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The Effect of Functional Diversity on Team Creativity: Behavioral and fNIRS Evidence

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Abstract. Variation in functional expertise is an important decision that managers face when designing teams tasked with being creative. We develop theory that predicts that functional diversity has countervailing effects on team creativity through its positive (negative) effect on the uniqueness (usefulness) of the proposals generated. We conduct an experiment where functionally homogeneous or heterogeneous two-person teams are tasked with proposing a creative use for an unused university space. We measure the uniqueness, usefulness, and overall creativity of team proposals. We also use functional near-infrared spectroscopy (fNIRS) neuroimaging technology to investigate the underlying team cognitive processes. Measured outcomes and fNIRS data support our predictions. Combining conventional experiment and advanced neuroimaging techniques, our study informs theory and practice by providing evidence of how functional diversity affects team creativity.

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Keywords: team creativity • functional diversity • management control • fNIRS • interbrain synchrony

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1. Introduction

An important management control decision is team composition (Merchant and Van der Stede 2017), and central to team composition is the functional diversity—variation in functional expertise, which encompasses job-related knowledge and perspective—within the team (Van Knippenberg and Mell 2016). Proponents stress the importance of functionally diverse teams generating creative solutions to complex problems (Williams and O'Reilly 1998, Tekleab et al. 2016, Edmondson and Harvey 2018). However, the evidence supporting the efficacy of functional diversity is mixed, and there is limited evidence regarding the process underlying these mixed effects (Hundschell et al. 2022). We use behavioral outcomes from an experiment and functional near-infrared spectroscopy (fNIRS) neuroimaging technology to provide insights into how functional diversity affects team creativity.

The current knowledge-based economy has accelerated the need for firms to build effective teams asked to design creative solutions (Mukherjee et al. 2012). Scholars largely agree that team creativity is the generation of ideas that are both *unique* (i.e., novel) and *useful* (i.e., implementable) by a group of interdependent individuals (Shin and Zhou 2007, Diedrich et al. 2015, Aggarwal and Woolley 2019). Some research finds that functional diversity facilitates greater team creativity (Bantel and Jackson 1989, Sung and Choi 2012), whereas other research finds that functional diversity has no effect or is even detrimental to team creativity (Sethi et al. 2001, Bunderson and Sutcliffe 2002, Somech 2006). Notably, there is limited research aimed at understanding the process underlying these mixed findings (Hundschell et al. 2022).

We develop and test a conceptual model to address this gap in the literature. Our fundamental premise is that creativity requires the combination of views from different perspectives into something that is both unique and useful (Shin and Zhou 2007, Diedrich et al. 2015, Aggarwal and Woolley 2019).[1] We develop theory that predicts that functional diversity has countervailing effects on team creativity. Specifically, we argue that functional diversity will increase the uniqueness of the proposals generated by teams by promoting divergent, flexible thinking.[2] We also argue that functional diversity will decrease the usefulness of the proposals

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generated by teams by obstructing convergent, focused thinking. Collectively, because of our inability to predict the strength of these countervailing effects in our experiment setting, we pose a research question regarding the overall effect of functional diversity on team creativity.

Scholars argue that it is impossible to truly understand the effect of functional diversity without opening the "black box" in terms of team processes and call for related research (Lawrence 1997, Pelled et al. 1999, Van Knippenberg et al. 2004). Motivated by this call and by recent neuroscientific evidence, we explore the interpersonal neural correlations to reveal team cognitive processes underlying the effect of functional diversity on team creativity. In this study, we use a nascent neuroimaging technology known as fNIRS-based hyperscanning. Specifically, there is an established neuroscience literature linking right hemisphere angular gyrus (r-AG) activity to divergent thinking and the exposure to diverse perspectives (Jung et al. 2010, Seghier 2013, Lu et al. 2020). Also, there is an established neuroscience literature linking right hemisphere superior temporal gyrus (r-STG) activity to convergent thinking and social cognition (Jung-Beeman et al. 2004, Shen et al. 2017). Prior research finds that synchronization of team members' brain oxygenated blood movement is a predictor of collective cognitive processes (Cui et al. 2012, Jiang et al. 2012, Mayseless et al. 2019, Reinero et al. 2021). We apply theory from these studies to predict that the positive (negative) effects of functional diversity on the uniqueness (usefulness) of ideas generated will be mediated by a more (less) synchronized r-AG (r-STG) region of brain activity among team members.

We test our predictions using an experiment where 40 functionally homogeneous or heterogeneous two-person teams design a creative use for an unused university space, built upon the task used by Chen et al. (2012). Consistent with Chen et al. (2012, p. 1892), the instruction defines a *creative use* as "a use that is original, innovative, practical, and implementable within a reasonable budget." Student participants are recruited from an engineering school and a business school, and they work with another student who is either from their same school (homogeneous) or a different school (heterogeneous). On arrival, both team members are fitted with the fNIRS cap. Teams work on the creative task for 20 minutes over Zoom Meetings (a videotelephony software program), and then submit a final proposal using the chat function. We have panels of PhD students and experienced professionals rate the proposals' uniqueness, usefulness, and overall creativity. Using the nascent fNIRS-based hyperscanning technology, we also measure teams' interbrain synchrony (IBS) for the r-AG and r-STG regions of the brain. IBS is the correlation of the regional brain activity time series across multiple individuals and has been found to be a predictor of team performance (Cui et al. 2012, Jiang et al. 2012, Mayseless et al. 2019, Reinero et al. 2021). This powerful tool enables us to collect brain data from multiple individuals simultaneously, and hence enables us to identify the team cognitive processes underlying creativity (Cui et al. 2012, Boas et al. 2014, Wang et al. 2018).

Univariate and path analysis results support our predictions. Specifically, we find that functional diversity increases the uniqueness of proposals but decreases the usefulness of proposals. Further, and consistent with our fundamental premise, we find that measures of usefulness and uniqueness of proposals are both positively associated with proposal creativity. Thus, we find functional diversity has countervailing effects on team creativity, and in our experimental setting, these countervailing effects net out such that there is no overall effect of functional diversity on team creativity. We further use fNIRS data to provide process evidence supporting our hypotheses. Evidence shows that functional diversity increases the synchronization of the r-AG area of the brain associated with divergent thinking, whereas it decreases the synchronization of the r-STG area of the brain associated with convergent thinking. Ultimately, we find the synchronized activity of these two regions of the brain mediates the effect of functional diversity on proposal uniqueness and usefulness.

Our study contributes to both accounting and cognitive science literature. First, our study provides evidence to explain how functional diversity impacts team creativity. Accounting research has explored various factors that affect team creativity such as incentive system design (Chen et al. 2012), information sharing (Li and Sandino 2018), control tightness (Davila et al. 2009, Grabner and Speckbacher 2016), and budgeting (Cools et al. 2017). We extend this research by examining functional diversity, which is a critical management control issue.

From a researcher perspective, although there is consensus that creativity is defined by both uniqueness and usefulness (Shin and Zhou 2007, Diedrich et al. 2015, Aggarwal and Woolley 2019), it remains an empirical question as to how these two dimensions are simultaneously affected by a firm's management control system (MCS). Our study is one of the first to tackle this research question. Specifically, we provide behavioral and fNIRS evidence of the countervailing effects of functional diversity on team creativity through uniqueness and usefulness. From a practitioner perspective, our study suggests that managers should carefully consider team composition when seeking creative output. Specifically, our results suggest that a more diverse team can produce more unique, but less useful ideas. Cropley (2006, p. 399) states that "if novelty proves to be ineffective, we can speak of 'recklessness,' which raises the danger of disastrous change." That is, for something to be truly creative, it needs to be both

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unique and useful. Thus, it is important for managers to consider the countervailing effects of functional diversity on the two subdimensions of team creativity.

Second, the black box of team processes has been perplexing researchers for decades (Bell et al. 2011), and neuroscientific technologies serve as a powerful tool to help open this box. Lu et al. (2021) provide important inductive, exploratory evidence that educational diversity—a construct related to functional diversity—increases the flexibility but decreases the fluency and convergence of idea generation in teams tasked with identifying alternative uses for common items.[3] However, Lu et al. (2021) do not predict or find supportive evidence between team behaviors (i.e., fluency, flexibility, convergence) and idea qualities such as uniqueness and usefulness. We extend Lu et al. (2021) in several ways. First, we conduct a deductive, theory-testing study that examines both the behavioral and neuroscientific effects of functional diversity using a task that allows for greater advantages in terms of theory testing and generalizability. Second, unlike Lu et al. (2021), we predict and find that functional diversity has countervailing effects on team creativity through uniqueness and usefulness. Third, findings from our fNIRS experiment provide support for our hypotheses regarding how team cognitive processes underlying dimensions of creativity performance (i.e., uniqueness and usefulness) are affected by functional diversity. Specifically, we find that functional diversity (1) stimulates the interbrain synchronization in the r-AG brain area of team members, which is associated with divergent thinking, leading to more unique proposals, and (2) suppresses the interbrain synchronization in the r-STG brain area of team members, which is associated with convergent thinking, leading to less useful proposals. For these reasons, our findings expand both Lu et al. (2021) and the understanding of the fundamental interpersonal neural basis that makes creative teamwork effective.

Finally, ours is the first study in accounting that we are aware of to use neuroimaging technology to investigate *team* cognitive processes. Despite multiple calls for research that incorporates knowledge or methodologies from neuroscience into accounting to help unveil the neurophysiological processes underlying decision and judgment (Dickhaut et al. 2010, Birnberg and Ganguly 2012, Tank and Farrell 2022), neurocognition is still in its incipient stage. In their recent review, Tank and Farrell (2022, p. 200) stress that "neuroaccounting has provided, and can continue to provide, unique insights into the black box of how decision-makers process accounting information and respond to accounting control systems." The current eight published empirical studies (Tank and Farrell 2022, Black et al. 2024) in accounting research that use neurotechnologies pioneered this interdisciplinary area and provide important first evidence on the neural processes underlying *individual* decision making. In the modern business world, team-based work is ubiquitous in organizational activities; therefore, understanding *team* decision making is also critical. Nonetheless, a major obstacle to research on team cognitive processes is that most neurotechnologies measure brain activity in only one person at a time (Montague et al. 2002, Wang et al. 2018). In this study, using the fNIRS-based hyperscanning technology, we can simultaneously collect brain data from multiple individuals. This method enables us to detect correlated regional brain activity across team members, and hence identify the team cognitive processes underlying collective creativity behavior.

