundamentally unknowable (Simonton, 2003; Huang & Pearce, 2015). Therefore, the uncertainty about novel ideas cannot be eliminated.

Prior research has conceptualized uncertainty as an inherent feature of novelty (e.g., Simonton, 2003), or a result of environmental unpredictability (e.g., Lampel et al., 2009). In

the present research, we suggest an alternative source of uncertainty – group context. The nature of group context can produce both certainty – acting as a source of biased decision-making (e.g., Janis, 1975) – and doubt – acting as a check on poor decision-making (e.g., Nemeth, 1986). In this research, we suggest that group environments that amplify uncertainty can also create or enhance a bias against novel ideas.

This broad insight produces a surprising possibility. It suggests that the group contexts that are most likely to stimulate the generation of new ideas and to be associated with effective decision making for selecting high quality ideas are also most likely to produce a bias against novel ideas. Diverse group composition is a great example of such group contexts. Diversity is beneficial for group idea generation (Milliken, Bantel, & Jackson, 2003). Recent research also suggested that diversity aid idea evaluation (Crisuolo et al., 2016). That is because diversity promotes elaborative discussions- they make groups double check their ideas, consider multiple perspectives, and identify possible risks (Laughlin, 1988). Yet, the equivocal empirical results of diversity studies on a variety of group outcomes (e.g., Harvey, 2013; Srikanth et al., 2016; van Knippenberg & Schippers, 2007) suggest that the relationship between diversity and creativity remains murky. We argue that diversity can promote discussion practices that highlight the uncertainty of novel ideas, and in doing so, may lead groups away from their most novel ideas.

There are many different types diversity and we focus on informational diversity and functional diversity. Informational diversity (Jehn, Northcraft, & Neale, 1999; van Knippenberg & Schippers, 2007; Srikanth et al., 2016) comes from differences in the information, leading group members to hold different opinions and attitudes. Functional diversity occurs when group members have different functional or educational backgrounds that lead to alternative ways of thinking about an issue (Harrison, 2007). These two types of diversity are often grouped together as similar manifestations of deep-level diversity.

However, Harrison and Klein (2007) argue these two types of diversity are fundamentally distinct. An extreme level of information diversity means that members are polarized into opposing subunits holding different opinions. Functional diversity, however, means that each member is one of a kind. Explicitly distinguish different types of diversity would sharpen researchers' predictions (Harrison & Klein, 2007). It also helps to reconcile the equivocal results of diversity on group creativity.

We examine how two types of group diversity affect novelty selection in groups in an experimental study with 62 creative idea decision-making groups. Our findings show that informational diversity, but not functional diversity, makes groups experience more uncertainty and less likely to select novel ideas. Our study contributes to a growing body of literature on creative idea recognition, evaluation, and selection (Mueller, Melwani, Loewenstein, & Deal, 2017; Mueller et al., 2012; Berg, 2016), particularly in group contexts (Criscuolo et al., 2016; Harvey & Kou, 2013; Goncalo & Staw, 2005) by revealing an insidious paradox of novelty selection in groups – when groups institute practices expected to stimulate idea generation, they may also become less likely to select the novel ideas they produce.

Theory and Hypothesis

Group Preferences for Novelty

Individuals and groups have been found to respond negatively to novel ideas, undervaluing novel ideas relative to more familiar ideas, especially when they select ideas for implementations (Mueller et al., 2012; Rietzschel et al., 2010; Putman & Paulus, 2009). The preference for less novel ideas is expected to be particularly strong in groups because groups amplify uncertainty about novel ideas in at least three ways. First, the process of discussion raises issues, concerns, risks, and alternative perspectives (e.g., Kaplan & Miller, 1987;

Hirokawa, 1985) that highlight what is unknown about ideas. Whereas, for ideas that are low in quality, issues and concerns can be worked through, addressed, and mitigated based on the implementation and success of ideas in the past, for novel ideas, concerns are much more difficult to assuage, because by definition, novel ideas have not been tried and tested in the past. Second, the precise uses of highly novel ideas have yet to be determined, so the metrics upon which one should evaluate novel ideas remain unclear (Long-Lingo & O'Mahony, 2010). In those cases, decision makers tend to focus on attributes that can be more easily evaluated, even though those attributes may be less relevant for the decision (Hsee, 1996). Third, whereas individuals may have a relatively clear understanding of a novel idea they have generated, in groups, individuals have to also communicate that understanding to others before ideas can be evaluated. For lower novelty ideas, that communication can be effective, but for high novelty ideas, it is likely to be challenging, as the idea itself is more ambiguous and by nature, less familiar.

