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The Impact of Top Performers in Creative Groups

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The role of top or "star" performers was examined in an electronic collaborative creativity task. Participants worked in dyads on a series of four idea generation tasks and then participated in two different groups of four on two new idea generation tasks. The composition of the pairs and groups were changed for each new task. The top performers from the paired sessions, in terms of number of ideas or novelty, enhanced the number of ideas generated by the other members in the group sessions. The greater the discrepancy in performance of the top performer and the other group members in terms of number of ideas, the greater the positive impact on the other group members. This research suggests that top performers or "star" team members can have a positive effect on the creative performance of other group members over and above other predictors. We discuss the theoretical and practical implications for including high individual performers in groups.

Keywords: creativity, group performance, social comparison, top performer, star performer

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Today there is much interest in top or "star" performers in both industry and sports. It is often suggested that top performers can have transformative effects on teams and organizations (see Aguinis & O'Boyle, 2014). These performers are highly valued in organizations (Hacker, 2000) for their presumed disproportionate contributions. The return of Steve Jobs to Apple appeared be a major factor in the subsequent success of that company (Weinberger, 2017). In the sports world the addition of a top new player can energize the other team members to perform at a higher level (Steinberg, 2018). However, such a positive impact is not necessarily assured. Organizations are often challenged to keep top performers happy, and these "stars" may not be particularly appreciated by their coworkers (Kim & Glomb, 2014). Furthermore, we know of no definitive experimental evidence on the impact of top performers on the performance of their other group members. This research set out to systematically examine whether top performers would enhance or inhibit the performance of fellow group members.

One limitation of research on the impact of top performers is that it is difficult to determine precisely how much of the impact on the group is due to the star's performance and how much to their influence on the others in the team or organization. Although there is some evidence in the star performer literature of the importance of team members on the impact of stars (Groysberg & Lee, 2009), this literature has not been able to determine the degree to which stars enhance the performance of others. This is difficult to examine in real-world contexts because the selection process cannot be controlled and is often subject to self-selection biases. For example, famous academics, such as Nobel Laureates, and top athletes may draw other high-ability performers to work with them. The disproportionate success of students of Nobel Laureates may in part be due to the high caliber of the students that they attract in the first

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place (Zuckerman, 1996). Merton (1968) called this the Matthew effect, often summarized as "the rich get richer."

With the contemporary emphasis on collaborative innovation and problem-solving (Graesser et al., 2018; Hoever et al., 2012; Van Knippenberg, 2017), we decided to examine the role of top performers in a context of collaborative idea generation. Researchers have examined many factors for their influence on collaborative ideation and creativity (Paulus et al., 2012; Reiter-Palmon et al., 2012). For example, Somech and Drach-Zahavy (2013) found that teams with a higher average of creative personality and greater functional diversity had higher levels of innovation, especially when the team climate was supportive of innovation. Yet, no one has systematically examined the role of top performers—as a type of group composition variable—in this context. Will top performers motivate other group members to exert greater efforts, either because of feelings of competition or because they enhance cognitive stimulation (Bechtoldt et al., 2010; Paulus & Brown, 2007; Paulus & Dzindolet, 2008)? Or will the group members respond by reducing their efforts because of large social comparison discrepancies, social loafing, or free riding (Karau & Williams, 1993; Kerr & Bruun, 1983)?

We examined this question in a controlled experimental setting in which participants exchanged ideas in a round-robin fashion across four dyadic interactions and subsequently exchanged ideas in two different groups of four. The dyadic sessions enabled us to determine a baseline performance level for each of the participants in a collaborative situation. This allowed identification of top performers in terms of both the number and novelty of generated ideas. Such a procedure also enabled participants to interact with four different partners and thus facilitate their own observation and assessment of their relative efficacy. In turn, during the subsequent group sessions, there was some degree of familiarity and prior experience, and potentially some feelings of competition.

Theory Concerning the Impact of High Performers in Groups

Social comparison theory (Festinger, 1954; Suls & Wheeler, 2000) proposes that individuals are motivated to evaluate their own abilities, and that they will compare to other people to achieve such evaluations. One of this theory's key propositions is that when discrepancies between the self and another become too large, social comparison becomes both less likely and less useful for evaluation purposes. Thus, those who are similar or moderately dissimilar should provide the most subjectively useful information regarding one's own abilities. Coupled with the theoretical proposition that for abilities there is a motivational drive upward (Festinger, 1954, p. 124), this implies that in groups, we will tend to compare upward to those who are slightly better in the hope of matching or exceeding those group members. Much of the support for this assumption comes from the coaction literature in which the performance of individuals performing independently as pairs is compared with individuals performing alone on relatively simple tasks (e.g., Seta, 1982). Similarly, research on the Köhler effect (e.g., Kerr et al., 2005; Köhler, 1926, 1927) has found that lower ability members will increase their performance when paired with a higher ability member on a task where joint performance determines outcomes (viz., conjunctive tasks). More recently, a study of sport relays found that those athletes whose prior performances were lower in the preliminary events improved their performances in the final relay events (Osborn et al., 2012). A meta-analytic review of this literature (viz., motivational gains of inferior group members; Weber & Hertel, 2007) found that motivation gains were obtained for both additive and conjunctive tasks and for both physical and cognitive tasks, with an overall effect size in the medium range. These motivation gains were enhanced when there was continuous performance feedback.