2. Background and Hypothesis Development

2.1. Background

2.1.1. Team Creativity. Team creativity is the generation of ideas that are both unique (novel) and useful (implementable) by a group of interdependent individuals (Shin and Zhou 2007, Diedrich et al. 2015, Aggarwal and Woolley 2019). Team creativity remains the lifeblood of companies in a wide range of knowledge-intensive industries, including technology, automobiles, and pharmaceuticals. In the modern business world, team-based work is common, and consistently, creative organizational endeavors are undertaken in team settings (Thompson and Choi 2006, Mannix et al. 2009, Adler and Chen 2011, Sawyer 2017). Researchers have been studying creativity (generally) for over a century and team creativity (specifically) for the past 40 years (Paulus and Nijstad 2003, Sawyer 2003). Research finds that individuals gain the opportunity to observe and integrate others' perspectives in a team setting, and thus teams have a greater potential for creative idea generation than individuals (Paulus and Yang 2000, Toubia 2006, Adler and Chen 2011).

Accounting researchers contribute to this literature by proposing that proper MCSs can enhance team creativity, which is contrary to the conventional view that formal controls undermine creativity. For example, using a sample of 69 early-stage entrepreneurial companies, Davila et al. (2009) find that a formal MCS is widely adopted within one of the highest creative organizational activities (new product development), indicating the important role that a MCS plays in managing team creativity. Li and Sandino (2018) conduct a field experiment at a retail chain and show that the adoption of an information-sharing system improves the creative work in stores that frequently access the system, that have fewer nearby store locations, and that service divergent markets. Thus, the MCS can help to disseminate information that improves creativity. Chen et al. (2012) examine the relation between incentive design, a core component of MCSs, and team creativity. Their

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findings suggest that incentive structure plays an important role in motivating team creativity because group tournament pay results in more creative solutions than individual tournament pay. Using survey data from 457 companies, Grabner and Speckbacher (2016) provide further evidence that creativity-dependent organizations implement formal MCSs when creativity is highly important, and they make MCS choices based on employees' intrinsic motivation along with managers' task-specific knowledge. This research highlights the important role of management controls on team creativity in the current knowledge-based economy. Findings from the comparative case study by Cools et al. (2017) show that budgets are used in a more interactive way when creativity for open problems is weighed more and are used in a more diagnostic way when creativity for closed problems is weighed more. This study highlights the multidimensional nature of creativity and how controls have differential effects on different types of creativity tasks. We next discuss how we extend the prior accounting research on team creativity by examining how functional diversity affects team creativity.

2.1.2. Functional Diversity. Team composition is a critical management control decision (Merchant and Van der Stede 2017), and a central aspect of team composition is the level of functional diversity within the team. Functional diversity is defined as the variation of functional expertise within a team (Van Knippenberg and Mell 2016), and an expert is widely considered to be an individual with exceptional job-related knowledge and perspective (Stone and Shelley 1997, Williams and O'Reilly 1998, Bell et al. 2011, Runco and Jaeger 2012). Many organizations that rely on team creativity stress the use of functionally diverse teams to generate creative solutions and/or solve complex problems (Williams and O'Reilly 1998, Licalzi and Surucu 2012, Tekleab et al. 2016, Edmondson and Harvey 2018). However, the evidence supporting the efficacy of functional diversity is mixed.

On the one hand, research finds that heterogeneity in functional expertise inspires divergent, flexible thinking, which can facilitate more creative team outcomes (Williams and O'Reilly 1998, Van Knippenberg and Schippers 2007). Consistent with this perspective, the diversity of experiences and skills rooted in job-related expertise is considered a fundamental ingredient to foster team creativity as it provides a wider range of valuable information (Bantel and Jackson 1989, Sung and Choi 2012). Multiple field studies (e.g., Ancona and Caldwell 1992, Drach-Zahavy and Somech 2001, Somech and Drach-Zahavy 2007) also suggest that functional heterogeneity offers benefits to team creativity. Two meta-analyses (Hülsheger et al. 2009, Bell et al. 2011) find that functional diversity has a positive, albeit weak, effect on team creativity.

On the other hand, research also finds that heterogeneity in functional expertise has no effect or a detrimental effect on team creativity. This research largely finds that heterogeneity among team members is detrimental to team coordination and communication, which negatively affects team performance.[4] For example, Sethi et al. (2001) study 141 product development teams and find no effect of functional diversity on team creativity. The authors posit that this null result may be due to the relatively wide range of functional diversity, such that the benefits of diversity were overshadowed by the dysfunction it causes. Consistent with this finding, Bunderson and Sutcliffe (2002) examine 44 business unit management teams from a Fortune 100 company and find that the functional diversity has a negative effect on information sharing and perspective taking, which are critical antecedents to team creativity (Milliken et al. 2003, Hoever et al. 2012). Using a sample of 96 research and development teams, Cheung et al. (2016) find that functional diversity has a negative relationship with team creativity and affect-based trust moderates this relation. Specifically, increasing affect-based trust reduces the negative effect of functional diversity on team creativity such that functional diversity has no effect on team creativity when such trust is high.

The mixed empirical findings regarding the effect of functional diversity on team creativity have led some researchers to suggest that functional diversity is a double-edged sword, in that it has countervailing effects on team creativity (Tsui et al. 1995, Williams and O'Reilly 1998). However, limited research has focused on understanding the cognitive processes underlying these mixed findings and how those processes affect dimensions of creative performance such as uniqueness and usefulness.

2.1.3. Neurocognitive Mechanisms of Creativity. Creativity researchers have concluded that creative cognition is a two-stage iterative process of *idea generation* and *idea evaluation* (Finke et al. 1992, Cropley 2006, Kachelmeier et al. 2008). Recently, with the advent of modern neuroimaging technologies, scientists have made progress on understanding the neurocognitive mechanisms underlying the two-stage creative process (Jung et al. 2013). The consensus, as expertly captured in Jung et al. (2013), is that idea generation is a bottom-up process involving divergent, flexible thinking, whereas idea evaluation is a top-down process involving convergent, focused thinking. However, because of the complexity of the human brain and the limitations of empirical tools, our knowledge regarding the neural bases of creativity remains fragmented (Dietrich 2019).

Despite the inconclusive evidence on the neurocognitive mechanisms of creativity, two brain areas, the r-AG and the r-STG, have consistently been shown as being associated with creativity (Jung-Beeman et al.

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2004; Berkowitz and Ansari 2010; Fink et al. 2010, 2012; Jung et al. 2010; Seghier 2013; Shen et al. 2017; Lu et al. 2021). First, neuroimaging research has identified multiple functions of the r-AG, including prompting attention to relevant events, memory retrieval for problem solving, and social cognition (Seghier 2013).[5] The r-AG has consistently been shown to be closely associated with divergent thinking (Berkowitz and Ansari 2010; Fink et al. 2010, 2012; Jung et al. 2010; Benedek et al. 2018; Lu et al. 2021). For example, a whole brain study correlating cortical thickness with a creativity score based on divergent thinking finds that a significant association exists in the r-AG (Jung et al. 2010). Employing functional magnetic resonance imaging (fMRI) technology, Fink et al. (2010, 2012) and Benedek et al. (2018) show that there are significant brain activity variances in the r-AG during divergent thinking tasks. Consistent with these findings, Berkowitz and Ansari (2010) find that musicians have significant neural activity change in the r-AG when improvising music, which largely requires divergent thinking. Recently, Lu et al. (2021) found education diversity results in significant brain synchronization variance in the r-AG area for teams completing a divergent thinking task.

Second, neuroimaging research has identified multiple functions of the r-STG, including being responsible for the formation of novel association, semantic processing, and conceptual integration (Shen et al. 2017). Patil et al. (2021, p. 2) argue that these identified functions support convergent thinking, which is the mental process used to strategically associate task-related information and narrow down the ideas to reach a single (correct) solution. Neuroimaging studies have found consistent patterns of the r-STG during convergent thinking tasks (e.g., Jung-Beeman et al. 2004, Cranford and Moss 2011, Zhang et al. 2011). For example, Jung-Beeman et al. (2004) find that the activation of the r-STG is greater when individuals solve single-solution verbal problems using insight than without insight.[6] Kounios and Beeman (2009) show that r-STG is the *only* brain area that demonstrates reliable association with the insight effect during convergent thinking tasks. Further, a recent large-scale study examining the relationship between the brain's gray matter density (GMD) and the creativity score of convergent thinking tasks shows that the score is *only* significantly related with the GMD in the r-STG (Li et al. 2019).

Despite the advances of our knowledge of the neuroscience underlying *individual* creativity, neuroresearch on *team* creativity is in its infancy. Traditional neuroimaging methods capture brain activities of *single* participants during social interaction, and thus only one part of the team interaction is recorded at a time (Montague et al. 2002, Wang et al. 2018). To break through this limitation, scientists proposed the idea of hyperscanning, a technology to measure the activity of multiple brains simultaneously (Montague et al. 2002, Wang et al. 2018, Czeszumski et al. 2020).[7] The significant advantage of this technique is that it allows the investigation of real-time team cognitive dynamics between multiple interacting members. This nascent technology enables researchers to identify the brain areas that are synchronized among team members during team tasks, and thus offers a new approach to examine team cognitive processes (Cui et al. 2012, Boas et al. 2014, Wang et al. 2018, Czeszumski et al. 2020). The detected synchronization of participants' brain activity, the IBS, is suggested to be a predictor of team cognitive processes and a powerful tool to investigate collective performance (Cui et al. 2012, Jiang et al. 2012, Mayseless et al. 2019, Reinero et al. 2021).[8] In our study, we use fNIRS-based hyperscanning technology to investigate the team cognitive processes that team members are engaged with during the team task.

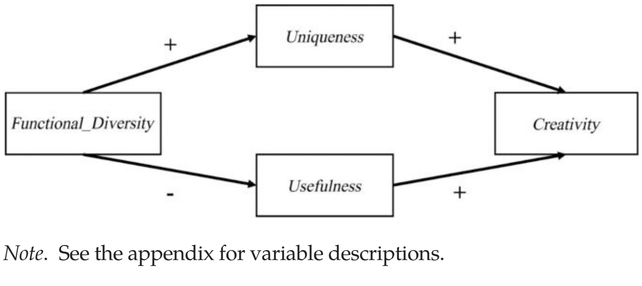
We next develop our conceptual model that depicts the hypothesized effect of functional diversity on team creativity through its effect on the usefulness and uniqueness of the ideas generated (Figure 1). We further discuss the neurocognitive mechanisms expected to underlie our hypothesized effects.