Preferences for lower novelty over higher novelty ideas are problematic when groups desire creative ideas. Creative ideas are higher in novelty, so if groups cannot appreciate and select their most creative ideas, some of their creative efforts will be lost. Moreover, just because the quality and risks associated with implementing a novel idea cannot be accurately assessed, the quality of novel ideas is not necessarily lower. This argument runs parallel to research on ambiguity aversion, which shows that even when the expected outcome from two alternatives is the same, people prefer the less ambiguous alternative (Fox & Tversky, 1995). Thus, it is not the case that, by preferring low novelty alternatives, groups are ensuring that they pick high quality alternatives. Indeed, some of those highly novel options may also be high in quality, so that by undervaluing those ideas, groups are missing out on a significant opportunity.

We propose that preferences for novelty may vary depending on the several group level factors. Some group contexts promote discussions that make salient and amplify the uncertainty of novel ideas, decreasing preferences for novelty when groups select between novel and less novel ideas. In particular, we propose that collective contexts associated with idea generation may enhance uncertainty those contexts lead to idea generation specifically by providing an open environment with opportunities for new ideas to emerge, in which group members are encouraged to consider ideas even if they may appear crazy or bizarre (Osborn, 1953). That openness may lead to a sense of uncertainty amongst group members; it is uncertainty that opens the space for new ideas.

Information Diversity and Perceived Uncertainty

We argue that information diversity would amplify uncertainty and cause group to shy away from novel ideas. Information diversity comes from differences in information, leading group members to hold different opinions and attitudes toward a particular thing (Jehn, Northcraft, & Neale, 1999; van Knippenberg & Schippers, 2007; Srikanth et al., 2016).

One reason for the proposed link between information diversity and perceived uncertainty is that information diversity raises disagreement among group members. Unique information could significantly bias people's preferences before and during group discussions (Stasser & Titus, 1985; Greitemeyer and SchulzHardt, 2003). When teams are selecting creative ideas, different information creates disagreement about the pros and cons of an idea, making people to worry about how well the group understands the idea, its risks, and its change of success. Indeed, novel ideas are inherently more uncertain and difficult to assess. Therefore, groups may experience more disagreement when discussing novel ideas. The lack of consensus will reduce group confidence (Julian, Regula, & Hollander, 1968). Also, supporting this, different literature has found that conflicting opinions elicit uncertain and discomforting feelings, such as conflicting reviews would make customers feel more

uncertain about product quality (Dimoka, Hong, and Pavlou, 2012; Chang, 2016); conflicting news coverage of scientific controversies will make readers feel greater uncertainty about the issue (Jensen & Hurley, 2010). As diverse information creates disagreements, conflicting opinions, and divergent attitudes, we argue that groups that are high in information diversity will experience higher uncertainty.

Another reason for the proposed link between information diversity and perceived uncertainty is that groups high in information diversity require higher cognitive effort, which is coupled with a feeling of uncertainty. Groups that are high in information diversity, even with constant information load (number of cues) require members to put more cognitive effort (Iselin, 1988), since it takes extra effort for the group to aggregate all the distributed information and process them. In that case, less attention would be paid to deeply elaborate the information (De Drue, 2003). Making decision about creative ideas, is also a burdensome experience and people tend to look for evaluable and verifiable criteria to make the judgment (Mueller et al., 2018). Therefore, informational diversity will reduce information elaboration regarding the novel idea. Research also suggests that in diverse information situation, groups tend to rely on a consensus-implies-correctness heuristic. When group members focus on the evaluable and verifiable criteria to make judgment, the uncertainty of more novel ideas would become more salient.

Hypothesis 1a: Groups high in informational diversity will have less of a preference for novel ideas than groups low in informational diversity

Hypothesis 1b: Groups high in informational diversity will experience greater uncertainty about novel ideas than groups low in informational diversity

Hypothesis 1c: Uncertainty will mediate the relationship between informational diversity and preference for novel ideas

Functional diversity and perceived uncertainty

We wanted to argue that group members build on their confidence about novel ideas since they have used different criteria to evaluate the ideas so they believe their judgments are valid.

Finally, the two types of diversity are independent and can simultaneously influence how groups evaluate creative ideas. Group members who come from different functional backgrounds do not necessarily hold different opinions. Moreover, those from same functional background may hold different opinions about the same idea. Two types of diversity can also coexist. Because we expect both informational and functional diversity to increase uncertainty and reduce group preferences for novel ideas, we predict that groups will experience the highest level of uncertainty and therefore have the lowest likelihood of preferring novel ideas when they are diverse in both information and perspective. The hypothetical model is displayed in Figure 1.

Hypothesis 3a: Groups with both informational diversity and functional diversity will be the least likely to prefer novel ideas relative to groups with only type of diversity or groups with no diversity

Hypothesis 3b: Groups with both informational diversity and functional diversity will experience more uncertainty than groups with only one type of diversity or groups low in both types of diversity

Hypothesis 3c: Uncertainty will mediate the relationship between the interaction of informational diversity and functional diversity and preference for novel ideas.

[Insert Figure 1 about here]

Methods

One-hundred and eighty-six adults (72% female; $M_{age} = 23.43$, $SD_{age} = 7.012$) were recruited from a UK university participation pool for a study on group work and received 10 pounds for their participation in the study. Participants were randomly assigned to work in 62 groups on a creative decision-making task, in which they were asked to work together to discuss, evaluate, and select between two ideas. One idea was high in novelty and the other was low in novelty. The study was a fully crossed 2x2 design (informational diversity x functional diversity).

