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Cues of working together fuel intrinsic motivation ☆

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HIGHLIGHTS

- A defining aspect of human society is that people work together toward common ends.
- Five experiments examined cues that evoke a psychological state of working together.
- As hypothesized, these cues increased intrinsic motivation as people worked alone.
- Outcomes were diverse, e.g., task persistence, enjoyment and, 1–2 weeks later, choice.
- These cues also increased feelings of working together but not other processes.

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ABSTRACT

What psychological mechanisms facilitate social coordination and cooperation? The present research examined the hypothesis that social cues that signal an invitation to work with others can fuel intrinsic motivation even when people work alone. Holding constant other factors, participants exposed to cues of working together persisted longer on a challenging task (Experiments 1 and 3), expressed greater interest in and enjoyment of the task (Experiments 1, 3, and 5), required less self-regulatory effort to persist on the task (Experiment 2), became more engrossed in and performed better on the task (Experiment 4), and, when encouraged to link this motivation to their values and self-concept, chose to do more related tasks in an unconnected setting 1–2 weeks later (Experiment 5). The results suggest that cues of working together can inspire intrinsic motivation, turning work into play. The discussion addresses the social–relational bases of motivation and implications for the self and application.

An important quality of human society is that people work together in socially coordinated and cooperative ways. To organize a government, to build a business, to develop a scientific theory, or to create a new technology often requires the efforts of many people devoted to a common objective. The importance of coordinated social action for cultural innovation and change and for human welfare in general suggests that people may have psychological mechanisms that facilitate the coordination of individuals' motivation and behavior. Understanding these mechanisms is an important subject of research (Bratman, 1992; Tomasello, Carpenter, Call, Behne, & Moll, 2005; Walton & Cohen, 2011).

The present research explored the hypothesis that social cues that signal an invitation or an opportunity to work with others can inspire intrinsic motivation, leading people to work hard on difficult tasks for their "inherent satisfactions" even in the absence of external pressure or reward (Ryan & Deci, 2000a, p. 56). Cues of working together can function, we theorize, like social glue. They create social contexts that bring people together to put forth sustained effort on common or related tasks.

A feeling of working together arises, we hypothesize, not so much from social structures, such as when people work together physically or share outcomes, but from cues that signal an invitation to work together with another person or group or that signal that others treat you as though you are working together. This hypothesis draws in part on theorizing that the power of situations lies in their psychological construal or meaning (Ross & Nisbett, 1991). As a consequence, people may experience a feeling of working together—that is, of jointly engaging around a common task or objective—even when they work alone.

Suppose you and a colleague are each writing a paper about a new scientific finding. Perhaps you are part of an informal writing group and you exchange thoughts or strategies and mutual expressions of goodwill. If so, your writing might come to feel like a task done together. This feeling of working together may arise even if you and your colleague are each responsible for your own paper and you write in different offices for different outlets. Alternately, even if you wrote in the same room or, indeed, even if you coauthored a paper but without positive task-related exchanges, your writing could feel separate from your

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colleague's—a personal task completed in parallel to but separately from that of another person.

The present research isolates *cues of working together*—not necessarily working jointly with another person on a specific problem and not necessarily sharing outcomes, but cues that evoke a feeling of joint engagement with well-dispositioned others as one pursues common tasks or objectives. We compare cues of working together to *cues of working in parallel to others*—cues that lead people to feel they are working at the same time on the same task as others but without a sense of togetherness. We propose that cues of working together turn work into play, leading people to become more interested in challenging tasks and thus to persist longer on them, to enjoy them more, to require less self-regulatory effort to persist on them, and to become more absorbed in, to perform better on, and to choose to complete more of these tasks.

How social settings affect motivation and performance is a classic question in psychology. One of the first studies in the field found that cyclists biked faster in head-to-head races than in time trials (Triplett, 1898). Subsequent research shows that working in the presence of others (*social facilitation*, Zajonc, 1965), observing the performance of others (*social comparison*, Kerr et al., 2007), having pooled outcomes (*social loafing*, Karau & Williams, 1993), and knowing that one's outcomes could be undermined by the incompetence of others (*compensatory motivation*, Williams & Karau, 1991) reliably affect people's effort and motivation. This past research maps ways the structural aspects of groups affect motivation with a primary emphasis on extrinsic motivation—the drive to work hard because of external rewards or pressure. Complementing this work, the present research investigates symbolic social cues that foster a feeling of working with others. Such cues, we hypothesized, can inspire intrinsic motivation—the motivation to work hard on tasks for their own sake, which can sustain people's effort over time and facilitate greater growth and learning (Ryan & Deci, 2000a). If even symbolic cues of working together fuel intrinsic motivation, this mechanism could enhance motivation and social coordination not only when people are physically together or cooperate to solve a specific problem but also when people work independently bound only by a feeling of working together as they tackle common or related problems.

Why would cues of working together fuel intrinsic motivation? Working with others affords humans many advantages. It can facilitate social bonds (Baumeister & Leary, 1995) and help people accomplish goals that would be out of reach of any one individual working alone (Asch, 1952). Thus, a capacity to work with others and a mechanism that facilitates motivation for tasks that feel as though they are done together could confer many benefits to individuals and their communities (Tomasello et al., 2005; Vygotsky, 1978; Walton & Cohen, 2011).

Consistent with this reasoning, people have a variety of social, cognitive, and neurological qualities that support the capacity to work together. These include cognitive mechanisms that facilitate joint attention and shared task representations (Sebanz, Bekkering, & Knoblich, 2006), neural networks that represent the intentions of both others and the self (Iacoboni et al., 2005), and a tendency to "tune" behaviors and attitudes to those of others (Sinclair, Lowery, Hardin, & Colangelo, 2005). Further, specific brain regions seem to be devoted to representing triadic relationships between the self, others, and a task (Saxe, 2006).

Are people, however, motivated by the opportunity to work with others? Some research suggests this possibility. Early in life infants and young children eagerly take part in tasks with adults. They prod adults who have stopped participating in activities with them to reengage (Carpenter, Tomasello, & Striano, 2005; Moore & Dunham, 1995; Ross & Lollis, 1987; Warneken, Chen, & Tomasello, 2006), spontaneously help adults (Warneken & Tomasello, 2006), and mimic adults' intentions (Meltzoff, 1995). Some scholars theorize that these findings reflect an early manifesting drive in humans "to participate with others in collaborative activities with shared goals and intentions" (i.e., *shared intentionality*; Tomasello et al., 2005, p. 675; see also Warneken et al., 2006). These studies, however, do not isolate children's task motivation in the absence of adults; hence it could be that children are motivated to engage in positive interactions with caregivers but do not develop shared task-related goals. Consistent with our theorizing, however, one study found that just representing a challenging puzzle to preschoolers as done with another child instead of as done separately or in turns increased children's persistence on and liking for the puzzle as they worked on it on their own (Butler & Walton, 2013). Research thus suggests that young children are responsive to and motivated by opportunities to do tasks with others.

Working with others can also have motivational benefits among adults, at least in some circumstances (cf. Karau & Williams, 1993). Most directly relevant to the present research, Sansone and colleagues have shown that working with or alongside a peer can increase interest in a complex task and motivation to pursue related activities in the future, especially for people high in interpersonal orientation (Isaac, Sansonse, & Smith, 1999). In addition, talking with responsive peers about a task or course (Thoman, Sansone, Fraughton, & Pasupathi, 2012; Thoman, Sansone, & Pasupathi, 2007) and participating in cooperative work and learning groups (Aronson & Osherow, 1980; Johnson & Johnson, 2009; Mitchell, 1993; Muldner, Dybvig, Lam, & Chi, 2011; Palmer, 2009; Shteynberg & Apfelbaum, 2013) can increase interest and performance. In a self-regulation context, one standard behavior treatment to promote weight loss was more effective when people formed teams to support one another than when they did not (Wing & Jeffery, 1999; cf. Fitzsimons & Finkel, 2011). This past research describes ways people's experience working on tasks or toward goals changes when they work with others rather than alone, and how this can enhance motivation. Complementing this past work, the present research isolates symbolic cues that invite people to work together and tests their effects on motivation as people work alone. In doing so, we hold constant other factors, such as pressure from a friend, the physical presence of others, exposure to role models, and opportunities for scaffolding afforded by observing and interacting with others.

The hypothesis that symbolic cues of working together can fuel intrinsic motivation extends past research on interest and motivation. Predominant theories emphasize that motivation arises from self-beliefs about competence, autonomy, and control (e.g., Bandura, 1997; Carver & Scheier, 2001; Dweck & Leggett, 1988; Ryan & Deci, 2000a, 2000b) and from situational factors that evoke these self-perceptions, such as proximal goals that facilitate the development of self-efficacy (Bandura & Schunk, 1981) and choice, personalization, and autonomy-supportive language that encourage people's personal involvement in a task (Cordova & Lepper, 1996; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004; see also Hidi & Renninger, 2006). Additionally, past research identifies features of tasks that can inspire interest, such as novelty and the use of technology (Mitchell, 1993; Palmer, 2009).

By contrast, the present research examines the perceived social–relational context as a source of motivation. Consistent with our approach, motivation is readily transmitted along social lines. For instance, mere exposure to another person can cause their goals to spread in an automatic fashion (Aarts, Gollwitzer, & Hassin, 2004), close relationship partners can prime people with goals associated with those partners (Fitzsimons & Bargh, 2003), and minimal cues of social connection, like a shared birthday with a math major, can cause people to internalize that person's goals and achievement motivation (Walton, Cohen, Cwir, & Spencer, 2012; see also Master & Walton, 2013; Shteynberg & Galinksy, 2011). The present research, however, examines not the transmission of goals and motivation from one person to another but whether motivation can arise collectively among people as a consequence of cues of working together.