Group members may also be motivated by perceived social consequences (e.g., achieving positive ones and avoiding negative ones; Paulus, 1983; Shepperd, 1993). That is, individuals may be motivated to be perceived positively by other group members, and the presence of top performers may motivate others to increase efforts to achieve favorable interpersonal outcomes (Stroebe et al., 1996). Another basis for expecting a positive impact of top performers in idea generation contexts is that the high number of ideas generated by such performers should cognitively stimulate more ideas in other group members (Dugosh & Paulus, 2005; Dugosh et al., 2000; Nijstad et al., 2002). This might also be seen as similar to the sociocultural and interactional factors influencing, stimulating, or regulating learning and behavior from Vygotsky's (1978) zone of proximal development framework.

The most direct support for the positive impact of top performers in idea generation groups comes from a study by Choi and Thompson (2005). They examined the impact of group member turnover on a three-person verbal brainstorming task in which one person was assigned to also transcribe the ideas (see Bushe & Chu, 2011, for a discussion of some of the issues inherent in groups that change their membership; see also Prislin et al., 2002). When groups exchanged one member for a second task, the groups generated more ideas. The greater the fluency in terms of number of ideas of this newcomer, the more ideas were generated by the two "old timers" in the group. This suggests that the presence of a high performer can enhance the overall performance of the group on an idea generation task. However, the newcomer was highly salient to other group members and one of the group members had the role of a scribe. It remains to be determined whether a positive effect of a high performer will occur without unique and salient roles of its members (e.g., newcomer, scribe).

The impact of top performers on the performance of other group members can also be negative. Social comparison theory (Festinger, 1954) predicts that when there is a significant discrepancy in ability levels, individuals will not use that person as a basis of comparison and that person will serve no motivational function. Several studies have supported this prediction in task performance contexts (e.g., Seta, 1982). Exposure to high performers in a learning or task performance context can actually be associated with frustration and can have negative effects on one's performance and self-esteem (Dijkstra et al., 2008; Göllner et al., 2018; Seta et al., 1991; Wheeler & Suls, 2005). Further, being in a competitive group context with top performers can lead to maladaptive physiological threat reactions (Cleveland et al., 2011). This effect was particularly strong when there had been some prior group interaction which increased feelings of psychological closeness. Self-esteem maintenance theory (Tesser, 2000) suggests that under such conditions the comparison with superior others may lead to lowered self-esteem.

Discrepancies in performance can also lead to downward comparison whereby high performers move their performance in the direction of low performers over time (Osborn et al., 2012; Paulus & Dzindolet, 1993). Similarly, the presence of high performers in groups may lead other members to loaf or "free ride" on their efforts (Karau & Williams, 1993; Kerr & Bruun, 1983; Latané et al., 1979). The loafing phenomenon is especially likely when group members are not individually evaluated on their performance (Karau & Williams, 1993; Weldon & Gargano, 1988). Free riding is typically observed in disjunctive tasks in which other group members feel that their efforts are dispensable, as the performance of the best member determines the group outcome, but it can also occur in additive tasks in which the total performance of the group is the criterion for success (Kerr & Bruun, 1983; Paulus, 1983).

The literature thus suggests several possibilities for the effects of top performers on the other group members. The degree of discrepancy in the performance of the top group member with those of the other group members may also be important. Most of the theoretical models which suggest positive effects on performance imply that greater discrepancies will lead to more performance enhancement. For example, research on the Köhler effect has found that higher discrepancies are related to increased performance of the low ability partner unless they have prior knowledge of the discrepancy in performance (Messé et al., 2002). However, it is possible that high degrees of discrepancies will make the other group members less likely to use the top group member as a relevant basis for comparison (Festinger, 1954; Seta, 1982; Stroebe et al., 1996) or may yield negative emotional reactions inhibiting performance (e.g., Tesser, 2000; Wheeler & Suls, 2005).