Participants had various subject backgrounds, with 18% coming from arts/humanities, 16% business studies, 18% sciences, 23% social sciences, and the remaining 25% from other disciplines. Participants were also diverse in terms of ethnic background; 54% of participants were of Asian background, 32% were Caucasian, 3% were African and 11% were mixed race or other.

Procedure. The task was adapted from a creative idea recognition task used in prior research (Mueller et al., 2011) designed to assess individual bias against creative ideas. To extend the task to the team context, participants were asked to take on the role of a team evaluating ideas submitted by entrepreneurs to an innovation accelerator. First, participants individually studied role instructions and information about two ideas for running shoes that were submitted to the accelerator. They took notes of their individual information and roles. After that, they had to hand in their information sheets. Then, participants were informed that they would need to evaluate these two ideas as a group and jointly select one idea on behalf of the accelerator. Participants were asked to answer some questions about the role materials and instructions individually, before engaging in a group discussion. Group discussion about the two ideas was limited to 15 minutes for all groups. After the group discussion we asked them

to complete a group questionnaire about their joint decision, and individual questionnaires about their preferences and experiences working in the team.

The two ideas for running shoes presented to the participants were *NanoRun* (high novelty) and *GoShoe* (low novelty). The description for *NanoRun*, was adapted from past research by Mueller et al. (2011). We pretested both the ideas using a different sample of 251 participants who were recruited using Amazon Mechanical Turk (MTurk; 49% female, $M_{\text{age}} = 33$). Participants in the pre-test rated NanoRun as significantly more novel ($M = 5.25$, $SD = 1.37$) than GoShoe ($M = 3.99$, $SD = 1.54$), $t(250) = 9.33$, $p = .000$. Participants in the pre-test rated NanoRun ($M = 5.33$, $SD = 1.22$) as useful as GoShoe ($M = 5.45$, $SD = 1.11$), $t(250) = 1.12$, $p = .264$.

Manipulations. The study included two diversity manipulations. One manipulation induced informational diversity while the other induced functional diversity. Although both of those variables are often measured by proxies such as educational background or work function, in this study we manipulated each directly. To manipulate *informational diversity*, we developed a package of information about the two ideas to distributed between group members, modelled on the hidden profile task (Stasser & Titus, 1985). In groups without informational diversity, each of the three group members had the full package of information, so that they all had identical information and groups had the full range of information available to the diverse groups. In groups with informational diversity, each group member had a sub-set of information from the package, distributed in such a way that it created different preferences between group members. In order to develop the full package of information and the specific information sets that would be distributed to participants, we conducted several pre-tests¹.

¹ We recruited 251 participants from Amazon Mechanical Turk (MTurk; 49% female, $M_{\text{age}} = 33$) to participant this pre-test.

In the pre-test, we need to make sure that the particular subset of information would prime the individual have a particular preference. For example, when we provided positive information about NanoRun and negative information about GoShoe, the participants would prefer NanoRun. When we provide neutral information about two shoes, participants will have more balanced preference. The results support this conclusion. In the condition that participants receive the subset of information that contains positive information about NanoRun and negative information about GoShoe, 73.1 % of participants selected NanoRun. In the conditions that participants receive the subset of information that contains negative information about NanoRun and positive information about GoShoe, 13.8% participants selected NanoRun. In the condition that participants received neutral, 38.5% of participants selected NanoRun. In addition, participants who received all information about two shoes, 46.2% selected NanoRun. Based the results of the pre-tests, we changed the information about NanoRun to make it more positive so that participants in the neutral condition and full information condition would have more balanced preference. Please see Appendix A for our final informational diversity manipulations.

To manipulate *functional diversity*, we developed three different roles and associated evaluation criteria that we asked participants to read and use to guide their group discussions. The roles asked group members to take on the role of an innovation consultant, focused on the benefits to customers an idea could produce; a financial consultant, focused on the profitability of the ideas; or a project management consultant, focused on the feasibility of the ideas.

We did a pre-test to make sure participants could understand their roles and the role manipulation would not change participants' preferences about the two ideas. In the pretest, we tried development manager (impact on customers), financial consultant (profitability), project manager (feasibility). Most of participants correctly choose the right role they were

assigned to (development manager: 92.6%; financial consultant 66.7%; project manager: 73.9%). The role did not prime participants to prefer one shoe than another. 40.7% participants who took development manager role selected NanoRun. 50% participants who took financial consultant selected NanoRun. 39.1% participants who took project manager selected NanoRun. In the real study, we changed to title of develop manager to innovation consultant. Please see Appendix B for the functional diversity manipulations.