Our hypothesis also complements recent research on culture, which shows that, in independent cultural contexts, appeals to work together can sometimes undermine motivation. Hamedani, Markus, and Fu (2013) found that priming interdependence, for instance with words

like *coordinate*, *accommodate*, *adjust*, *connect*, and *flexible*, undermined motivation among European Americans (but not Asian Americans) on challenging tasks (e.g., persistence on anagrams). Hamedani and colleagues argue that the independent self-concept prevalent among European Americans renders "appeals to act interdependently…inconsistent with Americans' chronic motivational orientation" (p. 190) and thus conclude that, "[M]otivating [European] Americans to take action for today's pressing societal challenges will be accomplished most effectively when people are encouraged to 'take charge' rather than to 'work together'" (p. 195; see also Sanchez-Burks, Nisbett, & Ybarra, 2000). In contrast to this past research, we hypothesized that cues of working together would enhance motivation both among European Americans and among people of other ethnicities. This hypothesis and our research testing it differs from Hamedani and colleagues research' in two subtle but important respects. Although we do not test these differences directly in the present research, they represent potentially important boundary conditions. First, whereas Hamedani and colleagues primed the concept or idea of interdependence and then assessed motivation on a subsequent task, the manipulations in the present studies were designed, instead, to serve as social invitations to participants to work with rather than separately from others on a challenging task. Second, although working together can take an interdependent form that may well clash with an independent self-concept, as when a need to accommodate to others is salient, we examine a form of working together that is consistent with an independent self-concept (see also Butler & Walton, 2013). Participants in our studies worked with a degree of choice or autonomy simply knowing that supportive, well-dispositioned others were working on the same or related task or problem. In this sense, symbolic cues that invite people to work together may give rise to a form of "optimal distinctiveness" in which people can feel similar to (working together with) and different from (working autonomously) others at the same time (Brewer, 1991). We hypothesized that this state of working together would enhance motivation among people from diverse backgrounds.

Overview of experiments

To isolate the effect of cues that signal an opportunity to work together, the studies strip away structural aspects of working in groups, which can affect alternative processes. All participants worked while physically alone on an individual task. All knew that others—strangers to them—were working on the same individual task. Participants were unaware of others' effort and progress and participants' own efforts and progress were not visible to other participants. As participants worked, we manipulated cues that signaled an opportunity to work together. Participants were told that the study investigated either "how people work on puzzles together" or "how people work on puzzles." Further, participants were told they would either write or receive a tip on the puzzle either to or from a peer working on the same task (designed to evoke a state of working together) or to or from the experimenter (designed to evoke a state of working in parallel to but not with others). After working on the puzzle for several minutes, all participants received a tip. The tip was identical for all participants but it was attributed either to another participant and written "From" him or her and "To" the participant or it was attributed to the experimenter and written "For" the participant. In representing the tip as a routine aspect of the study, we anticipated that this procedure would instantiate the experience of working with or separately from others without arousing alternative processes (cf. Nadler & Fisher, 1986).

In an effort to provide convergent evidence for effects on intrinsic motivation as opposed to effort or extrinsic motivation the studies assessed diverse behavioral and nonbehavioral outcomes. Experiment 1 examined (a) freely chosen persistence on a challenging task in the absence of external pressure and (b) self-reported interest in the task, important indices of intrinsic motivation (Deci, Koestner, & Ryan, 1999; Ryan & Deci, 2000a). Experiment 2 measured self-regulatory depletion after the task (Baumeister, Muraven, & Tice, 2000): If cues of working together increase participants' motivation for the task for its own sake, working hard on it should require less self-regulatory control, reducing the depletion of self-regulatory resources. Experiment 3 used four experimental conditions to compare the effect of cues of working together to other aspects of sociality (e.g., the mere presence of others) on freely chosen persistence and task interest. Experiment 4 tested whether cues of working together increase task engagement using a cognitive measure and, if so, whether greater engagement mediates better performance. Finally, Experiment 5 examined participants' spontaneous, free-response reports of enjoyment and intrinsic interest.

As the experiments held constant across conditions structural variables that affect extrinsic motivation, they also measured relevant variables—including participants' feelings of obligation to others and competition with others—to ensure they did not vary with the working-together manipulation. Instead, what was predicted to vary by condition was participants' feeling of working together.

The primary outcomes assessed participants' motivation for the task in the situation at hand—what interest theorists call "situational interest." This form of interest or motivation may or may not last over time or arise in other situations (see Hidi & Renninger, 2006). An important question involves whether the motivation elicited by cues of working together can generalize to other tasks in later situations, moving toward what interest theorists call "individual interest" (a "relatively enduring predisposition to reengage particular content over time"; Hidi & Renninger, 2006, p. 113). Because we hypothesized that cues of working together inspire people by changing their experience within a situation, we anticipated that such cues would not necessarily give rise to a more general or enduring motivation. However, drawing on past research, we hypothesized that this motivation could begin to generalize if people, in addition, had the opportunity to articulate the value the task held for them and to connect it to other aspects of their enduring self-concept (see Deci, Eghrari, Patrick, & Leone, 1994; Hidi & Renninger, 2006; Hulleman & Harackiewicz, 2009; Mitchell, 1993; Steele, 1997). We tested this hypothesis in Experiment 5 by manipulating a writing task participants completed after having worked on a challenging puzzle under working-together or control conditions. Then, in an unrelated context 1–2 weeks later, we used a free-choice measure (a classic measure of intrinsic motivation; Ryan & Deci, 2000a) to assess the extent to which participants' motivation for the laboratory puzzle endured and generalized to other challenging puzzles in this subsequent setting. Notably, this approach complements classic research, which examines how manipulations can enhance motivation on the same task over time (e.g., Lepper, Greene, & Nisbett, 1973). Experiment 5 tested whether participants' motivation for a given task generalized to affect their motivation for related tasks in a subsequent setting without working-together cues.

Experiment 1: Freely chosen task persistence

In Experiment 1, participants met in small groups and then separated to work on their own on a challenging (in fact, insoluble) puzzle. Participants were either told they were working on the puzzle "together" or not; and that they would either write a tip for or receive a tip from either another participant working on the puzzle or the experimenter. The primary outcome was how long participants persisted on the puzzle—an unobtrusive measure of intrinsic motivation as participants did not know that their persistence was assessed (Deci et al., 1999). In addition, because people can persist on tasks as a consequence of extrinsic motivations (e.g., feelings of obligation to others; Hertel, Kerr, & Messé, 2000), we also assessed participants' self-expressed reasons for working hard on the puzzle: because they (a) found it interesting and (b) felt obligated to others (Ryan & Deci, 2000a).

Method

Participants

Thirty-five college students (17 men, 18 women; 12 White, 17 Asian, 6 other/unidentified) participated in exchange for $10.[1]

Procedure

Three to 5 participants took part in each session. The experimenter was blind to hypotheses. No participant had previously met another participant in the same session. Participants met and introduced themselves to each other. (This equates for participants' identifiability, which can affect extrinsic motivation [Karau & Williams, 1993].) Participants then signed consent forms and were told that the study investigated puzzle solving and that they would each work on puzzles. Each participant was then escorted to an individual room where they were randomly assigned to condition. For the remainder of the study, all participants were physically alone, except when the experimenter delivered materials to them.

In the "psychologically together" condition, participants were told that the study investigated "how people work on puzzles together" and that they "and the other participants here today" would "each" work on "a puzzle called the map puzzle" (described below). Participants were told that, after working on the puzzle for several minutes, they would either be asked to write a tip for or would receive a tip from "another participant also working on the map puzzle" about it. The experimenter then explained the puzzle. Participants were invited to "take as much or as little time as you like" on the puzzle and told that they did "not have to complete the puzzle to move on with the rest of the tasks in the study." Participants were thus free to persist as long as they liked. They then started work. The experimenter left the room. Two-and-a-half minutes later, he or she returned and gave the participant a tip (described below) in a neutral manner ("Here's a tip one of the other participants here today wrote for you to help you as you work on the puzzle"). The tip was handwritten by the experimenter but presented as authored by another participant in the same session. In a space marked "To" the tip listed the participant's first name and in a space marked "From" it listed the first name of another participant in the session (see Fig. 1a).

The "psychologically separate" condition was identical in all respects except that the cues did not evoke a feeling of working together. The experimenter told participants that the research investigated "how people work on puzzles" and that they would "work on a puzzle called the map puzzle." The instructions implied that the other participants in the study were working on the same puzzle (this was made explicit in control conditions in Experiments 3–5). Participants were told that, after working on the puzzle for several minutes, they would either be asked to write a tip for or would receive a tip from "the experimenter" about the puzzle. The tip the experimenter gave the participant was again presented in a neutral manner ("Here's a tip we wrote for you to help you as you work on the puzzle") and handwritten by the experimenter. However, it was presented as authored by the experimenter. In a space marked "For," the experimenter had written the participant's first name (see Fig. 1b). The content of the tip was identical to that in the "psychologically together" condition.

This presentation of the tip holds constant alternative processes. The tip was described as a routine aspect of the study and participants were led to expect its receipt. Writing the tip was thus not a voluntary act on the part of the tip-writer and did not reflect a particular interest in the task, liking for the participant, or desire to communicate with or to help the participant. Participants in all conditions received the same tip from a present person, equating the social support they received. The content of the tip was not particularly helpful and did not imply that the other person was doing particularly well or poorly; it recounted an unsuccessful strategy for solving the puzzle. In addition, it was received early in the exercise and thus did not provide meaningful information about the other person's performance or perceptions of the participant's own progress.

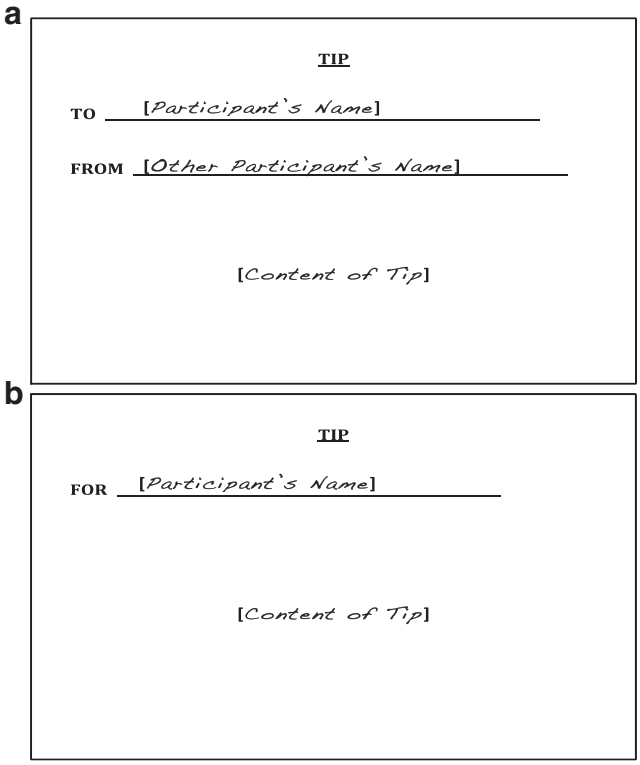

Fig. 1. The tip delivered in (a) the "psychologically together" condition and (b) the "psychologically separate" condition. The tip content varied as a function of whether the map puzzle (Experiments 1–3, 5) or the hidden objects puzzle (Experiment 4) was used but was identical across conditions within study.

