A strategic mindset: An orientation toward strategic behavior during goal pursuit

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Many attractive jobs in today's world require people to take on new challenges and figure out how to master them. As with any challenging goal, this involves systematic strategy use. Here we ask: Why are some people more likely to take a strategic stance toward their goals, and can this tendency be cultivated? To address these questions, we introduce the idea of a domain-general "strategic mindset." This mindset involves asking oneself strategy-eliciting questions, such as "What can I do to help myself?", "How else can I do this?", or "Is there a way to do this even better?", in the face of challenges or insufficient progress. In three studies (n = 864), people who scored higher on (or were primed with) a strategic mindset reported using more metacognitive strategies; in turn, they obtained higher college grade point averages (GPAs) (Study 1); reported greater progress toward their professional, educational, health, and fitness goals (Study 2); and responded to a challenging timed laboratory task by practicing it more and performing it faster (Study 3). We differentiated a strategic mindset from general self-efficacy, self-control, grit, and growth mindsets and showed that it explained unique variance in people's use of metacognitive strategies. These findings suggest that being strategic entails more than just having specific metacognitive skills—it appears to also entail an orientation toward seeking and employing them.

strategic mindset | metacognitive strategies | goal pursuit | self-regulation | mindset

Jobs in the contemporary and future economy will require less routine deployment of well-learned skills and more "thinking through" and "figuring out" of challenging new problems. Indeed, the pursuit of any challenging goal often involves actively analyzing tasks and then planning, self-monitoring, and revising strategies (1–5). Such strategic behaviors are typically referred to as metacognitive strategies, because they require taking a perspective on oneself and one's tactics (6–8).

The use of metacognitive strategies is associated with greater goal commitment, progress, and achievement across important domains of life—including academic goals (9, 10), health and fitness goals (11–13), and challenging personal goals more generally (14–17). However, what our science still cannot fully explain is why some people are more likely than others to spontaneously apply metacognitive strategies when they encounter challenges (18, 19) and whether this tendency can be cultivated.

To shed light on these issues, we introduce a psychological construct—a "strategic mindset." We show that a domain-general strategic mindset is associated with people's use of metacognitive strategies (such as planning, monitoring progress, and flexibly adjusting approaches) as they pursue specific goals across multiple domains; moreover, this mindset can be induced in an experimental setting.

A strategic mindset involves frequently asking oneself such questions as: "What can I do to help myself?", "How else can I do this?", or "Is there a way to do this even better?" Asking these questions can serve as a self-prime that prompts people to generate and use strategies appropriate to the task—a useful approach especially when encountering new challenges or ongoing difficulty. This means that a strategic mindset does not simply reflect people's overall knowledge of strategies or how much people use any one particular strategy; instead, it is a general tendency toward self-priming metacognitive strategy use more broadly. This strategic mindset may offer us a key to understanding—and potentially influencing—how much people are inclined to engage in strategic behavior during goal pursuit and, in turn, how effectively they pursue their goals.

Much research and practice to date has focused on the teaching of individual metacognitive strategies as skills to learn in distinct areas of endeavor. For example, there are interventions that teach people how to self-monitor their weight loss (11) and others that guide students to plan out their learning (9); there are also programs that teach an array of such skills in lengthy training sessions (20). However, having these strategies in one's repertoire is no guarantee that one will use them when they are needed (21, 22)—and being able to access and use them when needed is becoming increasingly critical for obtaining and exceling at many modern jobs.

Our contribution in this paper is to identify a mindset that can prompt the spontaneous accessing of metacognitive strategies. By shedding light on how some people prime themselves to behave more strategically when pursuing their goals, we could potentially teach others how to do so. Consider students in a college class who want to master challenging concepts before an upcoming examination. Although some may know a variety of study techniques, they may not spontaneously think to apply these techniques. However, frequently asking themselves strategic mindset questions ("What can I do to help myself master these concepts? How else can I study to be even more effective?

Significance

Modern life and work involve grappling with many novel challenging tasks. What makes some people more strategic, and hence more effective, as they approach these tasks? This research introduces and tests a psychological construct—a "strategic mindset"—which involves asking oneself strategy-eliciting questions, such as "What can I do to help myself?" or "Is there a way to do this even better?" in the face of challenges or insufficient progress. A strategic mindset uniquely predicts how much people report actively using strategies and, in turn, how effective they are at pursuing goals across life domains. The findings suggest that being strategic entails more than just having specific strategic skills—it appears to also entail an orientation toward accessing and employing them.

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") might prompt them to plan, generate, monitor, and adjust their study techniques when needed. In turn, the more such strategic behavior they practice, the better they should learn and perform (10, 23). If we could demonstrate that a strategic mindset is indeed associated with greater use of metacognitive strategies during goal pursuit (beyond just the knowledge of individual strategies), and that inducing a strategic mindset can increase people's spontaneous use of such metacognitive strategies, we may be on our way toward understanding how to help people achieve their goals.

We present the results of three studies: two field surveys of people pursuing important life goals and an experimental laboratory study in which a strategic mindset was induced. In our studies, we predicted that a strategic mindset would have an indirect effect on goal achievement. This is because simply asking oneself the strategic mindset questions may not in itself make people higher performers; rather, these self-primes need to be translated into actual metacognitive strategy use to make people more likely to achieve their goals. Thus, these studies tested, and found support for, the hypotheses that (*i*) a strategic mindset predicts individual differences in the use of metacognitive strategies during goal pursuit (above and beyond knowledge of individual strategies), (*ii*) a strategic mindset indirectly predicts goal achievement through the use of such metacognitive strategies, and (*iii*) a strategic mindset can be experimentally induced to causally increase people's use of metacognitive strategies.

