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Time to Move On? When Entity Theorists Perform Better Than Incremental Theorists

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Abstract

Previous research has shown that when confronted with failure, individuals with a fixed view of intelligence (entity theorists) perform worse on subsequent tasks than those with a malleable view of intelligence (incremental theorists). This study finds that entity theorists perform worse than incremental theorists only when they believe that a subsequent task measures the same ability as the task they previously failed. However, when individuals believe that the subsequent task measures an ability unrelated to the ability needed for the initial failed task, incremental theorists perform worse than entity theorists. Across five studies, we show that entity theorists are more likely to choose a different-ability task as a second task and perform better than incremental theorists on that task. We also examine the role of thoughts about previous failure in the performance differences.

Keywords

theory of intelligence, performance, rumination, working memory

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Introduction

> "It is only through labor and painful effort, by grim energy and resolute courage, that we move on to better things."
>
> —Theodore Roosevelt

The quotation tells us that we should try hard and believe that our effort will pay off, even when we face difficulties. Consistent with these ideas, we are told that when we perform tasks (e.g., taking the Scholastic Aptitude Test), trying hard will make a difference in our outcomes and that this belief is essential to success. Empirical studies have shown that when individuals are asked to persist in a task at which they previously failed, those who believe effort can make a difference in their outcomes persist longer and perform better than those who believe their ability is fixed and their effort cannot make a difference (see Dweck, 2006, for a review).

While anecdotal evidence and empirical findings have confirmed that individuals with a malleable mind-set perform better than those with a fixed mind-set when given a second chance after experiencing failure (Cury, Da Fonseca, Zahn, & Elliot, 2008; Hong, Chiu, Dweck, Lin, & Wan, 1999; Snyder, Malin, Dent, & Linnenbrink-Garcia, 2014), individuals in real-life environments are not always given the opportunity to try the same task again right after they experience failure. Rather, they are often required to complete different kinds of tasks in sequence that they might believe require different abilities. We suggest that when individuals move on to a new task they believe requires a different ability from a prior failed task, believing in the power of effort might lead them to have difficulty abandoning thoughts about the prior failure (e.g., "I should have tried harder") and moving on to the new task. This in turn impairs their performance on the new task. We first review the relevant literature and develop our hypotheses for empirical testing.

Role of Theories of Intelligence (TOIs) in Performance

Dweck and colleagues suggested that different people hold different implicit theories about the nature of intelligence (Dweck, 2006; Dweck & Leggett, 1988; Hong et al., 1999). Some believe their intellectual abilities are fixed, so no matter how hard they try, they cannot change their intelligence (entity theorists). Others believe their intelligence is

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malleable, so that by applying more effort they can improve their intelligence (incremental theorists).

The literature has shown that individuals' TOIs affect academic performance (Aronson, Fried, & Good, 2002; Cury et al., 2008; Hong et al., 1999; Snyder et al., 2014). When confronted with failure, entity theorists perform worse on a subsequent task than incremental theorists (Dweck & Leggett, 1988; Elliott & Dweck, 1988). College students who read an artificial article supporting entity theory performed worse on a subsequent task than those who read an article supporting incremental theory (Cury et al., 2008). Furthermore, when children's TOIs were induced via performance feedback, those who received entity feedback performed worse than those given incremental feedback (Mueller & Dweck, 1998).

One way in which TOIs affect students' performance is by creating different attributional styles that guide their reactions to failure (Aronson et al., 2002; Dweck, 2006; Dweck & Leggett, 1988). Entity theorists attribute failure to a lack of fixed intellectual ability, which leads them to believe they cannot succeed no matter how hard they try. Thus, upon failure, entity theorists display *helpless* responses, such as high-performance worries and lack of persistence (Cury et al., 2008; Mangels, Butterfield, Lamb, Good, & Dweck, 2006). In contrast, incremental theorists attribute their failure to a lack of effort and believe that applying more effort will improve their performance. Thus, after experiencing failure, incremental theorists exhibit more *mastery* responses, such as exerting more effort and persisting despite initial setbacks (Dweck & Leggett, 1988; Hong et al., 1999).

However, it is important to note that previous studies adopted situations in which participants might have construed the second task as an opportunity to directly make up for their prior failure. Participants engaged in the same intelligence task twice in a row or were told two consecutive tasks measured abilities that are important components of intelligence (Cury et al., 2008; Hong et al., 1999; Snyder et al., 2014). Thus, previous findings imply that after failing a task, entity theorists perform worse than incremental theorists if they engage in a task that requires the same ability as the previous one (e.g., intelligence). However, what if participants believed that a subsequent task measured a different ability from the previous failed task (e.g., abilities independent of intelligence)? Will entity theorists' helpless response and incremental theorists' mastery response spillover into such subsequent tasks?

Moderating Role of Type of Subsequent Task

We propose that when a subsequent task is described as measuring a *different* ability, incremental theorists perform worse than entity theorists. Although our predictions might appear to contradict prior findings, they are actually consistent with the mechanism proposed in prior work on self-critical thoughts. Entity theorists attribute their poor performance to lack of fixed ability, so when they fail at a task, they conclude that they do not have the ability to succeed at it. Thus, when a second task measures an ability that entity theorists believe they do not have (the same ability needed for the failed task), self-critical thoughts about their lack of ability are likely to linger in their mind and disrupt their performance on the second task (Cury et al., 2008; Mangels et al., 2006). For instance, after receiving negative performance feedback, entity theorists showed greater frontal P3 response, a sign of higher fixation on negative feedback and greater self-critical thoughts, than incremental theorists (Mangels et al., 2006).

In the current research, we suggest that in certain situations, incremental theorists can experience self-critical thoughts about the previous failure, particularly about their lack of effort in the failed task, and such thoughts disrupt a subsequent task. We propose that incremental theorists are more likely to experience self-critical thoughts about their previous failure than entity theorists when the given task does not provide a chance to make up for the failed task by putting in more effort. In this situation, entity theorists will not necessarily feel helpless because the second task does not measure the ability they think they lack. In contrast, such a second task does not provide a second try on the same-ability task for incremental theorists who gravitate toward improving their performance on the failed task by putting in more effort. Thus, for incremental theorists who think they should have put in more effort on the failed task, self-critical thoughts about their lack of effort on the failed task are likely to linger in their mind during the second task, thereby impairing their performance on that task. In support of our hypothesis, Heine et al. (2001) showed that Japanese participants persisted less on a subsequent task when the task differed from the task they initially failed than North American participants, and the authors argued that this might be because Asians are more likely to hold an incremental view of intelligence than Western people.