In both conditions the procedure ensured that participants completed tasks that were individual in nature, minimizing extrinsic pressures examined in past research: All participants worked alone, in individual rooms, on an individual task labeled with their participant number. They placed their puzzle in an individual covered box when they finished; outcomes were not shared. These procedures mimic the working-alone control conditions used in past research (e.g., Karau & Williams, 1993). Instead, the manipulation precisely targeted cues that evoke a state of working together.

The insoluble puzzle and measure of intrinsic motivation

The primary outcome was *freely chosen persistence on an insoluble puzzle* in the absence of extrinsic pressure, a measure of intrinsic motivation (Deci et al., 1999; Walton et al., 2012). The puzzle, called "the map puzzle," was based on the 4-color theorem (Apple & Haken, 1977), which posits that no 2-dimensional map in which adjacent regions must be shaded in different colors requires more than four colors to complete. Participants were asked to create a map that would require five colors. In both conditions, the experimenter unobtrusively recorded how long participants persisted on the puzzle. Participants who had not stopped after 25 min were stopped then.

[1] Following past practice (Walton et al., 2012), systematic interviews were conducted at the end of each experiment using the puzzle featured in this study (the "map puzzle"; Experiments 1–3 and 5) to determine whether participants knew prior to the study that the puzzle was insoluble. This procedure led to the exclusion of a few participants in each study (three in Experiment 1; five each in Experiments 2 and 3; one in Experiment 5).

Puzzle tip

The tip in both conditions indicated that a pie-shaped map with 5 wedge-shaped regions that met in the center did not solve the puzzle.

Supplementary measures

After working on the puzzle, participants were asked the extent to which they had worked hard on the puzzle (1) because it was "interesting" and (2) because they "didn't want to let other people down" on separate 7-point scales (*1 = strongly disagree*, *7 = strongly agree*).[2]

Validation study

The cues used in the "psychologically together" condition in Experiment 1 were designed to evoke a construal and feeling of working together. To examine in more detail whether it had this effect and not other effects we asked a separate group of participants from the same population ($n = 45$) to imagine participating in Experiment 1. Detailed instructions described the exact experience of participants in either the "psychologically together" condition or the "psychologically separate" condition. In each case, participants saw an image of the handwritten tip participants in their condition in Experiment 1 received.[3]

First, to examine participants' construal of the social situation, we asked participants to write down "three thoughts you might share with a friend to describe what you did in the study" and "three thoughts about what the experience would be like for you." Two coders, blind to condition, coded whether these free-response descriptions referenced several categories relevant to the experience of working with or separately from others ($\kappa s \geq .87$; disagreements were resolved through discussion). There was no difference, overall, in the number of social references participants made by condition, $t < 1.25$, $p > .25$. However, participants showed the intended difference in construal. In the "psychologically together" condition, they referenced collaborating, developing relationships, and exchanging tips more; in the "psychologically separate" condition, they referenced working in parallel to others, receiving tips, and producing tips more. See Table 1.

We also examined participants' free-response reports for evidence of two possible alternative construals. Participants could wonder why they received the tip instead of being asked to write the tip. They might think they were seen as in need of help or that the tip-giver liked them (see Nadler & Fisher, 1986). On an *a priori* basis, these interpretations seemed unlikely, as the receipt of tips was described as a routine aspect of the study. As predicted, there were few references of either type in either condition (≤5%) with no difference by condition, $\chi^2(1)s < 1$.

Finally, participants completed scale items assessing their anticipated feelings working on the puzzle. As predicted, participants reported a greater feeling of working together in the "psychologically together" condition than in the "psychologically separate" condition but no difference by condition in their anticipated feelings of competition, obligation to others, and help and support from others (see Table 1). All 2 (between-subjects condition: "psychologically together" vs. "psychologically separate") × 2 (within-subjects measure: feeling of working together vs. other outcome) interactions were significant, $Fs \geq 8.00$, $ps < .01$.

These results suggest that, at least in this anticipated context, the manipulation created the predicted psychological effect. Participants in the "psychologically together" condition described working with others; those in the "psychologically separate" condition described working in parallel to others

Results

In Experiment 1 and in all subsequent studies, no primary analysis was moderated by participant gender, $Fs < 3.25$, $ps > .075$, or race-ethnicity (i.e., European American, Asian American, other), $Fs < 1$ (cf. Hamedani et al., 2013). Therefore analyses collapse across these demographic variables.

Freely chosen persistence

As displayed in Fig. 2a, participants freely persisted 48% longer on the insoluble map puzzle in the "psychologically together" condition ($M = 17$ min 3 s) than in the "psychologically separate" condition ($M = 11$ min 30 s), $t(30) = 2.42$, $p = .022$, $d = .89$.

Reasons for working hard

Consistent with an intrinsic-motivation account, participants reported that they had worked hard on the map puzzle because it was "interesting" more in the "psychologically together" condition ($M = 5.56$) than in the "psychologically separate" condition ($M = 4.64$), $t(30) = 2.88$, $p = .007$, $d = 1.07$. By contrast, if anything participants reported they had worked hard because they "didn't want to let other people down" less in the "psychologically together" condition ($M = 3.56$) than in the "psychologically separate" condition ($M = 4.43$), though this difference was not significant, $t(30) = 1.52$, $p = .14$, $d = .53$. The 2 (condition: "psychologically together" vs. "psychologically separate") × 2 (reason for working hard: interest vs. obligation) interaction was significant, $F(1, 30) = 8.53$, $p = .007$, $\eta_p^2 = .22$.

Discussion

In Experiment 1, symbolic cues that signaled an opportunity to work together led participants to persist 48% longer on a challenging puzzle and to report that they had worked hard on the puzzle because they found it interesting. By contrast, there was no evidence that the working-together manipulation induced feelings of obligation to others.

Experiment 2: Self-regulatory depletion

To provide convergent evidence that cues of working together inspire intrinsic motivation, Experiment 2 assessed self-regulatory depletion. A defining quality of intrinsic motivation is that it requires minimal self-regulatory efforts—it is what people want to do, not what they feel compelled to do (Ryan & Deci, 2000b). Thus, people who are intrinsically motivated should find effortful work less burdensome and suffer less depletion of self-regulatory resources (Baumeister et al., 2000). If, on the other hand, people feel obligated to work hard they may persist longer but exhibit greater self-regulatory depletion. In Experiment 2, participants were required to work on the map puzzle for 15 min—a period of time intermediate between the average persistence in the two conditions in Experiment 1. We then assessed participants' level of self-regulatory depletion. Participants in the "psychologically together" condition were predicted to exhibit less depletion.

Experiment 2 also addressed a potential alternative explanation. Perhaps cues of working-together lead participants to think about other people instead of to work hard on a challenging puzzle; in theory, this could reduce self-regulatory depletion. To examine this possibility, we counted the number of map regions participants drew while

[2] Each experiment also assessed individual-differences in extraversion (Buchanan, Johnson, & Goldberg, 2005); in no study did this variable moderate any of the primary results, $Fs < 1$.

[3] The validation study was conducted after Experiment 4. As a consequence, the "psychologically separate" condition was the version used in Experiments 3–5 rather than that used in Experiments 1 and 2 (i.e., it was not just implied but made explicit that others in the study were working on the same puzzle as the participant). For the same reason, the primary experiments have more limited measures assessing the felt experience of working together than the scale included in the validation study.

Table 1
Results of the Validation Study (reported in Experiment 1).

A. Free-response reports indicating participants' construal of the experience of doing the puzzle.

Coding category	Example statement(s)	Psychologically separate condition	Psychologically together condition	Statistical test
Total references to working separately	[Sum of categories 1–3]	1.15	0.60	$t(43) = 2.79, p = .008, d = .78$
1. Working in parallel ($\kappa = .91$)	"I did an individual puzzle while other people did the same puzzle"	20%	4%	$\chi^2(1) = 2.88, p = .090$
2. Receiving tips ($\kappa = 1.00$)	"Received a tip on what NOT to do to solve the puzzle"	85%	56%	$\chi^2(1) = 4.36, p = .037$
3. Producing tips ($\kappa = .87$)	"After a couple of minutes, you either got a tip or you wrote down a tip of your own"	10%	0%	$\chi^2(1) = 2.62, p = .11$
Total references to working together	[Sum of categories 4–6]	0.15	0.84	$t(43) = 3.38, p = .002, d = .91$
4. Collaborating ($\kappa = .91$)	"It might be fun trying to collaborate with an invisible partner to solve the problem by sending each other tips"	5%	32%	$\chi^2(1) = 5.06, p = .024$
5. Developing relationships ($\kappa = .91$)	"I know the name of the person who wrote the tip"; "I introduced myself"	0%	16%	$\chi^2(1) = 3.51, p = .061$
6. Exchanging tips ($\kappa = .96$)	"I might receive or give advice to others working on the same puzzle"; "Exchange tips with another participant'	10%	36%	$\chi^2(1) = 4.07, p = .044$

B. Likert-scales assessing participants' anticipated feelings doing the puzzle.

Scale	Sample item			
Feeling of working together	"I would feel like I am doing the puzzle together with the other participants" (5-items, $\alpha = .94$)	2.96 (.30)	4.31 (.30)	$t(43) = 3.15, p = .003, d = .97$
Feeling of competition	"I would feel like I was competing against the other participants" (5-items, $\alpha = .79$)	4.27 (.28)	3.96 (.22)	$t < 1$
Feeling of obligation to others	"I would feel obligated to work hard on the puzzle so as not to disappoint other people" (2-items, $\alpha = .89$)	4.28 (.41)	4.58 (.23)	$t < 1$
Feeling helped and supported by others	"I would feel like the person writing the tip was helpful" (3-items, $\alpha = .93$)	4.20 (.35)	4.28 (.27)	$t < 1$

Note. Standard errors are indicated in parentheses. Each scale item was assessed on a 7-point scale (*1 = strongly disagree*, *7 = strongly agree*). The full scales are available upon request.

attempting to solve the puzzle. If participants were less engaged, they should draw fewer regions. We also return to this issue in Experiment 4.

Method

Participants

Forty-three college students (21 men, 21 women, 1 unidentified; 14 White, 15 Asian, 14 other/unknown) participated in exchange for $10.[4]

Procedure

Participants were randomly assigned to the same "psychologically together" condition or "psychologically separate" condition used in Experiment 1. The procedure was identical to Experiment 1 with one modification: Participants were not asked to work on the puzzle for as long as they liked but "with your full effort and full attention for 15 min." After 15 min, the experimenter stopped participants and administered the dependent measures.