Study 1

In Study 1, 365 college students participated (59.2% female, 0.5% "other" gender, 0.8% gender missing; M_{age} = 20.0 y; M_{GPA} = 3.53; 71 freshmen, 106 sophomores, 83 juniors, 91 seniors, 11 fifth year seniors or above, 3 class standing missing; see *SI Appendix*, Study 1 Supplementary Text for further information on the sample). All studies reported in this paper had approval from the University of Michigan or Stanford University Institutional Review Board, where they were conducted, and all participants provided informed consent.

Participants completed an online survey midway through the fall semester. They self-reported their general strategic mindset on our six-item strategic mindset scale (e.g., When you are struggling with something, how often do you ask yourself: "What can I do to help myself?", Whenever you feel like you are not making progress, how often do you ask yourself: "Is there a better way of doing this?"; 1 = Never, 5 = Most of the time; α = 0.90; see *SI Appendix*, Table S1 for full scale). Later in the survey, to test the predicted association between a general strategic mindset and the use of specific metacognitive strategies in their classes, participants reported their use of specific metacognitive strategies, including the extent to which they planned, self-monitored, and flexibly adjusted their learning approaches in their current classes (e.g., "When studying for a class, I tend to keep track of how effective my learning approach is."; 1 = Never, 5 = Most of the time; eight-item scale α = 0.84; see *SI Appendix*, Table S2 for full scale adapted from ref. 10).

In all our studies, we sought to minimize any carryover or demand effects by taking a number of precautions. In Studies 1 and 2, we separated the strategic mindset and metacognitive strategy-use scales into different sections of the survey, with other scales and questions (e.g., self-control scale, grit scale, descriptions and ratings of people's professional/educational and health/fitness goals) placed in between. In a later study, Study 3, we manipulated a strategic mindset, assessed metacognitive strategy use in a different situation, and corroborated our metacognitive strategy-use measure with two additional measures, including independent coders' observations of participants' actual behavior and participants' descriptions of actual techniques they had used.

To test our key hypothesis in Study 1, we examined the extent to which students' strategic mindset indirectly predicted their objective college grade-point average (GPA) through their use of metacognitive strategies in their courses. Participants gave consent for us to obtain their college GPA from the school registrar, which included (*i*) their GPA for the fall semester in which they took the survey ("Fall GPA"), and (*ii*) their GPA for the winter semester immediately following ("Winter GPA"). These GPA measures gave us objective outcome measures of their performance within the same fall semester that we measured their strategic mindset and metacognitive strategies, and also during the subsequent winter semester in which they took new classes.

As hypothesized, students' general strategic mindset scores were positively and significantly associated with how much they reported using specific metacognitive strategies in their classes: A one-unit increase in students' strategic mindset was positively associated with a 0.41-unit increase in their use of metacognitive strategies (out of a five-point scale), linear regression b = 0.41, [0.32, 0.50], se = 0.05, $t(358)$ = 9.04, $P < 0.001$. In turn, students' reported use of metacognitive strategies in the fall semester predicted their Fall GPA, b = 0.08, [0.01, 0.16], se = 0.04, $t(344)$ = 2.30, P = 0.022, and also their Winter GPA in new, different classes, b = 0.13, [0.03, 0.23], se = 0.05, $t(331)$ = 2.52, P = 0.012.

Also as hypothesized, students' strategic mindset indirectly predicted their Fall GPA, indirect effect ab = 0.05, [0.02, 0.08], se = 0.02 and their Winter GPA, indirect effect ab = 0.06, [0.02, 0.11], se = 0.02, through their use of such adaptive metacognitive strategies (see Fig. 1; analyzed with 1,000 bootstrap resamples using the lavaan package in R; version 0.5–23.1097; ref. 24). There was no total effect of strategic mindset on either of the GPA outcomes, P values >0.250. Results were the same when we transformed the GPA measures using a Box–Cox transformation (λ = 5) to correct for nonnormality (25, 26).

Study 2

We proposed that a strategic mindset is a domain-general tendency that has implications for effective goal pursuit more broadly, but Study 1 only tested its effects within one domain.

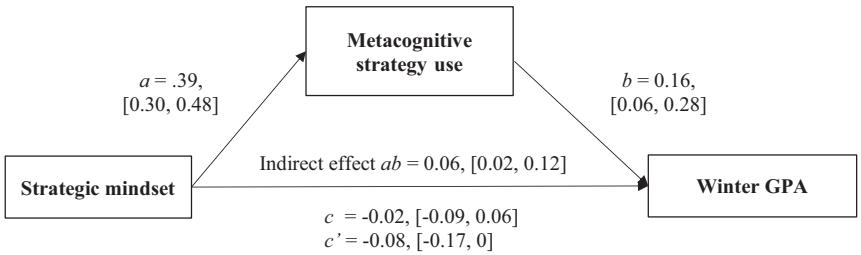

Fig. 1. Mediation model representing the relation among people's strategic mindset, their reported use of metacognitive strategies in their classes, and their Winter GPA. Regression coefficients were estimated using 1,000 bootstrapped resamples; numbers in brackets represent their 95% CIs. This same model also applied to the mediated effect of a strategic mindset on students' Fall GPA.

Hence, Study 2 extended this research to investigate whether a strategic mindset can apply across important domains of striving, such as people's professional/educational goals and their health/fitness goals. Another purpose of Study 2 was to address the question of whether a strategic mindset has explanatory power above and beyond other self-regulatory and mindset constructs that are related to goal progress, including general self-efficacy, self-control, grit, and growth mindsets of intelligence, of personality, and of the social world. Here, we investigated whether a strategic mindset significantly predicted goal progress when we controlled for each of the other variables.