2.2. Hypotheses Development

Our fundamental premise is that team creativity requires the combination of views from different perspectives into something that is both unique (novel) and useful (implementable; Shalley et al. 2004, Cropley 2006, Shin and Zhou 2007, Runco and Jaeger 2012, McCarthy et al. 2018, Aggarwal and Woolley 2019). We first develop our hypothesis regarding the effect of functional diversity on proposal uniqueness, and then develop our hypothesis regarding the effect of functional diversity on proposal usefulness. We finish this section by developing our research question regarding the effect of functional diversity on proposal creativity.

We predict that functional diversity will increase the uniqueness of proposals generated by teams. Uniqueness (or novelty) describes ideas that are particularly unusual such that few groups will come up with them (Diedrich et al. 2015, McCarthy et al. 2018). Based on the value-in-diversity and information processing

Figure 1. Conceptual Model



Note. See the appendix for variable descriptions.

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theory, functional diversity equips teams with more diverse knowledge and motivates divergent thinking (Williams and O'Reilly 1998, Van Knippenberg and Schippers 2007). This divergent thinking is found to occur in the idea generation phase of the creative process, where novel ideas are produced (McMullan 2010, Ellamil et al. 2012, Kachelmeier et al. 2024). As previously discussed, neuroimaging research finds this phase of the creative process to be associated with the r-AG. It is this area of the brain that responds to diverse perspectives and new information, reallocates attention to relevant events, and regulates memory retrieval for problem solving. We conjecture that the expanded knowledge and divergent thinking associated with functional diversity will result in more unique team proposals. Therefore, we predict the following.

Hypothesis 1. *The uniqueness of team proposals is greater for functionally heterogeneous teams than functionally homogeneous teams.*

We also predict that functional diversity will decrease the usefulness of proposals generated by teams. Useful (or implementable) ideas are those that are cost-effective, feasible, and practical such that they are relevant to the problem at hand (Long 2014, Diedrich et al. 2015, McCarthy et al. 2018). In the idea evaluation phase of the creative process, where ideas are assessed for their appropriateness, convergent thinking is pivotal (Cropley 2006, Ellamil et al. 2012, Kachelmeier et al. 2024). Convergent thinking necessitates robust top-down cognitive control to focus attention on relevant issues and to filter out irrelevant information (Colzato et al. 2012, Jung et al. 2013, Hongdizi et al. 2023). However, functional diversity introduces a broad array of job-related knowledge and perspectives, which can distract team members from efficiently focusing their cognitive resources and impair the team's ability to engage in convergent thinking. Neuroimaging research has attributed this idea evaluation phase of the creative process to an activated r-STG, which is responsible for the formation of novel association, semantic processing, and conceptual integration (Jung-Beeman et al. 2004, Shen et al. 2017). We argue that retrieving and integrating distributed knowledge within the team is critical when evaluating an idea and improving its practical use (Jung et al. 2013). However, functional diversity challenges this region of the brain, which hinders team members' convergent thinking and results in less useful team proposals. Therefore, we predict the following.

Hypothesis 2. *The usefulness of team proposals is lesser for functionally heterogeneous teams than functionally homogeneous teams.*

Finally, we pose a research question regarding the effect of increasing functional diversity on team creativity. As previously discussed, there is mixed evidence regarding the effect of functional diversity on team creativity. Hypothesis 1 predicts the positive effect of functional diversity on the uniqueness of ideas, whereas Hypothesis 2 predicts the negative effect of functional diversity on the usefulness of ideas. Given our fundamental premise that uniqueness and usefulness have a positive effect on creativity, Hypotheses 1 and 2 predict countervailing effects of functional diversity on team creativity. Furthermore, we are unable to ex ante predict the relative weights of these countervailing effects in our laboratory experiment and whether their effects are additive or multiplicative (Diedrich et al. 2015). Therefore, we are unable to make a directional prediction regarding overall team creativity and pose the following research question.

Research Question 1. What is the effect of functionally heterogeneous versus functionally homogeneous teams on the creativity of team proposals?

Multiple studies point out that it is impossible to fully understand the relationship between functional diversity and team creativity without opening the black box in terms of team processes (Lawrence 1997, Pelled et al. 1999, Van Knippenberg et al. 2004). Motivated by this body of literature and neuroscientific evidence, we explore the underlying interpersonal neural correlations to reveal team processes affected by functional diversity. During any moment, millions of brain activities are occurring in one's brain, making it very difficult to identify those associated with a specific social interaction. The emerging technology of hyperscanning using fNIRS in the recent decade enables researchers to collect brain data from multiple individuals simultaneously in a setting that is as close as possible to a naturalistic environment (Cui et al. 2012, Jiang et al. 2012, Wang et al. 2018). The detected brain activity synchronization of participants is proposed to be a predictor of team cognitive processes, providing a powerful tool to examine collective performance (Cui et al. 2012, Jiang et al. 2012, Mayseless et al. 2019, Reinero et al. 2021). By exploiting this technology, we attempt to glimpse the inside of the black box of the team's cognitive processes that are associated with the team's creativity.

3. Experimental Design and Measures

3.1. Participants and Manipulation

We conduct a two-condition (functional diversity: homogeneous versus heterogeneous) between-subjects experiment to test our hypotheses.[9] Eighty participants across 40 two-person teams participate in our experiment. Participants are undergraduate and master's students from a large public university. To minimize the hierarchy within teams, undergraduate students are paired with undergraduates, and master's students are paired with master's students. Half of the participants (40) come

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from the management school, and the other half of the participants (40) come from the engineering school. The average age of participants is 22.0, and 68.8% are female.

Participants are randomly assigned to one of the two functional diversity conditions. Recall functional diversity is the variation of functional expertise within a team (Van Knippenberg and Mell 2016), and functional expertise is exceptional job-related knowledge and perspective (e.g., Stone and Shelley 1997, Williams and O'Reilly 1998, Bell et al. 2011, Runco and Jaeger 2012). We recruited students who have relatively more knowledge in one domain compared with another. Although these students may not be "experts" in the traditional sense, they do possess a depth of knowledge in their respective fields that is enhanced by their educational background. Consistent with prior research (e.g., Bunderson and Sutcliffe 2002, Hoever et al. 2012), we further manipulate "perspective" by reminding student-participants of their educational background and their functional role consistent with that educational background. This combination of knowledge and perspective enables our participants to apply their domain of relative expertise. Specifically, we operationalize expertise by recruiting participants from the management school (business professionals) and the engineering school (engineers), and by reminding them of their expertise. For functionally heterogeneous teams (20 teams), the two teammates are from different schools (one from the management school and the other from the engineering school). For functionally homogeneous teams (20 teams), both teammates are from the same school (10 teams from the management school and 10 teams from the engineering school). An indicator variable, *Functional_Diversity*, is generated and equals zero (one) if the two team members are from the same (different) schools.

3.2. Procedures

Participants assigned to the same team are instructed to arrive at the laboratory at the same time. The laboratory is divided into two rooms, and upon arrival, each participant is directed to one of the rooms and instructed to sit at a desk with a computer.[10] After both participants have read and signed the informed consent form, the experiment administrators assist them with putting on the hairnet and fNIRS caps. Both fNIRS caps are connected to the same fNIRS machine (Online Supplemental Figure 1, panel C). The process of connecting the fNIRS caps takes about 10 minutes to complete. During this time, participants are provided with a brief introduction (study overview) on the experimental setup (i.e., team composition and communication method). The study overview is customized to highlight the participant's and his or her teammate's functional expertise.[11] It also provides the guidance that all team communication is solely through Zoom and will be recorded. An example of the study overview is shown in Online Supplemental Appendix A.

After the participants have been fitted with the fNIRS caps and have read the study overview, they are guided to sit still with their eyes closed and relax their minds for two minutes. During this time, a resting-state measurement is performed to collect the participants' baseline brain activity. Afterward, the experiment administrators turn on the Zoom video meeting for both computers and provide task instructions to the participants. Participants can see and talk with each other through Zoom. Participants wear the fNIRS caps throughout the task and their brain activity levels are measured. Details of fNIRS equipment and data acquisition are discussed in Section 3.4. After participants complete the task, the fNIRS caps are removed and participants complete a postexperimental questionnaire (PEQ). The PEQ collects general demographic information (e.g., age, gender, educational background, personality). After they complete the PEQ, participants receive a $23 show-up fee and exit the study. In addition to the show-up fee, participants can receive team performance-contingent compensation after all recruited participants have completed the experiments. Specifically, the team with the highest creative score earns an additional $78. The creativity score is based on the ratings of a panel of PhD raters (see Section 3.5 for rating details). Thus, all participants have strong incentives to generate a creative proposal. A session takes about 45 minutes to complete.

3.3. Experiment Task

After the two-minute resting-state stage, participants are provided with task instructions that inform them that they are working with their teammate to develop a specific proposal of a *creative* use for an empty space in the management school building (see Online Supplemental Appendix A for the task instructions). Consistent with Chen et al. (2012, p. 1892), the instructions define a *creative* use as "a use that is original, innovative, practical, and implementable within a reasonable budget." The instructions provide participants with the management school's mission statement, a budget for the project (USD 240,000), and a general description of the empty space that includes the location (top floor of the management school) and size (8,450 square feet).[12] The instructions lay out the three parts of the task with allotted time spans for each part. Participants are instructed to wait until the administrators give them additional instructions to proceed to each part of the task. In Part I (discussion stage), each two-person team spends 15 minutes freely discussing possible ideas through a Zoom video meeting. After Part I, teams enter Part II (summarization stage) and spend five minutes on determining which proposal to submit in the end. After the five minutes are completed, teams enter Part III (submission stage) and spend one minute

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submitting their final proposal by typing it in the Zoom chat panel. In this part, teams are asked to use the limited time to submit their *most creative* proposal for consideration.