Measures of self-regulatory depletion

The primary indicator of intrinsic motivation was post-puzzle self-regulatory depletion as assessed by a computer-based Stroop task. This task requires the use of self-regulatory resources to inhibit the prepotent response of reading text. Participants responded to 48 trials, each consisting of a color word ("red," "blue," "green," or "yellow") displayed in 1 of 4 colors (red, blue, green or yellow). Participants were asked to indicate the color of the text in which the word appeared as quickly as possible by pressing a color-coded key. Half of the trials were incompatible (the word's semantic meaning and the color in which it was displayed were different) and half were compatible (the semantic meaning and display color were the same). The key outcome was Stroop interference: mean response time to incompatible trials minus mean response time to compatible trials. Incorrect trials and trials with latencies 3 standard deviations above the mean (<1%) were excluded.

As a secondary measure of self-regulatory depletion, we asked participants how "tired" they felt (*1 = not at all*, *7 = very*).

Manipulation check

Finally, we asked participants how much they felt they were "collaborating" with other participants (*1 = not at all*, *7 = very much*). Because in neither condition did participants actually collaborate, this item serves as a manipulation check rather than as a precise measure of feelings of working together (cf. Validation Study).

Results

Manipulation check

There was greater variance in the "psychologically together" condition, Levene's Test $F(1, 31) = 10.31$, $p = .003$, so the manipulation check was analyzed using a nonparametric Mann-Whitney test. As predicted, participants reported feeling that they were collaborating more in the "psychologically together" condition ($M = 2.50$, $SD = 1.38$) than in the "psychologically separate" condition ($M = 1.20$, $SD = .41$), $Z = 3.46$, $p < .001$. (The low means in both conditions presumably reflect the fact that no participants actually collaborated.)

[4] Four participants refused to persist for 15 min and so did not have the same potentially depleting experience as other participants (all "psychologically separate" condition) and one participant was drunk ("psychologically separate" condition). These participants were excluded from analyses.

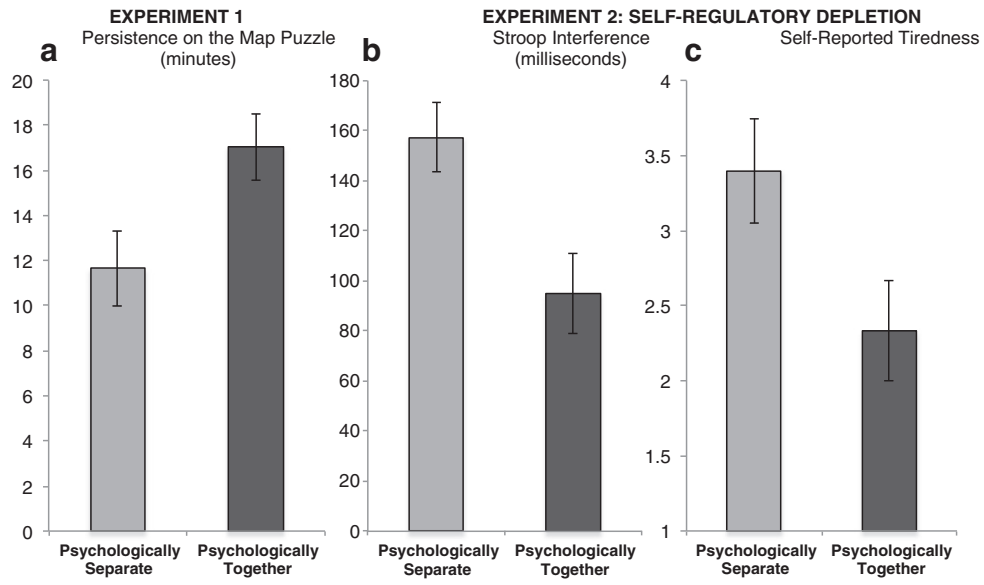

Fig. 2. (a) Persistence on the insoluble puzzle (in minutes) by condition in Experiment 1. Self-regulatory depletion in Experiment 2 after 15 min of persistence on the insoluble puzzle as assessed by (b) Stroop interference (in milliseconds; higher values indicate greater Stroop interference and greater depletion) and (c) self-reported tiredness. Error bars represent ±1 standard error.

Self-regulatory depletion

As predicted, participants showed less Stroop interference in the "psychologically together" condition ($M = 94.99$ ms) than in the "psychologically separate" condition ($M = 157.26$ ms), $t(31) = 2.88$, $p = .007$, $d = 1.04$.

The measure of felt tiredness showed the same pattern. Participants reported being less tired in the "psychologically together" condition ($M = 2.33$) than in the "psychologically separate" condition ($M = 3.40$), $t(31) = 2.20$, $p = .035$, $d = .80$. See Fig. 2b and c.

Number of attempted solutions to the map puzzle

Perhaps participants in the "psychologically together" condition showed less self-regulatory depletion because they worked less hard on the puzzle, not because they were more intrinsically motivated. If so, they should have drawn fewer map regions while working on the puzzle. This was not the case. If anything participants drew more map regions in the "psychologically together" condition ($M = 60.39$) than in the "psychologically separate" condition ($M = 50.07$), $t(31) = 1.46$, $p = .15$, $d = .53$. The results suggest that cues of working together may deepen task engagement. We pursue this hypothesis in Experiment 4.

Discussion

Participants exposed to cues of working together rather than in parallel to others suffered less self-regulatory depletion after having worked on a challenging puzzle for 15 min. Together Experiments 1 and 2 provide convergent evidence that cues of working together increase intrinsic motivation, increasing task persistence and making persistence less depleting.

Experiment 3: Are cues of working together a critical ingredient of sociality that increases motivation?

Are cues of working together transformative of motivation—do they produce a sharp boost in motivation—or just one step in a series of increasingly rich inductions of sociality, each of which increases motivation? Experiment 3 addressed this question using four conditions each of which successively increased the sociality of the task. Participants completed the puzzle after having been led to believe (1) that they were alone in the setting, (2) that others were present but working on different tasks, (3) that others were present and working on the same task as the self but in parallel to the self, or (4) that they were working with others.

The first three conditions differ from one another in important respects as shown in past research (e.g., mere presence of others, Zajonc, 1965; shared experience, Schachter, 1959; Shteynberg & Apfelbaum, 2013) but none represents a social invitation to work together that we suggest increases intrinsic motivation. So we expected the "psychologically together" condition to boost motivation above and beyond these conditions. As in Experiment 1, the primary outcome was freely chosen persistence. We also assessed participants' reasons for working hard on the puzzle and feelings of collaboration, as well as feelings of competition to ensure that the manipulation did not increase such feelings.

Method

Participants

Forty-two college students (19 men, 23 women; 18 White, 14 Asian, 10 other) participated in exchange for $10.[5]

Procedure

The procedure was identical to that of Experiment 1 but for the following modifications. Experimental sessions were randomly assigned to the "alone" condition or to the other three conditions. Participants in the "alone" condition never saw other participants. In this condition, up to 3 participants arrived for each session staggered 5 min apart so they would not meet. In the other three conditions, participants arrived in groups of 3 to 5, introduced themselves to each other, and signed consent forms together. However, unlike Experiments 1 and 2, participants were not told while they were together that they would each be working on puzzles. After meeting, participants in these conditions were directed to individual rooms where they were randomly assigned to

[5] Degrees of freedom vary slightly as some participants did not complete all measures.

condition. Thus, as previously, all participants in Experiment 3 worked on individual puzzles while physically alone without knowing of others' progress and without others knowing their progress. As in Experiment 1, participants worked on the puzzle for as long as they liked. Participants who had not stopped at 25 min were stopped then.

Experimental conditions

In the "alone" condition, participants were told that they would work on "the map puzzle." In the "mere-presence" condition, participants met the other participants in their session but were told once in their individual room that "everybody here today is doing different tasks" and "you will be doing the map puzzle." In the "shared-experience" condition, participants also met the other participants in their session but were told in their room that "each participant in the study" would work on "the same puzzle—the map puzzle." This condition was identical to the "psychologically separate" condition in Experiments 1 and 2 except that it was not just implied but said explicitly that all participants were working on the same puzzle. In each of these conditions participants were told that they would either write a tip for or receive a tip from the experimenter. After working on the puzzle for 2½ minutes, they received a tip from the experimenter. The content of the tip in each condition in Experiment 3 was identical to that in Experiments 1 and 2.

The "psychologically together" condition was identical to this condition in Experiments 1 and 2. Participants were told that they would work on the map puzzle "together," told they would write a tip for or receive a tip from another participant in the same session, and then received a tip attributed to another participant.

Dependent measures

As in Experiment 1, the primary measure of intrinsic motivation was freely chosen persistence on the insoluble map puzzle. The measure was positively skewed, $Z = 1.58$, $p = .11$, and so was subjected to a square-root transformation, which reduced skew to nonsignificance, $Z < 1$. For intuitive clarity, means are presented in the original metric.

After the puzzle, participants reported the extent to which they had worked hard on it because they (1) found it "interesting" and (2) "didn't want to let other people down." Finally, manipulation checks assessed the extent to which participants felt they were (3) "collaborating" and taking part in a "joint endeavor" with other participants ($r = .76$, $p < .001$) and (4) "competing with" and wanted "to do better than" other participants ($r = .74$, $p < .001$). All measures were assessed on 7-point scales (1 = *not at all*, 7 = *very much*).[6]

Results

We predicted that the "alone," "mere-presence," and "shared-experience" conditions (hereafter called the "psychologically separate" conditions) would not differ from one another but would differ from the "psychologically together" condition. Therefore, we first tested for differences among the former conditions and second for differences between these conditions and the "psychologically together" condition.

Manipulation checks

There was no condition difference in the variance in either measure, $Fs < 1$, so data were analyzed in t-tests and ANOVAs.

[6] We also included a series of measures to ensure that the social context created in each condition was believed by participants, for instance that participants in the "mere-presence" condition thought that others were present but working on different tasks. Analyses confirmed that the manipulations were effective. Measures and results are available upon request.