To replicate our own Study 2 findings, we conducted two independent, well-powered rounds of sampling with similar measures (sample 1: $n = 202$, sample 2: $n = 163$; total $n = 365$ Amazon Mechanical Turk participants; 45.2% female, 0.3% gender missing; $M_{age} = 37.0$ y). We report the analysis of data aggregated across both rounds, which each produced the same pattern of results (the *SI Appendix*, Study 2 Supplementary Text presents the analyses of each sample separately). All regression analyses employed listwise deletion, reflected in the degrees of freedom reported.

Participants completed our strategic mindset scale, as in Study 1. They were all asked to list a current professional/educational goal of theirs (e.g., "learn programming in Python") and a current health/fitness goal of theirs (e.g., "I want to lose 20 pounds"). As our primary outcome measure of goal progress, participants reported how much progress they had made toward each of their goals ("So far, how much progress would you say you have made towards this goal?") on a seven-point scale.

Later, after answering filler questions, participants rated our key mediational measure: how frequently they had been applying metacognitive strategies during their pursuit of each goal within the previous week (e.g., "While working towards my goal, I kept track of how effective my approach was."; 1 = Never, 5 = Most of the time; eight-item scale α values >0.90 across both goal domains). Following recommended practice in survey methodology (27), we placed these behavior frequency questions about their concrete use of specific metacognitive strategies after participants' earlier reports on their overall progress toward each of their goals. This ordering was meant to reduce the demand effects on participants' responses. Questions from the two goal domains were presented in counterbalanced order among participants to rule out possible order effects.

Supporting the domain-general nature of the strategic mindset, scoring higher on a strategic mindset was indeed associated with using more metacognitive strategies in both goal domains: A 1-unit increase on our five-point strategic mindset scale was related to a 0.59-unit [0.48, 0.71] increase in people's reported use of metacognitive strategies as they pursued their professional/educational goals (out of a five-point scale), $t(362) = 9.97$, $P < 0.001$, and to a 0.40-unit [0.29, 0.51] increase in people's reported use of metacognitive strategies toward their health/fitness goals (out of a five-point scale), $t(362) = 7.05$, $P < 0.001$. As expected, people's use of metacognitive strategies in each domain was, in turn, positively associated with their goal progress within that same domain—this applied to their professional/educational goals, $b = 0.86$, [0.71, 1.02], $se = 0.08$, $t(362) = 10.90$, $P < 0.001$ and to their health/fitness goals, $b = 0.80$, [0.62, 0.98], $se = 0.09$, $t(361) = 8.90$, $P < 0.001$.

As hypothesized, we found a robust indirect effect of a strategic mindset on goal progress through their reported use of metacognitive strategies in both goal domains (represented in Fig. 2), and these indirect effects replicated across both samples (*SI Appendix*, Table S6).

Next, we examined how strongly a strategic mindset was correlated with self-regulatory and mindset constructs, which have been associated with goal progress (including general self-efficacy, self-control, grit, and growth mindsets). In particular, we examined whether a strategic mindset could explain people's strategic behavior and goal progress, even when controlling for each of these previous constructs. We measured participants' general self-efficacy (e.g., "I can always manage to solve difficult problems if I try hard enough."; 10-item α = 0.92; ref. 28), self-control (e.g., "I am good at resisting temptation."; 13-item scale α = 0.90; ref. 29), grit (e.g., "Setbacks don't discourage me."; 8-item scale α = 0.90; ref. 30), and three growth mindset measures of intelligence (e.g., "You have a certain amount of intelligence, and you can't really do much to change it."; 4-item scale α = 0.97; ref. 31), personality (e.g., "The kind of person you are, is something very basic about you and it can't be changed very much."; 4-item scale α = 0.94; ref. 32), and the social world (e.g., "Though we can change some social phenomena, it is

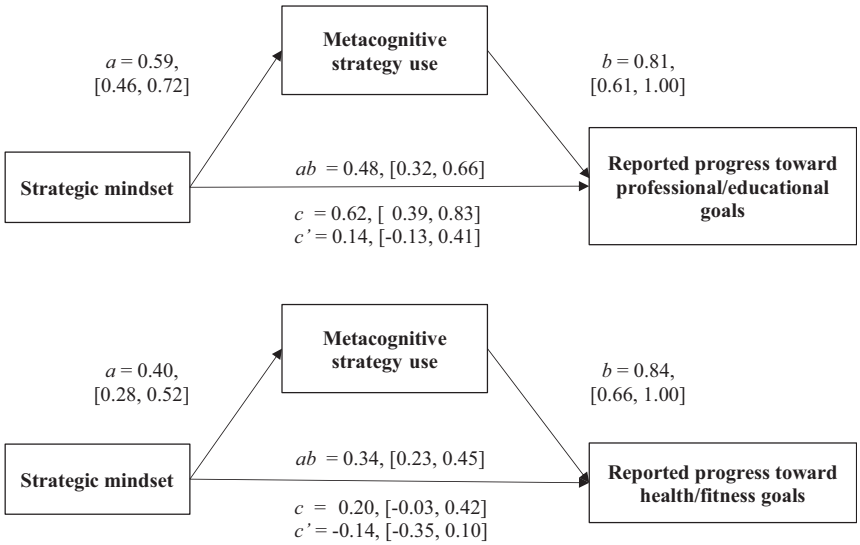

Fig. 2. Mediation models representing the relationship among people's strategic mindset, reported use of metacognitive strategies during goal pursuit, and reported goal progress toward their professional/educational goals (*Upper*) and their health/fitness goals (*Lower*). Regression coefficients were estimated using 1,000 bootstrapped resamples; numbers in brackets represent their 95% CIs.

unlikely that we can alter the core characteristics of our social world."; 4-item scale α = 0.96; adapted from ref. 33).