Prior work on counterfactual thinking and goal disengagement also provide support for our hypotheses. Counterfactual thoughts are typically activated by a failed task, and they specify what might have been done differently to have succeeded in that task (Epstude & Roese, 2008; Markman, Gavanski, Sherman, & McMullen, 1993; Roese, 1997). Individuals who believe in possible change (e.g., incremental theorists) are more likely to engage in counterfactual thoughts about better alternatives to the past outcome (i.e., upward counterfactuals; Roese & Olson, 1995; Sherman & McConnell, 1995), and those who dwell on upward counterfactuals are doomed to regret and feel an excruciating sense of loss (Sherman & McConnell, 1995) unless they have a chance to make their counterfactuals come true (Roese, 1994). Upon facing negative outcomes, upward counterfactuals are demotivating and even hurt performance when individuals are not given an opportunity to realize the reflection and correct the past mistakes (Epstude & Roese, 2008; Testa

& Major, 1990). Thus, it is reasonable to propose that incremental theorists are more likely to engage in counterfactual thinking about better alternatives (e.g., "If only I had worked harder, I would have succeeded in the task"), which in turn hurts their performance, especially when they have to perform a task that cannot realize their counterfactuals.

In addition, studies on goal disengagement have shown that individuals differ in their tendency to disengage from the initial goal that they failed to attain and move on to a new goal, and those who have difficulty abandoning an initial goal tend to experience lower well-being (Wrosch, Scheier, Carver, & Schulz, 2003; Wrosch, Scheier, Miller, Schulz, & Carver, 2003). Although the goal disengagement literature has emphasized the consequences of goal disengagement rather than antecedents (Wrosch, Scheier, Carver, & Schulz, 2003; Wrosch, Scheier, Miller, et al., 2003), a few researchers have speculated that a belief that effort can change outcomes may lead people to be less likely to disengage from the initial goal they failed to attain and move on to the next goal as they have more difficulty in recognizing certain goals as unattainable (Wrosch, Scheier, Carver, & Schulz, 2003).

Taken together, we suggest that when incremental theorists are asked to move on to a new task without having a second chance to demonstrate better performance on a failed task via more effort, they might dwell on the prior failure and have more self-critical thoughts about the failure than entity theorists. In turn, incremental theorists might perform worse than entity theorists because of the disruption from self-critical thoughts during the second task when the second task seems independent of their prior failure.

Self-Critical Thoughts and Performance

We argue that self-critical thoughts about previous failure play a mechanistic role underlying hypothesized performance differences between entity and incremental theorists. Specifically, we propose that when a second task measures the same ability needed for the failed task (i.e., same-ability task), entity theorists are more likely to experience self-critical thoughts about their lack of ability than incremental theorists. However, when the given task does not provide a chance to make up for the failed task by putting in more effort (i.e., different-ability task), incremental theorists are more likely to experience self-critical thoughts about their lack of effort than entity theorists. That is, incremental theorists might keep thinking how the results could have been better and regretting their lack of effort on the previously failed task while performing a second task that seems to be independent of the previous failure (e.g., "I would have performed better if I had put in more effort").

Self-critical thoughts and worries about the failed task while engaging in a subsequent task hinder individuals' performance on the subsequent task by consuming limited cognitive resources, such as working memory, which could otherwise be applied to the subsequent task (Gray, 2001; Gray, Braver, & Raichle, 2002). Working memory is a set of cognitive resources involved in storing and manipulating information regarding the task at hand (Engle, 2002); thus, when working memory is compromised, performance can suffer (Engle, 2002; Just & Carpenter, 1992). Self-critical thoughts about previous failure hinder performance, especially on tasks that demand high working memory, by creating a dual-task situation in which participants must simultaneously deal with self-critical thoughts and mentally taxing problem-solving (Ashcraft & Kirk, 2001; Beilock, 2008).

In this article, we used two methods to provide evidence of the role of self-critical thoughts about previous failure. First, in one study (Study 2), half the problems in the second task required relatively high working memory, while the other half required relatively low working memory. Prior work has shown that self-critical thoughts and worries impair performance, especially when the task requires high (vs. low) working memory (Ashcraft & Kirk, 2001; Beilock, 2008). Therefore, if self-critical thoughts are a mechanism underlying performance differences between entity and incremental theorists, the differences should become apparent in problems that require high working memory. Second, in two studies (Studies 3 and 4), we tested the role of self-critical thoughts more directly. In Study 3, we measured the extent to which individuals thought about prior failure. In Study 4, we measured different types of thoughts about prior failure and identified a specific type of thought that was particularly disruptive to the performance of the second task.

The Present Research

Across five studies, we tested our predictions that after experiencing failure, entity theorists are less likely to choose a same-ability task and perform worse on the same-ability task than incremental theorists, whereas incremental theorists are less likely to choose a different-ability task and perform worse on the different-ability task. Adopting settings from prior work suggesting that individuals' TOIs exert the most influence in facing challenges (Licht & Dweck, 1984; Plaks & Stecher, 2007), we centered our investigation on situations in which all participants received failure feedback on a first task and examined whether their reactions to a second task differed depending on their TOIs and the type of second task (same-ability vs. different-ability).

In Study 1, we first demonstrated that after experiencing failure entity theorists were more likely to choose a different-ability task as their second task than incremental theorists. In Studies 2, 3, and 4, we compared individuals' performance on a second task after failing a first task. We adopted an identical task as the second task but framed it differently depending on the condition. We told participants that the second task measured either intelligence (same-ability task) or another ability, such as mental imagery, which was ostensibly unrelated to the intelligence required for the first task

(different-ability task). By changing the framing of the task instead of using two different tasks, we controlled factors associated with the different tasks other than the perceived difference in required ability.

Study 1a

In this study, we provide initial evidence that entity (incremental) theorists might not engage in generalized helpless (mastery) behaviors by measuring individuals' willingness to engage in a same-ability versus different-ability task after experiencing failure. Specifically, we asked participants to choose between persisting with the same-ability task or switching to a different-ability task to test whether entity theorists are more willing to move on to a different-ability task than incremental theorists after experiencing failure.

Method

One hundred nineteen undergraduate students at a large university in Hong Kong participated in the study (78 women, M_{age} = 20.04 years). Participants completed the TOI questionnaire and then engaged in an intelligence task designed for all participants to fail. After receiving failure feedback, they were asked to choose a subsequent task.