Analysis of the collaboration measure yielded no difference among the "alone" ($M = 1.31$), "mere-presence" ($M = 1.45$), and "shared-experience" ($M = 1.13$) conditions, $ts < 1$. However, replicating the Validation Study and Experiment 2, participants reported they were collaborating more in the "psychologically together" condition ($M = 1.85$) than in the "psychologically separate" conditions ($M = 1.31$), $t(39) = 2.15$, $p = .038$, $d = .74$. The pair-wise contrast was marginal with the "alone" condition, $t(37) = 1.83$, $p = .075$; nonsignificant with the "mere-presence" condition, $t(37) = 1.27$, $p = .21$; and significant with the "shared-experience" condition, $t(37) = 2.17$, $p = .037$.

Participants tended to perceive less competition in the "alone" condition ($M = 2.19$) as compared to the "mere-presence" condition ($M = 3.20$), $t(37) = 1.46$, $p = .15$, and the "shared-experience" condition ($M = 3.50$), $t(37) = 1.78$, $p = .084$. However, replicating the Validation Study, feelings of competition were not elevated in the "psychologically together" condition ($M = 3.05$) relative to the three "psychologically separate" conditions combined ($M = 2.85$), $t < 1$, or to any tested separately, $ts < 1.25$, $ps > .20$.

Freely chosen persistence

Participants' persistence on the insoluble puzzle in the "alone" ($M =$ 11 min 18 s), "mere-presence" ($M = 9$ min 53 s) and "shared-experience" ($M = 10$ min 48 s) conditions did not differ, $ts \leq 1$. However, participants persisted 64% longer ($M = 17$ min 37 s) in the "psychologically together" condition than in the three "psychologically separate" conditions combined ($M = 10$ min 44 s), $t(40) = 3.02$, $p = .004$, $d = 1.00$. Each pair-wise contrast was significant, $ts > 2.20$, $ps < .035$, $ds > .90$. See Fig. 3.

Reasons for working hard

Participants' reports that they worked hard on the puzzle because it was "interesting" did not differ across the "alone" ($M = 4.50$), "mere-presence" ($M = 4.70$), and "shared-experience" ($M = 4.38$) conditions, $ts < 1$. Replicating Experiment 1, participants reported working hard on the puzzle because it was "interesting" more in the "psychologically together" condition ($M = 5.60$) than in the "psychological-separate" conditions ($M = 4.53$), $t(40) = 2.26$, $p = .030$, $d = .82$. The pair-wise contrast was marginal with the "alone" condition, $t(38) = 1.99$, $p = .054$; a trend with the "mere-presence" condition, $t(38) = 1.51$, $p = .14$; and marginal with the "shared-experience" condition, $t(38) = 1.92$, $p = .062$.

Participants' reports of working hard out of a sense of obligation yielded no differences across the "alone" ($M = 3.50$), "mere-presence" ($M = 2.90$), and "shared-experience" ($M = 2.88$) conditions, $ts < 1.05$.

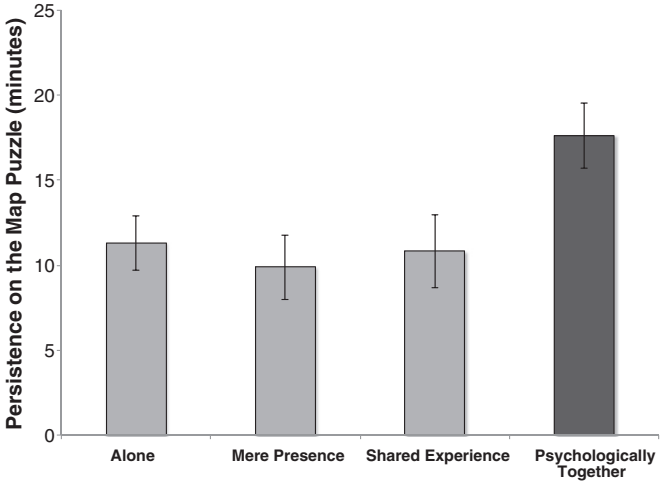

Fig. 3. Persistence on the insoluble puzzle (in minutes) by condition in Experiment 3. Error bars represent ±1 standard error.

The "psychologically together" condition ($M = 2.80$) did not differ from the three "psychologically separate" conditions combined ($M = 3.16$), $t < 1$, or to any tested separately $ts < 1.15$.

Discussion

In Experiment 3, cues of working together again caused participants to work substantially longer on a challenging puzzle (here, 64% longer) and to report to a greater extent that they had worked hard on the puzzle because they found it interesting. These effects were found relative to three control conditions in which participants believed themselves to be participating alone, to be in the presence of others working on different tasks, and to be working on the same task as others but in parallel to rather than with them. Although more subtle differences could emerge with larger samples, the fact that none of these conditions had any effect suggests that cues of working together are a transformative aspect of sociality that increases intrinsic motivation.

Experiment 4: Task attention and performance

In Experiments 1–3, cues of working together, compared to cues of working in parallel to others, increased freely chosen task persistence and reported task interest and decreased self-regulatory depletion. Does an invitation to work together also lead people to become more engrossed in tasks and to perform better on them?

To examine this question, Experiment 4 featured a new task, which afforded a measure of task attention and that was partially soluble. The measure involved participants' memory for the task. Much research finds that lack of attention while engaging in a task undermines memory for the task (e.g., Anderson & Craik, 1974). Experiment 4 tested whether participants in the "psychologically together" condition would show greater attention to a puzzle as evidenced by better memory for it after having worked on it. Further, we tested whether this heightened attention would mediate better performance.

In examining task attention and performance, Experiment 4 further addresses the possibility that people could persist longer on a task and exhibit less self-regulatory depletion because they worked *less* hard on it, for instance if they were distracted by task-irrelevant aspects of the situation such as the others present. Experiment 2 provided no evidence for this alternative explanation: Though all participants worked equally long on the puzzle in this study, those in the "psychologically together" condition did not draw fewer map regions than those in the "psychologically separate" condition; if anything, they drew more. In examining task attention and performance, Experiment 4 provides a direct test of this question.

Method

Participants

Forty-seven college students (21 men, 26 women; 17 White, 13 Asian, 17 other) participated in exchange for partial course credit.

Procedure

There were two conditions: the "psychologically together" condition (identical to this condition in Experiment 3) and the "psychologically separate" condition (identical to the "shared-experience" condition in Experiment 3). The only substantive change to the procedure was that the puzzle was referred to as the "hidden-objects puzzle" rather than as the "map puzzle." Participants were given this puzzle (described below), told they would give or receive a tip on it to or from either another participant or the experimenter, and received a tip on it (described below) after having worked on it for 2 min. Participants were asked to "to work on the hidden-objects puzzle with your full effort and full attention" for 8 min. After 8 min, the experimenter stopped participants and assessed participants' memory for puzzle-relevant details and other outcomes.

Materials

Hidden objects puzzle

Participants were given an 8″-by-6.5″ visually complex picture in which they were asked to find hidden objects and labeled images of 28 objects said to be hidden in the picture. To ensure that participants could not complete the puzzle, only 18 of the objects were actually hidden in the picture. Participants were asked to circle each hidden object they found. This visual-search task requires sustained attention (Wolfe, 1998), allows for a measure of task attention through memory for puzzle-relevant details (i.e., objects purportedly hidden in the picture), and provides a measure of performance because the puzzle is partially soluble.

Puzzle tip

Participants were told that the tip could not reveal the location of a hidden object. The tip they received indicated that one of the hidden objects (a screwdriver) was vertically oriented in the puzzle picture.

Dependent measures

Task attention

Task attention was assessed by participants' memory for details of the puzzle after the task. After participants had worked on the puzzle for 8 min, the experimenter removed the puzzle and asked participants to list "all the hidden objects you were asked to find." After this recall task, participants were given a list of 36 objects and asked to identify up to 15 they had been asked to find, 11 of which were among those they had been asked to find. Recall and recognition memory for task details are similarly affected by task attention (Craik, Govoni, Naveh-Benjamin, & Anderson, 1996). Thus, we totaled the number of objects participants recalled and recognized correctly (these correlated, $r = .32$, $p = .031$, and yielded similar results), standardized each measure, and averaged them to form a composite index of task attention.

Task performance

Performance was assessed by summing the number of objects out of 18 participants found in the allotted time.

Additional measures

At the end of the study, participants reported their feelings of collaboration and competition as in Experiment 3.

Results

Manipulation checks

The variance in participants' feeling of collaboration differed by condition, Levene's Test: $F(1, 45) = 55.65$, $p < .001$, and was analyzed using a Mann–Whitney test. Participants reported they were collaborating more in the "psychologically together" condition ($M = 2.85$, $SD = 1.33$) than in the "psychologically separate" condition ($M = 1.10$, $SD = .29$), $Z = 5.21$, $p < .0001$.

Feelings of competition did not differ between conditions ("psychologically together": $M = 3.73$; $SD = 1.96$; "psychologically separate": $M = 3.46$; $SD = 1.69$), $t < 1$.

Task attention

Participants remembered (i.e., recalled and recognized) more objects said to be hidden in the puzzle in the "psychologically together" condition ($M = .35$) than in the "psychologically separate" condition ($M = -.31$), $t(45) = 2.99$, $p = .004$, $d = .91$.

To ensure that this effect did not arise because participants simply listed and identified more objects in the "psychologically together" condition, we tested whether the condition effect held controlling for the number of objects participants recalled and identified incorrectly. It did, $F(1, 44) = 8.70$, $p = .005$. The results suggest that participants in the "psychologically together" condition had more accurate memory for the task.[7]

Task performance

Participants found more hidden objects in the "psychologically together" condition ($M = 13.14$) than in the "psychologically separate" condition ($M = 11.64$), $t(45) = 2.07$, $p = .045$, $d = .62$.

Mediation

Did participants' greater attention to the puzzle (as indexed by their better memory of it) mediate the condition effect on task performance? It did. Task attention predicted better performance, $\beta = .41$, $t(45) = 2.99$, $p = .004$. In a simultaneous regression, task attention again predicted performance, $\beta = .35$, $t(44) = 2.37$, $p = .022$, but condition did not, $\beta = .15$, $t < 1.10$. See Fig. 4. The reduction in the condition effect was significant, asymmetric distribution of products test (ADPT) 95% confidence interval: .34 to 1.12, $p < .05$.[8]

Discussion

In Experiment 4, cues of working together increased participants' task attention, as evidenced by better memory for the task, and improved their task performance. Participants became engrossed in the task, not distracted from it.