A strategic mindset showed moderate to low correlations with the array of potentially related constructs we measured (general self-efficacy: $r = 0.52$, $P < 0.01$; self-control: $r = 0.34$, $P < 0.01$; grit: $r = 0.45$, $P < 0.01$; growth mindset of intelligence: $r = 0.10$, $P = 0.062$; growth mindset of personality: $r = 0.09$, $P = 0.091$; growth mindset of the social world: $r = 0.08$, $P = 0.108$), suggesting that it is not the same as these prior constructs. Importantly, a strategic mindset offered unique value in (*i*) predicting people's use of metacognitive strategies and (*ii*) indirectly predicting their reported goal progress across domains. That is, when we controlled for each of the aforementioned covariates, a strategic mindset still significantly predicted people's reported use of metacognitive strategies, and it also indirectly predicted their reported goal progress within each domain (Table 1).

Taken together, Studies 1 and 2 support the proposal that a strategic mindset is a domain-general tendency that is associated with more strategic behavior (i.e., using metacognitive strategies) as people pursue important goals across different life domains; and that such strategic behavior, in turn, predicts people's progress toward each of their goals. Moreover, a strategic mindset is a meaningful psychological construct—it offers unique predictive value beyond other relevant self-regulatory and mindset constructs, including general self-efficacy, self-control, grit, and growth mindsets.

Study 3

Thus far, we have examined correlations between holding a strategic mindset and engaging in metacognitive strategies. However, we propose that a strategic mindset, like other mindsets (31, 32, 34), has causal effects—that is, when people adopt a strategic mindset, it prompts them to generate and apply metacognitive strategies. In Study 3, we tested the hypothesis that experimentally inducing a strategic mindset would lead to applying more metacognitive strategies during a novel task. Our random assignment of participants to experimental conditions controlled for the possibility that people in our prior studies who scored higher on a strategic mindset simply had a wider repertoire of metacognitive strategies, greater prior success, or other baseline differences that might be associated with their use of metacognitive strategies.

We employed a two-part experiment: In Part 1, we induced a strategic mindset, relative to a control condition, through an online article. After that in Part 2 (presented as a separate experiment), we assessed participants' reported use of metacognitive strategies and their performance on a challenging, unfamiliar task. During debriefing, very few participants in our study (only 4 of 134) spontaneously reported any suspected link between the strategic mindset exercise in Part 1 of the study and their strategy-use behaviors in Part 2 of the study.

We recruited 134 participants from a private university and the surrounding community in the Western United States (gender: 88 females, 1 "other"; $M_{age} = 24.5$ y). One participant's data were excluded due to an experimenter's error during data collection.

Part 1: Random Assignment to Condition and Experimental Induction. In Part 1, participants were randomly assigned to either the strategic mindset condition or a comparison control condition. Participants in the strategic mindset condition read an online article emphasizing that the key to success is strategic thinking (*SI Appendix*, C.1). It described strategic thinking as being able to take a step back from what one is doing to ask oneself questions such as, "How else can I do this? Are there things that I can do differently? Are there ways to do this even better?" The article contained anecdotes and research findings, for example about children and Fortune 500 CEOs, that emphasized the benefits of a strategic mindset.

For comparison, those in the control condition read an online article of comparable length and structure about an unrelated topic that was unlikely to prime a strategic mindset or metacognitive strategies: the mental health benefits of cold showers (*SI Appendix*, C.2). Pretesting with an independent group of adults, separate from the sample used in this study, showed that the two articles did not significantly differ in their persuasiveness, engagingness, informational value, or aesthetic qualities.

After reading their assigned articles, participants were given an open-ended summary box, and asked to write about the main message of the article as though they were sharing it with others on social media. Such saying-is-believing exercises are commonly used in social psychological experiments to encourage participants' self-endorsement, personalization, and internalization of the content (e.g., refs. 35 and 36).

Part 2: Metacognitive Strategy Use, Performance, and Practice on an Unfamiliar Challenging Task. In Part 2, a new experimenter obtained participants' consent to take part in an ostensibly unrelated study. We carefully developed and pretested a laboratory task—an egg cracking and separating task. Although this task does not seem like the kind of task that most people will encounter in modern life or the modern workplace, it was carefully designed to meet the

Table 1. Coefficients from covariate-inclusive (*i*) multiple regression models predicting reported metacognitive strategy use and (*ii*) indirect effect tests, with goal progress as outcome and metacognitive strategy use as a mediator

Covariate controlled for in model	Strategic mindset predicting metacognitive strategy use for professional/educational goals	Strategic mindset predicting metacognitive strategy use for health/fitness goals	Indirect effect of a strategic mindset on reported progress toward professional/ educational goals	Indirect effect of a strategic mindset on reported progress toward health/fitness goals
General self-efficacy	$b = 0.47$ [0.34, 0.61], $t(361) = 6.92$, $P < 0.001$	$b = 0.25$ [0.12, 0.38], $t(361) = 3.87$, $P < 0.001$	0.36 [0.23, 0.52]	0.20 [0.09, 0.31]
Self-control	$b = 0.51$ [0.39, 0.63], $t(361) = 8.21$, $P < 0.001$	$b = 0.28$ [0.17, 0.40], $t(361) = 4.91$, $P < 0.001$	0.40 [0.26, 0.57]	0.22 [0.12, 0.33]
Grit	$b = 0.45$ [0.32, 0.57], $t(361) = 6.96$, $P < 0.001$	$b = 0.28$ [0.16, 0.40], $t(361) = 4.55$, $P < 0.001$	0.34 [0.21, 0.50]	0.22 [0.11, 0.33]
Growth mindset of intelligence	$b = 0.58$ [0.46, 0.70], $t(360) = 9.76$, $P < 0.001$	$b = 0.39$ [0.27, 0.50], $t(360) = 6.81$, $P < 0.001$	0.47 [0.32, 0.64]	0.33 [0.22, 0.43]
Growth mindset of personality	$b = 0.58$ [0.46, 0.70], $t(361) = 9.79$, $P < 0.001$	$b = 0.38$ [0.27, 0.49], $t(361) = 6.83$, $P < 0.001$	0.47 [0.32, 0.65]	0.31 [0.31, 0.42]
Growth mindset of the social world	$b = 0.59$ [0.47, 0.70], $t(361) = 9.85$, $P < 0.001$	$b = 0.38$ [0.27, 0.50], $t(361) = 6.86$, $P < 0.001$	0.48 [0.32, 0.66]	0.32 [0.21, 0.44]