TOI measure. Participants completed a four-item questionnaire measuring their beliefs about the malleability of intelligence (e.g., "To be honest, you can't really change how intelligent you are"; Dweck, 1999) on a 6-point Likert-type scale (1 = *strongly disagree*, 6 = *strongly agree*; α = .87), embedded in filler questionnaires (i.e., need for belongingness, self-esteem). We averaged the four items to compute individuals' TOI score; thus, a higher score indicated greater endorsement of entity theories.

Task 1 (anagram task). We presented 10 anagram problems on a computer screen one at a time. Each problem was presented for 45 s, and then the software automatically moved to the next problem. We told participants that the task measured intelligence and they had to solve at least seven anagram problems correctly to succeed in the task. However, this goal was unattainable because five anagrams were unsolvable. Consequently, all participants received failure feedback (i.e., "You got less than seven correct answers. The average score for undergraduate students is 7.8"; Mogg, Mathews, Bird, & Macgregor-Morris, 1990).

Task 2 (choice of second task). Next, participants were asked to choose a follow-up task. Participants were told that the second task was either another intelligence task or a mental imagery task. Participants were explicitly told that mental imagery skills were independent of intelligence. After participants chose, they were told that they did not need to actually engage in the follow-up task and debriefed.

Results and Discussion

We conducted a binary logistic regression analysis to predict the choice of subsequent task (0 = another intelligence task, 1 = mental imagery task) using the standardized TOI score as a predictor.[1] A test of our model against a constant-only model was statistically significant, indicating that the TOI score reliably distinguished between participants who chose the intelligence task and those who chose the mental imagery task, $\chi^2(1) = 6.74$, $p = .009$. More importantly, the Wald criteria demonstrated that the TOI score contributed significantly to prediction, indicating that the more participants endorsed entity theories, the more they were willing to engage in a different-ability task, Wald $\chi^2(1) = 6.35$, $p = .012$, odds ratio (OR) = 1.65, 95% confidence interval (CI) = [1.12, 2.43]. Therefore, for every one-unit increase in TOI score (i.e., stronger entity theories), we observed a 65% increase in the odds of choosing the different-ability task (i.e., mental imagery skills) as the subsequent task. Neither of our filler questionnaires (i.e., need for belongingness, self-esteem) significantly predicted individuals' task choice, ps > .05, and our finding remained significant after controlling for the filler questionnaires, Wald $\chi^2(1) = 5.56$, $p = .018$.

Study 1a provided supporting evidence for our hypothesis that after experiencing failure, entity theorists are more likely to move on to a different task than incremental theorists. This also means that incremental theorists are more likely to persist on the same task than entity theorists. However, because the results were only correlational, other factors associated with TOIs might have influenced participants' choice of second task. Thus, in the next study, we experimentally manipulated individuals' TOIs.

Study 1b

Study 1b aimed to replicate the findings from Study 1a with a more diverse sample and to draw a causal relationship between TOIs and task choice by manipulating participants' TOIs.

Method

One hundred ninety-one participants were recruited from a national online subject pool using Amazon's MTurk in exchange for small monetary compensation (110 women, M_{age} = 35.46 years). The procedure was identical to Study 1a except that we manipulated participants' TOIs instead of measuring individual differences.

Theory of intelligence manipulation. Participants read an artificial science article that manipulated their TOIs (Plaks & Stecher, 2007; Rattan, Good, & Dweck, 2012). Half the participants read an article supporting entity theory (e.g., " . . . neither environmental factors nor intense willpower

appears to change this basic intelligence stability . . . "), while the other half read an article supporting incremental theory (e.g., " . . . intelligence is a product of one's willpower and environment . . . "). After reading the article, participants completed a manipulation check ("To what extent do you believe that a person's intellectual abilities are fixed and cannot be changed?"; 1 = not at all, 7 = very much). We also measured the article's credibility ("The content of the article is credible"), comprehension difficulty ("The content is easy to understand"), and attention to the article ("I paid great attention while reading the article") on a 7-point Likert-type scale (1 = *strongly disagree*, 7 = *strongly agree*) to ensure that the two articles did not differ on these variables.

Results and Discussion

We first checked whether our manipulation of TOIs succeeded. As expected, participants in the entity theory condition expressed a stronger belief in fixed intelligence (M = 4.72, SD = 1.33) than those in the incremental theory condition (M = 2.27, SD = 1.35), $t(189) = -12.59$, $p < .001$, $d = -1.82$. The articles did not differ in terms of credibility ($p > .70$), comprehension ($p > .10$), or attention ($p > .90$). Consistent with Study 1a, a chi-square analysis (0 = another intelligence task, 1 = mental imagery task) showed that task choice differed by manipulated TOIs (0 = incremental, 1 = entity), $\chi^2(1) = 7.26$, $p = .007$. Among participants primed with entity theory, 55.2% wanted to move on to a different task, whereas among those primed with incremental theory, only 35.8% wanted to move on to a different task. Studies 1a and 1b showed that participants with entity (vs. incremental) theories were more likely to choose a different-ability task. In the next study, we examined individuals' actual performance on a second task.

Study 2

Study 2 examined individuals' performance on a second task after failing a first task. We predicted that entity theorists perform worse on a same-ability task than incremental theorists, replicating previous findings (Cury et al., 2008; Hong et al., 1999; Snyder et al., 2014). However, incremental theorists perform worse on a different-ability task than entity theorists. We also tested the proposed mechanism that individuals' self-critical thoughts about their prior performance create the performance differences by varying the level of problem difficulty in the second task. Because task performance is particularly vulnerable to worries and self-critical thoughts when the task requires high (vs. low) working memory (Ashcraft & Kirk, 2001), if self-critical thoughts were responsible for the performance difference between incremental and entity theorists, such performance difference is more pronounced in high working memory–demanding problems than low working memory–demanding problems.

Method

One hundred eleven undergraduate students at a large university in Hong Kong participated in the study (66 women, M_{age} = 20.36 years). Participants completed the same TOI questionnaire as in Study 1a and the same anagram task as in Studies 1a and 1b. All participants received failure feedback and moved on to a second task.