Methodological Overview and Hypotheses

In the present study, we created a series of dyads and groups using an electronic idea exchange platform, which is an efficient and effective way to share ideas in groups (Dennis et al., 2019) and helps minimize the production blocking problems of face-to-face groups (Diehl & Stroebe, 1987; Gallupe et al., 1991). In face-to-face groups, disproportionate contributions from a top performer would limit the potential contributions of other group members in a short-term setting. The electronic medium allows for instant mutual access to each other's ideas and the ability to share ideas at any time during the collaboration process.

Participants in dyads and groups were given a number of different idea generation tasks, and we analyzed performance both in terms of the number and novelty of ideas produced. We considered a number of predictions.

Hypotheses for the Impact of Number of Ideas

Because of the discrepant and conflicting findings that we have highlighted in the literatures reviewed above, we present some competing directional hypotheses.

Hypothesis 1a: The presence of a top performer will lead to an increase in the number of ideas generated by other group members.

Hypothesis 1b: The presence of a top performer will lead to a decrease in the number of ideas generated by other group members.

Hypothesis 2a: Based on the Köhler effect, greater discrepancies or gaps between the top performer and the other group members will lead to an increase in the number of ideas generated by other group members (i.e., a positive interaction effect).

Hypothesis 2b: Greater discrepancies between the top performer and the other group members will instead lead to a decrease in the number of ideas generated by other group members (i.e., a negative interaction effect).

Hypotheses for the Impact of Novelty

There are alternative possibilities for the impact of high *novelty* top performers on the performance of other group members. Although one might expect that exposure to highly novel ideas will increase the novelty of the other group members' ideas, there is little evidence for this in the literature. In fact, more common ideas may be more stimulating because they are more likely to overlap with one's semantic network (Brown & Paulus, 2002; Dugosh & Paulus, 2005). The electronic brainstorming literature has demonstrated the impact of increased group size in terms of the number of ideas but not their novelty (DeRosa et al., 2007), and there is no evidence that rarer ideas are more stimulating (Connolly et al., 1993). In a group context where the emphasis is on generating a high number of ideas, the primary focus may be on the rate of idea generation rather than on the quality. Assessing quality requires a deeper level of processing (Kohn et al., 2011), which may inhibit the generation of ideas. However, if exposure to novel ideas suggests additional category domains for exploration, this may facilitate the generation of additional ideas. Further, exposure to novel ideas in a group setting likely constitutes a context of social learning (Bandura, 1986; van Dijk et al., 2020), and mimicry of novel idea explorations may occur. Based on these latter considerations, we propose the following:

Hypothesis 3: The presence of a highly novel top performer in the group may enhance the average novelty of the ideas of the remaining group members.[1]

Hypothesis 4: A high degree of discrepancy between the novelty of the top performer and other group members should enhance group members' novelty.

Hypothesis 5: The presence of a highly novel top performer in the group should increase the *number* of ideas generated by the other group members.

[1] Because the available literature suggests a true null (no effect) rather than an opposite effect, we have not presented a competing directional hypothesis here.

Method

Participants

One hundred sixty-eight undergraduate students[2] from a public university in the southern United States completed the study in exchange for partial course credit. Approximately 71% of participants were women, and the average age of the sample was about 20 (119 female, 49 male; age range 18–36, $M = 19.72$, $SD = 2.68$). See Table 1 for racial/ethnic demographics. Ethical approval for this study was obtained from the relevant university Institutional Review Board.

Materials

Participants first completed an electronic questionnaire consisting of demographic items, personality measures (e.g., Big Five), need for cognition (Cacioppo et al., 1984), and a series of verbal fluency tasks (described below). Brief questionnaires were administered after each dyad or group interaction, assessing perceptions of dyad and group cohesion, task focus, and partner/group likability. Skype text chats were used to record all dyadic and group interactions (converted to Excel using the program Skyperious; Suurjaak, 2011).

The verbal fluency tasks provided a measure of individual idea generation ability, using a set of four word-association tasks. Participants received the prompts "SCIENCE," "FUTURE," "ENGINEERING," and "BUSINESS," and in each case were asked to generate, in 60 s, as many related words as possible. Fluency was calculated as the average number of words produced across prompts.

A Latin Square design was used to assign participants to dyads and to groups. Each experimental session included eight participants, who completed four idea generation sessions in dyads and two sessions in groups of four. The Latin Square design was pseudorandom assignment with constraints. The constraints ensured that participants were never assigned the same dyad partner more than once, and similarly that the group composition was different in each of the two group sessions (see Figure 1). The determination of top performers was not an experimental variable in this design, so we wanted maximal differences in dyad and group assignments. Because top performers were determined based on their performance in the dyad sessions (details below), it was important to ensure that participants had different partners for each dyad session. With repeated pairings, it would be difficult to determine individual performance. Such a process allowed us to examine the effects of the naturally occurring absence or presence of a top performer and of discrepancies between top performers and other group members.