3.4. fNIRS Data Acquisition and Data Analysis

We use continuous wave fNIRS neuroimaging to capture the individuals' brain activities during the experiment.[13] fNIRS works by measuring the changes in blood flow in the brain. When a brain area is more active, it consumes more oxygen, changing the levels of oxygenated and deoxygenated blood. fNIRS detects these changes by using near-infrared light. This light is sent into the scalp, and the device measures how much light is absorbed by the blood, indicating brain activity (Cui et al. 2012, Boas et al. 2014, Scholkmann et al. 2014).[14]

The fNIRS system that is used in the study is the Hitachi ETG-4100 (Online Supplemental Figure 1, panels A and B), which conforms to the safety standards of the International Electrotechnical Commission 60825-1 class 1M and received the U.S. Food and Drug Administration (2018) 510(k) premarket approval in 2018. The two participants' brain data are collected simultaneously by the ETG-4100 system. Following the literature, we used 10 Hz as the sampling rate (i.e., every 0.1 seconds, a measurement of brain activity was taken) for measuring the absorption of near-infrared light (wavelengths: 695 and 830 nm; e.g., Cui et al. 2012; Dai et al. 2018; Lu et al. 2020, 2021). Because neuroimaging studies of creativity show that the r-AG and r-STG areas are associated with creativity activities (Jung et al. 2010, Shen et al. 2017, Lu et al. 2020), we select these as our regions of interest.

An fNIRS cap consisting of 24 measurement channels (CHs; each CH corresponds to a distinct location in the brain) is placed over each participant's head, covering r-AG and r-STG, as well as surrounding brain areas (Lu et al. 2020).[15] Brain activities in a specific brain region may be detected by multiple channels. The r-AG area is covered by CH10, CH13, and CH17, with different degrees of coverage. CH10 and CH13 offer the highest coverage for the r-AG (both are 84%) and are, therefore, our channels of choice for the r-AG (divergent thinking brain region). The r-STG area is covered by CH4, CH5, and CH9, although CH5 provides the best coverage (98%). Therefore, CH5 is selected as our channel of choice for the r-STG (convergent thinking brain region).

Oxygenated blood flow data are collected during the resting-state stage and three task stages (discussion stage, summarization stage, and submission stage). We use wavelet transform coherence (WTC)[16] to assess the transient correlations between oxygenated blood time series from the corresponding channels of both individuals in each team. We calculated the WTC of oxygenated-hemoglobin signals using the MATLAB Wavelet Toolbox. WTC calculates the cross-correlation between two time series as a function of both frequency and time; therefore, WTC is used as the measure of IBS in fNIRS hyperscanning data analysis (Cui et al. 2012, Jiang et al. 2012, Lu et al. 2020). Please refer to Online Supplemental Appendix C, Section C1, for more details about IBS, IBS increments, and how they are calculated.

For this study, we focus on the Part I and Part II stages because Part I is designed for teams to generate ideas (divergent thinking), and Part II is designed for teams to evaluate and summarize their ideas (convergent thinking). We calculate the IBS increment for each stage by subtracting the time-averaged IBS during the resting-state stage from that during the Part I and II stages, respectively. One-way analyses of variance (ANOVAs) are run using *Functional_Diversity* on IBS increments of each channel along the full brain activity frequency range (0.015–0.700 Hz). All resulting p-values (generated by ANOVAs) are adjusted using the false discovery rate (FDR) method (adjusted p-value PFDR < 0.05).[17] Consistent with fNIRS literature, FDR adjustment is applied to all of these p-values at one time (Cui et al. 2012, Jiang et al. 2012, Lu et al. 2020). Following prior studies, data above 0.700 Hz are not included in the analysis to exclude high-frequency noise (i.e., cardiac activity; Tong et al. 2011, Barrett et al. 2019, Lu et al. 2020). Data below 0.015 Hz are excluded to remove low-frequency noise (Lu et al. 2020).[18] There are 67 total brain activity frequencies along the full frequency range and 24 channels, resulting in 1,608 (24×67) p-values.

For the Part I stage, among all 24 channels, CH10 shows the strongest main effects of *Functional_Diversity* on the IBS increments at the frequency band of 0.258–0.345 Hz (PFDR < 0.05). For the Part II stage, CH5 shows significant main effects of *Functional_Diversity* on the IBS increments at the frequency band of 0.034–0.038 Hz (PFDR < 0.05). These results are consistent with the neuroscience literature that shows r-AG is heavily involved in divergent thinking (Part I stage), whereas r-STG is heavily involved in convergent thinking (Part II stage). Detailed IBS data processing and steps to identify the frequency band of interest can be found in Online Supplemental Appendix C, Section C2.

To further visually demonstrate these findings, following Jiang et al. (2012), we perform a one-sample t test on the IBS increments across the teams to examine whether the IBS increments of each channel are significantly different from zero. We use the t-values to generate the t-maps through the NIRS-KIT within MATLAB (Hou et al. 2021).[19] The warm (red) and cold (blue) colors indicate *increases* and *decreases* in IBS increments, respectively. Panels (a) and (b) of Figure 2 show that at the frequency band of 0.258–0.345 Hz, CH10 has the most significant synchronization variances (*increases)* in functionally heterogeneous teams during the Part I stage compared with functionally homogeneous teams, whereas panels (c) and (d) of Figure 2 show that at the frequency band of 0.034–0.038 Hz, CH5 has the most

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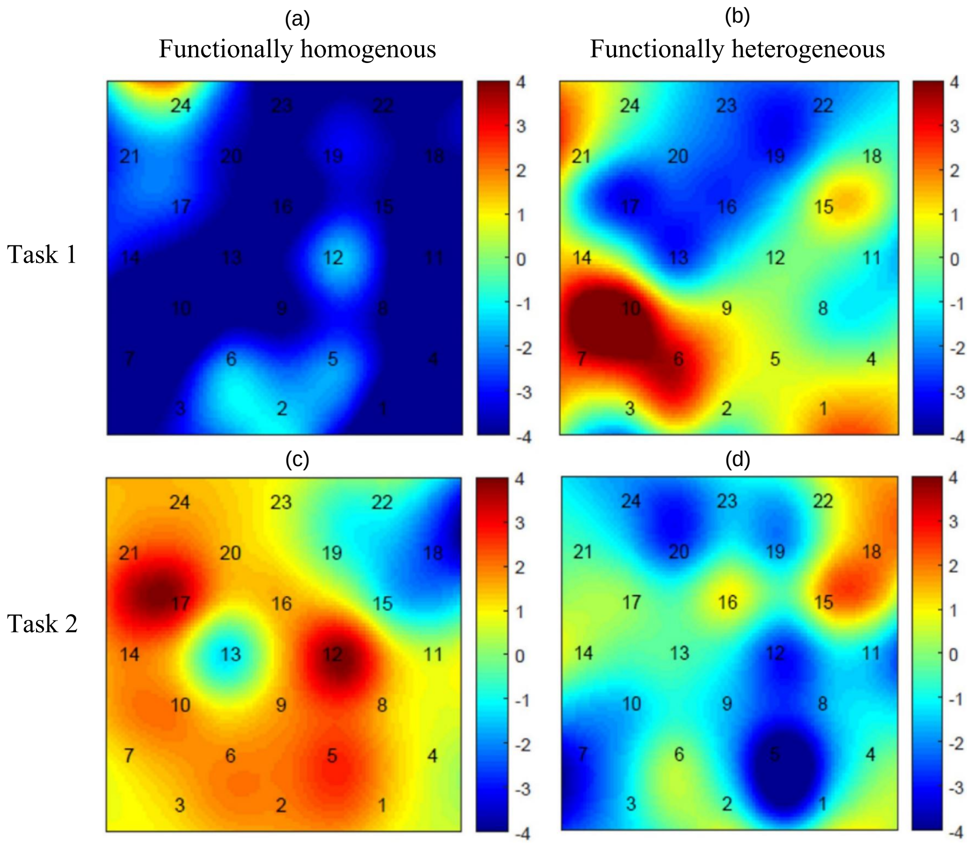
Figure 2. IBS Increment *t*-Maps



Notes. The figure shows IBS increment *t*-maps for the functionally homogeneous and functionally heterogeneous groups across the Task 1 idea generation stage (frequency band of 0.258–0.345 Hz) and the Task 2 idea evaluation stage (0.034–0.038 Hz). We performed a one-sample *t*-test on the IBS increments across the teams to examine whether the IBS increments of each channel were significantly different from zero. The warm (red) and cold (blue) colors indicate increases and decreases in IBS increments, respectively.

significant synchronization variances (*decreases*) in functionally heterogeneous teams during the Part II stage compared with functionally homogeneous teams. Therefore, for the corresponding brain activity frequencies, IBS increments of CH10 during the Part I stage and CH5 during the Part II stage are averaged to generate IBS increment measurements—*IBS_10Avg* and *IBS_5Avg*.

3.5. Uniqueness, Usefulness, and Creativity Measures

The uniqueness, usefulness, and overall creativity of a submitted proposal are rated by three different groups of raters, respectively. All raters are blind to our hypotheses and treatment condition. First, we ask three business school doctoral students from a large U.S. public university to evaluate the uniqueness dimension of the submitted proposals. They are required to rate the "original and innovative" quality of the proposals. Specifically, they are asked to consider proposals that are particularly unusual such that few groups come up with them as being more original and innovative (Diedrich et al. 2015, McCarthy et al. 2018). They work independently on rating the uniqueness of each proposal on a scale from 0 (*unoriginal and not innovative*) to 7 (*original and innovative*). The three ratings have a Cronbach's alpha at 0.81, and their average is used as the measure of a proposal's uniqueness dimension (*Uniqueness*) of creativity.

Second, we ask three professionals with an average of 12 years of full-time work experience to evaluate the usefulness dimension of the submitted proposals. The average age of these professional raters is 40, and one is female whereas the other two are male. Two of them are from industry, and one of them is from a large U.S. public university.[20] They are asked to rate the "practical and implementable" quality of the proposals. Specifically, they are asked to equally consider three aspects of the proposal: congruency to the management school's mission statement, reasonable usage of space, and effective and efficient use of the provided budget. They then work independently on rating the usefulness of each proposal on a scale from 0 (*impractical and unimplementable*) to 7 (*practical and implementable*). The three ratings have a Cronbach's alpha at 0.86, and their average is used as the measure of a proposal's usefulness dimension (*Usefulness*) of creativity.

