# Considering "Why" to Engage in STEM Activities Elevates Communal Content of STEM Affordances

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In 2015, science graduate students at Vanderbilt photographed themselves in their laboratories, writing about the reasons why they stay in their challenging fields with the hashtag #Iwillnotgiveup (Vanderbilt, 2015). Many focus on the broader purpose of benefitting people and society: Looking for cures for disease, offering hope to underrepresented groups, and providing help to humans, animals, and the environment. Although considering the purpose of work can have motivational benefits across roles, a focus on purpose might have heightened impact for science, technology, engineering, and mathematics (STEM) pursuits. In the current research, we examine whether considering the broader goals of STEM leads to the integration of communal content – that is, whether considering "why" people engage in STEM leads to considering the benefits of STEM for other people or society.

Such beliefs about goal opportunities are critical in understanding how individuals navigate different social roles to meet their goals (Diekman & Eagly, 2008). Perceivers consider whether a particular role will afford valued goals, and if it does, they evaluate that role more positively (Diekman, Steinberg, Brown, Belanger, & Clark, 2017). In the current research, we draw from construal level theory (Trope & Liberman, 2010), which considers the psychological impact of construing tasks at different levels (i.e., from greater psychological distance or focusing on broader purpose). We investigate whether higher level construals shift the affordances associated with the role – that is, whether considering a role abstractly yields different cognitions than considering a role concretely. In particular, we anticipate that greater abstraction will lead to seeing a role in terms of its purpose. We thus introduce a novel extension of construal level theory: Rather than focusing on how abstraction influences the values of the *perceiver,* we investigate how abstraction influences the values afforded by the *role.*

Abstraction fosters a focus on higher-level aspects of goals and actions: A more abstract mindset focuses the perceiver on purpose rather than process. As a result, these higher level construals lead to decisions and behaviors that align more with higher-order values. In particular, greater abstraction leads to decisions that reflect desired self-concept attributes (Freitas, Langsam, Clark, & Moeller, 2008), to avoiding short-term motives that conflict with long-term ideals (Fujita, Trope, Liberman, & Levin-Sagi, 2006), to more alignment between people's endorsed values and their future intentions (Eyal, Sagristano, Trope, Liberman, & Chaiken, 2009), and to policy preferences that reflect ideology rather than immediate social context (Ledgerwood, Trope, & Chaiken, 2010). Building from this previous evidence, we anticipate that greater abstraction will lead a role to be perceived in terms of its higher-level elements, such as the broader purpose of that role. However, differing from previous investigations, we focus on the how abstraction can lead to different kinds of beliefs about the role, and how these different kinds of beliefs might have particular impact for engaging in STEM fields.

Purpose is particularly important to consider in STEM decisions because it holds the possibility of integrating communal or other-oriented content into beliefs about STEM roles. Physical science, engineering, and mathematics fields are perceived as affording fewer communal opportunities, relative to other fields such as law, business, medicine, education, or social services (Diekman, Brown, Johnston, & Clark, 2010; Morgan, Isaac, & Sansone, 2001). Considering the higher-level purpose of scientific work can counter the deterring belief that STEM fields do not fulfill communal goals. Understanding how abstract versus concrete construals of roles changes their affordances provides a new vantage point to consider goal affordances: Affordances are not derived simply from the role, but also depend on the mindset of the perceiver.

Experiences that highlight communal opportunities in STEM can foster greater engagement in these fields. Endorsing the prosocial purpose of learning can lead high school and college students to persist longer on tedious math activities (Yeager et al., 2014). Among bioscience students, altruistic affordances provided more motivational benefit than collaborative affordances or agentic affordances (Brown, Smith, Thoman, Allen, & Muragishi, 2015). Moreover, research assistants' beliefs that science afforded prosocial goals was predicted by their labmates' affordance beliefs, and these aggregated beliefs predict students' motivation to pursue careers in science (Thoman, Muragishi, & Smith, 2017). Similarly, underrepresented minority students were more likely to pursue a science career to the degree that they believed that scientific research can solve many of the world's challenges (Estrada, Woodcock, Hernandez, & Schultz, 2011). In controlled laboratory studies, participants who read about a day in the life of a scientist framed as collaborative versus independent were more likely to believe that science afforded communal goals and in turn expressed more positivity toward the scientist career (Clark, Fuesting, & Diekman, 2016; Diekman et al., 2011). Thus, beliefs that STEM fields can afford opportunities to connect to or help others can foster motivation in STEM.

Given the accumulating evidence that communal affordances uniquely foster positivity toward pursuing STEM, the current research examines whether beliefs about STEM can incorporate communal opportunities more readily when considered abstractly than concretely. That is, do respondents see communal opportunities when considering STEM's purpose rather than process? Previous research has not answered this question: The goal of "helping others" (Diekman, Brown, Johnston, & Clark, 2010), for example, might entail the proximal act of helping others directly, as well as the more distal act of helping society. However, STEM fields can be perceived as communal in abstract terms: For example, the job of scientist was considered as generally likely to afford altruistic goals (a mean of 3.26 on a scale ranging from 1 to 4; Weisgram, Bigler, & Liben, 2010). These abstract communal goals align with how many professional societies position their fields as providing broader benefit to society: National Academy of Engineering President C.D. Mote argued that “Engineering, for its part, solves problems for people and society” (National Academy of Engineering, 2014).

Although STEM fields may not be thought of as directly helping others, they might be thought of as indirectly helping others. We address this question by investigating whether STEM fields are perceived as particularly deficient in proximal communal opportunities (i.e., those with direct benefit or direct contact with others), but similar to other fields in terms of distal communal opportunities (i.e., those with indirect benefit or indirect contact with others). Considering the ways in which STEM fields indirectly help others, then, might provide a pathway to greater positivity toward engaging in STEM.