Table 1
Participant Demographics

Race and ethnicity	*N*	Percentage
Black/African American	35	20.83%
Asian	29	17.26%
White/Caucasian	47	27.98%
Hispanic/Latino	41	24.40%
Middle Eastern/North African/Arab-American	1	0.60%
Other (indigenous Australian)	1	0.60%
Multiracial	14	8.33%

Figure 1
Schematic Example of Dyadic Pairings and Groupings Across Six Sessions. Numbers Indicate Assigned Participant Numbers, and Parentheses Indicate Pairings or Groupings of Participants

(1,3)(2,5) (4,8)(6,7)	(1,2)(3,5) (4,6)(7,8)	(2,4)(5,8) (1,6)(3,7)	(1,4)(2,6) (3,8)(5,7)	(1,2,3,4) (5,6,7,8)	(1,3,5,7) (2,4,6,8)
Dyad 1	Dyad 2	Dyad 3	Dyad 4	Group 1	Group 2

Procedure

Participants were randomly assigned to one of eight computers. After providing informed consent, they completed the prequestionnaire and fluency task and were then guided through the six idea-generation sessions (four dyad sessions followed by two group sessions). In these subsessions, participants were asked to think of alternative uses for one of six common items (shoelace, brick, paperclip, chair, mug, or tire), ordered randomly for each experimental session. All participants in each session performed the task for the same item (i.e., all dyads worked on the brick task simultaneously, and so on). Dyad sessions lasted 5 min each and group sessions lasted 10 min each. Skype chat was used for all idea exchanges, and between each session participants were paired or grouped into a new Skype chat session with their partner(s). Participants did see the contributions of all group members, but they were only identified by number. Students were assigned numbers when they arrived, but seating positions were not related to the numbers. They maintained their seating position throughout the experiment but were linked to different individuals or groups over the course of the experiment. In the group of four they might recognize a participant number from prior sessions but would not know who that specific person was. Participants received standard brainstorming instructions to not criticize ideas, say whatever ideas came to mind, focus on generating as many ideas as possible, to build on ideas and to stay focused on the task (Osborn, 1963; Putman & Paulus, 2009). Participants could see the contributions of their dyad partners and group members, but performance differences were not made explicit by the experimenters.

Dependent Measures

The primary dependent measures of performance in this study were (a) the number of ideas generated by participants in each session and (b) the average novelty of those ideas. Four trained coders, following coding protocols that have been used in prior research (e.g., Coursey et al., 2020; Litchfield et al., 2011), exam-

[2] Appropriate sample size determination in multilevel designs is not straightforward (e.g., Arend & Schäfer, 2019). As a guideline, typical sample sizes in groups research are ~20 or less per condition. We assessed 42 groupings of participants with a top performer present and 42 without using a within-participants design to increase power. Further, the multilevel models analyzed *individual* performance, meaning the effective sample size was 294 observations across 147 participants.

ined the data to identify the distinct ideas generated by individuals in each session. As the study was conducted using Skype chat, participants easily followed directions to write only a single, discrete idea into each submitted post. Afterward, 12 trained raters split into six pairs, and each pair rated a different subset of ideas for novelty on a 1–5 scale (1 = *common, low novelty idea*; 5 = *rare, high novelty idea*). The intraclass correlation coefficients, *ICC*(1, *k*), for the six pairs ranged from .73–.93. Thus, interrater reliability ranged from good to excellent.

Analysis

Because this was not a true experimental design in which top performers were determined before sessions, analyses concerning top performers and dyad/group composition were conducted after all sessions were complete. To determine the top performer in each experimental session, we assessed individual performance across the four dyad sessions. The person who generated the highest number of ideas across the four dyad sessions was deemed a top performer. There were two different kinds of top performers, the *number "star"* and the person whose ideas had the highest average novelty across the four dyad sessions was the *novelty "star."* Because there were always two concurrent groups at a time, and each star could only be a member of one of the two, half of all groups included a number star and half did not; similarly, half of all groups included a novelty star and half did not.[3] Table 2 presents the number and novelty stars' performance during the group sessions relative to the other group members.