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Finally, we use two measures of team creativity. First, we add the *Uniqueness* and *Usefulness* scores to compute a creativity rating for each proposal (*Creativity_Cal* = *Uniqueness* + *Usefulness*). Second, we ask a panel of six doctoral students who are from the same university as our participants to rate the overall creativity of proposals. Three raters are from the management school, and the other three raters are from the engineering school. Each rater is provided a brief introduction of the task along with rating guidance. They then work independently on rating the creativity of each proposal on a scale from 0 (*lowest creativity*) to 10 (*highest creativity*). They are instructed that the average rating across the proposals should equal 5. These are the same instructions used in Chen et al. (2012). The level of consistency among the raters is reasonable (Cronbach's alpha = 0.72). Therefore, we average the six ratings to obtain the measure of the subjective creativity score (*Creativity_Rater*). The instructions for raters of uniqueness, usefulness, and overall creativity are shown in Online Supplemental Appendix D, Sections D1, D2, and D3.

4. Results

4.1. Hypothesis Tests

We use univariate analysis to test Hypothesis 1, Hypothesis 2, and our research question. Hypothesis 1 predicts that functional diversity has a positive effect on the uniqueness of ideas generated. Descriptive statistics reported in Table 1, panel A, show that *Uniqueness* is higher in functionally heterogeneous teams (M_{HET} = 3.88) than in functionally homogeneous teams (M_{HOM} = 3.12; Table 1, panel B: t = 1.97, one-tailed p = 0.03). Thus, we find support for Hypothesis 1.

Hypothesis 2 predicts that functional diversity has a negative effect on the usefulness of ideas generated. Descriptive statistics reported in Table 1, panel A, show that *Usefulness* is lower in functionally heterogeneous teams (M_{HET} = 3.72) than in functionally homogeneous teams (M_{HOM} = 4.23; Table 1, panel B: $t = -1.89$, one-tailed p = 0.03). Thus, we find support for Hypothesis 2.

We pose a research question regarding the effect of functional diversity on team creativity given the predicted countervailing effects of functional diversity on *Uniqueness* and *Usefulness*. The descriptive statistics for our two proxies for creativity (*Creativity_Cal* and *Creativity_Rater*) are reported in Table 1, panel A. First, we find no significant difference in *Creativity_Cal* between functionally heterogeneous (M_{HET} 7.60) and homogeneous teams (M_{HOM} = 7.35; Table 1, panel B: t = 0.48, p = 0.64). Second, we find no significant difference in *Creativity_Rater* between functionally heterogeneous (M_{HET} 5.09) and homogeneous teams (M_{HOM} = 5.07; Table 1, panel B: t = 0.07, p = 0.95). These results show that, in our experiment setting, the countervailing effects of functional diversity on team creativity through uniqueness and usefulness net each other out such that functional diversity has no overall effect on team creativity.

We further test the effect of functional diversity on team creativity using path analysis. Path analysis allows for the relationship between manipulated variables and multiple dependent variables to be simultaneously computed, which reduces measurement error (Jollineau and Bowen 2023, Kline 2023). We test our path model using STATA 15 with the maximum likelihood estimation method. We use *Creativity_Rater* as our terminal dependent variable instead of *Creativity_Cal* because the latter is simply the sum of *Uniqueness* and *Usefulness* such that it is designed to be positively correlated with these two dimensions. We report the results of our path analysis in Figure 3 and Table 2.[21] Consistent with our univariate analysis supporting Hypotheses 1 and 2, we find that functional diversity increases proposal *Uniqueness* (B = 0.77, one-tailed p = 0.02) and decreases proposal *Usefulness* ($B = -0.52$, one-tailed p = 0.03).[22]

Table 1. The Effect of Functional Diversity on Uniqueness, Usefulness, and Creativity (N = 40)

	Uniqueness	*Usefulness*	*Creativity_Cal*	*Creativity_Rater*
Panel A: Mean (standard deviation)				
(0) *Functionally Homogeneous* (n = 20)	3.12	4.23	7.35	5.07
	(1.21)	(0.79)	(1.72)	(1.11)
(1) *Functionally Heterogeneous* (n = 20)	3.88	3.72	7.60	5.09
	(1.25)	(0.94)	(1.60)	(1.26)
Difference (mean 1 − mean 0)	0.76	−0.51	0.25	0.02
Panel B: t-test of differences (mean 1 − mean 0)				
t-statistic	1.97	−1.89	0.48	0.07
p-value[a]	0.03	0.03	0.64ˆ	0.95ˆ

Notes. Panel A reports the means of four teams' creativity measures in the study, namely, *Uniqueness*, *Usefulness*, *Creativity_Cal*, and *Creativity_Rater*, by teams' functional diversity (functionally homogeneous team vs. functionally heterogeneous team). Panel B reports the t-test results of comparing means of team creativity measures between functionally homogeneous teams and functionally heterogeneous teams. See the appendix for variable descriptions.

[a]The p-values are one-tailed unless indicated as two-tailed by ˆ.

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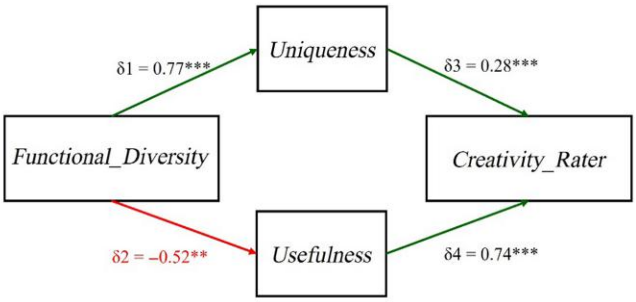
Figure 3. (Color online) Path Analysis of Functional Diversity on Creativity of Ideas Generated



	Path Analysis
Functional_Diversity on *Creativity_Rater*	−0.17
Through Uniqueness	0.22*
Through Usefulness	−0.38**

Notes. See the appendix for variable descriptions. See Table 2 for a tabulated analysis and full description. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$ one-tailed.

We also find that *Uniqueness* is positively associated with *Creativity_Rater* ($B = 0.28$, one-tailed $p < 0.01$) and *Usefulness* is positively associated with *Creativity_Rater* ($B = 0.74$, one-tailed $p < 0.01$). These results confirm that raters consider both the uniqueness and usefulness when rating proposals' creativity. Interestingly, untabulated results show that the standardized coefficient on *Usefulness* ($\beta = 0.59$) `almost doubles that on *Uniqueness* ($\beta = 0.32$). This suggests that raters weighed usefulness more than uniqueness when rating the overall creativity of proposals. Based on these path analysis results, we find that functional diversity has a positive indirect effect on *Creativity_Rater* through *Uniqueness* ($B = 0.22$, one-tailed $p = 0.06$) and a negative indirect effect on *Creativity_Rater* through *Usefulness* ($B = -0.38$, one-tailed $p = 0.04$). Finally, the total net effect of functional diversity on creativity rating is insignificant ($B = -0.17, p = 0.51$).

Table 3. Pearson Correlation Matrix

	(1)	(2)	(3)	(4)	(5)
(1) *Uniqueness*	1.00				
(2) *Usefulness*	0.12	1.00			
(3) *Creativity_Cal*	0.84***	0.64***	1.00		
(4) *Creativity_Rater*	0.37***	0.60***	0.62***	1.00	
(5) *IBS_10Avg*	0.36***	−0.15	0.20	−0.06	1.00
(6) *IBS_5Avg*	−0.07	0.23*	0.07	0.07	−0.28**

Notes. Table 3 presents the Pearson correlation matrix of creativity measures and IBS measures in the study. See the appendix for variable descriptions. Upper-triangular cells report Pearson's correlation coefficient, and lower-triangular cells are Spearman's rank correlation.
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$ (one-tailed).

Pearson correlation analysis in Table 3 shows that there is no correlation between *Uniqueness* and *Usefulness* ($r = 0.12$, one-tailed $p > 0.10$). Such finding suggests the independence of these two dimensions of creativity, which indicates the importance of considering them separately in future research. Table 3 also shows that our calculated overall creativity score (*Creativity_Cal*) and subjectively rated overall creativity score (*Creativity_Rater*) are positively correlated ($r = 0.62$; one-tailed $p < 0.01$), which indicates that these two measures are highly consistent but contain some deviation.

4.2. fNIRS Results

The literature concludes that IBS increments are neural indicators of social interaction (Dai et al. 2018, Mayseless

Table 2. Path Analysis of Functional Diversity on Creativity of Ideas Generated

	Unstandardized coefficient	p-value[a]
Direct effects		
Functional_Diversity → *Uniqueness*	0.77	0.02
Functional_Diversity → *Usefulness*	−0.52	0.03
Uniqueness → *Creativity_Rater*	0.28	<0.01
Usefulness → *Creativity_Rater*	0.74	<0.01
Indirect effects		
Functional_Diversity → *Uniqueness* → *Creativity_Rater*	0.22	0.06
Functional_Diversity → *Usefulness* → *Creativity_Rater*	−0.38	0.04
Total effect		
Functional_Diversity → *Creativity_Rater*	−0.17	0.51^
RMSEA	0.10	
CFI	0.97	
SRMR	0.09	
CD	0.16	

Notes. Table 2 presents the path analysis results of functional diversity on team creativity (*Creativity_Rater*) via the two dimensions of creativity—*Uniqueness* and *Usefulness*. See the appendix for variable descriptions. CFI, Comparative fit index; SRMR, standardized root mean residual; CD, coefficient of determination.
[a]All p-values are one-tailed unless indicated as two-tailed by ^.

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et al. 2019). To investigate the team processes underlying the relationship between functional diversity and team creativity, we use fNIRS neuroimaging technology and focus on two brain regions shown to be actively involved in aspects of creativity: r-AG and r-STG (Seghier 2013, Shen et al. 2017). Prior studies suggests that the r-AG region responds to diverse perspectives and new information, prompting attention to relevant events, memory retrieval for problem solving, and novel idea generation (Jung et al. 2010, Seghier 2013, Lu et al. 2020). Descriptive statistics reported in Table 4, panel A, show that IBS increments increase in the r-AG region (corresponding to CH10; *IBS_10Avg*) for functionally heterogeneous teams (M_{HET} = 0.03) and decrease for homogeneous teams (M_{HOM} = −0.04), and that this difference in *IBS_10Avg* is significant (Table 4, panel B: t = 3.83, one-tailed $p < 0.01$). These results suggest that functional diversity increases divergent thinking and novel idea generation among team members.