## The Present Research

We investigate two hypotheses related to how STEM fields at higher versus lower level construals will influence the communal content of goal affordances.

Hypothesis 1: STEM careers, unlike other careers, will be perceived as offering more distal communal opportunities than proximal communal opportunities.

Hypothesis 2: Considering science abstractly, compared to concretely, will lead to greater beliefs that science fulfills communal goals.

We examine these hypotheses in four datasets. Studies 1a and 1b documented perceptions of the proximal and distal goal affordances across different careers; Study 1c examined the effects of proximal and distal goal opportunities on interest in STEM careers. Study 2 experimentally manipulated higher versus lower construals of a science task to examine effects on goal affordances and interest in STEM. Throughout, we test whether perceived communal opportunities, relative to agentic opportunities, relate to greater interest in STEM.

## Studies 1a-1c

### Method

**Participants.** All participants completed the studies online via Amazon's Mechanical Turk in exchange for payment (such research yields results similar to laboratory research; Buhrmester, Kwang, & Gosling, 2011). Study 1a included 188 participants (73 women, 93 men, 22 gender unreported; ages 19-74; median age = 31 years); an additional 75 respondents did not complete the task. Study 1b included 178 participants (96 women, 79 men, 3 gender unreported; ages 20-76; median age = 37 years); an additional 83 respondents did not complete the task. Given that career interest would be more relevant among those who are entering into careers, we specifically recruited college students in Study 1c. Study 1c included 132 participants (62 women, 70 men; ages 18-35; median age = 26 years); an additional 66 respondents did not complete the task. Across all studies, those who did not finish the task are not included in analyses.

Sample sizes were determined before any data analysis. Post-hoc power analyses indicated sufficient power to detect medium effect sizes in mixed analyses of variance (ANOVAs). All subsequent analyses were conducted with a power of at least .80.

**Measures.**

***Studies 1a and 1b: Proximal and distal affordances.*** Participants rated how much each of several careers involved proximal and distal goals. They considered careers from the core field of interest, STEM, along with comparison careers (see Diekman et al., 2010, for details of item selection). For example, in Study 1a, they responded to items such as "How much do you think a career as a *mechanical engineer* includes *providing direct help to others*?" and in Study 1b they responded to items such as "How much does a career as a *mechanical engineer* involve *direct help, working face-to-face with others, or direct mentorship*?" Respondents rated STEM careers (mechanical engineer, computer scientist, environmental scientist, *aerospace engineer*); male-stereotypical careers (dentist, lawyer, doctor, *CEO*); female-stereotypical careers (registered nurse, human resources manager, social worker, *elementary school teacher*). Italicized careers were omitted from Study 1a for brevity.

For each career, respondents rated the proximal and distal affordances of communal and agentic goals on scales ranging from 1 (*not at all*) to 7 (*extremely*; see Table 1 for alphas and items). Items were averaged within each scale to form indices of proximal and distal communal or agentic affordances for each career.

***Study 1c: Interest in careers.*** Participants rated their hypothetical interest in each of the Study 1b STEM careers, given the opportunity to pursue certain goals. These goals varied by distance (proximal or distal) and type (communal or agentic; see Table 1 for items and alphas). For example, "If a career as a mechanical engineer would involve *helping society,* how much would you be interested?" STEM careers were embedded among the other Study 1b careers (see supplemental materials for analyses of other careers). Ratings were made on scales ranging from 1 (*not at all*) to 7 (*extremely*). Items were averaged within subscales to form indices of interest in STEM given different goal opportunities.

**Results**

We report all results relevant to key hypotheses as well as all significant (*p*s < .05) or marginally significant (*p*s < .10) results. Although age ranged widely, it did not significantly correlate with key dependent variables. Results were similar with or without age as a covariate and thus are reported without age as a covariate.

For the most part, gender did not moderate effects: An exception is that in both Studies 1a and 1b, women more than men rated communal affordances as lower in STEM careers than in other careers (Career Type × Gender interaction: Study 1a: $F(2, 322) = 3.30$, $p = .04$; Study 1b: Career Type × Gender interaction, $F(2, 346) = 4.74$, $p = .009$).

***Study 1a***. Affordances were analyzed in a 2(distance: proximal, distal) × 3(career type) × 2 (participant gender) mixed ANOVA, with gender as a between-subjects factor. Consistent with previous research, respondents perceived communal affordances to be lower in STEM than in other careers, $F(2, 322) = 255.80$, $p < .0001$. New to this research is the finding that this effect is moderated by distance (Career × Distance interaction, $F(2, 322) = 152.49$, $p < .0001$; see Figure 1).

Decomposing this interaction shows that the typical finding of lower communal affordances in STEM than other careers occurred more strongly within proximal goal opportunities. STEM was perceived as affording fewer communal goals than other careers in both conditions, and the effect was substantially larger when considering these goal opportunities proximally, $F(2, 322) = 513.05$, $p <.0001$, $\eta_p^2 = .70$, than distally, $F(2, 322) = 13.90$, $p < .0001$, $\eta_p^2 =.07$.

We also decomposed the interaction by examining effects within career type. STEM careers were perceived as affording communal goals distally more than proximally, $F(1, 322) = 227.06$, $p < .0001$, whereas the reverse was true for other careers, *p*s < .0001. Thus, STEM careers were perceived as uniquely deficient in affording proximal (relative to distal) ways of connecting with or helping others.