All regression coefficients are unstandardized; 95% CIs of the coefficients are represented in square brackets. Covariates were added individually to the regression models to avoid problems of multicollinearity.

following criteria: The task was relatively unfamiliar and challenging for most participants; it could be accomplished with different methods, some of which were more effective than others; and there were clear performance metrics.

All participants were given the same goal: to crack eggs and collect the greatest volume of egg white into a designated egg white bin within 2 min. To motivate them, participants were told that they would win $100 if they collected the greatest volume of egg white of any participant (i.e., performed the task with the fastest speed). Participants' reported that they were, on average, highly motivated to win ($M = 5.02$, $SD = 1.51$ on a seven-point scale), and this did not differ between conditions (control condition: $M = 5.11$, $SD = 1.44$; strategic mindset condition: $M = 4.92$, $SD = 1.59$), $P = 0.490$. In addition, participants were cautioned that if any yolk from any egg was accidentally poured into the egg white bin, they would have that egg (i.e., the average weight of one egg used in the study) deducted from their total egg white weight. This was to encourage participants to crack and separate the egg whites as cleanly as possible, while focusing on maximizing speed.

We measured each participant's reported use of metacognitive strategies on the task immediately after they performed the task, using the same kind of measure we used in the previous studies (e.g., "Throughout the study, I kept track of how effective each of my approaches to cracking and separating the eggs was."; 1 = Not at all true of me, 5 = Very true of me; four-item scale $\alpha = 0.80$; see *SI Appendix*, Table S2 for full scale). In this case, we were able to corroborate participants' reports with two additional measures, both of which were positively correlated with their reported use of metacognitive strategies: first, how many concrete techniques participants described using other than the default technique demonstrated by the experimenter ($r = 0.42$, $P < 0.001$); second, observation and coding of such technique-use by independent observers ($r = 0.30$, $P = 0.001$; refer to *SI Appendix*, Study 3 Supplementary Text for detailed description and analyses). These correlations suggest that participants who reported high degrees of metacognitive strategy use actually tended to generate and apply more new, different techniques during the task.

As a key outcome measure of participants' performance, we assessed the total volume of egg white that each participant had collected in the egg white bin within the 2 min allotted—a measure of their performance speed. We also computed participants' volume of egg white minus spills—a measure of performance taking into account speed and the strict accuracy penalty—by subtracting the average weight of one egg for any yolk spilled during cracking.

As a secondary outcome of interest in this study, we asked whether participants in the strategic mindset condition would be more likely to practice the task when given the opportunity. Practice is an indication of forethought and preparation—key indications of metacognition (3, 10). We gave participants 5 min of free time and eight practice eggs, allowing them to practice as little or as much as they wanted. We assessed two measures of practice behavior: (*i*) did participants practice at all (coded by two independent observers as "1" when there was observed practice, or "0" when there was not; interrater reliability was high at $\kappa = 1$ for this simple coding), and (*ii*) how many eggs did they practice on (which ranged from 0 to 8)?

Results

We tested our hypothesis that, compared to controls, people randomly assigned to the strategic mindset condition would report using more metacognitive strategies on the laboratory task, and that this, in turn, would predict better task performance. In all our analyses, we controlled for participants' reported prior experience with this egg cracking and separating task, because as one might expect, prior experience was significantly related to all dependent variables of interest, including reported use of metacognitive strategies, performance, and practice (see *SI Appendix*, Study 3 Supplementary Text for more details).

Was there a difference between conditions in participants' use of metacognitive strategies? As hypothesized, participants in the strategic mindset condition indeed reported using metacognitive strategies to a greater extent than those in the control condition, $b = 0.38$, [0.07, 0.69], $se = 0.16$, $t(128) = 2.39$, $P = 0.018$. At the mean level of prior experience ($M = 3.17$), participants' average ratings of metacognitive strategy use in the strategic mindset condition was 3.77, compared to an average of 3.39 in the control condition. Therefore, inducing a strategic mindset causally increased participants' reported likelihood of spontaneously exhibiting such strategic behavior during the egg cracking and separating task—building upon our earlier correlational findings. Random assignment to condition also supported the idea that differences in the number of metacognitive strategies resulting from a strategic mindset are not just a function of a larger repertoire of preexisting metacognitive strategies or other such individual differences.

The more participants reported using metacognitive strategies, the faster they performed on the task, $b = 25.79$ g, [5.45 g, 46.13 g], $se = 10.28$, $t(124) = 2.51$, $P = 0.013$. For every one-unit increase in reported metacognitive strategy use, participants deposited an average of 25.79 g more egg white during the 2-min performance time window—approximately one-third the weight of the average egg used in our experiment. As in earlier studies, we found an indirect effect of strategic mindset condition on performance speed, controlling for prior experience as a covariate. Use of metacognitive strategies mediated the relationship between participants' condition and their speed on the egg cracking and separating task, bootstrapped indirect effect $ab = 9.45$, [0.42, 25.94], $se = 6.61$ (Fig. 3).