We coded the two concurrent groups within the two group sessions as either containing or not containing the *number star*, and then separately and independently as containing or not containing the *novelty star*. We thus assessed individual performance (in terms of both number of ideas and novelty) in the group sessions based on the presence or absence of a star performer. Note that in each analysis, the data for the relevant number or novelty stars are excluded so that the effect of the presence of stars in a group is only considered for nonstar group members. Because each individual participated in two group sessions with different group members in each, there is a nested structure to the data. Accordingly, we used multilevel models to determine the impact of top performers on group members' performance, taking into account the two-level structure of the data (each participant at the top, Level 2, and the repeated measure of each participant's two group sessions at the lower, Level 1).[4]

For each of the two variables of interest (number of ideas and novelty), we generated a "base" model with several participant-level (Level 2) variables that typically predict idea generation performance, including fluency, openness to experience, extraversion, and need for cognition (Coursey et al., 2018), as well as each participant's own prior performance during the dyad sessions. We then added to this base model additional hypothesized predictors of interest (e.g., the presence/absence of the star performer) to determine if these variables were able to predict performance above and beyond the standard ability and individual difference metrics. All data and code for analysis are available at the Open Science Framework (OSF).

Table 2
Individual Performance During the Group Task for Top Performers Versus Other Group Members

Group member type	*n*	Number of ideas *M* (*SD*)	Average novelty *M* (*SD*)
Top ideas performer	21	18.20 (7.18)	2.57 (0.81)
Other group members	147	11.10 (5.73)	2.36 (0.78)
Top novelty performer	21	14.20 (5.86)	2.64 (0.81)
Other group members	147	11.70 (6.38)	2.35 (0.78)

Results

Number of Ideas

As described above, the base model predictors included each individual's fluency, need for cognition, openness to experience, and extraversion scores, as well as the average number of ideas generated by that individual during the dyad sessions. The model also allows a varying intercept for each participant. We fit multilevel models for counts using the glmmTMB package in *R* (Brooks et al., 2017; R Core Team, 2019; see online supplementary material for details).

Presence of Number "Star"

To assess Hypotheses 1a and 1b, we added to the base model a Level 1 predictor indicating the presence/absence of the number star in each group session. Both the likelihood ratio test (LRT) and Akaike's information criterion (AIC) indicated that this addition improved the model (see Table 3), with the evidence ratio indicating the more complex model was 3.41 times more likely than the base. The presence of a number star in the group predicts a 9.5% increase in ideas generated by each other individual during that group session (see Table 4), contrary to Hypothesis 1b and supporting Hypothesis 1a.

Discrepancy Interaction Effect

To assess Hypotheses 2a and 2b, we first computed for each individual a discrepancy score—the difference between the number star's and each individual's average number of ideas in the dyad sessions; a larger number indicates a larger discrepancy. We added this discrepancy score and an interaction term between the discrepancy and the presence/absence of the number star (see Table 5), which further improved the model (see Table 3; the more complex model was 4.36 times more likely). Figure 2 shows the nature of the predicted interaction effect. Consistent with Hypothesis 2a, but inconsistent with Hypothesis 2b, individuals with larger discrepancy scores (their performance in the dyads was considerably lower than that of the number star's) are predicted to perform much better in the group sessions if a number star is present.

[3] Because there were two types of star performers, determined after the fact, it was possible that both types of stars could be present in the same group (in fact, in six of the 21 experimental sessions, the number star and the novelty star were the same person). This occurred in 30% (25/84) of the groups. Thirty percent (25/84) of our groups had no top performer (ideas or novelty), and 40% (34/84) of the groups had one but not the other.

[4] Note this structure differs from the typical multilevel model used in behavioral experiments where Level 2 is the overall effect and Level 1 is individuals.

Table 3
Estimates of Fixed Effects for Model 1 Predicting the Number of Ideas Generated During the Group Sessions

Predictor	Estimate (IRR)	95% CI (IRR)	Estimate (Linear, at Mean)	95% CI (Linear, at Mean)
Fluency	1.02	[1.01, 1.04]	0.24	[0.06, 0.43]
Need for cognition	1.00	[1.00, 1.00]	0.00	[−0.05, 0.05]
Openness to experience	1.06	[0.94, 1.20]	0.72	[−0.64, 2.25]
Extraversion	0.96	[0.90, 1.03]	−0.44	[−1.13, 0.30]
Prior dyad performance	1.14	[1.11, 1.17]	1.58	[1.26, 1.92]
Top performer presence	1.10	[1.01, 1.19]	1.06	[0.07, 2.13]

Note. The model coefficients are incidence rate ratios (IRR). The corresponding linear estimate (number of additional ideas predicted for a one-unit increase in the predictor) at the mean value is also provided.

Novelty

We conducted similar analyses to predict average novelty of ideas during the group sessions. As before, we started with a base multilevel model that included each individual's fluency, need for cognition, openness to experience, and extraversion as predictors, and allowed a varying intercept for each participant. Prior performance did not meaningfully improve model fit and thus was not included (see online supplementary materials).