***Study 1b*.**

This study extended Study 1a by including ratings of agentic affordances. Affordance ratings were submitted to a 2 (goal) × 2 (distance) × 3 (career) × 2 (gender) mixed ANOVA, with gender as a between-subjects factor. As predicted, the effects of career type and distance varied by communal or agentic goals, as reflected in the three-way Goal × Distance × Career interaction, $F(2, 346) = 58.72$, $p < .0001$ (see Figure 2). We decomposed this interaction by examining effects within communal and agentic affordances separately.

*Communal affordances*. Effects replicated Study 1a. Respondents perceived communal affordances to be lower in STEM careers than in other careers, $F(2, 346) = 149.70$, $p < .0001$, and this effect was moderated by distance (Career × Distance interaction: $F(2, 346) = 81.89$, $p < .0001$). Similar to Study 1a, the perception of STEM fields as relatively deficient in affording communal opportunities was stronger when considering goal opportunities proximally, $F(2, 346) = 193.06$, $p <.0001$, $\eta_p^2 = .53$, than distally, $F(2, 346) = 38.99$, $p < .0001$, $\eta_p^2 =.23$.

Decomposing the interaction by career type showed that STEM careers were seen as more likely to afford communal goals distally than proximally, $F(1, 354) = 59.72$, $p < .0001$, whereas the opposite was true for other careers, *p*s < .0001.

*Agentic affordances*. Agentic affordances yielded a different Career × Distance interaction, $F(2, 346) = 22.73$, $p < .0001$. Here, participants perceived distal affordances as less likely than proximal affordances in STEM, $F(2, 346) = 11.32$, $p < .0001$, and female-stereotypic careers, $F(2, 346) = 22.73$, $p < .0001$. In contrast, they viewed male-stereotypic careers as most likely to afford both proximal and distal agentic goals. This pattern rules out the possibility that distal forms of all goals are considered more likely in STEM.

Studies 1a-b thus show that STEM fields were perceived as especially deficient (relative to other careers) in proximal opportunities to work with or help others, but they were perceived as providing distal opportunities to work with or help others.

***Study 1c.*** We next examined whether considering STEM careers as providing proximal versus distal goal opportunities elevated interest in pursuing these careers. We examined STEM interest in a 2 (goal: communal vs. agentic) × 2 (distance: proximal, distal) × 2 (participant gender) mixed ANOVA, with gender as a between-subjects factor. Considering STEM as affording communal more than agentic goals yielded greater interest, $F(1, 130) = 22.43$, $p < .0001$ (particularly among women, as evidenced in the Gender × Goal interaction, $F(1, 130) = 5.10$, $p = .03$). Moreover, considering STEM as affording distal goals yielded greater interest, $F(1, 130) = 5.68$, $p = .02$. Goals and distance did not interact, but combined additively so that the highest interest occurred when considering STEM as affording distal communal goals (Communal: $M_{\text{distal}} = 4.20$, $SD = 1.24$; $M_{\text{proximal}} = 4.11$, $SD = 1.24$; Agentic: $M_{\text{distal}} = 3.87$, $SD = 1.38$; $M_{\text{proximal}} = 3.79$, $SD = 1.34$).

**Discussion**

Perceptions of STEM fields depend on whether the perceiver is thinking about their proximal or distal impact. In perceivers' eyes, STEM fields did not offer communal opportunities when considered proximally, but did offer communal opportunities when considered distally. When the opportunity to help the broader community or society is present, individuals reported high levels of interest in pursuing STEM.

These proximal versus distal asymmetries appear for communal, but not agentic, affordances. Considering distal opportunities in STEM yielded no benefit in terms of agentic affordances, but did for communal affordances. Indeed, STEM fields were thought to offer lower distal agentic than communal opportunities. Overall, these findings suggest that abstract communal opportunities can be generated by perceivers, and that considering STEM abstractly offers the chance to disrupt chronically-accessible stereotypes about STEM.

## Study 2

Studies 1a-c demonstrated that although STEM fields may not be thought of as directly helping others, they can be thought of as indirectly helping others. When STEM fields are considered as offering distal communal opportunities, interest in pursuing these careers is higher. In Study 2, we moved away from explicit direction to a more subtle shifting of perceiver mindset. Specifically, we predicted that participants who consider scientific tasks more abstractly will generate more communal beliefs about science. Additionally, because more abstract mindsets are associated with goal pursuit (Fujita et al., 2006), we examined whether the effects of abstract construals of science are related to more goal content generally (i.e., higher agentic and communal affordances) or more communal content specifically (i.e., higher communal affordances only).

### Method

**Participants.** Participants were 193 Mturk workers (117 women, 76 men; ages 18-99; median age = 32 years). An additional 118 respondents began but did not finish the task, and they are not included in analyses. [1] Sample size was determined before any data analysis.

**Procedure.** Participants completed a writing task that elicited either high or low level construals of a scientific task, as described below. They then rated the extent to which the STEM

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[1] We attempted to determine whether those who completed the study differed in a meaningful way from those who did not; the only measure available for this analysis was self-reported communal and agentic goal endorsement (which was completed prior to the construal level manipulation). No differences were detected between completers and noncompleters. No other systematic effects were found for goal endorsement, and thus it is not included in analyses.

tasks they had generated afforded agentic or communal goals, and rated their attitudes toward the self-generated STEM tasks and several STEM careers.