On our additional performance measure of speed with the stringent accuracy penalty, we found an indirect effect of

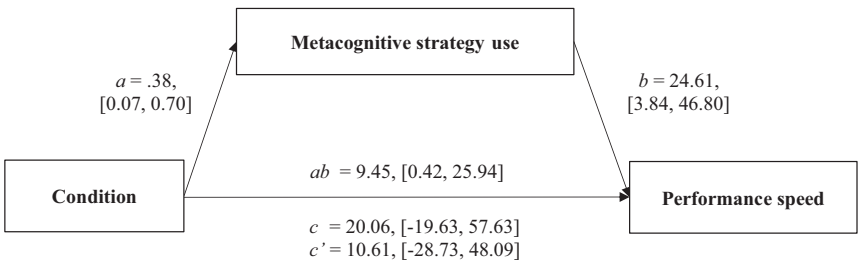

Fig. 3. Mediation model representing the relationship among condition (0 = Control, 1 = Strategic Mindset), participants' reported use of metacognitive strategies, and their performance speed. Performance speed refers to the total egg white volume participants collected during the 2-min performance time window. Participants' prior experience with the activity was included as a covariate in the mediation model but not represented in this figure. Regression coefficients were estimated using 1,000 bootstrapped resamples; numbers in brackets represent their 95% CIs.

strategic mindset condition that was trending in the same predicted direction, but its 95% CI overlapped with 0, bootstrapped indirect effect $ab = 7.50$, [−0.27, 21.70], $se = 5.69$. Participants in the strategic mindset condition reported using more metacognitive strategies during the task, compared to those in the control condition, $b = 0.38$, [0.07, 0.69], $se = 0.16$, $t(128) = 2.39$, $P = 0.018$. In turn, the more metacognitive strategies they reported using, the (marginally but nonsignificantly) faster they performed on the task when we subtracted a stringent penalty of 1 entire egg's weight for any yolk spilled per egg, $b = 19.24$ g, [−1.20 g, 39.67 g], $se = 10.32$, $t(125) = 1.86$, $P = 0.065$. It is possible that we might have penalized inaccuracy too severely, particularly given the inexperience on the part of most participants. It is also possible that the task instructions put the premium on speed and, hence, speed was what most participants strove for.

Prior to performing, did participants take the initiative to practice the task at all? Five participants' practice data were not included in the analyses due to technical issues with their practice time videos (e.g., video recording ended midway), leaving 128 videos for analyses. We found that exposure to the strategic mindset induction increased participants' observed likelihood of practicing at all, as well as how much they practiced before they had to perform. Controlling for prior experience, the odds of practicing at all were 2.40 times higher among participants in the strategic mindset condition than those in the control condition, log odds = 0.88, [0.08, 1.72], $se = 0.42$, $z = 2.11$, $P = 0.035$. On average, participants in the strategic mindset condition practiced on more eggs ($M = 4.17$ eggs, $SD = 3.21$), compared to those in the control condition ($M = 3.16$ eggs, $SD = 3.38$), $b = 1.16$, [0.03, 2.30], $se = 0.57$, $t(124) = 2.03$, $P = 0.045$, controlling for prior experience. Results were the same when we used a nonparametric Wilcoxon Rank Sum test (because of the nonnormally distributed data) after parceling out the variance explained by their prior experience, $Z = 2.19$, $P = 0.028$.

In summary, Study 3's findings provide empirical support for causality by showing that inducing a strategic mindset can evoke changes in people's strategic behavior as they undertake a novel, challenging task. Relative to controls, those presented with a brief strategic mindset induction reported applying more metacognitive strategies to the task, and in turn, they performed the task more quickly. They were also more likely than controls to be observed practicing techniques in the initial phase of the task.

Discussion

A major motivation for our research was the observation that many jobs in the modern world, as well as challenging goals more generally, require people to actively think through and figure out how to best navigate the tasks at hand. In the midst of such challenges, many people simply adopt and stick with suboptimal strategies, which may seem good enough to get by. We set out to shed light on what makes some people take a metacognitive "figuring out" stance to find better ways of doing things.

Our three studies pointed toward the role of a strategic mindset. Across the three studies and 864 participants, this mindset predicted people's tendency to generate and apply metacognitive strategies as they pursued challenging goals. Moreover, the more people reported employing such strategic behavior during goal pursuit, the more progress they actually made toward achieving their goals across different domains of life. These included students' college grade point averages (Study 1), adults' professional, educational, health, and fitness goals (Study 2), and performance on a novel task (Study 3). Thus, as we hypothesized, a strategic mindset indirectly predicted goal achievement.

It is important for our work to distinguish between a strategic mindset and metacognitive strategy use, both theoretically and empirically. Definitionally, one (a strategic mindset) is a prompt for the other (metacognitive strategy use). They are also conceptually dissociable. It is clear that one can know metacognitive strategies without using them at the appropriate times. That is, simply possessing knowledge of metacognitive strategies does not necessarily translate into practicing them when needed (21). Methodologically, we sought to minimize the possibility that possessing more metacognitive strategies, rather than a strategic mindset, was driving our benefical effects. We did so by conducting an experiment (Study 3) in which we controlled for people's preexisting knowledge of strategies through (*i*) random assignment, (*ii*) the presentation of a largely unfamiliar task, and (*iii*) the inclusion of participants' reported prior experience as a covariate in our analyses in Study 3. Finally, statistically, exploratory factor analyses in Studies 1 and 2 showed that the strategic mindset items loaded highly onto their own "strategic mindset" factor (Study 1 loadings > 0.740; Study 2 loadings > 0.500 across domains), separate from the items measuring metacognitive strategies, which loaded onto their own factor; none of the items cross-loaded highly onto the other factor (Study 1 cross-loadings < 0.320; Study 2 cross-loadings < 0.160), indicating that they are empirically distinct (see details in *SI Appendix*, Studies 1 and 2 Supplementary Text).