Measures

Preference for novelty. We measured preference for novelty in two ways. First, we collected a measure of group choice. We asked groups to work together to choose one of the two ideas, either GoShoe (low novelty) or NanoRun (high novelty), for the entrepreneurship accelerator following their group discussion.

Second, we calculated a novelty avoidance score. We calculated novelty avoidance by using the novelty score of the group choice subtracts the highest novelty score of the two ideas. Then, we took the absolute number as the indicator of novelty avoidance. For example, if the group chose the more novel idea, then the novelty avoidance score would be 0. If the group gave NanoRun "5" on a 7-Likert scale of novelty, but gave GoShoe "3" on a 7-Likert scale of novelty. They chose GoShoe to add to the accelerator program. Then, their novelty avoidance was 2 (3 subtracts 5, and then take the absolute number).

Uncertainty. We measured uncertainty by assessing how uncertain a group felt about the high novelty idea NanoRun with three items, measured on a 1-7 scale: "How confident does your team feel about NanoRun?" (reverse scored); "How uncertain does your team feel about NanoRun?"; and "How feasible does your team think NanoRun is?" (reverse scored). The group answered these questions together. The three items had a Cronbach's alpha = 0.70. We therefore averaged them together into a measure of uncertainty about the novel idea.

Control variables. We controlled two team process variables that might influence team's choice of novel ideas, task conflict and psychological safety. Task conflicts are defined as task-related disputes (Bunderson & Hays, 2012). Task conflicts are particularly difficult to reconcile for highly novel ideas. It is easy to find out the pros, cons, and potential success of familiar ideas. So members will easily reach agreements about less novel ideas. Therefore, task conflicts may force members to choose a less novel idea so that task conflicts will be reconciled. The pressure of reaching agreements may guide group members to move away from highly novel ideas. Therefore, we control task conflicts to exclude this alternative explanation. Psychological safety enhances information sharing and allows people to talk about different opinions freely. Psychological safety is a common belief that the team is safe for interpersonal risk taking (Edmondson, 1999). These newly formed student teams may have variances in their psychological safety. We argue that if team members feel unsafe to share information, they may withhold their different information or perspectives. Therefore, the discussion will not highlight the uncertainty of the novel ideas. Therefore, it is necessary to control psychological safety.

Task Conflict. We asked participants to answer their individual experience in the group discussion. In the individual questionnaire, we measured task conflict using existed scales (Bendersky & Hays, 2012; Jehn, 1995). The three items are "my team members experienced conflict of ideas", "my team members frequently has disagreement about the task we were working on" and "my team members frequently had disagreement about the task we were doing". The three items had a Cronbach's alpha = 0.83. We therefore averaged them together into a measure of task conflict. Team members shared agreement on their evaluation of group task conflict. The mean of $r_{WG(j)}$ is 0.70. The median of $r_{WG(j)}$ is 0.79. Therefore, we aggregate individual responses to a group level variable: group task conflicts.

Psychological Safety. We measured psychological safety in the individual questionnaire with 7 items, measured on a 1-7 scale. The scale is commonly used scale and developed by Edmondson (1999). The example items are: "If you make a mistake on this team. it is often held against you" (reverse coded), and "it is safe to take a risk on this team". The seven items had a Cronbach's alpha = 0.71. We therefore averaged them together into a measure of psychological safety. Team members shared agreement on their evaluation of group psychological safety. The mean of $r_{WG(j)}$ is 0.84. The median of $r_{WG(j)}$ is 0.92. Therefore, we aggregate individual responses to a group level variable: group psychological safety.

Findings

Descriptive statistics are provided in Table 1.

[Insert Table 1 about here]

Manipulation checks

Informational diversity. We created several items to check the effectiveness of manipulation. For the group information diversity, we asked participants to answer the two statements as a group on 7-Likert scales. The statements are "Our team had diverse information distributed between team members", "Different members of our team were in possession of different pieces of information about the ideas we ere evaluating". The Cronbach's alpha of the scales: $\alpha_{\text{information diversity}} = .818$. Therefore, we aggregated the two items as a manipulation check variable: perceived group information diversity.

Besides, in order to check whether individuals in groups with diverse information hold diverse preferences toward NanoRun and GoShoe. We asked participants to indicate their preferences for NanoRun and GoShoe before they started to discuss with their group members. We calculated the standard deviations of individuals' preferences within a group to check the preference diversity in a group.

Planned contrasts found that the perceived groups information diversity was higher in the information diversity conditions ($M = 6.48, SD = 1.90$) than in the information homogeneity conditions ($M = 3.27, SD = 0.70$), $F(1,60) = 81.84, p = .000, \eta_p^2 = .58$. In addition, the standardized deviations of individuals' preferences towards NanoRun was higher in the information diversity conditions ($M = 1.39, SD = .64$) than in information homogeneity conditions ($M = .95, SD = .54$), $F(1,57) = 8.23, p = .006, \eta_p^2 = .13$. The result also held for individuals' preferences toward Goshoe. The standardized deviations of individuals' preferences towards Goshoe was higher in the information diversity conditions ($M = 1.45, SD = .62$) than in information homogeneity conditions ($M = 1.06, SD = .64$), $F(1,57) = 5.79, p = .019, \eta_p^2 = .09$. Thus, the manipulations were effective.