Experiment 5: Spontaneous expressions of intrinsic motivation and generalization to related tasks in a subsequent setting

Experiments 1–4 showed that cues of working together increase task persistence, reported task interest, task attention, and task performance and decrease self-regulatory depletion. To provide further convergent evidence that cues of working together fuel intrinsic motivation, Experiment 5 assessed participants' spontaneous free-response reports of enjoyment and intrinsic interest for a puzzle after having worked on it.

In addition, Experiment 5 examined the conditions under which intrinsic motivation for a challenging puzzle would generalize to affect motivation for related tasks in subsequent settings (cf. Lepper et al., 1973). In Experiments 1–4, cues of working together facilitated situational interest (Hidi & Renninger, 2006); in the context of these cues, participants exhibited greater interest in and motivation for a challenging task. Under what conditions will people generalize this motivation to related tasks in future settings without additional invocations of working together? Past research and theory on the development of interests emphasizes how perceptions of value and relevance to the self can promote the development of situational interests into more general and enduring forms (Hidi & Renninger, 2006; see also Deci et al., 1994; Harackiewicz, Durik, Barron, Tauer, & Linnenbrink, 2008; Hulleman & Harackiewicz, 2009; Mitchell, 1993; Steele, 1997). Following this work, we hypothesized that providing participants an opportunity to articulate the enjoyment they found in working on a challenging puzzle and to connect this motivation to personal values and identities would facilitate this generalization.

In addition to its inherent importance, assessing the generalization and subsequent expression of participants' motivation provides another test of our central intrinsic-motivation hypothesis. Extrinsic incentives and pressures do not readily lead to the expression of motivation in a new setting (Deci et al., 1994; Lepper et al., 1973). If the opportunity to connect a newfound interest to personal values and identities leads participants to exhibit greater motivation for related tasks in a new setting, it would provide further evidence that cues of working together enhance intrinsic motivation.

The study used a 2 × 2 between-subjects design. First, participants worked on the map puzzle used in Experiments 1–3 in the "psychologically together" or "psychologically separate" condition for 10 min. Second, after having done so, participants were randomly assigned to either have the opportunity to write about why they found this puzzle enjoyable and how it related to personal values and identities ("puzzle writing" condition) or to write, instead, about the room they were in ("room writing" condition).

There were two key outcomes. First, we examined participants' free-responses within the "puzzle writing" condition for spontaneous reports of intrinsic motivation. We predicted that participants in the "psychologically together" condition would express greater enjoyment of and intrinsic interest in the puzzle. Second, 1–2 weeks later, participants took part in an unconnected study of "leisure activities." In this study, participants could choose to do additional challenging puzzles or unrelated activities. The critical outcome was how many puzzles participants freely chose to complete, a classic measure of intrinsic motivation (Lepper et al., 1973; Ryan & Deci, 2000a). We predicted that only participants who had *both* worked on the puzzle in the "psychologically together" condition—developing, we theorized, greater intrinsic motivation for this challenging puzzle—and who had had the opportunity to articulate their interest in the puzzle and its relation to personal values and identities would show greater intrinsic motivation for other challenging puzzles in the follow-up.

Method

Participants

The study involved a laboratory session and a subsequent, ostensibly unconnected online study. A total of 87 college students (53 women, 34 men; 30 White, 27 Asian, 6 Hispanic, 8 Black, 16 other) participated in the laboratory session in exchange for $10. Of these, 62 (70.46%) participated in the subsequent online study in

[7] As a further index of memory accuracy, we also examined d′. For recognition, the condition effect was significant ($M_{\text{psychologically together}} = 3.22$; $M_{\text{psychologically separate}} = 2.82$), $t(45) = 2.64$, $p = .011$, $d = .73$. For recall, the set of possible false alarms was infinite; thus the false alarm-rate could not be calculated. However, if we take as this set the number of objects to be recalled (i.e., 28), the condition effect on d′ for recall was nonsignificant $t(45) = 1.24$, $p = .22$, $d = .36$. Replicating the analysis of overall memory, an analysis of average d′ scores across the recall and recognition tasks was also significant ($M_{\text{psychologically together}} = 2.75$; $M_{\text{psychologically separate}} = 2.49$), $t(45) = 2.52$, $p = .015$, $d = .70$.

[8] A possible alternative explanation involves the reverse relationship: Perhaps participants' better performance finding hidden objects improved their memory of the task, for instance, if they remembered objects they found. If this were the case, task performance should correlate with memory for objects present in the puzzle, which could be found, but not with memory for objects said to be present but not. This was not the case. Both correlations were significant, $r(47) = .32$, $p < .05$ and $r(47) = .29$, $p < .05$, respectively, and did not differ, $F < 1$. We also tested the reverse-causal relationship statistically. In a simultaneous regression of task memory, performance was significant, $t(44) = 2.37$, $p = .022$, but condition also remained significant, $t(44) = 2.31$, $p = .026$, suggesting that the improvement in memory in the psychologically-together condition was not simply a consequence of better performance.

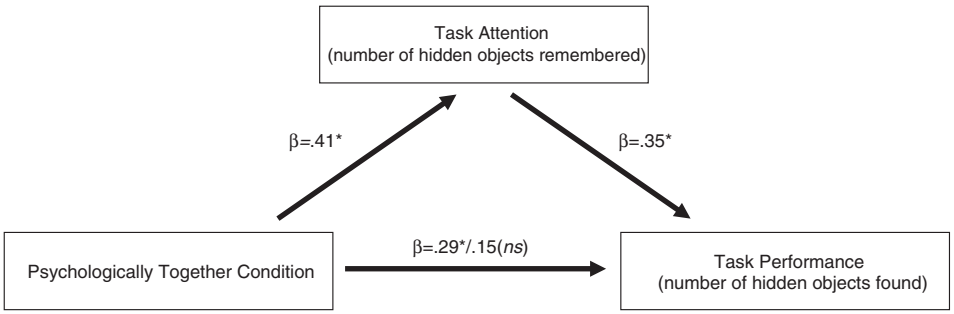

Fig. 4. Mediation of the effect of condition on task performance by task attention in Experiment 4. *$p < .05$.

exchange for $5. There was no difference in retention rate in the second session by either manipulation (described below) or their interaction, $\Delta\chi^2$s < 1.

Procedure

Laboratory session: Manipulating cues of working together and the opportunity to link intrinsic motivation to personal values and identities

As in the previous experiments, participants worked on the map puzzle (used in Experiments 1–3) in either the "psychologically together" condition (identical to this condition in Experiments 1–4) or the "psychologically separate" condition (identical to the "shared experience" condition in Experiment 3). There was one change in the instructions: Participants were not asked to work on the puzzle for as long as they liked but to do so "with your full effort and attention for 10 min." Again they were told they would give or receive a tip on the puzzle to or from either another participant or the experimenter. After 2½ min, participants received the tip (the same tip delivered in Experiments 1–3) attributed to either another participant working on the puzzle or the experimenter.

After working on the puzzle for 10 min, participants were stopped and randomly assigned to write about either the puzzle ("puzzle writing" condition) or the room they had been in ("room writing" condition). In the "puzzle writing" condition, participants were asked to write for 8 min about their enjoyment of the puzzle and its connection to other important aspects of their lives: They responded to three questions: "Why did you find the map puzzle enjoyable?", "How does working on a puzzle like this relate to other kinds of things you do that are important to you?", and "How is working on a puzzle like this linked for you to things, people, activities you value?". This exercise was designed to provide participants an opportunity to articulate the enjoyment the map puzzle had for them and to connect any intrinsic motivation they felt for it to personal values and identities. In addition, as described below, the task provides a measure of participants' enjoyment of and intrinsic interest in the puzzle. In the "room writing" condition, participants were asked to write for 8 min about the room they had been in, how much they liked the room, and how the room was similar to or different from other rooms.

Laboratory session: Coding of participants' spontaneous free responses in the "puzzle writing" condition for indices of intrinsic motivation

Two coders, blind to participants' condition and to hypotheses, independently coded participants' responses to the writing prompts in the "puzzle writing" condition. The primary purpose of this coding was to assess spontaneous reports of intrinsic motivation. As participants in the "room writing" condition did not write about the task, their responses were not coded.

Although there are is no single barometer of intrinsic motivation, past research identifies reports of enjoyment, connections to the self, and appreciation for the process of doing or learning from a task as central indices (e.g., Dweck & Leggett, 1988; McAuley, Duncan, & Tammen, 1989; Ryan, Connell & Plant, 1990). We coded these dimensions using 4 categories: (1) the number of words or phrases expressing enjoyment of the puzzle (e.g., "enjoyed," "found interesting," "intriguing"); (2) an overall rating of how much participants expressed enjoyment of the puzzle (-2 = *did not enjoy at all*, 2 = *enjoyed very much*); (3) the number of self-relevant domains to which participants connected the puzzle (e.g., "This puzzle uses many of the skills that I use everyday as an engineer"); and (4) the number of times participants mentioned the value of the process of doing or the learning elicited by the puzzle (e.g., "This puzzle made me realize the importance of thinking outside the box"). Although these categories vary in various ways, we anticipated that each would reflect the common dimension of intrinsic motivation and would thus load on a single factor. This was the case. In a factor analysis, all four measures loaded onto one factor, which explained 60.78% of the variance. We therefore standardized and combined the four measures to create a composite index of free expressions of intrinsic motivation ($\alpha = .79$; dropping any item would reduce the scale reliability).

We also coded two other constructs: (5) the overall amount participants wrote (total number of words written); and (6) the number of references participants made to outcomes or evaluation, such as to how well participants felt they had performed, their abilities, and thoughts about being evaluated (e.g., "I really wanted to find the solution," "It allowed me to show my intelligence"). These references, we reasoned, would be more likely to reflect extrinsic motivations (e.g., to perform well) than an "inherent satisfaction" doing the task (i.e., intrinsic motivation, Ryan & Deci, 2000a, p. 56). Interrater reliability was adequate on all dimensions. For the scale category (category 2) coders' ratings correlated ($r = .76$) and were averaged. For the count categories (categories 1, 3, 4, 6), coders were reliable (rs > .90 and κs > .88) and disagreements were resolved through discussion.[9]

"Unconnected" study 1–2 weeks later: Free-choice measure of intrinsic motivation for other challenging puzzles

A week after participating in the laboratory, participants were invited to take part in an online survey of "leisure activities" by a researcher not associated with the laboratory session. This survey was presented as a new study and participants were unaware of the connection to the laboratory session. Participants who did not complete the survey within 3 days of the first invitation were sent a second invitation.