Should a strategic mindset always predict enhanced progress or performance? What might be some plausible boundary conditions? In our studies, we found that a strategic mindset indirectly predicted progress toward challenging goals that were long-term (Study 1), important (Studies 1 and 2), and unfamiliar (Study 3). These are goals that may require the repeated accessing or invention of new strategies—precisely the kinds of goals that are increasingly stressed in many modern jobs. However, if an individual does not have appropriate strategies to draw upon, then a strategic mindset may not be as helpful. Similarly, if an individual does not know how to match the strategies in their repertoire to the goal in question, then using a strategic mindset to prime and access strategies may be less beneficial. There may also be times when too much searching for new strategies could derail a perfectly good strategy, which would be counterproductive, particularly if one is under time pressure and needs to be decisive. In a related vein, some activities in life are routine or straightforward and can be efficiently dispatched without being overly perfectionistic or compulsive about seeking new and better strategies. Future research could fruitfully explore these potentially interesting boundary conditions of strategic mindset effects.

What are the implications of our findings for interventions that seek to enhance goal progress and attainment? As noted above, since a strategic mindset is proposed to facilitate goal progress by priming metacognitive strategy use, it might not be fruitful to teach a strategic mindset if an individual has a sparse repertoire of metacognitive strategies. In such cases, an intervention to promote metacognitive strategies and a strategic mindset might be most effective. That is, future interventions could build upon our brief laboratory induction by designing and testing more extensive interventions that guide people to ask themselves these few, simple self-prompts whenever they encounter challenges or would like to raise their game. At the same time, these interventions should also ensure that the target individuals have a repertoire of strategies that they can access and apply.

Another implication for interventions may reside in the combining of a strategic mindset with other interventions or using it as a support for other self-regulatory processes. Although a strategic mindset has distinct predictive power beyond self-control, grit, and growth mindsets, it could potentially complement any of these factors in facilitating goal achievement. For example, practicing a strategic mindset could relieve the need for exerting chronically high levels of self-control during goal pursuit, which may not be sustainable. Indeed, research suggests that active and effective strategizing can actually minimize the need

for high levels of effortful control (37). Similarly, a growth mindset or grit may encourage persistence, but persistence also requires effective strategies for goals to come to fruition. That is, people may believe that their abilities can be developed, but they may not necessarily think about how best to do so. Self-exhortations to simply try harder may actually prove discouraging if a person is simply doubling down on the wrong strategy. A strategic mindset might instead encourage the person to search for and try out new strategies, consult with mentors, or seek out other experts. Even when things are going fine, there may still be better ways to move forward, and a strategic mindset may encourage people to find those ways. Thus, a strategic mindset could complement other factors that motivate effort investment and persistence, but often do not directly target strategy regulation (32, 38, 39).

Our hope is that our findings and further research in this area may lead scientists and practitioners to reconsider what being strategic toward one's goals entails. Importantly, metacognitive strategies need not be just a set of skills that we learn and occasionally remember to apply. Rather, the more people can use a strategic mindset to figure out how to do things differently and better, the more creative and effective they may be in many areas of life.

Data Deposition. The deidentified data and code reported in this paper are available at https://osf.io/f5dzy/?view_only=27d76aed61664adb8dde491c4cf7c750.