Functional diversity. For the group functional diversity, we asked participants to answer to the following statement on a 7-Likert scale: "The members of our team had diverse roles".

The perceived functional diversity was higher in the functional diversity conditions ($M = 6.0, SD = 1.16$) than in functional homogeneity ($M = 2.97, SD = 2.02$), $F(1,60) = 41.647, p = .000, \eta_p^2 = .57$. Thus, the manipulations were effective.

Hypothesis Testing

The results of our hypothesis tests are summarized in Tables 2 and 3.

[Insert Tables 2 and 3 about here]

Informational Diversity

To test hypotheses 1a, that informational diversity would lead to a lower preference for novel idea, we performed two tests. First, a chi-square test was conducted to assess whether groups high in information diversity were more likely to choose more novel idea (NanoRun). The results were found to be significant, $X^2(1, n=62) = 5.083, p = .024$. The percentage of selection NanoRun was lower in groups with diverse information (60.6%) than in groups without diverse information (86.2%). Second, an ANOVA was conducted to assess

whether groups high in informational diversity are more likely to avoid novelty. Planned contrasts found that the novelty avoidance was higher in the information diversity conditions ($M = 1.51, SD = 2.16$) than in the information homogeneity conditions ($M = .34, SD = 1.17$), $F(1,60) = 21.14, p = .012, \eta_p^2 = .10$. Hypothesis 1a was supported.

To test hypothesis 1b, that groups with informational diversity would experience greater uncertainty, we conducted an ANOVA to model uncertainty as a function of the informational diversity condition. Groups that were high in informational diversity reported greater uncertainty about novel idea NanoRun ($M = 3.57, SD = 1.12$) than groups without informational diversity ($M = 3.05, SD = 0.79$), $F(1,60) = 4.31, p = .042, \eta_p^2 = .067$. The results supported hypothesis 1b.

Hypothesis 1c proposed that uncertainty would mediate the relationship between informational diversity and preference for novel ideas. We used PROCESS to test the mediation model (Hayes, 2012). For choosing NanoRun as dependent variable, results indicated that informational diversity was a significant predictor of uncertainty, $B = -.44, SE = .13, p = .00$, and that uncertainty was a significant predictor of choosing NanoRun, $B = -1.91, SE = .76, p = .01$. The indirect effect was tested using a bootstrap estimation approach with 5000 samples (Shrout & Bolger, 2002). These results indicated the indirect coefficient was not significant, $B = .43, SE = .35, 95\% CI = -.03, 1.24$. Therefore, Hypothesis 1c did not receive sufficient support.

The same results held for novelty avoidance, which is another way to measure people's preference for novelty. In sum, the results generally supported our predictions about the effects of informational diversity on uncertainty and group preferences for novel ideas.

Functional diversity

The results were less supportive of our expectations about the relationship between functional diversity, uncertainty, and group preferences for novel ideas.

To test hypotheses 2a, that functional diversity would lead to a lower preference for novel ideas, we performed two tests (as for informational diversity). First, we conducted a chi-square test to assess whether groups with preference diversity were less likely to choose the more novel idea (NanoRun). The results were found to be not significant, $X^2(1, n=62) = .485, p = .575$. Surprisingly, however, the direction of the results was opposite to our prediction – groups with functional diversity were more likely to choose novel ideas (76.7% of groups with preference diversity chose NanoRun) than groups low in preference diversity (68.8% chose NanoRun in this condition). Next, we conducted an ANOVA to assess whether groups high in functional diversity were more likely to avoid novelty. There was no significant difference of novelty avoidance between functional diversity conditions ($M = .97, SD = 1.90$) and perspective homogeneity conditions ($M = .97, SD = 1.84$), $F(1,60) = .00, p = .99, \eta_p^2 = .00$. The results fail to support hypothesis 3a.

To test hypothesis 2b, that functional diversity would lead to greater uncertainty about novel ideas, we conducted an ANOVA between preference diversity conditions for uncertainty. There was no significant difference between conditions, failing to support hypothesis 2b. As for preference for novel ideas, the results were directionally the opposite of our predictions, with groups high in functional diversity experiencing less uncertainty ($M = 3.31, SD = 1.03$) than groups without functional diversity ($M = 3.33, SD = 1.00$), $F(1,60) = .007, p = .93, \eta_p^2 = .00$. Since the results did not support a main effect, we did not further explore a mediating relationship. Our findings therefore also do not support hypothesis 2c.