In the "Leisure Activities Survey" participants were presented with a list of 12 activities they could choose to do: 6 challenging puzzles and 6

[9] We also examined participants' responses for references to the social context in which they worked. There were few such references; only two participants (4.76%) mentioned the social context. This may be because the questions prompted participants to reflect on the map puzzle itself and their broader self-identity. More broadly, this result is also consistent with the findings of Experiment 4, where working on a challenging puzzle in the "psychologically together" condition drew participants' attention to the puzzle. In this sense, other people with whom people have the psychological experience of working together may serve as a background context, not a primary focus of attention.

Table 2
Free-response expressions of intrinsic motivation for the challenging puzzle in the "puzzle writing" condition (Experiment 5).

Coding category	Psychologically separate condition	Psychologically together condition	Statistical test
Composite index of free-response expressions of intrinsic motivation (average of the following standardized measures)	−.40 (.11)	.46 (.17)	$t(41) = 4.30$, $p < .0001$, $d = 1.35$
Number of enjoyment-related words used to refer to the puzzle (e.g., "enjoyed, found interesting")	1.61 (.25)	3.25 (.46)	$t(41) = 3.26$, $p = .002$, $d = 1.02$
Assessment of overall enjoyment (−2 to +2 scale)	.12 (.12)	.80 (.14)	$t(41) = 3.86$, $p < .001$, $d = 1.21$
Number of self-relevant domains connected to the puzzle (e.g., "This puzzle uses many of the skills that I use everyday as an engineer")	1.04 (.19)	1.75 (.26)	$t(41) = 2.21$, $p = .033$, $d = .69$
Number of references to the value of the process of or learning elicited by the puzzle (e.g., "This puzzle made me realize the importance of thinking outside the box")	1.17 (.32)	2.80 (.41)	$t(41) = 3.16$, $p = .003$, $d = .99$

Note. Standard errors are indicated in parentheses.

non-puzzle activities. Participants were told that they could do whichever activities they liked but that they had to do at least 3. Given our interest in the extent to which any interest participants developed in the laboratory for the map puzzle generalized to other puzzles, we included in the online session two kinds of challenging puzzles, some more closely and others less closely related to the map puzzle. In the laboratory, we described the map puzzle as "an insight puzzle." In the online session, three puzzles were also labeled "Insight Puzzles" (e.g., "Insight Puzzle 1: Golf Balls"); these were logic problems as was the map puzzle; however, none shared surface similarities with the map puzzle (e.g., none involved maps or geography). The remaining 3 puzzles were labeled "Verbal Puzzles" (e.g., "Verbal Puzzle 1: Scrambled Sentences"); these included unscrambling sentences, solving anagrams, and word-search tasks. This distinction allowed us to assess whether participants' motivation generalized only to challenging puzzles linked to the puzzle completed in the laboratory or to challenging puzzles more broadly.

The 6 nonpuzzle activities consisted of "reading" and "visual" activities (e.g., "Reading Activity 1: What makes a dog look guilty?", "Visual Activity 1: Thoughts about Abstract Art"); these comprised, respectively, brief reading passages and images of art on which participants were invited to comment.

When they chose an activity, participants were shown it and asked to work on it. Because the primary outcome involved how many puzzles participants chose to work on, we did not want participants to get stuck on any particular puzzle and thus to spend excessively long on it. Therefore, for each puzzle, participants were asked to "tell us your thoughts about this puzzle and/or…give us your solution. You do not have to solve the puzzle to move on." When participants finished working on each activity, they were shown a list of the remaining activities and given the option to choose from among these or to end the survey. The primary measure of intrinsic motivation for challenging puzzles was the number of puzzles participants chose to do (Ryan & Deci, 2000a), both overall and in terms of "insight" and "verbal" puzzles.

Results

Free expressions of intrinsic motivation in the laboratory

Analysis of participants' free-response writings in the "puzzle writing" condition yielded no difference between the "psychologically together" and "psychologically separate" conditions in how many words participants wrote ($M_{grand} = 122.24$), $t < 1$. But the content of their writing differed. Participants expressed greater intrinsic motivation for the puzzle in the "psychologically together" condition than in the "psychologically separate" along the composite index and each specific measure: in the "psychologically together" condition, participants (1) used more words expressing enjoyment of the puzzle, (2) were rated as expressing greater enjoyment of the puzzle, (3) connected the puzzle to more self-relevant domains, and (4) mentioned the value of the process of doing and the learning elicited by the puzzle more (Table 2).

Finally, we examined references to outcomes and evaluation, which, as noted, may reflect extrinsic motivations (e.g., to perform well). Consistent with the view that the working-together manipulation enhanced intrinsic motivation and not extrinsic motivation or evaluative concerns, participants mentioned outcomes and evaluation less often in the "psychologically together" condition ($M = 1.10$) than in the "psychologically separate" condition ($M = 2.09$), $t(41) = 2.48$, $p = .017$, $d = .78$.

Free-choice measure of intrinsic motivation 1–2 weeks later

On average, participants took part in the second session 8.19 days after the first session (range: 7–12 days). The lag did not vary by either manipulation or the interaction between conditions, Fs < 1, and did not moderate any effect in the second session, $t < 1$. The "insight" and "verbal" puzzles yielded the same pattern of results. No analysis was moderated by this distinction, Fs < 1. Therefore, primary analyses combine these categories; subsequently, we examine them separately.

A 2 (psychological togetherness: "psychologically together" vs. "psychologically separate") × 2 (writing task: "puzzle writing" vs. "room writing") ANOVA examined the number of challenging puzzles participants chose to do 1–2 weeks later. The analysis yielded a marginal main effect of togetherness condition, $F(1, 57) = 3.40$, $p = .071$, a significant main effect of writing task, $F(1, 57) = 4.88$, $p = .031$, and the predicted interaction, $F(1, 57) = 6.52$, $p = .013$, $\eta_p^2 = .10$. As depicted in Fig. 5, participants who had both worked on the puzzle in the "psychologically together" condition and who had had the opportunity to link this motivation to their broader self-concept chose to do more challenging puzzles 1–2 weeks later than participants in each other condition, ts > 2.85, ps < .01, ds > 1.06, or all three combined, $t(57) = 4.51$, $p < .001$. No pair-wise comparison among the latter three conditions was significant, ts < 1.[10]

When we examined "insight" and "verbal" puzzles separately, the 2-way interaction was marginal or a trend on each, $F(1, 57) = 3.13$, $p = .082$ and $F(1, 57) = 2.49$, $p = .12$, respectively. However, the key predicted contrast between the "psychologically together"/"puzzle writing" condition and the three other conditions was significant for both outcomes, $t(57) = 2.99$, $p = .004$ and $t(57) = 2.81$, $p = .007$, respectively. The results suggest that participants' motivation for challenging puzzles generalized both to other logic (or "insight") puzzles and to other challenging puzzles more broadly.

[10] We also examined how long participants worked on each activity. Because the session was online, we cannot parse time spent doing the activities from time spent on distractions (e.g., checking email). Thus task choice was the primary outcome. Nonetheless, time spent yields parallel results. The 2-way interaction was significant, $F(1, 57) = 8.58$, $p = .005$, $\eta_p^2 = .13$. Participants in the "psychologically together' condition who wrote about the puzzle worked longer on challenging puzzles 1–2 weeks later ($M = 17$ min 55 s) than participants in each other condition ($M_{range} =$ 9 min 14 s to 9 min 51 s), ts > 3.65, ps < .001, ds > 1.35.

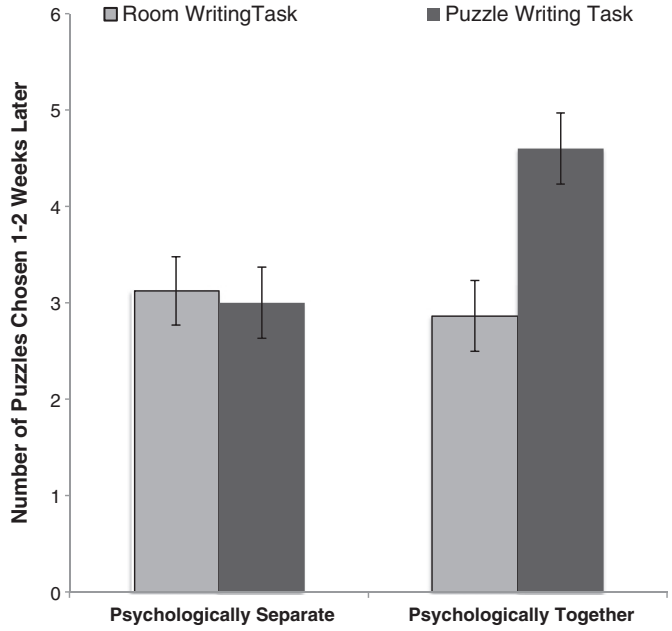

Fig. 5. Number of challenging puzzles participants chose to do 1–2 weeks later in an unconnected study of "leisure activities" by psychological togetherness manipulation and writing task manipulation in Experiment 5. Error bars represent ±1 standard error.

Mediation

If, as hypothesized, the intrinsic motivation participants expressed for the initial puzzle in the laboratory in the "psychologically together" condition endured and generalized to raise their motivation for other challenging puzzles 1–2 weeks later when participants had had the opportunity to connect this interest to personal values and identities, then this relationship should emerge in a mediation analysis. We tested whether participants' free expressions of intrinsic motivation for the map puzzle mediated the effect of the psychological togetherness manipulation on the number of challenging puzzles participants chose to do in the online session. This analysis is restricted to participants in the puzzle-writing condition who completed the online session. In this sample, the psychological togetherness manipulation predicted increased expression of intrinsic motivation for the initial puzzle (the aforementioned composite index), $\beta = .61$, $t(28) = 4.04$, $p < .001$, and increased choice of challenging puzzles in the online session, $\beta = .53$, $t(28) = 3.29$, $p = .003$. But in a simultaneous regression, only expressions of intrinsic motivation for the map puzzle predicted the choice of puzzles in the online session, $\beta = .77$, $t(27) = 5.43$, $p = .0001$; psychological togetherness condition was not significant, $\beta = .06$, $t < 1$. The reduction in the effect of the psychological togetherness manipulation was significant, ADPT 95% confidence interval: .86 to 1.58, $p < .05$ (Mackinnon et al., 2002).

Thus it was the heightened development of intrinsic motivation for a challenging puzzle in the laboratory in the "psychologically together" condition that, when connected to participants' personal values and identity, endured and generalized to increase motivation for other challenging puzzles in a subsequent setting.