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1. G. A. Bonanno, C. L. Burton, Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspect. Psychol. Sci.* **8**, 591–612 (2013).
2. C. S. Carver, M. F. Scheier, *On the Self-Regulation of Behavior*, (Cambridge University Press, Cambridge, UK, 1998).
3. B. J. Zimmerman, Becoming a self-regulated learner: An overview. *Theory Pract.* **41**, 64–70 (2002).
4. P. M. Gollwitzer, G. Oettingen, "Planning promotes goal striving" in *Handbook of Self-Regulation: Research, Theory, and Applications*, K. D. Vohs *et al*., Eds. (Guilford Press, New York, NY, ed. 2, 2011), pp. 162–185.
5. A. A. Scholer, D. B. Miele, The role of metamotivation in creating task-motivation fit. *Motiv. Sci.* **2**, 171–197 (2016).
6. J. H. Flavell, Metacognition and cognitive monitoring: A new era of cognitive-developmental inquiry. *Am. Psychol.* **34**, 906–911 (1979).
7. J. Dunlosky, J. Metcalfe, *Metacognition*, (SAGE, Thousand Oaks, CA, 2009), Vol. ix.
8. D. B. Miele, A. A. Scholer, The role of metamotivational monitoring in motivation regulation. *Educ. Psychol.* **53**, 1–21 (2018).
9. P. Chen, O. Chavez, D. C. Ong, B. Gunderson, Strategic resource use for learning: A self-administered intervention that guides self-reflection on effective resource use enhances academic performance. *Psychol. Sci.* **28**, 774–785 (2017).
10. P. R. Pintrich, D. A. F. Smith, T. Garcia, W. J. McKeachie, *A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ)*, (University of Michigan, National Center for Research to Improve Postsecondary Teaching and Learning, Ann Arbor, MI, 1991).
11. L. E. Burke *et al*., The effect of electronic self-monitoring on weight loss and dietary intake: A randomized behavioral weight loss trial. *Obesity (Silver Spring)* **19**, 338–344 (2011).
12. L. E. Burke, J. Wang, M. A. Sevick, Self-monitoring in weight loss: A systematic review of the literature. *J. Am. Diet. Assoc.* **111**, 92–102 (2011).
13. K. B. Johannessen, G. Oettingen, D. Mayer, Mental contrasting of a dieting wish improves self-reported health behaviour. *Psychol. Health* **27** (suppl. 2), 43–58 (2012).
14. G. Oettingen, H. Pak, K. Schnetter, Self-regulation of goal setting: Turning free fantasies about the future into binding goals. *J. Pers. Soc. Psychol.* **80**, 736–753 (2001).
15. G. Oettingen, Expectancy effects on behavior depend on self-regulatory thought. *Soc. Cogn.* **18**, 101–129 (2000).
16. P. M. Gollwitzer, Implementation intentions: Strong effects of simple plans. *Am. Psychol.* **54**, 493–503 (1999).
17. P. M. Gollwitzer, V. Brandstätter, Implementation intentions and effective goal pursuit. *J. Pers. Soc. Psychol.* **73**, 186–199 (1997).
18. A. T. Sevincer, G. Oettingen, Spontaneous mental contrasting and selective goal pursuit. *Pers. Soc. Psychol. Bull.* **39**, 1240–1254 (2013).
19. A. T. Sevincer, T. Musik, A. Degener, A. Greinert, G. Oettingen, Taking responsibility for others and use of mental contrasting. *Pers. Soc. Psychol. Bull.*, 10.1177/0146167219898569 (2020).
20. H. Bembenutty, A. Kitsantas, T. J. Cleary, *Applications of Self-Regulated Learning across Diverse Disciplines: A Tribute to Barry J. Zimmerman*, (IAP, Charlotte, NC, 2013).
21. C. I. Diener, C. S. Dweck, An Analysis of Learned Helplessness: Continuous changes in performance, strategy, and achievement cognitions following failure. *J. Pers. Soc. Psychol.* **36**, 451–462 (1978).
22. P. R. Pintrich, The role of metacognitive knowledge in learning, teaching, and assessing. *Theory Pract.* **41**, 219–225 (2002).
23. M. V. J. Veenman, M. A. Spaans, Relation between intellectual and metacognitive skills: Age and task differences. *Learn. Individ. Differ.* **15**, 159–176 (2005).
24. Y. Rosseel, lavaan: An R package for structural equation modeling. *J. Stat. Softw.* **48**, 1–36 (2012).
25. G. E. Box, D. R. Cox, An analysis of transformations. *J. R. Stat. Soc. B* **26**, 211–243 (1964).
26. J. W. Osborne, Improving your data transformations: Applying the box-cox transformation. *Pract. Assess. Res. Eval.* **15**, 1–9 (2010).
27. N. Bradburn, S. Sudman, B. Wansink, *Asking Questions: The Definitive Guide to Questionnaire Design—For Market Research, Political Polls, and Social and Health Questionnaires*, (Jossey-Bass, San Francisco, CA, 2004).
28. R. Schwarzer, M. Jerusalem, "Generalized self-efficacy scale" in *Measures in Health Psychology: A User's Portfolio. Causal and Control Beliefs*, J. Weinman, S. Wright, M. Johnston, Eds. (NFER-NELSON, Windsor, UK, 1995), pp. 35–37.
29. J. P. Tangney, R. F. Baumeister, A. L. Boone, High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *J. Pers.* **72**, 271–324 (2004).
30. A. L. Duckworth, P. D. Quinn, Development and validation of the short grit scale (grit-s). *J. Pers. Assess.* **91**, 166–174 (2009).
31. Y. Y. Hong, C. Y. Chiu, C. S. Dweck, D. M. S. Lin, W. Wan, Implicit theories, attributions, and coping: A meaning system approach. *J. Pers. Soc. Psychol.* **77**, 588–599 (1999).
32. C. Y. Chiu, Y. Y. Hong, C. S. Dweck, Lay dispositionism and implicit theories of personality. *J. Pers. Soc. Psychol.* **73**, 19–30 (1997).
33. C. Y. Chiu, C. S. Dweck, J. Y. Y. Tong, J. H. Y. Fu, Implicit theories and conceptions of morality. *J. Pers. Soc. Psychol.* **73**, 923–940 (1997).
34. D. S. Yeager *et al*., The far-reaching effects of believing people can change: Implicit theories of personality shape stress, health, and achievement during adolescence. *J. Pers. Soc. Psychol.* **106**, 867–884 (2014).
35. J. Aronson, C. B. Fried, C. Good, Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *J. Exp. Soc. Psychol.* **38**, 113–125 (2002).
36. T. D. Wilson, "Self-persuasion via self-reflection" in Self-Inference Processes: *The Ontario Symposium*, J. Olson, M. Zanna, Eds. (Erlbaum, Hillsdale, NJ, 1990), Vol. 6, pp. 43–67.
37. A. L. Duckworth, T. S. Gendler, J. J. Gross, Situational strategies for self-control. *Perspect. Psychol. Sci.* **11**, 35–55 (2016).
38. A. L. Duckworth, C. Peterson, M. D. Matthews, D. R. Kelly, Grit: Perseverance and passion for long-term goals. *J. Pers. Soc. Psychol.* **92**, 1087–1101 (2007).
39. C. S. Dweck, C. Y. Chiu, Y. Y. Hong, Implicit theories and their role in judgments and reactions: A word from two perspectives. *Psychol. Inq.* **6**, 267–285 (1995).