Interaction of Informational and Functional Diversity

Since the results did not support our predictions about functional diversity, we also did not find a significant effect for informational and functional diversity together ($p = 0.455$). As can be seen in Table 3, groups were the least likely to choose the novel idea (NanoRun) in the condition where they had informational diversity, but not functional

diversity (52.9% of groups chose NanoRun in that condition). Having functional diversity appeared to somewhat mitigate the effects of informational diversity, as more groups chose NanoRun when they had both informational and functional diversity (68.8% chose NanoRun in that condition). In addition, we tested a moderated mediation model using PROCESS (Hayes, 2012). When the functional diversity is low, informational diversity had a significant effect on preference for novel ideas ($B = -2.16$, $SE = .97$, $p = .03$, 95% CI = -4.07, -.25). However, when the functional diversity is high, this effect disappeared ($B = -1.59$, $SE = 1.04$, $p = .13$, 95% CI = -3.65, .46). No matter the functional diversity is high or low, the mediation effects of uncertainty did not receive support ($B = .22$, $SE = .44$, 95% CI = -.23, 1.68). The moderated mediation model was not supported.

Discussion

The group informational diversity, surprisingly, leads a preference for less novel ideas. Informational diversity should improve a group's idea generation efforts by giving the group access to a broader range of inputs to stimulate new ideas; yet, we suggested and found that informational diversity also increases uncertainty about novel ideas, making groups have a lower preference for novel ideas and less likely to select novel ideas to implement. The uncertainty inherent in novel ideas can be problematic for individuals and groups, leading to a preference for lower novelty ideas (Mueller et al., 2012).

The finding suggests interesting dynamics of the same group generates and selects ideas. We propose that groups face a paradox – the practices used to enhance idea generation can lead to higher levels of uncertainty that reduce group preferences for novel ideas. If groups are not able to select the novel ideas that they generate, then their efforts to improve creative idea generation will be lost. Groups may therefore face precisely the dilemma described here. The harder they work to generate novel ideas, the less likely they will be to appreciate, value, and select the novel ideas they have generated.

We expected to find a similar pattern for the relationship between functional diversity and preference for novel ideas, but the results did not support our predictions and, surprisingly, suggested the possibility that the relationship may work in the opposite way – functional diversity may make groups more likely to select novel ideas in some situations. We suggest two possibilities to explain why our study did not find effects and speculate on an alternative way that functional diversity may influence judgements of novel ideas. One reason may be that, because the perspectives given to participants in our study were not irreconcilable and groups selected between two ideas, all members of the group could satisfy their evaluation criteria by choosing a particular idea (or indeed, either idea). As a result, group discussion did not create uncertainty, and may have even created certainty when group members developed consensus around an idea. Further research could explore whether varying compositions of perspectives produce different effects on uncertainty and preferences for novelty in groups; groups with overlapping or reconcilable perspectives may have a greater preference for novelty than groups with conflicting perspectives. An alternative possibility is that some groups in our study may have realized that they held different perspectives on the task and that knowledge may have given them greater confidence that they had considered the ideas from all angles, reducing their uncertainty and increasing their preference for novelty. We did not make it explicit that group members had different perspectives, so not all groups in our study may have discovered this. Further research could explore whether groups with knowledge of functional diversity have a greater preference for novelty than groups with functional diversity that they are unaware of.

Theoretical implications

Our study contributes to emerging interest in the processes of creative idea recognition (Mueller et al., 2017; Mueller et al., 2012; Berg, 2016; Criscuolo et al., 2016; Harvey & Kou, 2013) by demonstrating that group context can influence preferences for and

selection of novel ideas. Our research therefore calls for greater attention to the precise environments in which groups operate and the practices that they use for evaluating ideas. We speculate that other aspects of group context may also amplify uncertainty. For instance, uncertainty and preferences for novelty may be affected by whether ideas are considered alone or in sets; the extent to which groups share a common understanding of the group task, the expertise necessary for completing the task, and evaluation criteria for selecting ideas; and the discussion practices through which ideas are assessed.

Our research also contributes to research on diversity and group creativity (Milliken et al., 2003; van Knippenberg & Hoeser, 2017). Our study reveals a potentially nuanced relationship between informational and functional diversity. Those two forms of diversity are often grouped together as similar manifestations of deep level diversity. Yet, we found strong effects for informational diversity on group uncertainty and preferences for novelty, but no significant effects of functional diversity. Our study suggests further research to explore whether these two forms of diversity have different relationships with group creativity.

Finally, our study has broader implications for group creativity. It suggests that groups may face a challenging paradox: the practices and processes that help groups to generate more novel ideas may also make them less likely to value or select their most novel ideas. For groups to reach the highest levels of creativity, researchers will need to find ways to help teams overcome this paradox.

Limitations and future research

This study represents an initial step towards understanding the group context that amplifies uncertainty when groups evaluate ideas to implement. This study has several limitations, which indicate directions for future research. First, we did not study this mechanism when the groups generate ideas by themselves and evaluate them. Individuals forecast the success of their own ideas less accurately than that of other's ideas (Berg, 2016).