Task 2. We used a mental modular arithmetic (MA) task (Beilock & Carr, 2005) as a second task. In the MA task, participants received MA problems in the form of $36 \equiv 12 \pmod 6$ on a computer screen. The $\equiv$ operation means that participants first subtract the second number from the first ($36 - 12 = 24$) and then divide that number by the number in parentheses (6, $24/6 = 4$ with no remainder). If the remainder is 0, the statement is true; if not, it is false. Participants were asked to judge the validity of each problem as quickly and accurately as possible by pressing either the T (true) or F (false) button on the computer.

All participants engaged in the same MA task, but half were told that the MA task also measured intelligence (same-ability task), whereas the others were told that the task measured motor and process skills ostensibly known to be independent of intelligence (different-ability task).[2] All participants first completed six practice MA problems followed by a main examination composed of 24 MA problems. Half the main problems demanded low working memory, which included single-digit numbers and never required a borrowing operation in the first step, whereas the other half demanded high working memory, which included double-digit numbers and required a borrowing operation (Beilock & Carr, 2005).

Results and Discussion

The proportion of correct answers (accuracy) served as our main dependent variable. MA accuracy for low- and high-demand problems was separately regressed on the TOI score, task frame (0 = same, 1 = different), and their interaction. All variables were z standardized prior to creating the interaction term (i.e., TOI × Task frame). On high-demand problems, the analysis revealed non-significant main effects of TOI, $\beta = .04$, $p > .60$, 95% CI = [−0.14, 0.23], and task frame, $\beta = -.06$, $p > .50$, 95% CI = [−0.24, 0.13], which were qualified by the interaction between TOI and task frame, $\beta = .28$, $p = .004$, 95% CI = [0.10, 0.47] (Figure 1). As expected, the results showed that the more participants endorsed entity theories, the worse they performed on the second task, but only when the second task was framed as measuring intelligence, $\beta = -.24$, $p = .054$, 95% CI = [−0.47, 0.00], replicating prior findings. More importantly, however, when the second task was framed as measuring skills other than intelligence, the pattern was reversed. The more participants endorsed incremental theories, the worse they performed on the MA task, $\beta = .33$, $p = .030$, 95% CI = [0.03, 0.62].

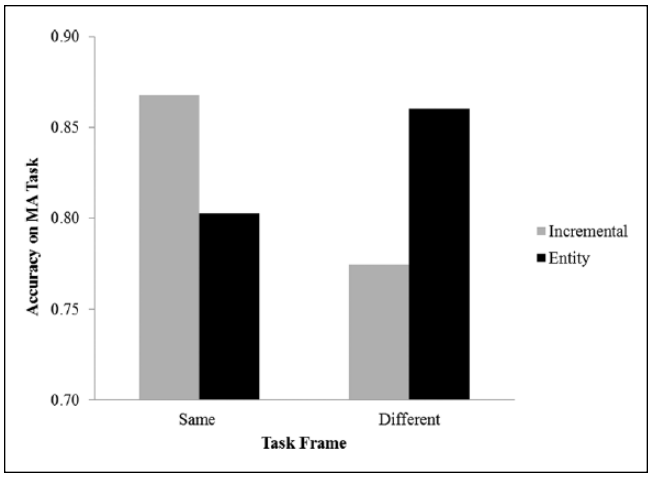

Figure 1. Performance on high working memory demand MA problems in Study 2.
Note. The incremental condition represents participants who were 1 *SD* below the mean on the TOI scale, whereas the entity theory condition represents participants who were 1 *SD* above the mean on the TOI scale. MA = modular arithmetic; TOIs = theories of intelligence.

On low-demand problems, however, neither the two main effects nor the interaction was significant, *p*s > .30. Therefore, we observed a more pronounced performance difference by TOI and task frame with high-demand problems that are more vulnerable to self-critical thoughts and worries than low-demand problems. Neither main effects nor the interaction effect of TOIs and task frame on reaction time was significant for either high- or low-demand problems, *p*s > .40.

Study 2 suggests that individual differences in TOIs have opposing effects on performance depending on task framing. After experiencing failure on a first intelligence task, when a second task was also described as tapping intelligence, entity theorists performed worse than incremental theorists. In contrast, when the second task was described as being unrelated to intelligence, incremental theorists performed worse than entity theorists. These performance differences were particularly apparent on high-demand problems, which suggested that the performance differences might be driven by self-critical thoughts about the initial failure. However, because we did not directly ask participants how much they were thinking about their previous performance, it was not clear whether participants were actually disrupted by thoughts related to their previous failure during the second task.

Study 3

In Study 3, we aimed to replicate the finding from Study 2 that entity theorists perform worse on a same-ability task, whereas incremental theorists perform worse on a different-ability task. In addition, to provide more direct evidence of thoughts about the initial failure, we asked participants to what extent they ruminated on their previous performance while engaging in the second task. We also used different performance tasks to examine whether the findings from Study 2 extended to new tasks.

Method

We used a 2 (Manipulated TOIs: entity vs. incremental) × 2 (Task frame: same- vs. different-ability) between-subjects design. One hundred five undergraduate students at a large university in Hong Kong were randomly assigned to one of the four conditions (75 women, M_{age} = 20.50 years). Participants first engaged in a TOI manipulation task. As in Study 1b, participants read an article supporting either entity or incremental theory depending on the condition. After reading the article, participants completed a manipulation check and questions on credibility, comprehensibility, and attention to the article. Then, participants completed two tasks.

Task 1. Participants engaged in a task framed as an intelligence task. On a computer screen, we presented 10 remote association test (RAT) problems one at a time (Mednick, 1962). Participants were asked to find a commonality among three presented words. For instance, participants had to type "Phone" when given "Call-Pay-Line." Participants were informed that the RAT measured intelligence and then received failure feedback ("Your performance is in the bottom 29th percentile among other students who performed the same task"; Plaks & Stecher, 2007).

Task 2. The second task was framed either as another intelligence task or a task measuring another skill (i.e., mental imagery skill) ostensibly independent of intelligence. Following the task frame manipulation, participants engaged in the operational span task (OSPAN; Turner & Engle, 1989; Unsworth, Heitz, Schrock, & Engle, 2005). In this task, participants were required to verify a series of math equations while trying to remember a sequence of letters. For instance, participants were first given a math equation (e.g., "2 × 1 + 1 = 5") and had to judge whether the equation was true or false. Each verification question was followed by a letter (e.g., "L") that appeared on the screen for 1,000 ms. After a certain number of sets (equation–letter pairs), participants were asked to recall the letters in the order presented. The total number of letters correctly recalled served as the main dependent variable.