Presence of Novelty "Star"—Impact on Novelty

To assess Hypothesis 3, we added the Level 1 predictor of whether or not the novelty star was present in the individual's group. These models did not statistically differ (see Table 6). Hypothesis 3 was not supported.

Discrepancy Interaction Effect

To assess Hypothesis 4, we again computed a discrepancy score for each individual, this time representing the difference between the novelty star's and each individual's average novelty of ideas in the dyad sessions. Adding this discrepancy score and the interaction with the presence/absence of the novelty star did not improve the model (see Table 6). Hypothesis 4 was not supported.

Presence of Novelty "Star"—Impact on Number of Ideas

To assess Hypothesis 5 (impact of the novelty star on the *number of ideas*), we constructed a new model for predicting number of ideas. In this dataset, the novelty star, rather than the number star, was excluded from analysis. Including the presence/absence of the novelty star did improve the base model for predicting number of ideas (see Table 7). Supporting Hypothesis 5, the presence of a *novelty* star in the group predicts a 7.2% increase in ideas generated by each individual during that group session (see Table 8).

Discussion

Our results indicate that the presence of a top performer in idea generation groups has a positive effect on the performance of the other group members over and above other predictors. Both number stars and novelty stars enhanced the number of ideas generated by the other group members. Supporting Hypothesis 1a (and contra Hypothesis 1b), the presence of a number star in the group predicted a higher number of ideas generated by each other group member, over and above what was predicted by personality, ability, and prior performance variables. Supporting Hypothesis 2a (and contra Hypothesis 2b), larger discrepancies between number stars and the other group members predicted an increase in the number of ideas generated in the stars' presence, but a decrease in their absence. Hypothesis 3—that the presence of novelty stars would stimulate greater novelty in other group members—was not supported. Hypothesis 4 was also not supported: greater discrepancies between the novelty of group members and the novelty star did not predict greater novelty in group members' ideas. However, the presence of novelty stars did facilitate a greater number of ideas in other group members, supporting Hypothesis 5.

Our findings, showing the positive effects of the number star, are consistent with a motivational perspective (Paulus & Dzindolet, 2008). The presence of such a performer in the group appears

Table 4
Estimates of Fixed Effects, Given as IRRs and as Linear Estimates at the Mean, for Model 2 Predicting the Number of Ideas Generated During the Group Sessions

Predictor	Estimate (IRR)	95% CI (IRR)	Estimate (Linear, at Mean)	95% CI (Linear, at Mean)
Fluency	1.02	[1.01, 1.04]	0.25	[0.07, 0.43]
Need for cognition	1.00	[1.00, 1.00]	0.00	[−0.04, 0.05]
Openness to experience	1.05	[0.93, 1.19]	0.60	[−0.73, 2.09]
Extraversion	0.96	[0.90, 1.02]	−0.49	[−1.16, 0.23]
Prior dyad performance	1.14	[1.11, 1.17]	1.53	[1.21, 1.86]
Top performer presence	0.95	[0.82, 1.11]	−0.53	[−2.02, 1.20]
Discrepancy score	0.98	[0.96, 1.00]	−0.27	[−0.48, −0.05]
Discrepancy × Top Performer	1.03	[1.00, 1.05]	0.31	[0.03, 0.60]

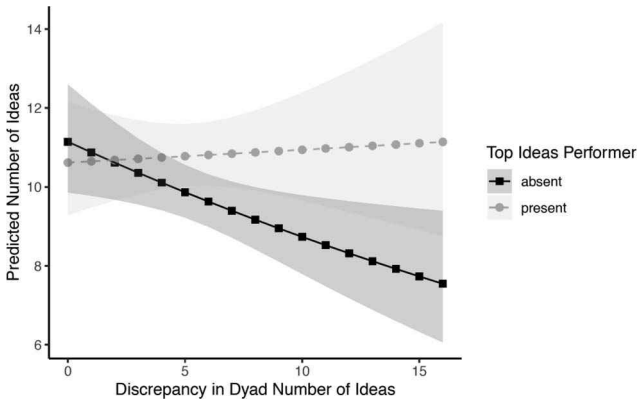
Note. IRR = incidence rate ratios.