The psychological attachment to people's own ideas would also create interesting dynamics in groups. When groups need to evaluate their own ideas, group members still face the challenge of uncertainty in novel ideas. If a novice member generates the novel idea, the uncertainty of this idea would be amplified. However, if a star member comes up with a novel idea, the uncertainty inherent in this idea may be ignored, since people trust the star's ability can assure the novel idea to succeed. We did not explore these interesting phenomena here, but encourage future research to study how groups evaluate their own ideas and what the role of group context in preference of novel ideas.

In this study, we also collected some qualitative data to understand why groups choose a particular idea to implement. We asked them to write down top-three reasons of their choices. We also recorded groups' discussions. Using the information, we can better understand the group dynamics and their actual concerns about these ideas. For example, we can use their group discussion to code their perceived uncertainty. Moreover, our sample size is relatively small. In the future manuscript, we will work on these limitations.

Finally, we did not explore how the consensus pressure influences groups' preference of novelty. Groups tend to find a safer decision in order to reach consensus, because they only have limited time working on their tasks. Therefore, they could not continue the discussion until when they reach an agreement. Group members would like to sacrifice their own stances so that the group can reach an agreement within a reasonable time episode. They sacrifice their own opinions not because they are convinced or persuaded by their peers. They do it because they also care about finishing the task and maintaining the harmonious atmosphere in groups. Therefore consensus pressure may be another factor drives people to settle down in a less novel idea. Future research should explore this mechanism.

In conclusion, informational diversity, that are found to stimulate the generation of new ideas and to be associated with effective decision making for selecting high quality ideas

are also most likely to produce a bias against novel ideas. Group contexts that benefit idea generation might dampen idea evaluation because they promote uncertainty and doubt. Future research should pay more attention to the processes involved in determining which ideas to retain, develop, adopt, resource and implement and the links between idea generation with these processes.

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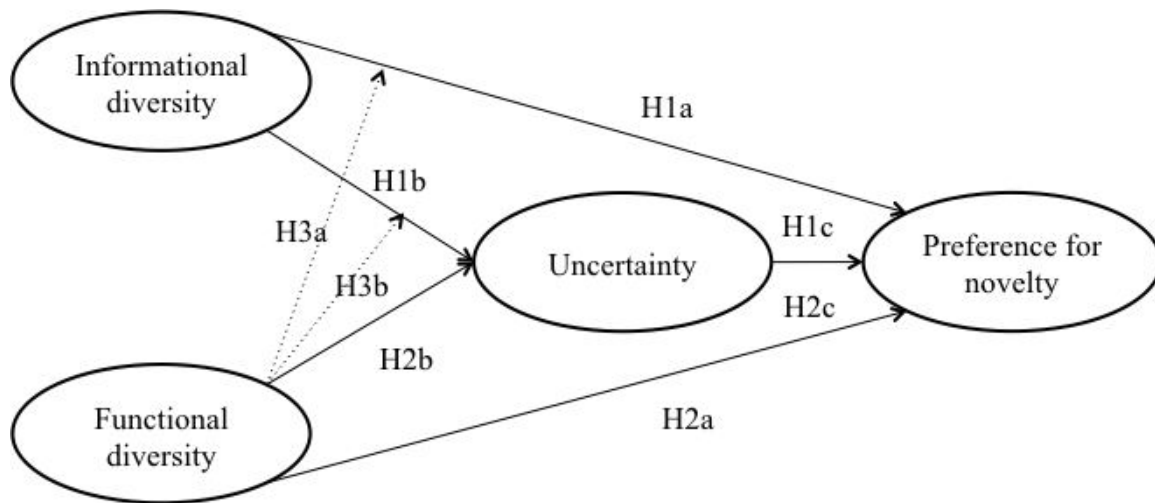
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Figure 1. The Hypothesized Model



Note: H3c is the moderated mediation model

Table 1: Means, Standard Deviations, and Correlations

	Mean	SD	1	2	3	4	5
1. Informational diversity	0.53	0.50					
2. Functional diversity	0.48	.893	.002				
3. Novelty avoidance	0.97	1.86	.317*	-.001			
4. Uncertainty	3.32	1.00	.259*	-.011	.545**		
5. Task Conflict	3.35	1.23	.237 ⁺	.174	-.190	.354**	
6. Psychological Safety	5.46	0.63	.180	.071	.025	-.011	-.417**

⁺ p<.10 * p<.05 ** p<.00

Table 2: Effects of Informational and Functional diversity on Preference for Novel Ideas, Uncertainty, and Group Process

	High Information Diversity M (SD)	Low Information Diversity M (SD)	p<	High Functional diversity M (SD)	Low Functional diversity M (SD)	p<
% Choose NanoRun	60.6%	86.2%	0.03	76.7%	68.8%	0.49
Novelty Avoidance	1.52 (2.16)	0.35 (1.17)	0.01	0.97 (1.90)	0.97 (1.84)	1.00
Uncertainty	3.56 (1.12)	3.05 (0.79)	0.04	3.31 (1.03)	3.33 (1.01)	0.93
Task Conflict	3.63 (1.19)	3.05 (1.23)	0.06	3.57 (1.19)	3.15 (1.24)	0.18

Psychological Safety	5.57 (0.54)	5.34 (0.72)	0.16	5.51 (0.64)	5.42 (0.64)	0.59
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Table 3: Percentage of Groups Choosing NanoRun (high novelty option) by Condition

	Low Informational Diversity	High Informational Diversity
Low Functional diversity	86.7%	52.9%
High Functional diversity	85.7%	68.8%

Appendix A

Informational diversity condition:

The manipulation of information 1 (Negative information about NanoRun, negative information of GoShoe):

Additional Information

NanoRun

People who previously worked with the developers of NanoRun have found them rather difficult to work with.