**Materials.**

***Construal-level manipulation.*** Participants were randomly assigned to consider either *how* or *why* one would engage in a task (e.g., Belding, Naufel, & Fujita, 2015; Freitas, Gollwitzer, & Trope, 2004). In this study, the target task was conducting a scientific experiment. Participants in the low construal condition were prompted to become increasingly concrete about the task, successively indicating *how* to conduct a scientific experiment. Participants in the high construal condition were prompted to become increasingly abstract about the task, successively indicating *why* to conduct a scientific experiment. For instance, a participant in the low construal condition responded that how to conduct a scientific experiment is to "establish a hypothesis" and that how to do that is to "develop an idea that you want to prove." A participant in the high construal condition responded that a reason why to conduct a scientific experiment is to "achieve something that is relevant to the world or people in some way," and a reason why to do that is "because discovering new things and proving them worthwhile matters."

***Science task affordances.*** Participants rated how much their own responses to the *how* or *why* questions involved communal goals (e.g., connecting with others, helping others) and agentic goals (e.g., developing mastery or competence, seeking new experiences or excitement) on scales ranging from 1 (*not at all*) to 7 (*extremely*). Ratings were averaged within each goal type to form indices of communal ($\alpha$ = .91) and agentic ($\alpha$ = .68) affordances of self-generated statements.

***Science career affordances.*** Communal affordances of a science career were assessed with the item "How much do you think a scientist career would fulfill goals such as helping others, working with others, and altruism in general?" Agentic goal affordances of a scientist career were assessed with the item "How much do you think a scientist career would fulfill goals such as power, achievement, and seeking new experiences or excitement in general?" These items were rated on scales ranging from 1 (*not at all*) to 7 (*extremely*).

***Science career attitudes.*** Attitudes toward a science career were assessed via responses to the items, "What is your impression of a scientist career?" on a scale ranging from 1 (*very negative*) to 7 (*very positive*), "How enjoyable do you believe you would find a career as a scientist?" on a scale ranging from 1 (*not at all enjoyable*) to 7 (*extremely enjoyable*), "How interested are you in a career as a scientist?" on a scale ranging from 1 (*not at all interested*) to 7 (*extremely interested*), and "How successful do you believe you would be as a scientist?" on a scale ranging from 1 (*not at all successful*) to 7 (*extremely successful*). Items were averaged to form an index of attitudes toward a scientist career ($\alpha = .86$).

## Results

Although age ranged widely, age was not significantly correlated with dependent variables; communal affordances of the STEM tasks were marginally positively correlated with age among women, $r(193) = .13$, $p = .07$. Results were similar with or without age as a covariate and thus are reported without age as a covariate.

## Goal Affordances

Each affordance measure was analyzed in a 2 (construal: low vs. high) × 2 (goal type: communal vs. agentic) × 2 (participant gender) mixed ANOVA with goal type as a within-subjects factor.

***Science task descriptions.*** Consistent with previous research, participants in a high construal mindset ($M = 4.93$, $SD = 1.15$) viewed their self-generated statements as involving more goals (across agentic and communal) than those in a low construal mindset (*M* = 4.01, *SD* = 1.22), $F(1, 189) = 23.02$, $p < .0001$, $d = 0.29$. Replicating previous findings that science is believed to be noncommunal, self-generated statements in response to *how* or *why* to perform a science task were rated as higher in agentic opportunities (*M* = 4.63, *SD* = 1.21) than communal opportunities (*M* = 4.19, *SD* =1.86), $F(1, 185) = 7.39$, $p = .0007$, $d = 0.51$.

More critical is the predicted Construal × Goal Type interaction, $F(1, 189) = 21.53$, $p < .0001$ (see Figure 2). This interaction reflected that a more abstract mindset led to more communal content in the self-generated statements, $F(1, 189) = 33.06$, $p < .0001$, $d = 0.92$, but not more agentic content, $F(1, 189) = 1.91$, $p = .17$, $d = 0.23$. Thus, considering science more abstractly led to greater inclusion of communal content.

In addition, the marginal Construal × Goal Type × Participant Gender interaction, $F(1, 189) = 2.85$, $p = .09$, reflected somewhat stronger effects for women than men (see Figure 4). For both women and men, Construal × Goal Type interactions emerged, women: $F(1, 115) = 21.04$, $p < .0001$, men: $F(1, 74) = 5.11$, $p = .03$. For both, higher level construal produced greater communal affordances (women: $F(1, 115) = 37.19$, $p < .0001$, $d = 1.15$; men: $F(1, 74) = 5.87$, $p = .02$, $d = 0.42$). In contrast, for both women and men, the construal effect was smaller for agentic affordances (women: $p = .16$, $d = 0.26$; men: $p = .56$, $d = 0.14$).

***Science career affordances.*** Parallel but weaker effects emerged for beliefs about opportunities in science careers. Affordances were higher in the high construal mindset (*M* = 5.48, *SD* = 1.11) than the low construal mindset (*M* = 5.13, *SD* = 1.05), $F(1, 185) = 3.72$, $p = .06$, $d = 0.44$. Consistent with hypotheses, communal affordances of a science career were higher in the high construal (*M* = 5.55, *SD* = 1.19) than low construal mindset (*M* = 5.02, *SD* = 1.35), $F(1, 185) = 4.75$, $p = .003$, $d = 0.42$.

The Construal × Participant Gender interaction, $F(1, 185) = 4.99$, $p = .03$, reflected that the predicted effects were stronger among women (see Figure 5). Among women, communal affordances were greater in the high construal condition than the low construal condition, $F(1, 114) = 13.61$, $p = .0003$, $d = 0.71$; this effect was diminished for agentic affordances, $F(1, 114) = 3.25$, $p = .07$, $d = 0.34$. Among men, no effects emerged, *d*s < .12, *p*s > .49.