Although OSPAN performance has been used to index pre-existing individual differences in working memory capacity (Unsworth et al., 2005), it can also capture momentary changes in working memory capacity within the individual depending on performance contexts (Johns, Inzlicht, & Schmader, 2008). Thus, performance on the OSPAN task can reveal the extent to which working memory is disrupted by thoughts about the initial failure. The greater the extent of working memory disruption, the lower the performance on the OSPAN task.

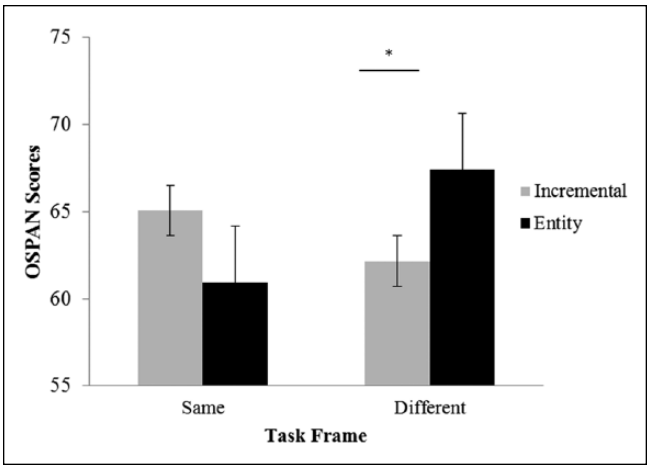

Figure 2. The effect of manipulated TOIs and task frame on OSPAN performance in Study 3.
Note. Error bars represent ±1 standard error. TOIs = theories of intelligence; OSPAN = operational span task.
*$p \leq .05$

Thoughts about previous failure. At the end of the second task, participants indicated the extent to which they thought about the previous failure ("Please tell us to what extent thoughts that are relevant to the first task—RAT task—kept running through your mind while you were solving the second task—OSPAN task"; 1 = not very much, 5 = a great deal; adapted from Brunstein & Gollwitzer, 1996).

Results and Discussion

We first checked whether our TOI manipulation (0 = incremental, 1 = entity) succeeded. As expected, participants in the entity theory condition expressed a stronger belief in fixed intelligence ($M = 4.15$, $SD = 1.31$) than those in the incremental theory condition ($M = 3.02$, $SD = 1.17$), $t(103) = -4.64$, $p < .001$, $d = -0.91$. In addition, the two articles did not differ in terms of their credibility ($p = 0.09$), comprehension ($p > .20$), or attention ($p > .30$).

OSPAN performance. A 2 (Manipulated TOIs: entity vs. incremental) × 2 (Task frame: same- vs. different-ability) between-subjects ANOVA revealed non-significant main effects, $ps > .30$, but a significant interaction, $F(1, 101) = 6.20$, $p = .014$, $\eta_p^2 = .06$ (Figure 2). Similar to the findings in Study 2, when the OSPAN task was framed to measure intelligence, participants in the entity theory condition ($M = 60.93$, $SD = 12.42$) performed worse than those in the incremental theory condition ($M = 65.04$, $SD = 8.79$), although the difference was not significant, $t(101) = -1.56$, $p = .123$, $d = -0.38$. However, when the OSPAN task was framed to measure a different skill, the pattern was reversed: Participants in the incremental theory condition ($M = 62.16$, $SD = 10.58$) performed significantly worse than those in the entity theory condition ($M = 67.41$, $SD = 5.29$), $t(101) = 1.96$, $p = .052$, $d = 0.63$.

Thoughts about previous failure. Next, we examined the role of thoughts about previous failure. First, we tested whether TOIs and task framing changed the *amount* of thoughts experienced during the OSPAN task. Specifically, we tested whether participants in the entity (vs. incremental) theory condition thought more about their previous performance when given a same-ability task, whereas those in the incremental (vs. entity) theory condition thought more about the previous failure when given a different-ability task. To test these predictions, we conducted a 2 (Manipulated TOIs: entity vs. incremental) × 2 (Task frame: same- vs. different-ability) between-subjects ANOVA on the degree of thoughts about previous failure. The results showed that neither main effects nor the interaction was significant, indicating that TOIs and task frame did not change the *amount* of thoughts about previous failure, all $ps > .20$.

One reason we did not observe significant changes in the *amount* of thoughts across conditions may be that we measured overall thoughts about previous performance rather than specific types of thoughts. That is, OSPAN performance might not have been equally disrupted by any type of thought about the previous failure. Rather, specific types of thoughts might be particularly disruptive to the task at hand. For example, for the same-ability task, the thoughts of participants in the entity theory condition (e.g., "I failed before so I will fail again") might be more disruptive than the thoughts of those in the incremental theory condition (e.g., "I failed before but I will put in more effort this time"). In contrast, for the different-ability task, the thoughts of those in the incremental theory condition (e.g., "I should have put more effort into the previous task") might be more disruptive than the thoughts of those in the entity theory condition (e.g., "I don't have to do the task that I failed"). Even though we did not measure specific types of thoughts, if certain types of thoughts were particularly disruptive to OSPAN performance, the *impact* of thoughts on OSPAN performance should differ across conditions.

To examine whether the *impact* of thoughts on OSPAN performance differed across conditions, we ran separate regression analyses for each condition. For the same-ability task, we observed a significant negative impact of thoughts on OSPAN performance only with participants in the entity theory condition, $\beta = -.77$, $p < .001$, 95% CI = [−1.13, −0.41], not with those in the incremental theory condition, $p > .90$. For the different-ability task, we observed a significant negative impact of thoughts only with participants in the incremental condition, $\beta = -.44$, $p = .036$, 95% CI = [−0.84, −0.03], not with those in the entity theory condition, $p > .50$. Our findings suggest that the thoughts by participants in the entity theory condition were particularly disruptive to the same-ability task, whereas the thoughts by those in the incremental theory condition were particularly disruptive to the different-ability task, possibly because different types of thoughts were evoked. To further investigate the types of thoughts that were particularly disruptive, we measured specific types of thoughts in the next study.

Study 4

Study 4's main purpose was to measure specific types of thoughts. For a same-ability task, entity theorists' self-critical thoughts about lack of ability (e.g., "Because I failed before, I will fail again") may have lowered their performance on the second task, rather than incremental theorists' self-enhancing thoughts about failure boosting their performance (e.g., "Even though I failed before, I can be better at it if I work harder in this task"). Similarly, for a different-ability task, incremental theorists' self-critical thoughts about lack of effort on the failed task (e.g., "I should have put in more effort on the first task") may have impaired performance on the second task, in contrast to entity theorists' self-enhancing thoughts and relief from not needing to work on the failed task again (e.g., "I am glad that I moved on to a task that is different from the intelligence task").