It would be difficult to develop NanoRun in a variety of different colours or shapes.

GoShoe

It is expected that GoShoe will work well in a variety of different terrains.

Individual investors who partner with the accelerator were very impressed with how passionate the team behind GoShoe were about their idea.

After reading this information most people prefer GoShoe

The manipulation of information 2 (Positive information about NanoRun, negative information of GoShoe):

Additional Information

NanoRun

People who previously worked with the developers of NanoRun have found them rather difficult to work with.

It would be difficult to develop NanoRun in a variety of different colours or shapes.

GoShoe

It is expected that GoShoe will work well in a variety of different terrains.

Individual investors who partner with the accelerator were very impressed with how passionate the team behind GoShoe were about their idea.

After reading this information most people prefer GoShoe

The manipulation of information 3 (Neutral information about NanoRun, neutral information of GoShoe):

Additional Information

NanoRun

The results of a focus group with professional sprinters indicated the 9/10 participants felt that NanoRun would significantly improve their running experience.

One reviewer commented that without a prototype it might be difficult to forecast the longevity of NanoRun.

GoShoe

A leading sports magazine gave GoShoe 4.5/5 stars for addressing the needs of long distance runners.

One seasoned sprinter who was told about this shoe was not impressed by its features – he said that it does not provide significant benefits over existing products.

After reading this information people do not have a clear preference

Information homogeneity condition:

NanoRun

- The group of entrepreneurs who developed NanoRun have significant experience in successfully developing sports apparel.
- It is expected that NanoRun can help runners perform consistently despite harsh weather conditions and maintain their speed and form.
- People who previously worked with the developers of NanoRun have found them rather difficult to work with.
- It would be difficult to develop NanoRun in a variety of different colours or shapes.
- The results of a focus group with professional sprinters indicated the 9/10 participants felt that NanoRun would significantly improve their running experience.
- One reviewer commented that without a prototype it might be difficult to forecast the longevity of NanoRun.

GoShoe

- It is expected that GoShoe will work well on a variety of different terrains.
- Individual investors who partner with the accelerator were very impressed with how passionate the team behind GoShoe were about their idea.
- This is the first entrepreneurial venture for the developers of GoShoe.
- GoShoe does not provide runners any protection from bad weather like excessive heat or rain.
- A leading sports magazine gave GoShoe 4.5/5 stars for addressing the needs of long distance runners.
- One seasoned sprinter who was told about this shoe was not impressed by its features – he said that it does not provide significant benefits over existing products.

Appendix B

Functional diversity condition:

The manipulation of perspective 1:

Your Role

Imagine you are an *innovation consultant* who has been contracted by the accelerator. The innovation consultant's greatest concern is the *benefit to consumers* provided by new ideas. Many new products often fall short of providing a significant *benefit to consumers*. When deciding on the best idea for the accelerator to support, please consider its potential *benefit to consumers*.

The manipulation of perspective 2:

Your Role

Imagine you are an *innovation consultant* who has been contracted by the accelerator. The innovation consultant's greatest concern is the *benefit to consumers* provided by new ideas. Many new products often fall short of providing a significant *benefit to consumers*. When deciding on the best idea for the accelerator to support, please consider its potential *benefit to consumers*.

The manipulation of perspective 3:

Your Role

Imagine you are a *financial consultant* who has been contracted by the accelerator. The financial consultant's greatest concern is the *profitability* of new ideas. New products often fail to capture market share from existing products and generate *profits*. When deciding on the best idea for the accelerator to support, please consider whether the product is likely to be *profitable*.

Perspective homogeneity conditions:

Your Role

The accelerator usually has three consultants assess ideas – an innovation consultant, a project management consultant, and a financial consultant. One key concern for consultants is the benefit to consumers provided by new ideas. Many new products often fall short of providing a significant benefit to consumers. When deciding on the best idea for the accelerator to support, please consider its potential benefit to consumers. Another important concern is the feasibility of new ideas. New products often remain in the R&D stage for a very long time because of low feasibility. When deciding on the best idea for the accelerator to support, please consider whether its development seems feasible. A final core concern is the profitability of new ideas. New products often fail to capture market share from existing products and generate profits. When deciding on the best idea for the accelerator to support, please consider whether the product is likely to be profitable.