***Indirect effects of construal level on positivity through communal affordances.*** Using the PROCESS macro with 10,000 bootstrap samples (Hayes, 2013), we examined indirect effects of construal level on attitudes through communal and agentic affordances of a scientist career (see Figure 6). The bias-corrected indirect effect of communal affordances was estimated to be 0.11 (SE = 0.07; 95% CI [0.0084, 0.2853]). In contrast, the indirect effect of agentic affordances was estimated to be 0.02 (SE = 0.03; 95% CI [-0.0143, 0.1254]). These patterns are consistent with the prediction that higher level construals can elicit greater positivity toward science careers through beliefs that a scientist career would afford communal, but not agentic, goals.

We next examined whether the mediation by communal affordances would be unique to women. PROCESS model 59 (Hayes, 2013) tested for moderation of the paths from construal mindset to affordances to positivity toward a science career. This analysis revealed mediation among women (0.34, SE = 0.13, 95% CI [0.13, 0.66]), but not among men (-0.0003, SE = 0.04, 95% CI [-0.10, 0.09]).

**Discussion**

Considering why a particular science task is done led to more communally-oriented content than considering how the task is done. Moreover, the effects of construal level were unique to communal beliefs about science; construal did not influence agentic beliefs about science to the same extent. This pattern, and the lack of moderation by individual differences in goal endorsement, suggests that the effects of higher construal on communal affordances is not simply due to the activation of all high-level goals under higher construal levels (Eyal et al., 2009). Instead, higher construal led people to think about the purpose of the STEM role, which includes other-oriented content. These communal beliefs can be impactful, because stereotypes of STEM generally reflect perceived deficiency of proximal communal activities.

Mediational analyses were consistent with the prediction that greater abstraction can indirectly foster greater positivity toward a STEM career through increased communal affordances of a STEM career. Replicating previous evidence (e.g., Brown et. al., 2015; Brown, Thoman, Smith, & Diekman, 2015), communal but not agentic affordances predicted more positive STEM attitudes. Finally, although most effects held for both men and women, the effect of construal level on communal goal affordances tended to be larger for women.

## General Discussion

Considering the broader purpose of STEM yields a communally-oriented perception of these fields, and this different view of STEM affordances is associated with greater interest in STEM careers. The current research elaborates the goal congruity perspective by documenting that STEM fields were perceived as deficient in proximal communal opportunities but similar to other fields in distal communal opportunities. These distal opportunities can be generated through explicit direction (i.e., asking about helping broader communities or society in Studies 1a-c), or by more subtle invocations of an abstract mindset (i.e., considering the purpose of a specific scientific task in Study 2). When these distal communal opportunities are perceived in STEM, respondents report more interest in pursuing STEM careers.

This research extends construal level theory by demonstrating the benefits of flexibility in construals of goals and means. Prior evidence has shown high-level construals can aid in the pursuit of long-term goals when short-term motives conflict (Fujita & Carnevale, 2012; Fujita et al., 2006). The current evidence demonstrates that abstraction influences the perceived affordances of a particular social role. Here, a high-level construal was beneficial for STEM attitudes because of more communal opportunities at higher levels of abstraction. A key question for future research is whether the affordances of other social roles would also vary with abstraction, and whether this variation would be as impactful on attitudes. Our evidence from Study 1 suggests that STEM roles may be particularly advantaged by considering their abstract purpose; however, consistent with the complementary principle of the goal congruity model (Diekman et al., 2017), we anticipate that abstract purpose should be most impactful for any role in which purpose is perceived as lacking.

These findings suggest that one route to communal affordances is through a more abstract construal of a STEM task. A key direction for subsequent research is specifying the mechanism by which abstract thinking about science fosters communal affordances. Consistent with the evidence presented here, one explanation is that proximal versus distal affordances of STEM careers differ, and abstract mindsets increases the accessibility of distal affordances. Another possibility that cannot be ruled out on the basis of the current evidence is that abstract thinking fosters creativity (e.g., De Dreu, Giacomantonio, Shalvi, & Sligte, 2009), which leads people to think more divergently about STEM fields (i.e., in ways that include both agentic and communal opportunities). Investigating how abstraction influences the perceived affordances across a range of social roles would elucidate these processes in future research.

The documented ability of individuals to generate communal reasons for performing a science task suggests that communal purposes of STEM tasks are available to perceivers. In intervention efforts, such self-generated responses may help to induce long-term changes because they operate through self-persuasion (Yeager & Walton, 2011) and avoid the risk of reactance (Yeager et al., 2014). Moreover, such small interventions can lead to big changes over time, if they initiate recursive processes. For instance, perceiving that a scientist works to develop cancer treatments might lead a student to consider a science career for the first time; this student may in turn take a science elective in high school, which may open more doors to STEM engagement.

This research thus contributes to a growing body of knowledge demonstrating the benefits of highlighting a broader communal purpose for STEM engagement. Nonetheless, there are surely boundary conditions to this effect. For instance, some roles might entail more communal opportunities at lower levels of construal: A human resources employee might work face-to-face with employees to maximize their health benefits for the broader purpose of saving the company money (in this case, an apparently communal specific action facilitates an agentic purpose). For such a role, lower levels of construal may increase perceptions of communal opportunities. Even for the STEM fields examined here, a key question is identifying the conditions in which distal affordances yield the most benefit. For instance, considering prosocial purpose was particularly beneficial during a boring math task (Yeager et al., 2014). Similarly, thinking about distal others may provide benefits when proximal connections are lacking, but not when such proximal connections are present. In addition, it is critical to understand whether the benefits of considering distal purpose in STEM translate to improved behavior. Past research has found that thinking about the communal purpose led to increased persistence and thus performance on a STEM-related or mathematics task (Rodriguez, Romero-Canyas, Downey, Mangels, & Higgins, 2013; Yeager et al., 2014). However, considering abstract construals might inhibit focused work that would benefit from a concrete mindset. Overall, the ability to traverse different levels of abstraction may best serve effective self-regulation (Fujita, 2001; Ledgerwood, Trope, & Liberman, 2015).