Furthermore, prior studies suggest that the r-STG is responsible for the formation of novel association, semantic processing, and conceptual integration (Jung-Beeman et al. 2004, Shen et al. 2017). Descriptive statistics reported in Table 4, panel A, show that IBS increments decrease in the r-STG region (corresponding to CH5; *IBS_5Avg*) for functionally heterogeneous teams (M_{HET} = −0.09) and increase for homogeneous teams (M_{HOM} = 0.05), and that this difference in *IBS_5Avg* is significant (Table 4, panel B: t = −3.33, one-tailed $p <$ 0.01). These results suggest that functional diversity decrease team member engagement in processing and integrating information from varying perspectives.

Table 4. The Effect of Functional Diversity on the IBS Increments (N = 40)

	IBS_10Avg	*IBS_5Avg*
Panel A: Mean (standard deviation)		
(0) *Functionally Homogeneous* (n = 20)	−0.04	0.05
	(0.07)	(0.14)
(1) *Functionally Heterogeneous* (n = 20)	0.03	−0.09
	(0.05)	(0.13)
Difference (mean 1 − mean 0)	0.07	−0.14
Panel B: t-test of difference (mean 1 − mean 0)		
t-statistic	3.83	−3.33
p-value[a]	<0.01	<0.01

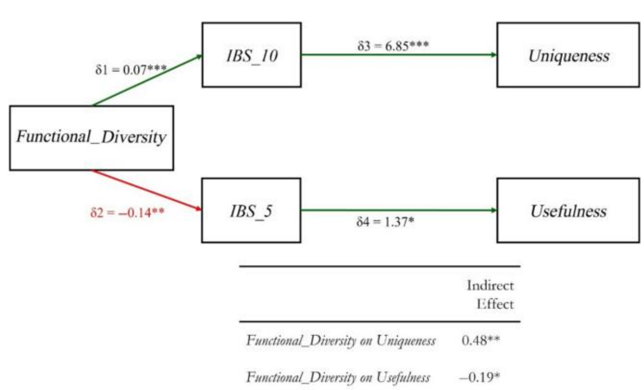
Notes. Panel A reports the means of IBS increments from channel 10 and channel 5 averaged across the brain activity frequency bands of interest, by teams' functional diversity (functionally homogeneous team vs. functionally heterogeneous team). Panel B reports the t-test results of comparing means of IBS increments between functionally homogeneous teams and functionally heterogeneous teams. See the appendix for variable descriptions.
[a]All p-values are one-tailed.

To further investigate the role that these two brain regions play regarding the effect of functional diversity on team creativity, we examine the association between *IBS_10Avg* and *IBS_5Avg* with *Uniqueness* and *Usefulness* ratings. Correlation results in Table 3 show that *IBS_10Avg* has a significant association with *Uniqueness* (Pearson's r = 0.36, one-tailed $p < 0.01$) and no association with *Usefulness* (Pearson's r = −0.15, one-tailed $p >$ 0.10). Conversely, *IBS_5Avg* has a significant association with *Usefulness* (Pearson's r = 0.23, one-tailed $p < 0.10$) and no association with *Uniqueness* (Pearson's r = −0.07, one-tailed $p > 0.10$). Based on these findings, we conduct a path analysis to examine whether *IBS_10Avg* mediates the relationship between functional diversity and *Uniqueness* and whether *IBS_10Avg* mediates the relationship between functional diversity and *Usefulness*.

We test our path model using STATA 15 with the maximum likelihood estimation method. We report the results of our path analysis in Figure 4 and Table 5. We find that functional diversity has a significant positive effect on *IBS_10Avg* (B = 0.07, one-tailed $p < 0.01$) and a significant negative effect on *IBS_5Avg* (B = −0.14, one-tailed $p < 0.01$).[23] Consistent with our correlation results, we also find that *IBS_10Avg* is positively associated with *Uniqueness* (B = 6.85, one-tailed p = 0.01) and *IBS_5Avg* is positively associated with *Usefulness* (B = 1.37, one-tailed p = 0.07). Based on these path analysis results, we find that functional diversity has a positive indirect effect on *Uniqueness* through an increased *IBS_10Avg* (B = 0.48, one-tailed p = 0.02) and a negative indirect effect on *Usefulness* through a decreased *IBS_5Avg* (B = −0.19, one-tailed p = 0.09).

Taken together, these fNIRS results further support the theory underlying our hypotheses that functional diversity has countervailing effects on team creativity. Specifically, functional diversity appears to activate divergent thinking to a greater extent, which leads to

Figure 4. (Color online) Path Analysis of Functional Diversity on Uniqueness and Usefulness



Notes. See the appendix for variable descriptions. See Table 5 for a tabulated analysis and full description. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$ one-tailed.

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Table 5. Path Analysis of Functional Diversity on Uniqueness and Usefulness

	Unstandardized coefficient	p-value[a]
Direct effects		
Functional_Diversity → *IBS_10Avg*	0.07	<0.01
Functional_Diversity → *IBS_5Avg*	−0.14	<0.01
IBS_10Avg → *Uniqueness*	6.85	0.01
IBS_5Avg → *Usefulness*	1.37	0.07
Indirect effects		
Functional_Diversity → *IBS_10Avg* → *Uniqueness*	0.48	0.02
Functional_Diversity → *IBS_5Avg* → *Usefulness*	−0.19	0.09
RMSEA	<0.01	
CFI	>0.99	
SRMR	0.07	
CD	0.40	

Notes. Table 5 presents the path analysis results of functional diversity on the two dimensions of team creativity, *Uniqueness* and *Usefulness*, via IBS increments from channel 10 and channel 5 averaged across the brain activity frequency bands of interest. See the appendix for variable descriptions. CFI, Comparative fit index; SRMR, standardized root mean residual; CD, coefficient of determination.
[a]All p-values are one-tailed.

more unique ideas. However, functional diversity creates challenges for teams in terms of convergent thinking, which leads to less useful ideas.

4.3. Additional Analyses

4.3.1. Homogeneous Subgroups. Our homogeneous team manipulation contains two subgroups of participants with homogeneous functional backgrounds: business student teams and engineering student teams. We examine whether our hypothesis support is driven largely by the performance of one of the homogeneous subgroups. For each of our dependent variables, we conduct simple t-test between our two homogeneous subgroups and our heterogeneous group. In terms of Hypothesis 1, we find heterogeneous team proposals are more unique than both *Homogeneous_Business* team proposals ($t = 1.65$, one-tailed $p = 0.06$) and *Homogeneous_Engineering* team proposals ($t = 1.51$, one-tailed $p = 0.07$). In terms of Hypothesis 2, we find heterogeneous team proposals have lower but insignificant usefulness than *Homogeneous_Business* team proposals ($t = 1.13$, one-tailed $p = 0.13$), and are significantly less useful than *Homogeneous_Engineering* team proposals ($t = 1.92$, one-tailed $p = 0.03$). Finally, *Creativity_Rater* and *Creativity_Cal* of heterogeneous team proposals is not significantly different from *Homogeneous_Business* teams proposals (respectively, $t = 0.30$, $p = 0.77$; $t = 0.67$, $p = 0.51$) or *Homogeneous_Engineering* team proposals (respectively, $t = 0.34$, $p = 0.74$; $t = 0.11$, $p = 0.92$).

An important caveat to this additional analysis is the small sample size (n = 10) of each of the homogeneous subgroups, which reduces the power of these robustness tests. Despite this reduced power, we continue to find consistent evidence of the countervailing effects of functional diversity on creativity through uniqueness and usefulness when separating out our homogeneous subgroups with one exception: a directional, but insignificant difference in the usefulness of homogeneous business team and heterogeneous team proposals. Collectively, these results suggest that our hypothesis support is not driven by the performance of one of the homogeneous subgroups.[24]

4.3.2. Gender Difference. We explore the potential confounding effects of gender and team gender mix on team creativity. First, the percentage of females on a team is higher for heterogeneous teams than homogeneous teams (untabulated $t = 2.24$, $p = 0.03$). However, untabulated pairwise correlation analysis shows that the percentage of females on a team is not correlated with *Uniqueness* ($r = 0.17$, $p = 0.31$), *Usefulness* ($r = -0.06$, $p = 0.73$), or *Creativity_Cal* ($r = 0.10$, $p = 0.55$). Although the percentage of females on a team is positively correlated with *Creativity_Rater* ($r = 0.34$, $p = 0.03$), all inferences about the effects of functional diversity are unaffected by whether we control for the percentage of females in our analysis. We next examine whether team gender differences affect team creativity. To do so, we create an indicator variable, *GenderDiff*, which equals zero (one) if the two teammates have different (same) genders. The mean of *GenderDiff* is 0.575, and untabulated results show that *GenderDiff* does not differ by *Functional_Diversity* condition ($t = 1.61$, $p = 0.12$). Further, *GenderDiff* has no effect on the *Uniqueness* ($t = 0.87$, $p = 0.38$), *Usefulness* ($t = 1.11$, $p = 0.27$), *Creativity_Cal* ($t = 0.08$, $p = 0.94$), or *Creativity_Rater* ($t = 0.82$, $p = 0.42$) of proposals.

Again, an important caveat to this analysis is our relatively small sample. That said, our analysis suggests (1) successful randomization of gender and team gender mix across functional diversity conditions, and (2) that gender and team gender mix do not appear to be alternative explanations for the support of our hypotheses.

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4.3.3. Personality Difference. To rule out potential confounding effects of participants' individual personality traits, we examine whether participants' Big Five personality traits differ by functional diversity condition. The Big Five personality traits constitute a widely recognized framework for understanding human personality (John and Srivastava 1999). This model posits that personality can be distilled into five distinct dimensions: *Openness* (creativity and curiosity), *Conscientiousness* (organization and dependability), *Extraversion* (sociability and enthusiasm), *Agreeableness* (compassion and cooperativeness), and *Neuroticism* (emotional volatility and vulnerability to stress). We use the well-established 44-item Big Five Inventory in the postexperimental questionnaire to measure participants' stable personality traits (John and Srivastava 1999).[25] Following prior literature, we calculate a personality trait score by averaging the scores of the items designed to measure each personality trait. For each team, we average the scores of the two team members to create personality trait scores for the team.