Another purpose of Study 4 was to examine whether observed performance differences were driven by entity or incremental theory. For example, when given a different-ability task, do our results reflect performance impairment among incremental theorists, or performance boost among entity theorists, or both? Based on Study 3, which revealed a significant negative relationship between incremental theorists' thoughts about the previous failure and performance on the different-ability task, we predicted that the performance difference in the different-ability task would be driven by incremental theory rather than entity theory. To test this prediction, we added a control condition in which we did not manipulate either of the two theories.

Method

We used a 3 (Manipulated TOIs: entity vs. incremental vs. control) × 2 (Task frame: same- vs. different-ability) between-subjects design. Two hundred twenty-six undergraduate students at a large university in Hong Kong were randomly assigned to one of the six conditions (161 women, M_{age} = 20.48 years).

Theory of intelligence manipulation. Participants first engaged in a TOI manipulation task. Two experimental conditions were identical to those in Studies 1b and 3. Participants (n = 75) in the entity theory condition read an article supporting entity theory, whereas those in the incremental theory condition (n = 75) read an article supporting incremental theory. We also included a control condition (n = 76) in which participants read an article about categorization of intelligence but nothing about beliefs in its malleability (e.g., "This article introduces three types of intelligence: naturalistic intelligence, interpersonal intelligence, and bodily-kinesthetic intelligence"). After reading the article, all participants completed a manipulation check and questions on credibility, comprehension, and attention to the article.

Task 1. We used the same RAT task and failure feedback as in Study 3 where all participants were informed that the task measured intelligence and then received failure feedback (Plaks & Stecher, 2007).

Task 2. As in Study 2, we used the MA task (Beilock & Carr, 2005) as a second task, but because we observed performance differences only among high-demand problems, we only included high-demand problems. All participants solved the same 24 high-demand MA problems, but half of them were told that the MA task also measured intelligence and the other half that the task measured a skill independent of intelligence (i.e., mental imagery task).

Types of thoughts. Next, participants completed questionnaires about types of thoughts related to the prior failure. We measured two types of thoughts about previous failure: thoughts that can impair task performance (self-critical) and those that can boost task performance (self-enhancing). We measured six items in each condition: three items for self-critical thoughts and three for self-enhancing thoughts. However, since the second task was framed differently depending on the task frame condition (same- vs. different-ability task), wording for each type of thought differed depending on the task-framing condition. In the same-ability condition, the three items measuring self-critical thoughts concerned respondents' helpless thoughts about their incompetence (e.g., "I failed the first intelligence task, so I will fail again," α = .90; adapted from Blackwell, 2002), and the three items measuring self-enhancing thoughts concerned motivational thoughts regarding belief in their effort (e.g., "Failing in the RAT makes me want to work more on this task, not less," α = .87; adapted from Blackwell, 2002). In the different-ability conditions, the three items measuring self-critical thoughts concerned regrets related to lack of effort (e.g., "I should have put in more effort for the first intelligence task," α = .86), and the three items measuring self-enhancing thoughts concerned relief from the previous task (e.g., "I am glad that this task does not measure intelligence," α = .74).

Results and Discussion

A manipulation check revealed that participants in the different TOI conditions (−1 = incremental, 0 = control, 1 = entity) had different levels of belief in fixed ability, $F(2, 223) = 25.91, p < .001$. Those in the entity theory condition expressed a stronger belief in fixed intelligence (M = 4.12, SD = 1.37) than those in the incremental theory condition (M = 2.55, SD = 1.11), $t(223) = -7.10$, $p < .001$, $d = -1.26$. The control condition (M = 3.57, SD = 1.56) fell between the two conditions and differed from both entity, $t(223) = 2.51$, $p = .013$, $d = 0.38$, and incremental conditions, $t(223) = 4.61$, $p < .001$, $d = 0.75$. The articles did not differ in terms of comprehension or attention, ps > .60, but participants rated the control article as more credible than the other two, ps < .05. The entity and

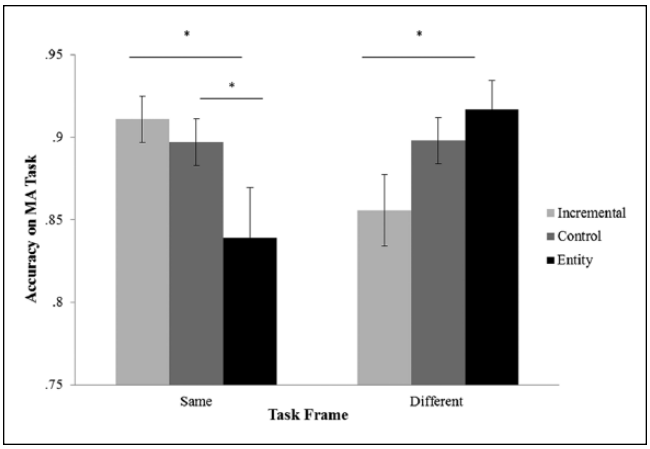

Figure 3. The effect of manipulated TOIs and task frame on MA performance in Study 4.
Note. Error bars represent ±1 standard error. TOIs = theories of intelligence; MA = modular arithmetic.
*$p < .05$.

incremental articles did not differ in their credibility, $p > .40$. However, the patterns and significance of our results remained the same regardless of whether we included credibility as a covariate in our analyses.

MA performance. Accuracy on the second task served as our main dependent variable. A 3 (Manipulated TOIs: entity vs. incremental vs. control) × 2 (Task frame: same- vs. different-ability) between-subjects ANOVA revealed non-significant main effects of manipulated TOIs and task frame, $ps > .50$, but a significant interaction, $F(2, 220) = 5.65$, $p = .004$, $\eta_p^2 = .05$ (Figure 3). Planned contrasts revealed that for the same-ability task, participants in the entity theory condition ($M = 0.84$, $SD = 0.19$) performed worse than those in the incremental theory condition ($M = 0.91$, $SD = 0.08$), $t(220) = -2.55$, $p = .011$, $d = -0.49$, and those in the control condition ($M = 0.90$, $SD = 0.09$), $t(220) = -2.09$, $p = .038$, $d = -0.40$. Participants in the incremental condition did not differ from those in the control condition, $t(220) = -0.49$, $p > .60$. Our findings indicate that after experiencing a failure, asking individuals to persist with a same-ability task diminished the performance of individuals in the entity theory condition rather than enhancing the performance of those in the incremental condition.