Considering the communal purpose in STEM might have particular weight and impact among members of underrepresented groups in STEM (Estrada et al., 2011; Estrada et al., 2016; Thoman et al., 2017). In particular, because women on average endorse communal goals more than men do (Diekman et al., 2010), the presence of communal purpose might be especially impactful for recruiting and retaining women. In the current studies, a few effects were perceived more strongly or only among women. Similar to past research (Diekman et al., 2011), women in Studies 1a-b perceived stereotypic patterns of goal affordances in STEM more strongly than did men. In Study 2, women's beliefs about goal affordances were more strongly influenced by considering purpose versus process than were men's; in turn, the indirect path from construal level to communal affordances to STEM positivity held only for women. This greater sensitivity to communal information may have its roots in different levels of chronic accessibility of communal goals; individuals who have internalized communal goals might attend to, encode, and use communal information more. If so, then members of other underrepresented groups in STEM who highly endorse helping motives might particularly benefit from considering the purpose of STEM (e.g., first generation, underrepresented minority students; Harackiewicz, Canning, Tibbetts, Priniski, & Hyde, 2016).

Conveying the purpose of STEM tasks may be as essential to learning as the process of how to perform those tasks. Highlighting the broader purpose of STEM can illuminate the ways in which STEM tasks enable connection to other people, and may thus provide the interest and motivation needed to inspire engagement across challenges. Contrary to stereotypic beliefs about a “lone scientist” toiling away in the laboratory, simply considering *why* that scientist is toiling away may lead to considering the broader societal impact of science.

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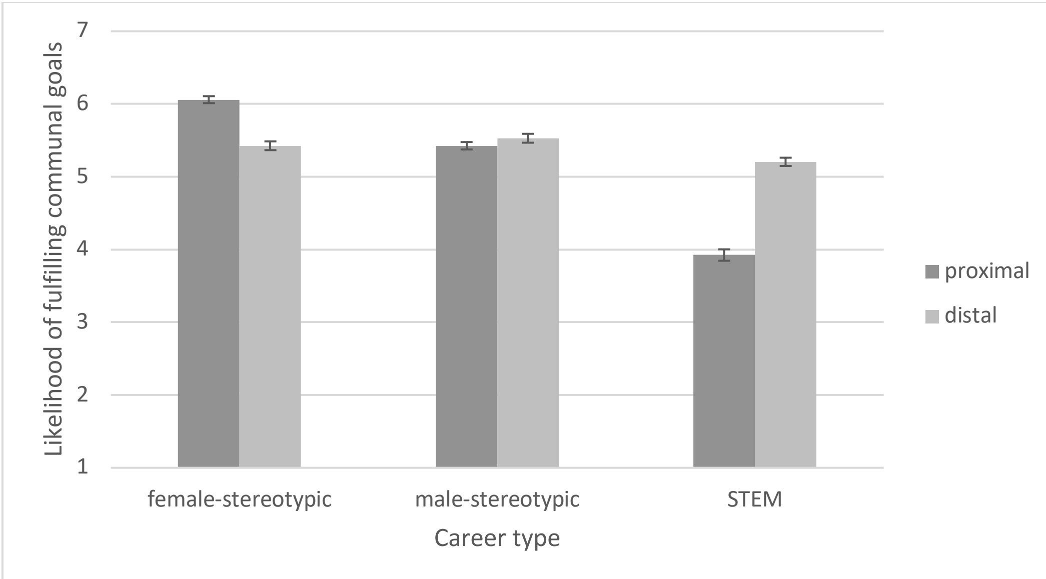
**Table 1**