Discussion

Providing convergent evidence of intrinsic motivation, Experiment 5 found that participants exposed to cues of working together spontaneously expressed greater enjoyment of and intrinsic interest in a challenging puzzle. Further, when participants had the opportunity to connect their motivation for this initial puzzle to their personal values and identity, this motivation endured and generalized to increase their motivation for other challenging puzzles in an unconnected setting 1–2 weeks later. Participants given this opportunity chose to do 53% more challenging puzzles in the subsequent study of "leisure activities" when they had been in the "psychologically together" condition than when they had been in the "psychologically separate" condition. By contrast, participants not given this opportunity showed no effect of psychological togetherness in the subsequent setting. The results suggest that the intrinsic motivation elicited by cues of working together arises from and exists within this social situation; it is not an enduring interest or aspect of self. But if people are encouraged to link this motivation to their values and self-concept, it can transcend the situation to change future behavior (see also Deci et al., 1994; Hidi & Renninger, 2006).

General discussion

The tendency for people to work together—to establish and run businesses, to conduct research projects, and to create and share music—is a foundation of human culture. For individuals, working with others affords enormous social and personal benefits. Given these benefits, a tendency to increase motivation when presented with an opportunity to work with others would have significant value. In the present research, five experiments found that cues that signaled an opportunity to work with others fueled intrinsic motivation as people worked on their own: People led to feel they were working together freely persisted 48–64% longer on a challenging task (Experiments 1 and 3), reported greater interest in the task (Experiments 1 and 3), required less self-regulatory resources to persist on it (Experiment 2), became more engrossed in the task and performed better on it (Experiment 4), and spontaneously expressed greater enjoyment of and interest in the task (Experiment 5). Moreover, when encouraged to connect this motivation to their personal values and identity, participants freely chose to do 53% more related tasks in an unconnected setting 1–2 weeks later (Experiment 5). Past research shows how structural features of groups like working in the presence of others or contributing to shared outcomes affect effort and extrinsic motivation. The present research shows that symbolic cues that evoke a state of working together inspire intrinsic motivation.

Several aspects of the studies confirm that the effects reflect an increase in intrinsic motivation, not a sense of obligation, competition, or other external pressure. Most importantly, the studies assessed diverse indices of intrinsic motivation—including reported task interest, spontaneous expressions of enjoyment, behavioral persistence, task engagement and performance, free-task choice, and reduced self-regulatory depletion. This diversity of measures provides strong convergent evidence that cues of working together cause a broad increase in intrinsic motivation, not a more specific process that could idiosyncratically affect a particular outcome (e.g., pressure to persist on a task). In addition, the manipulations precisely targeted cues of working together while holding constant alternative processes such as the presence of others, social comparison information, and shared outcomes. Indeed, the manipulation led participants to construe themselves as working together (validation study) and evoked feelings of working together (validation study) and of collaboration (Experiments 2–4) but not feelings of obligation or of competition (validation study, Experiments 1–4) or thoughts about outcomes and evaluation (Experiment 5).

In demonstrating the robust effect that cues of working together can have on intrinsic motivation, the present research raises important questions for future research. For instance, what social, affective, and cognitive processes underlie this relationship? In general, we assume that the state of working with others sets in motion several processes. One possibility involves the sense of social connection people may feel to others as a consequence of cues of working together. If, as we have suggested, such cues function as a "social glue" that brings people together, do people experience this as a

social connection? To begin to explore this question, we asked participants in Experiments 2–4 how "connected" they felt to the other participants in the study after they had completed the primary outcome measures. Although this single-item measure provides only preliminary evidence, across the three studies participants reported greater feelings of social connection in the "psychologically together" conditions than in the "psychologically separate" conditions, meta-analytic results: $d = 0.53$, $Z = 2.68$, $p = 0.007$.[11] Future research may examine whether feelings of social connection, or of self–other overlap or merging, contribute to the motivational effects of cues of working-together (Walton & Cohen, 2011; Walton et al., 2012). A second interesting possibility is whether cues of working together lead people to feel a greater sense of meaning and purpose beyond the individual self in otherwise dull tasks, which can promote academic self-regulation (Yeager & Henderson, under review). A third possibility involves positive mood. Past research shows that positive mood inductions can enhance creativity (see Ashby, Isen, & Turken, 1999; Hirt, Devers, & McCrea, 2008; Isen, Daubman, & Nowicki, 1987), persistence, and motivation (Isen & Reeve, 2005). Although the present research does not address the role of mood, it will be interesting to explore whether cues of working together foster a positive mood and if this contributes to effects on intrinsic motivation.

The present findings also carry important implications for our understanding of groups and motivation. First, rather than emphasizing the structural aspects of groups as in past studies, the present research highlights symbolic cues that shape the perceived relationship between a person and other people in a work context. The robust effects of these cues suggest that the effect of structural aspects of groups may not be automatic but may, instead, depend on how people construe their relationships with others in the setting (cf. Ross & Nisbett, 1991). Probing this relationship with studies that test interactions between structural factors (e.g., whether outcomes are pooled, Karau & Williams, 1993) and cues that define people's relationship to one another in a setting (e.g., cues of working together) may prove fruitful.

Second, the present findings underscore the role of social–relational processes in motivation and achievement. Predominant theories conceptualize intrinsic motivation as driven by individualistic self-beliefs, such as beliefs about ability and autonomy (e.g., Bandura, 1997; Carver & Scheier, 2001; Dweck & Leggett, 1988) and from situational factors that evoke these self-perceptions (e.g., Bandura & Schunk, 1981). By contrast, several lines of recent research highlight social–relational processes. For instance, research on social-identity threat finds that students are closely attuned to cues that imply that they and their group are seen through the lens of a negative stereotype in school (Steele, Spencer, & Aronson, 2002) or that imply that they may not belong (Murphy, Steele, & Gross, 2007; Walton & Cohen, 2007). Even a Star Trek poster in a computer science classroom can cause women to view computer science as masculine and unwelcoming of them; this undermines their motivation to pursue the field (Cheryan, Plaut, Davies, & Steele, 2009). Research on mere belonging finds that seemingly trivial social connections—like a shared birthday with a math major or membership in a minimal "numbers group"—can cause people to internalize the achievement motivation of others for themselves (Walton et al., 2012; see also Master & Walton, 2013; Shteynberg & Galinksy, 2011). These lines of research show, more than many theories suggest, that motivation and achievement derive from feelings of togetherness, social belonging, and connection. They suggest the importance of developing broader theories of motivation that incorporate both people's individual attributes and self-perceptions and their social–relational perceptions and experiences.

Third, the present research highlights a form of social influence not often examined in past research. Much past research examines how people are influenced *by* others, changing their attitudes, behaviors, emotions, and goals to conform to others they encounter, value, and are connected to (e.g., Aarts et al., 2004; Chartrand & Bargh, 1999; Sinclair et al., 2005; Walton et al., 2012). In this model, behaviors and psychological states emanate from one individual or social group to another. By contrast, the present research finds that socially shared motivation can arise collectively *among* individuals: Here intrinsic motivation arose from the felt sociality of work itself—from cues of togetherness in doing a task—not from the preexisting interests of other people. This finding is consistent with theorizing that important aspects of the self such as intentions and motivation arise from social interactions and social relationships in ways that become socially shared and facilitate social coordination (Aron et al., 2004; Asch, 1952; Tomasello et al., 2005; Walton et al., 2012). But it suggests that such socially shared aspects of self can arise with others, not just from others (see also Shteynberg & Apfelbaum, 2013).

Finally, the present research raises implications for application. For instance, could cues of working together enhance motivation in school or work settings where people do not otherwise experience a sense of working together (see Aronson & Osherow, 1980; Butler & Walton, 2013; Muldner et al., 2011)? Could they fuel better self-regulation? Already people readily share tips to accomplish personal goals (e.g., to lose weight) on social networking websites (Stelter, 2010). If delivered in such a manner as to foster a feeling of working together, could these exchanges help people achieve their desired outcomes (cf. Fitzsimons & Finkel, 2011; Wing & Jeffery, 1999)? Another intriguing question involves collective action problems, especially free-rider problems in which individuals can benefit from the sacrifices of others without making similar sacrifices themselves (e.g., many environmental problems). By inspiring motivation to work toward a common objective, can cues of working together forestall such problems (Carr, Walton, & Howe, 2013)?

In suggesting these possibilities, the present research also raises several important considerations. First, symbolic cues of working together can be sufficient to raise motivation. Thus structural changes such as to make people work on shared rather than individual tasks may be unnecessary. Indeed, such changes can be counterproductive (e.g., if they reduce accountability; Karau & Williams, 1993). Second, we tested symbolic social cues that signaled an opportunity to work together even as peopled worked on their own with a degree of autonomy. But seemingly similar cues may produce divergent effects, for instance if they convey a need to accommodate to others (Hamedani et al., 2013). Third, even as cues of working together can enhance motivation in the immediate situation, this motivation may not endure or generalize to related tasks in later settings unless people connect this motivation to their personal values and identity (Experiment 5; Hidi & Renninger, 2006).

Conclusion

Human life is wrought through with working with others. Even a fiercely competitive basketball game is also a collaboration in which both sides must adhere to implicit and explicit rules (e.g., to try to score on each other) to play the game. Soldiers on opposing sides of trench warfare in World War I cooperated so much—such as holding fire at dinnertime—that generals kept realigning troops (Axelrod, 1984). Communication in general and teaching and learning in particular are inherently collaborative acts, as speakers adapt their speech to listeners' style and knowledge (Bell, 1984; Clark, 1996) and even infants attend to ostensive cues (e.g., eye contact) that signal that an adult is conveying knowledge to them (Csibra & Gergely, 2006). The ubiquity, early emergence, and diverse forms of working together imply its importance to humans (Tomasello & Hamann, 2012). The present research

[11] The effect was significant in Experiments 2 and 4 ($ps < .025$) and nonsignificant in Experiment 3. In each study, the measure was positively skewed ($Zs > 2.40$, $ps < .025$). Thus condition effects were tested using both t-tests and nonparametric Mann–Whitney tests; both yielded the same results. Exploratory mediation analyses were nonsignificant; controlling for felt connection did not reduce the significance of the condition effects on outcome measures. However, given the limitations of this measure, including the fact that it was a single item and was skewed, the process analyses are best viewed as inconclusive.

found that cues that evoke this form of social interaction itself inspire intrinsic motivation, causing people to work harder on challenging tasks for their inherent satisfaction. This tendency may help bring humans together to address common objectives and solve common problems.

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