As expected, for the different-ability task, the pattern was reversed. Participants in the incremental theory condition ($M = 0.86$, $SD = 0.14$) performed worse than those in the entity theory condition ($M = 0.92$, $SD = 0.11$), $t(220) = 2.18$, $p = .030$, $d = 0.50$ and in the control condition ($M = 0.90$, $SD = 0.09$), $t(220) = 1.53$, $p = .129$, $d = 0.37$, although the latter effect was not significant. Participants in the entity condition did not differ from those in the control condition, $t(220) = 0.66$, $p > .50$. Neither the main nor the interaction effect of TOIs and task frame on reaction time was significant, $ps > .40$.

Types of thoughts. Next, we examined whether the observed performance differences can be explained by self-critical or self-enhancing thoughts about the previous failure. We averaged the three items for each type of thought to create one self-critical thought score and one self-enhancing thought score. First, we tested whether the degree of self-critical thought differed across conditions. A 3 (Manipulated TOIs: entity vs. incremental vs. control) × 2 (Task frame: same- vs. different-ability) between-subjects ANOVA revealed a significant main effect of task frame, $p < .01$, which was qualified by a significant interaction between manipulated TOIs and task frame, $F(2, 220) = 3.57$, $p = .030$, $\eta_p^2 = .03$. Planned contrasts revealed that in the same-ability task condition, participants in the entity theory condition had a higher level of self-critical thoughts ($M = 2.89$, $SD = 1.73$) than those in the incremental theory condition ($M = 2.20$, $SD = 1.27$), $t(220) = 2.05$, $p = .041$, $d = 0.46$. The control condition ($M = 2.47$, $SD = 1.27$) fell between the two theory conditions but did not differ statistically from either of the two conditions, $ps > .20$. However, in the different-ability task condition, participants in the incremental theory condition ($M = 3.53$, $SD = 1.39$) had a higher level of self-critical thoughts than those in the entity theory condition ($M = 2.96$, $SD = 1.25$), $t(220) = -1.70$, $p = .090$, $d = -0.43$, although the effect was marginally significant. The control condition ($M = 3.28$, $SD = 1.69$) fell between the other two conditions, but did not differ statistically from either, $ps > .30$.

To rule out the alternative explanation—performance difference driven by self-enhancing thoughts—we also conducted a 3 (Manipulated TOIs: entity vs. incremental vs. control) × 2 (Task frame: same- vs. different-ability) between-subjects ANOVA on the self-enhancing thought score. The analysis revealed a significant main effect of task frame, $p < .001$, but non-significant main effect of manipulated TOIs or interaction, $ps > .70$.

Our findings indicate that after experiencing failure, for a same-ability task, participants in the entity theory condition experienced a higher degree of self-critical thoughts about their lack of competence on the previous task than those in the incremental theory condition. In contrast, for a different-ability task, individuals in the incremental theory condition experienced a higher degree of self-critical thoughts about their lack of effort on the previous task than those assigned to the entity theory condition.

Mediation analyses. To test whether self-critical thoughts account for the interactive effect of TOIs and task frame on performance, we conducted a bootstrap analysis using PROCESS (Hayes, 2013). All variables were z standardized before creating the interaction term (i.e., TOI × Task frame). We first ran two separate bootstrapping analyses, one for the same-ability and the other for the different-ability conditions (Model 4, Hayes, 2013). The results showed that when self-critical thoughts were examined as the mediating factor, the 95% bias-corrected CI for the indirect effect excluded zero

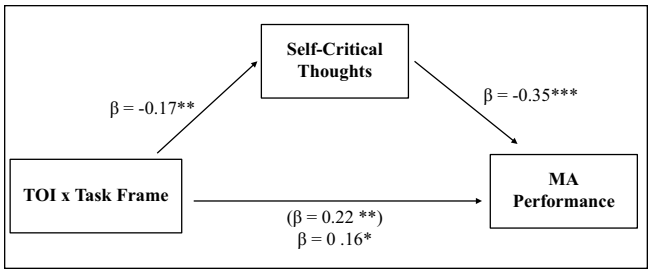

Figure 4. Moderated mediation model in Study 4. The beta in parenthesis represents the analysis without the mediator.
*p < .05. **p < .01. ***p < .001.

for the same-ability condition—indirect effect = −0.09, *SE* = 0.05, CI = [−0.20, −0.01]—and for the different-ability condition—indirect effect = 0.04, *SE* = 0.03, CI = [0.00, 0.12], indicating that the amount of self-critical thoughts mediated the effect of TOIs on MA task performance in both task frame conditions. We then conducted an overall mediation analysis (Model 8, Hayes, 2013). We found a significant indirect effect of self-critical thoughts on the link between TOIs × Task frame and MA task performance—indirect effect = 0.12, *SE* = 0.05, CI = [0.03, 0.24]. When we conducted a bootstrap analysis with self-enhancing thoughts as a mediating factor, the 95% bias-corrected CI for the indirect effect included zero—indirect effect = −0.01, *SE* = 0.02, CI = [−0.06, 0.01], indicating self-enhancing thoughts did not mediate the effect of TOIs × Task frame on MA task performance.

We further confirmed the mediation effect with path analyses (Baron & Kenny, 1986; Hayes, 2013; Figure 4). The results showed a significant effect of TOIs × Task frame on MA task performance, β = .22, p < .01, 95% CI = [0.09, 0.35], and a significant effect of TOIs × Task frame on the self-critical thought score, β = −.17, p < .01, 95% CI = [−0.30, −0.05]. When we included the self-critical thought score as a covariate examining the interactive effect between TOIs and task frame on MA task performance, the effect of self-critical thoughts was still significant, β = −.35, p < .001, 95% CI = [−0.48, −0.23], but the interaction reduced in significance, β = .16, p < .05, 95% CI = [0.04, 0.28], Sobel's z = 2.40, p = 0.016. Therefore, self-critical thoughts mediated the interaction effect between TOIs and task frame on MA task performance.