*Affordance items: Studies 1a-c*

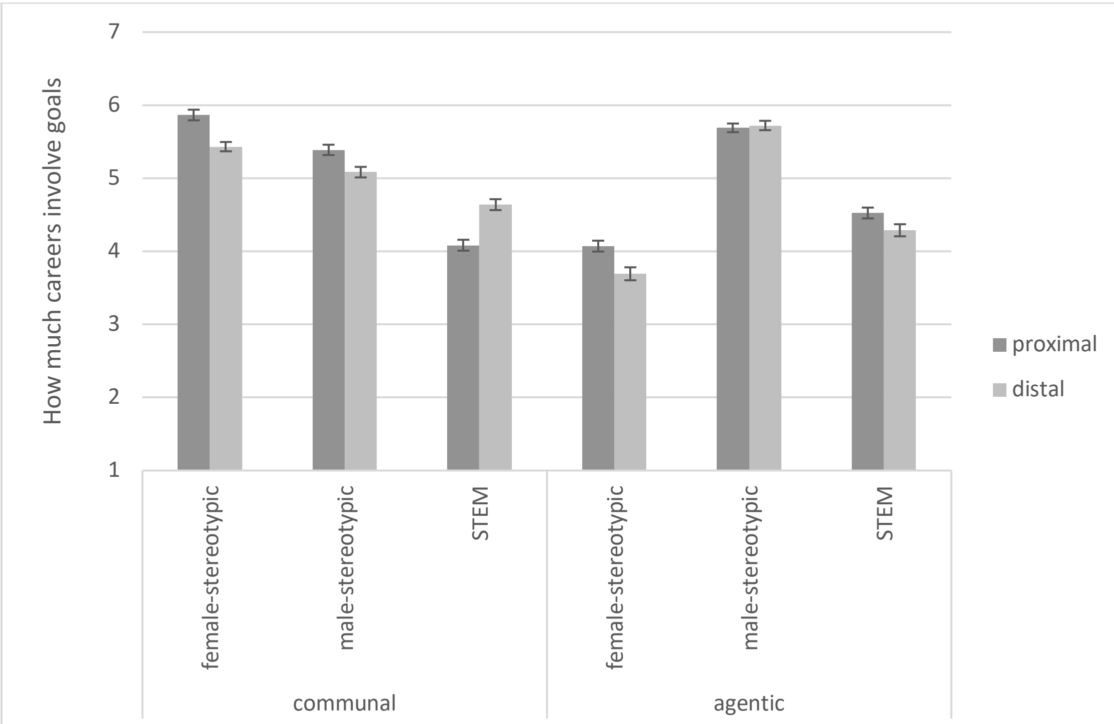
| Proximal | Distal |
|---|---|
| Study 1a | |
| Communal | |
| providing direct help to others | helping society |
| directly mentoring others | serving as a role model in the broader community |
| working face-to-face with others | participating in the broader community |
| improving the lives of others through direct contact | generally improving the lives of others through innovation [policy] |
| *αs: STEM .84; MST .71; FST .75* | *αs: STEM .72; MST .76; FST .78* |
| Study 1b | |
| Communal | |
| direct help, working face-to-face with others, or direct mentorship | helping society, participating in a broader community, or serving as a role model to the broader community |
| *αs: STEM .72, MST .65, FST .81* | *αs: STEM .67, MST .66, FST .60* |
| Agentic | |
| power, status, or recognition from coworkers | power, status, or recognition in society |
| *αs: STEM .72, MST .64, FST .78.* | *αs: STEM .75, MST .65, FST .78* |
| Study 1c | |
| Communal | |
| work face-to-face with others | participate in a broader community |
| directly mentor others | serve as a role model in the broader community |
| help others directly | help society |
| *αs: STEM .77, MST .77, FST .82* | *αs: STEM .77, MST .76, FST .82* |
| Agentic | |
| gain status among your coworkers | gain status in the broader community |
| have power over your coworkers | have power in the broader community |
| gain recognition from your coworkers | gain recognition in the broader community |
| *αs: STEM .81, MST .81, FST .82* | *αs: STEM .82, MST .80, FST .82* |

*Figure 1.* Study 1a communal affordances as a function of distance.



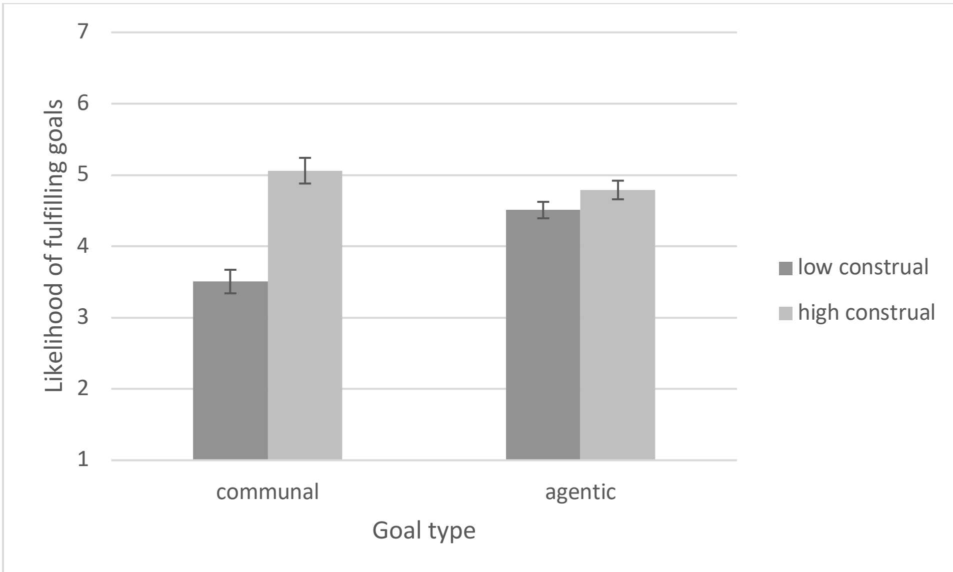

*Note.* Ratings of how much careers involved communal goals were made on scales ranging from 1 (*not at all*) to 7 (*extremely*). Within proximal, STEM vs. MST, $p < .0001$, $d = 2.27$; STEM vs. FST, $p = .0002$, $d = 2.42$. Within distal, STEM vs. MST: $p = .009$, $d = 0.41$; STEM vs. FST: $d = 0.28$. Error bars represent ±1 standard error of the mean.

*Figure 2.* Study 1b goal affordances as a function of distance, goal type and career type.