Untabulated t-test results show that there is no significant difference between *Functionally Homogeneous* teams and *Functionally Heterogeneous* teams in terms of four of the five personality traits, namely, *Openness* ($t = 0.41$, $p = 0.68$), *Extraversion* ($t = 0.47$, $p = 0.64$), *Conscientiousness* ($t = 0.64$, $p = 0.53$), and *Neuroticism* ($t = 0.92$, $p = 0.36$). However, we find that *Agreeableness* is higher in *Functionally Homogeneous* teams than *Functionally Heterogeneous* teams ($t = 2.23$, $p = 0.03$). Pairwise correlation results (untabulated) show that there are no significant correlations between any of the Big Five personality traits and *Uniqueness*, *Usefulness*, *Creativity_Rater*, and *Creativity_Cal* (all $|r| < 0.35$, all $p > 0.11$).[26]

In addition to examining the level of Big Five personality traits, we also consider the disparity of personality traits. We first calculate the difference (absolute value) between two team members with respect to each of the Big Five personality traits. Untabulated results show that there is no significant difference between *Functionally Homogeneous* teams and *Functionally Heterogeneous* teams in terms of four of the five personality traits' within-team disparity.[27] Pairwise correlation results (untabulated) show that, with one exception, there are no significant correlations between any of the Big Five personality traits' within-team disparity and *Uniqueness*, *Usefulness*, *Creativity_Rater*, and *Creativity_Cal* (all $|r| < 0.35$, all $p > 0.10$). The one exception is that Δ*Openness* is significantly correlated with *Usefulness* ($r = 0.31$, $p = 0.05$).[28]

4.3.4. Other Team Behaviors. We trained two PhD students who were blind to the experiment to code the recorded transcripts from all 40 teams. Initially, they independently reviewed the transcripts. They then individually identified and tallied instances of explicit disagreements between team members, counting the number of these occurrences during Part I and Part II of the experiment.[29] Additionally, the PhD students independently developed a comprehensive lexicon, summarizing and categorizing ideas discussed by team members during both parts of the experiment, counting the number of distinctive ideas proposed during Part I and Part II of the experiment. In the final step, they reconciled their findings and crafted a unified data set, which reflects their mutual agreement.[30]

We then analyze the pairwise correlations (untabulated) between team behaviors and our main independent and dependent variables. First, in comparison with functionally homogeneous teams, functionally heterogeneous teams exhibit a more equitable distribution of speaking time (*Total_Diff_Time* $r = -0.41$, $p < 0.01$) and opportunities to contribute (*Total Turns* $r = 0.34$, $p = 0.03$) between team members.[31] Second, we observed that functionally heterogeneous teams are less fluent (i.e., more redundant) than their homogeneous counterparts in generating ideas (*Total Idea* $r = -0.24$, $p = 0.13$), and experience fewer disagreements (*Total Disagreement* $r = -0.39$, $p < 0.01$). Third, *Total Turns* is significantly negatively correlated with *Usefulness* ($r = -0.41$, $p < 0.01$) and uncorrelated with *Uniqueness* ($r = 0.03$, $p = 0.84$).

These findings indicate that in our study, functional diversity could alter team members' behaviors (i.e., more equitable speaking time distribution, fewer disagreements, lower fluency in generating ideas). However, using team members' behaviors during the experiment to predict team's creativity is challenging. The limited size of our sample constrains our ability to conduct granular analyses.[32] Consequently, the results of these supplementary analyses should be approached with caution. Given these considerations, we refrain from asserting any causal links between these team behaviors and team creativity outcomes. These observations present valuable avenues for future research and highlight the advantages of application of neuroimaging technologies.

5. Conclusion

Managers supervising teams tasked with creative problem solving must make personnel control decisions regarding the functional diversity of the teams. Prior research finds mixed effects of functional diversity on creativity, and few studies examine this issue within a team setting, which highlights the need to understand how such diversity influences creativity. We develop a theory that predicts functional diversity has countervailing effects on team creativity through its positive (negative) effects on the uniqueness (usefulness) of ideas generated. We conduct an experiment where we use fNIRS technology and measure IBS between team members engaged in a creative task. Measured behavior outcomes of usefulness and uniqueness and fNIRS data support our predictions.

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We make three contributions to the existing literature. First, we provide evidence of how functional diversity can affect the two dimensions (i.e., uniqueness, usefulness) of team creativity. This has important implications for both researchers and practitioners alike. Our study is one of the first to tackle the research question of how the two dimensions of creativity are affected by management control decisions. The differential effects of functional diversity on uniqueness and usefulness indicate the importance of considering creativity at a more granular level in future research. Our findings caution organizations to take heed that functional diversity may not fulfill the expectation of enhancing team creativity. Specifically, our results suggest that a more diverse team can produce more unique but less useful ideas. But, for something to be truly creative, it needs to be both unique and useful (Cropley 2006). Thus, it is important that managers consider the countervailing effects of functional diversity on the two subdimensions of team creativity.

Second, findings from our fNIRS experiment provide more direct evidence to help open the black box of team processes underlying collective creativity performance. Recently, Lu et al. (2021) provided the initial exploratory fNIRS evidence that educational diversity has mixed effects on the processing of groups tasked with identifying alternative uses for common items. We extend Lu et al. (2021) by being the first deductive research to examine the neuroscientific effects of functional diversity while also bridging the theory between accounting and neuroscience. Specifically, we predict and find that functional diversity imposes different impacts on the two brain regions that are heavily involved with creativity, leading to varied effects on the uniqueness and usefulness of team creativity. This evidence links the theory between accounting and neuroscience and advances our understanding of the fundamental interpersonal neural basis that makes teamwork effective and valuable. Therefore, our findings expand both Lu et al. (2021) and the understanding of the fundamental interpersonal neural basis that makes creative teamwork effective.

Third, we are the first in accounting to use fNIRS to investigate *team* cognitive processes. A major obstacle to research on team cognitive processes is that most neurotechnologies measure *individual* brain activity (Montague et al. 2002, Wang et al. 2018). The few empirical studies in accounting research that use neurotechnologies provide precious first evidence on the neural processes underlying individual decision making (Tank and Farrell 2022, Black et al. 2024). Using the emerging fNIRS technology, we can detect correlated regional patterns of brain activity across team members, and hence identify the team cognitive processes underlying collective creativity behavior. Although we focus on team creativity in this study, other interdependent activities such as budget negotiations and tournament incentive systems can also be examined using this method.

Our study contains some limitations that can be addressed by future research. First, we examine a setting where communication between team members is unstructured. Prior accounting research finds that communication structure and group composition interactively affect team performance (Arnold et al. 2018, 2020). Future research could explore how structured communication could enhance idea usefulness in functionally diverse teams while preserving idea uniqueness. Second, our experiment was extremely costly to administer because of our use of fNIRS technology, resulting in a relatively small sample of student participants. A larger team setting can introduce theoretical tensions such as hierarchies, groupthink, and increased coordination challenges, which are muted in our two-person-team setting (e.g., Andre et al. 1979, Fern 1982, Björkman 2004, Stewart 2006). Future research could examine the robustness of our theory among larger sample sizes and/or professional participants. Third, we recruit participants from various educational backgrounds and use functional perspective priming to manipulate expertise. Future research could examine whether our results are driven by the homogeneity versus heterogeneity in education, perspective priming, or both. Finally, we assume and find that team creativity is an additive combination of uniqueness and usefulness. However, prior research suggests that there may be an interactive effect of these two dimensions of creativity in different task settings (Diedrich et al. 2015). Future research with a larger sample size can examine whether our theory generalizes to settings with a more complex relationship between these two underlying dimensions of team creativity.

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Appendix. Summary of Variables

	Construct description	Operationalization description
Independent variable		
Functional_Diversity	Variation of functional expertise (e.g., accounting, engineering, marketing) within a team	Indicator variable that is 1 if the two team member participants are from different (engineering, business) schools (i.e., functionally heterogeneous) and 0 if they are from the same school (i.e., functionally homogeneous)
Dependent variable		
Uniqueness	Ideas that are original and rare such that few groups will come up with them	A measure of the novelty dimension of creativity at team level. It is the average uniqueness rating by three independent raters on a 0–7 scale. Higher value indicates higher novelty of the final proposal by a team.
Usefulness	Ideas that are cost-effective, feasible, and practical such that they are relevant to the problem at hand	A measure of the usefulness dimension of creativity at team level. It is the average usefulness rating by three independent raters on a 0–7 scale. Higher value indicates higher usefulness of the final proposal by a team.
Creativity_Cal	Ideas that are both unique and useful by a group of interdependent individuals	The sum of *Uniqueness* and *Usefulness*; a calculated measure for the overall creativity of the final proposal by a team
Creativity_Rater		The average overall creativity score rated by six independent raters
fNIRS IBS increment measures		
IBS_5	Channel 5 IBS increments, which mainly capture signals from the r-STG that is responsible integration, perspective taking, and social cognition	The IBS increments captured at the frequency of 0.038 Hz, 0.036 Hz, and 0.034 Hz during task Part II, respectively. These three frequencies are adjacent and are selected based on the FDR-corrected *p*-value from the one-way ANOVA using *Functional_Diversity* on IBS increments of each channel along the full frequency range (0.015–0.700 Hz).
IBS_5Avg		The average of *IBS_5* increments at these three frequencies
IBS_10	Channel 10 IBS increments, which mainly capture signals from the r-AG that is responsible for attention, complex cognition, and novel idea generation	The IBS increments captured at the frequency of 0.345 Hz, 0.326 Hz, 0.307 Hz, 0.290 Hz, 0.274 Hz, and 0.258 Hz during task Part I, respectively. These six frequencies are adjacent and are selected based on the FDR-corrected *p*-value from the one-way ANOVA using *Functional_Diversity* on IBS increments of each channel along the full frequency range (0.015–0.700 Hz).
IBS_10Avg		The average of *IBS_10* increments at these six frequencies

Endnotes

[1] Chen et al. (2012, p. 1892) define creativity as "original, innovative, and implementable within a reasonable budget." That is, creative ideas are "novel" and "must be in some way appropriate to the problem" (Amabile 1996, p. 21). McCarthy et al. (2018) equate uniqueness with novelty and usefulness with relevance (i.e., appropriate to the problem) and feasibility (i.e., implementable given organizational constraints).