General Discussion

Prior work has documented that entity theorists' tendency to attribute their performance outcomes to fixed abilities can generate a response of helplessness in the face of failure (Blackwell, Trzesniewski, & Dweck, 2007; Dweck & Leggett, 1988). Their reactions to failure have been described as "maladaptive" because entity theorists were more likely to disengage from tasks and display heightened performance worries that can impair their future performance (Cury et al., 2008). In contrast, when faced with failure, incremental theorists attribute their failure to insufficient effort and look for ways to improve their performance, such as by exerting more effort. Their reactions to failure are traditionally considered "adaptive" because their willingness to persist in the task often improves their future performance.

In five studies, however, we show that entity theorists do not always react in maladaptive ways and incremental theorists in adaptive ways after experiencing failure. Rather, whether people demonstrate adaptive or maladaptive responses to failure varies depending on their construal of a task. Entity theorists performed worse when the subsequent task measured the same ability as the first task, a task they believed they could not accomplish, whereas incremental theorists performed worse when the subsequent task measured a different ability, preventing them from trying harder at the task they just failed.

In Studies 1a and 1b, we found that individuals with a stronger endorsement of entity theories were more likely to choose a subsequent task that measured abilities unrelated to the first task that yielded failure. Entity theorists' stronger willingness to move on to a task that measured a different-ability supports our premise that entity theorists do not always exhibit maladaptive reactions to subsequent tasks after failure. In Studies 2 to 4, we directly measured performance on the second task. We replicated prior findings when participants believed the second task measured the same skill as the first (e.g., intelligence) in that incremental theorists performed better after failure than entity theorists. More importantly, however, when the second task tapped a different skill than the first, incremental theorists performed worse than entity theorists.

In Studies 2 to 4, we also examined whether thoughts about the initial failure play a mechanistic role in subsequent task performance. In Study 2, the performance difference between entity and incremental theorists was more apparent among high (vs. low) working memory–demanding problems, which were more likely to be impaired by self-critical thoughts and performance worries (Ashcraft & Kirk, 2001; Beilock, 2008). Studies 3 and 4 directly measured participants' thoughts about previous failure. In Study 3, we showed that for a same-ability task, entity theorists' thoughts about previous failure hindered their performance on the subsequent task, while incremental theorists' thoughts did not. In contrast, when the task did not allow for making up for the previous failure because it measured a different ability, thoughts about the previous failure hindered incremental theorists' performance on the subsequent task but not entity theorists' performance.

These results suggested that specific types of thoughts might be related to performance, which we tested in Study 4. Participants were asked to rate both self-critical and self-enhancing thoughts related to the prior failure. When given the same-ability task, entity theorists were more likely to experience self-critical thoughts about their lack of

competence. In contrast, when given a different-ability task, incremental theorists were more likely to engage in self-critical thoughts about their lack of effort. Mediation analysis revealed that these self-critical thoughts explain the observed performance differences.

One possible reason why performance of the second task was only influenced by self-critical thoughts, but not by self-enhancing thoughts, is that performance on tasks requiring high cognitive demands is more likely to be affected by self-critical thoughts than self-enhancing thoughts. Although self-enhancing thoughts can motivate people to perform better, they might also consume cognitive resources, canceling out the positive impact on performance. In contrast, self-critical thoughts might demotivate and simultaneously deplete one's cognitive resources, thereby impairing performance. Consistent with this view, past research has documented a negative impact of self-critical thoughts and worries on a cognitive task (Ashcraft & Kirk, 2001; Beilock, 2008; Mangels et al., 2006) rather than a positive impact of self-enhancing thoughts on a cognitive task.

In Study 4, drawing on prior research (Butler, 2000; Mueller & Dweck, 1998), we included a control condition, where individuals' TOI was not experimentally manipulated, to examine whether performance differences were driven by entity or incremental theory. However, it is possible that participants in the control condition hold chronic TOIs even though we intended not to prime either entity or incremental theories. Thus, future studies can address this issue by using different control conditions. For example, future research can adopt a control condition in which participants get either no feedback or positive feedback on their performance of the first task.

Another limitation of the current work is that we measured different items for self-critical and self-enhancing thoughts depending on the task frame conditions. However, it should be noted that throughout the studies, comparison was made between participants with different TOIs (rather than comparing the same-ability task condition with the different-ability task condition) because our main research question involved comparing performance between entity and incremental theorists. In Study 4, we measured the identical six items within the same task frame conditions. Therefore, the comparison between entity and incremental theorists does not have any methodological limitation within the task frame conditions. However, measuring different items depending on the task framing (same vs. different) can be a limitation of the overall mediation analysis. Future research can develop the same items to measure self-critical (self-enhancing) thoughts regardless of the task frame condition to provide a more robust overall mediation analysis.

The current research enriches our understanding of the role of TOIs in performance after setbacks by examining different types of subsequent tasks. These findings are particularly important given the increasing number of interventions that encourage students to endorse incremental views of intelligence (Aronson et al., 2002; Blackwell et al., 2007). Our findings suggest that the effectiveness of such interventions may vary depending on how students perceive the relationship between the target task and their previous academic history. To maximize the effectiveness of these interventions, one may need to consider individuals' implicit theories as well as their perceived relationships among different tasks.

This study demonstrates that the impacts of TOIs can result in diametrically opposite effects on performance depending on the framing of the subsequent task. It offers theoretical implications by suggesting that incremental and entity theories can have both beneficial and detrimental effects depending on the context and role of self-critical thoughts in such effects. It also offers practical implications by suggesting how to negate the negative impacts of self-critical thoughts about failure in a first task on a subsequent task in various settings in different areas, including classroom settings and work environments.

Declaration of Conflicting Interests

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Notes

1. In Studies 1a and 2, we measured individual differences in theories of intelligence (TOIs) among participants from Hong Kong. The mean TOI scores were 3.74 and 3.78, respectively, and these scores were comparable to the sample from a study conducted in Western culture (3.82 from Plaks & Stecher, 2007).
2. To test whether our task framing indeed led participants to perceive the modular arithmetic (MA) task differently, we conducted a pretest ($N = 41$). In the pretest, participants were given information about the MA task and which skill it measured (intelligence vs. motor and process skills). The results showed that participants were more likely to perceive that the MA task measured intelligence in the same-task condition ($M = 4.70$, $SD = 1.26$) than in the different-task condition ($M = 3.57$, $SD = 1.47$), $t(39) = -2.63$, $p = .01$, $d = 0.83$. The two types of task framings did not differ in terms of participants' attention, comprehension, or interest in the MA task instructions (all ps $> .20$).

Supplemental Material

The online supplemental material is available at http://pspb.sagepub.com/supplemental.

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