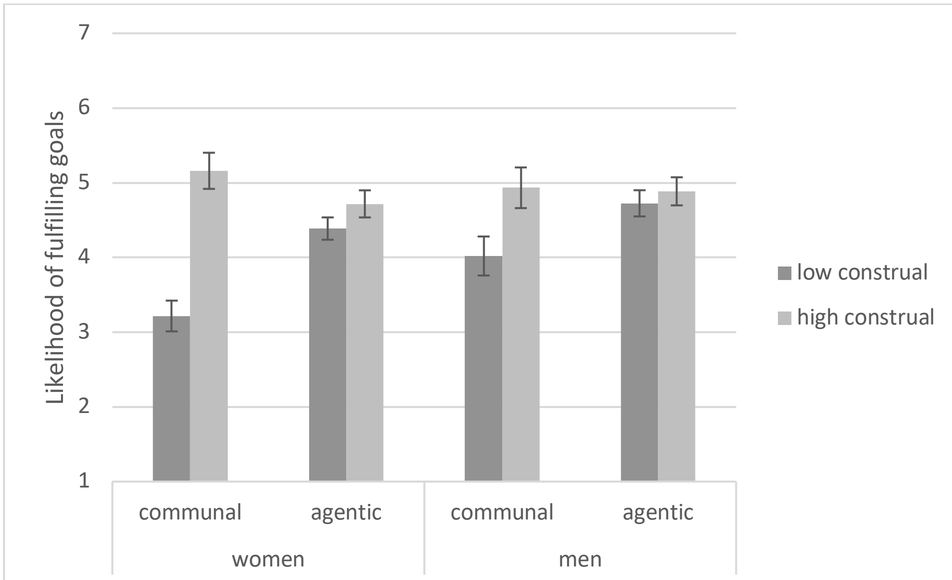

*Note.* Ratings of how much careers involved goals were made on scales ranging from 1 (*not at all*) to 7 (*extremely*). Error bars represent ±1 standard error of the mean.

*Figure 3.* Study 2 effects of construal level on science task affordances by goal type.



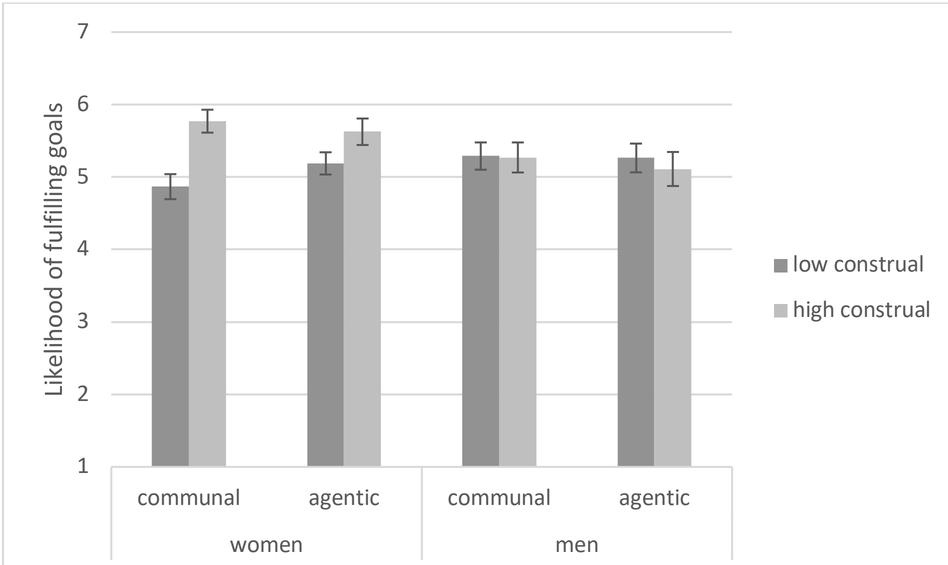

*Note.* Ratings of how much tasks involved communal and agentic goals were made on scales ranging from 1 (*not at all*) to 7 (*extremely*). Error bars represent ±1 standard error of the mean.

*Figure 4.* Study 2 effects of construal level on science task affordances by participant gender and goal type.



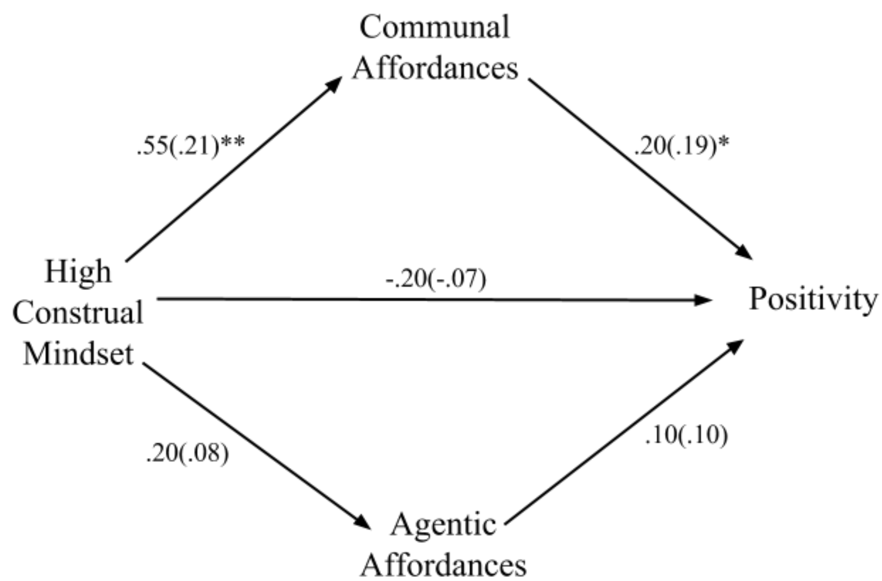

*Note.* Ratings of how much science task involved communal and agentic goals were made on scales ranging from 1 (*not at all*) to 7 (*extremely*). Error bars represent ±1 standard error of the mean.

*Figure 5.* Study 2 effects of construal level on scientist career affordances by construal level, participant gender and goal type.




*Note.* Ratings of how much a scientist career involved communal and agentic goals were made on scales ranging from 1 (*not at all*) to 7 (*extremely*). Error bars represent ±1 standard error of the mean.

*Figure 6*. Study 2 results of a path analysis of communal and agentic affordances of a scientist career as possible mediators of the relationship between high construal mindset and more positive attitudes toward a scientist career.




*Note.* Construal level was dummy-coded (0 = low, 1 = high). Unstandardized regression coefficients are given outside of parentheses, and standardized regression coefficients are given in parentheses. **$p < .01$; * $p < .05$.