[2] We apply Cropley's (2006, p. 391) definitions of divergent and convergent thinking. Specifically, divergent thinking "involves producing multiple or alternative answers from available information, … making unexpected combinations, recognizing links among remote associates, transforming information into unexpected forms." Conversely, convergent thinking "is orientated toward deriving the single best (or correct) answer to a clearly defined question, … recognizing the familiar, reapplying set techniques."

[3] Educational diversity is defined as "diversity in educational backgrounds" (Lu et al. 2021, p. 1). Functional and educational diversity are types of trait diversity that capture the difference in team member stable characteristics (Van Knippenberg and Mell 2016, p. 136). Other types of trait diversity include gender, personality, and race. Although both functional and educational diversity are indicative of variation in domain-specific knowledge (Jehn et al. 1999), functional diversity is a higher-order construct that results from a job-related perspective activating such knowledge.

[4] Research finds that functional homogeneity within the team increases member commitment (e.g., Tsui et al. 1992, Riordan and Shore 1997), improves team cohesion (e.g., O'Reilly et al. 1989),

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helps build intrateam communication and social networks (e.g., Klein et al. 2004), reduces conflicts (e.g., Jehn et al. 1999, Pelled et al. 1999), and decreases turnover (e.g., Wagner et al. 1984).

[5] This literature consistently finds that the r-AG area becomes deactivated when participants are engaged in divergent thinking tasks, for example, generating alternative uses of given objects or musical improvisation. One explanation is that the decrease in neural activity reflects inhibition or attenuation of retrieval of typical or directly stimulus-related information, allowing more remote or original responses to emerge (Fink et al. 2010). Another explanation is that suppressed activity in the r-AG area could prevent reorienting attention to task-irrelevant stimuli, facilitating the integration of more remote information (Fink et al. 2012). Our study does not intend to investigate the neurophysiological function of the brain's areas. Therefore, we do not attempt to reconcile existing neurotheories. Instead, we use the reported strong association between r-AG deactivation and divergent thinking when testing the process underlying our hypotheses.

[6] As summarized by Shen et al. (2017) in their integrated review of creative insight, insight is a type of creative cognition and requires novel associations of task-related knowledge.

[7] Neuroimaging tools such as electroencephalography, fMRI, and fNIRS can be used to conduct hyperscanning (Wang et al. 2018, Czeszumski et al. 2020).

[8] In the past half century, advancement in neuroimaging technologies has dramatically expanded our understanding of the neural basis of cognitive processes associated with social behavior (Boas et al. 2014, Wang et al. 2018). Nonetheless, a major limitation of this research is that, although social interaction involves multiple individuals, most studies of social cognition measure brain activity in only one person at a time (Montague et al. 2002, Wang et al. 2018). Hyperscanning technology largely helps researchers detect consistently correlated regional patterns of brain activity across team members (interbrain synchrony), therefore more accurately identifying the team cognitive processes underlying social behaviors (Cui et al. 2012, Boas et al. 2014, Wang et al. 2018).

[9] We obtained ethics approval from all of the authors' university ethics review boards and informed consent from all participants to conduct this experiment.

[10] We have teams interact over computer (i.e., Zoom) as opposed to in person because it allows us to better standardize the experiment procedures between participants and between teams. Furthermore, by using a computer, we can record individual participant contributions in a less intrusive manner.

[11] If a participant is paired with a teammate from the management school, in the study overview he or she reads, "The other person in your group has been recruited because he/she is trained to be a business professional." If his or her teammate comes from the engineering school, the content changes accordingly to read, "The other person in your group has been recruited because he/she is trained to be an engineer."

[12] These instructions emphasize to participants "feasibility (implementability)" to a greater extent than "relevance." However, like Chen et al. (2012), we ask participants to generate practical proposal ideas and provide them with the school's mission, both of which we believe highlight the relevance component of the usefulness construct. Furthermore, we ask our usefulness raters to evaluate the proposals' "practical and implementable quality," and to equally consider three aspects of the proposals: (1) fit with the school's mission statement, (2) effective and efficient use of the available space, and (3) effective and efficient use of the budget. Therefore, in terms of our measurement of usefulness, we believe it captures aspects of both feasibility and relevance.

[13] fNIRS has an unparalleled advantage over traditional neuroimaging technologies, such as fMRI, for its flexibility and safety. Unlike fMRI, fNIRS has few motion restraints, and thus can measure brain activity in a closer-to-real-world environment (Boas et al. 2014, Scholkmann et al. 2014). Furthermore, whereas fMRI utilizes radio waves, fNIRS utilizes optics that are noise free and safer (Wilcox and Biondi 2015, Scarapicchia et al. 2017). In the field of medicine, a pulse oximeter that uses near-infrared spectroscopy (NIRS) is commonly used. When NIRS is used for brain function research, it is called fNIRS (functional NIRS).

[14] Brain activation requires more oxygen consumption, which leads to a change in the concentration of the local oxygenated (HbO) and deoxygenated hemoglobin (HbR), and these have different near-infrared light absorption spectra. Following earlier fNIRS studies, we focus only on the HbO signal because the HbO signal is more sensitive to changes in cerebral blood flow than the HbR signal (e.g., Cui et al. 2012; Mayseless et al. 2019; Lu et al. 2020, 2021). When using fNIRS, near-infrared light is sent into the tissue, and the intensity of the back-scattered light is measured as a proxy of the brain activity.

[15] There are eight emitters and eight detectors with three-centimeter optode separations on the fNIRS cap. Details of the 24 measurement channels and their locations are presented in Online Supplemental Appendix B and Online Supplemental Figure 2.

[16] Please refer to Online Supplemental Appendix C, Section C1, and Grinsted et al. (2004) for more details about wavelet transform coherence.

[17] All p-values reported are two-tailed unless otherwise stated.

[18] Following the literature (Runco and Jaeger 2012, Nozawa et al. 2016, Dai et al. 2018), during preprocessing of the fNIRS data, we do not apply filtering or detrending procedures. We perform these procedures on the coherence value as described in the paper. In addition, because WTC normalizes the amplitude of the signal based on each time window, it is not vulnerable to the transient spikes generated by movements. Therefore, no artifact adjustments are performed at the single-subject level.

[19] See also "NIRS-KIT: A MATLAB toolbox for both task and resting-state fNIRS data analysis" (https://www.nitrc.org/projects/nirskit/).

[20] We invite four professional raters. One rater's rating has extremely low consistency with the other three raters' (item-rest correlation < 0.20). This rater's rating is therefore excluded from the usefulness score calculation. Out of the final three raters we use, two are from industry and one is from a large U.S. public university.

[21] In our path analysis model, we do not include the residual direct path of functional diversity on *Creativity_Rater* for three reasons. First, we find that the residual direct path is insignificant ($B = 0.24$, $p = 0.42$). Second, given our relatively small sample size, it is imperative to ensure the selection of the most appropriate model for our estimations. Including this residual direct path results in a notable change in the root mean square error of approximation (RMSEA) from 0.10 to 0.17, which suggests the model has a weak fit to the data and path results should be interpreted with caution (Kline 2023). Third, our theoretical framework does not provide a basis for anticipating a residual direct effect. That is, we apply theory to predict how functional diversity affects uniqueness and usefulness, which we assume are the only two dimensions of team creativity. All that said, incorporating this residual direct path in our model does not alter any conclusions regarding tests of our hypotheses.

[22] Coefficients and p-values from path analysis (Table 2) differ slightly from mean differences and p-values from univariate analysis (Table 1). This slight discrepancy is attributable to (1) differences in estimation methodologies between path analysis and t-tests, and (2) rounding to the third decimal.

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[23] The untabulated result shows that the covariance between *IBS_10Avg* and *IBS_5Avg* is insignificant ($p = 0.81$).

[24] There is no significant difference between *Homogeneous_Engineering* and *Homogeneous_Business* proposals in terms of *Uniqueness* ($t = 0.18$, $p = 0.86$), *Usefulness* ($t = 0.75$, $p = 0.46$), *Creativity_Rater* ($t = 0.59$, $p = 0.56$), or *Creativity_Cal* ($t = 0.46$, $p = 0.65$).

[25] The questionnaire contains 44 short phrases or statements with five-point Likert-type scales ranging from 1 (disagree strongly) to 5 (agree strongly).

[26] All inferences about the effect of functional diversity are unaffected by whether we control for agreeableness in our analysis.

[27] We find no significant difference between *Functionally Homogeneous* teams and *Functionally Heterogeneous* teams in terms of four of the five within-team personality traits disparity: Δ*Extraversion* ($t = 0.44$, $p = 0.67$), Δ*Agreeableness* ($t = 1.36$, $p = 0.18$), Δ*Conscientiousness* ($t = 0.86$, $p = 0.40$), and Δ*Neuroticism* ($t = 0.04$, $p = 0.97$). However, we find that Δ*Openness* is higher for functionally homogeneous teams than functionally heterogeneous teams ($t = 2.28$, $p = 0.03$).

[28] All inferences about the effect of functional diversity are unaffected by whether we control for Δ*Openness* in our analysis.

[29] Here is a common example of a disagreement identified in our study between two team members: One team member said, "What if it's a place for holding lectures?" and the other team member responded, "But the place for holding lectures already exists in the management building, and the environment there is even better. We cannot just move something that the school already has." This exchange counted as one disagreement.

[30] The additional team behavior variables and their definitions are as follows: *Total Turns* is the total number of turns taken by team members in the discussions during Part I and Part II of the experiment. *Total Disagreement* is the total number of disagreements in the discussions during Part I and Part II of the experiment. *Total_Diff_Time* is the absolute value of the relative difference (in seconds) in speaking time between two team members during Part I and Part II of the experiment. For example, consider a scenario where one team member speaks for 500 seconds and the other for 700 seconds throughout Part I and II. The difference in speaking time is 200 seconds. *Total Idea* is the total number of ideas proposed in the discussions during Part I and Part II of the experiment.

[31] We also examine indicator variables at discrete *Total_Diff_Time* to *Total_Time* ratios (10%, 15%, 20%, 30%, and 40%), and we find results consistent with *Total_Diff_Time* (untabulated).

[32] For example, our study did not provide participants with specific instructions on how to articulate their disagreements. In the analyses, we concentrated on words that explicitly signal disagreement, such as "no" or "not." Yet disagreement can also be expressed through proposing an alternative idea or changing the subject. Disagreement can be constructive or destructive in nature (Adams and Laursen 2007, De Kock and Vlachos 2021). Thus, its relationship with team creativity is unknown in the literature.

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