Table 5
Akaike Information Criterion (AIC) Values and Goodness-of-Fit Likelihood Ratio Test (LRT) Statistics for Models Predicting Number of Ideas Generated During the Group Sessions

Model (Predicting number of ideas)	Number of predictors	AIC	Δ AIC	χ^2	*p*
0) Base	8	1485.64	—	—	
1) + Top ideas performer presence	9	1483.19	−2.45	4.45	0.03
2) + Ideas discrepancy and interaction	11	1480.24	−2.94	6.94	0.03

to motivate higher levels of performance in others. This motivation could be based on feelings of competition or self-evaluation concerns. The positive impact of the high novelty performer suggests that cognitive processes may also play a role. That is, the highly novel ideas generated by the top performer may have primed additional categories of ideas in the other group members that would not otherwise be considered, thereby increasing the number of ideas generated. The lack of evidence for an effect of the high novelty performer and the degree of novelty discrepancy on the novelty of other group members' ideas may reflect the fact that such an outcome would require a deeper level of information processing. Participants had the challenging task of generating ideas while they were also monitoring the ideas of the other group members. A high number star should be more easily evident than a high novelty star. One does not have to process the content of the ideas of the number star to know that this person is generating a high number of ideas. To know that a person's idea is novel requires careful processing and evaluation of that idea. The fact that the high novel performer was associated with an increase in the number of ideas generated by the other indicates that there was some degree of processing of this element of the shared ideas. However, a major factor in increased novelty of ideas in collaborative contexts is the degree of elaboration of shared ideas (Kearney & Gebert, 2009; Kearney et al., 2009; van Knippenberg, 2017). This will typically require longer sessions in which reflection on shared ideas is more feasible, such as sessions in which participants interact over the course of days or have a separate opportunity to build on the previously generated ideas (Coursey et al., 2020; Kohn et al., 2011).

Figure 2
Predicted Interaction Effect for Discrepancy and Presence of Top Performer on Number of Ideas Generated in the Group Sessions. Shaded Areas for Each Group Represent 95% Confidence Intervals for the Predicted Values



The fact that the degree of discrepancy between the top performer and the remaining group members in terms on number of ideas generated in the prior sessions is related to the performance of the other group members has important theoretical implications. One reading of social comparison theory suggests that moderate discrepancies should have more impact than large ones (Festinger, 1954; Seta, 1982). However, we found that greater discrepancies led to greater increases in performance supporting the positive interaction effect posited in Hypothesis 2a. This pattern of results is more consistent with a competition perspective or self-esteem protection perspective. However, we did not assess feelings of competition or motivation during the group performance (although self-perceptions in such performance settings have typically not been particularly informative; e.g., Reiter-Palmon et al., 2012), so this is speculative. Future research on this topic might manipulate the salience or magnitude of discrepancies between top performers and others and might also attempt to measure some of the theoretical variables involved.

The results of this study are remarkable given the general findings in the group task performance literature. The social loafing and free rider literatures suggest that the presence of a high performer may reduce motivation of the other group members and thus reduce their performance (Karau & Williams, 1993; Kerr & Bruun, 1983). The literature on the Köhler effect suggests that the increase in performance of a lower performer occurs under very specific conditions (e.g., conjunctive tasks). Research on electronic brainstorming has found that large groups of eight or more will generate more ideas per person than small groups (DeRosa et al., 2007). However, we found facilitative effects of a high performer in an electronic paradigm with groups of four. Moreover, the electronic brainstorming literature has not demonstrated benefits of exposure to highly novel ideas (e.g., Connolly et al., 1993).

Limitations and Future Directions

Our study is the first to demonstrate the beneficial effects of top performers under controlled conditions, and the findings are consistent with prior research demonstrating the positive impact of new high performing members in idea-generating groups (Choi & Thompson, 2005). However, there is a need to discover relevant factors that will influence the effect of top performers in both controlled laboratory and field settings. The benefits, lack thereof, and even possibility of negative effects for top performers are likely to depend on a range of factors. The idea generation paradigm may be ideally suited for the demonstration of this effect because it can benefit from both motivational and cognitive ele-

Table 6
Akaike Information Criterion (AIC) and Goodness-of-Fit Likelihood Ratio Test (LRT) Statistics for Models Predicting Novelty of Ideas Generated During the Group Sessions

Model (Predicting novelty of ideas)	Number of predictors	AIC	Δ AIC	χ^2	*p*
0) Base	7	630.68	—	—	
1) + Top novelty performer presence	8	632.51	+ 1.83	0.17	0.68
2) + Novelty discrepancy and interaction	10	635.68	+ 5.00	1.00	0.80

ments. However, research on the Köhler effect suggests that performance enhancements for inferior performers in groups may also occur on other types of tasks such as physical tasks, and especially conjunctive tasks. The effect of top performers on fellow group members should be most evident on ego-relevant tasks—tasks on which team members compare themselves to others or on which they value high levels of performance (Groysberg & Lee, 2009).

The salience of the top performer role (either discovered as in this study or known prior to the task performance session) is also likely to have an impact on the performance of the other group members. The increased salience could motivate more competitive efforts or could lead to a lowering of efforts depending on the degree of discrepancy. Social comparison theory suggests that if the participant believes the discrepancy is small, there may be increased motivation. However, if the perception of discrepancy is large, there may be a reduced level of motivation (Festinger, 1954; Seta, 1982). In our methodology, participants were able to observe the relative contributions of their counterparts, but performance differences were not highlighted explicitly, as in a leaderboard, for example. Adding a more salient indicator of top performers' identities may have an impact on how their presence affects fellow group members.

We did not find any statistical gender differences in this study, but research on the Köhler effect suggests that there could be gender differences in future studies of this phenomenon (Kerr et al., 2007). It may also be of interest to examine the role of diversity discrepancies between the top performer and the other group members. If the top performer is an outgroup member or differs along some ego-relevant dimension such as ethnicity, race or nationality, there may be enhanced motivation to increase one's performance (Lount & Phillips, 2007).

The present study employed an electronic idea exchange platform that allowed participants to generate ideas freely. In face-to-face sessions, the positive impact of the top performer will be limited because there is less opportunity for others to perform and the top performer may block others from expressing their ideas. However, a positive impact of exposure to a top performer could be evident in subsequent solitary idea generation sessions (Korde & Paulus, 2017).

One limitation of our study is that we did not have detailed assessments of group members' feelings concerning their experience. Such subjective assessments have been found useful in survey studies or longer-term studies. However, in our experience participant self-reports in short-term task performance situations are not particularly informative (e.g., Nisbett & Wilson, 1977). In these contexts, attention is focused on the task and it may be difficult to retrospectively evaluate one's feelings (e.g., competition, social comparison) during that time. In future studies using longer-term settings involving multiple experiences, the personal feelings generated are likely to be more valid reflections of the experience.

Our study involved a short-term task setting, but observations in sports teams and work settings also suggest the potential positive impact of top performers. The one study that examined the Köhler effect in sports (Osborn et al., 2012) found that relative low performers show enhanced performance in the final relays. In work settings the dynamics may be more complex depending on the relationships among the group members and their past interactions. In a positive environment that encourages friendly competition and provides psychological safety, top performers can facilitate overall collaborative innovation. However, the relationship of the top performer to the other group members may moderate this relationship. If this star plays a role of encouraging and mentoring creativity in others, it can enhance the creative performance of the other team members (Hooker et al., 2003). If instead the top performer is primarily driven by feelings of superiority or ego gratification, this person is not likely to have a positive impact on the creative efforts of the team members.

Conclusions

We found a facilitative impact of top performers on an idea generation task; this task type may be particularly suited for demonstrating such a positive impact (e.g., Choi & Thompson,

Table 7
Akaike Information Criterion (AIC) and Goodness-of-Fit Likelihood Ratio Test (LRT) Statistics Comparing the Base Model for Predicting Number of Ideas With a Model Including the Presence of a top Novelty Performer as a Predictor

Model (Predicting number of ideas)	Number of predictors	AIC	Δ AIC	χ^2	*p*
0a) Base	7	1516.82	—	—	
1a) + Top novelty performer presence	8	1514.91	−1.91	3.91	0.048

Table 8

Estimates of Fixed Effects, Given as IRRs and as Linear Estimates at the Mean, for Model 1a Predicting the Number of Ideas Generated During the Group Sessions, Using the Presence of a Top Novelty Performer as a Predictor

Predictor	Estimate (IRR)	95% CI (IRR)	Estimate (Linear, at Mean)	95% CI (Linear, at Mean)
Fluency	1.02	[1.00, 1.04]	0.21	[0.01, 0.41]
Need for cognition	1.00	[1.00, 1.01]	0.02	[−0.04, 0.07]
Openness to experience	1.07	[0.94, 1.21]	0.76	[−0.73, 2.46]
Extraversion	0.97	[0.90, 1.04]	−0.35	[−1.14, 0.49]
Prior dyad performance	1.11	[1.08, 1.13]	1.25	[0.98, 1.53]
Top n*ovelty* performer presence	1.07	[1.00, 1.15]	0.84	[0.01, 1.73]

Note. IRR = incidence rate ratios.

2005). It will be important to examine this type of impact on other types of tasks. Research on the Köhler effect and related theoretical perspectives suggest that this effect should occur on a wide range of tasks. Our study and the Choi and Thompson (2005) study employed a paradigm that involved changes in group composition. Top performers may be more salient in this type of context. Our study involved brief tasks in a short-term setting. It will be of interest to examine this type of issue in longer-term settings, including tasks in real-world environments. If top performers have task-generalizable and persistent positive impacts, they have the potential to boost individual performance for challenging tasks executed in complex environments such as academia, industry, and the military.

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