Metamotivational Beliefs about Intrinsic and Extrinsic Motivation

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Although intrinsic motivation is often viewed as preferable to more extrinsic forms of motivation, there is evidence that the adaptiveness of these motivational states depends on the nature of the task being completed (e.g., Cerasoli, Nicklin, & Ford, 2014). Specifically, research suggests that intrinsic motivation tends to support better performance on open-ended tasks involving qualitative performance assessment (e.g., creative writing), while extrinsic motivation supports better performance on close-ended tasks involving quantitative performance assessment (e.g., multiple choice). This thesis examined people's *metamotivational beliefs* regarding this type of task-motivation fit. Across three studies ($N = 854$), participants provided beliefs about the usefulness of different types of motivation-regulation strategies: strategies that enhance one's interest and enjoyment in a task versus strategies that focus on the value associated with task outcomes (both self-relevance strategies and reward strategies). Overall, participants reported that interest-enhancing and self-relevance strategies would be more helpful for open-ended versus close-ended tasks (Studies 1, 2, and 3), whereas reward strategies would be more helpful for close-ended tasks (Studies 2 and 3). These beliefs predicted consequential behavioral choices (Study 2) and task performance (Study 3). Implications for understanding effective self-regulation are discussed.

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CHAPTER 1: INTRODUCTION

Successful goal pursuit is challenging on many fronts: Task demands can be overwhelming and temptations frequently abound. Figuring out how to pursue one's goals in the face of such obstacles, however, pays off. Individuals who can effectively self-regulate are more successful and satisfied across a number of metrics (Duckworth, 2011; Tangney, Baumeister, & Boone, 2004), including vocational esteem (Moffitt et al., 2011), self-efficacy (Wolters & Rosenhal, 2000), academic performance (Thiede, Anderson, & Therriault, 2003), interpersonal relationships (Mischel, Shoda, & Peake, 1988), and overall mental health (Rehm & Staiger, 2018). Increasingly, there is recognition that an important component of effective self-regulation may be knowledge about how motivation works, including beliefs about the trade-offs of qualitatively different motivational states (Miele & Scholer, 2018; Miele, Scholer, & Fujita, 2020; Scholer, Miele, Murayama, & Fujita, 2018; Scholer & Miele, 2016). This metamotivational knowledge may be particularly critical because research suggests that the optimal motivational state for performance is determined, in part, by the constraints and demands of a given task (e.g., Cerasoli, Nicklin, & Ford, 2014).

Within the motivation literature, an important qualitative distinction has been made between intrinsic and extrinsic motivation. Intrinsic motivation involves wanting to engage in a task because it is inherently enjoyable or satisfying to the person, whereas extrinsic motivation involves engaging in a task in order to attain an outcome that is separate from the task itself (DeCharms, 1968; Kruglanski et al., 2018; Ryan & Deci, 2000b; Vallerand, 1997). Intrinsic motivation can be strengthened by thinking about how a task is inherently interesting or enjoyable (Bomia et al., 1997; Sansone et al., 1992; Thoman, Smith, & Silvia, 2011). In contrast, extrinsic forms of motivation can be strengthened by focusing on the outcomes that will be attained by completing the task (Touré-Tillery & Fishbach, 2017). Importantly, a secondary distinction can be made between forms of extrinsic motivation where the individual feels controlled by some external force (e.g., monetary rewards or social expectations) and forms where the individual feels that they are autonomously choosing to engage in the task (e.g., because the task and its outcomes are personally important to them or consistent with their self-concept). Compared to controlled forms of extrinsic motivation, autonomous forms are thought to more closely resemble intrinsic motivation in terms of how they are experienced and how they affect task performance (Deci & Ryan, 2000; Ryan & Deci, 2017).

Although it is sometimes implied that intrinsic motivation is universally more beneficial than extrinsic motivation (e.g., Cordova & Lepper, 1996; Deci & Ryan, 1995), a recent meta-analysis by Cerasoli and colleagues (2014) suggests that the benefits of each type of motivation are dependent on the nature of the task or context. Specifically, autonomous forms of motivation (including intrinsic motivation) are more strongly associated with performance on relatively open-ended tasks (e.g., tasks assessed in terms of creativity) than extrinsic incentives (which induce a more controlled form of motivation). In contrast, extrinsic incentives are more strongly associated with performance on close-ended tasks (e.g., tasks assessed in terms of speed and accuracy). However, what is not yet known is whether people are aware of this type of task-motivation fit and whether this awareness predicts important outcomes.

Trade-Offs of Intrinsic and Extrinsic Motivation

Intrinsic motivation is thought to derive from the satisfaction of people's basic human needs for autonomy, competence, and relatedness (Ryan & Deci, 2000b; White, 1959). Historically, there has often been a focus on the seemingly universal benefits of intrinsic motivation, coupled with an awareness of the downsides of extrinsic motivation (particularly in its more controlled forms; DeCharms, 1968; Nakamura & Csikszentmihalyi, 2001; Ryan & Deci, 2000b; Vallerand, 1997; Woodworth, 1918). And, indeed, intrinsic motivation is linked to clear positive benefits in many contexts. In relation to goal pursuit, intrinsic motivation is associated with task engagement that is relatively effortful, intense, and involved (Benware & Deci, 1984; Deci, 1972; Patall, Cooper, & Robinson, 2008; Simons, Dewitte, & Lens, 2004). Based on such findings, Kruglanski et al. (2018) argue that the more individuals are intrinsically motivated to engage in an activity, the more likely they will be to attain their goals. In contrast, controlled forms of extrinsic motivation are often linked to negative consequences for goal pursuit—for example, disinterested engagement and reduced persistence (Ryan & Deci, 2000a; Kohn, 1993). Furthermore, some researchers have argued that extrinsic motivation, particularly when it stems from external rewards, can undermine the satisfaction of basic human needs (Deci, Koestner, & Ryan, 1999; Deci & Ryan, 2012; Lepper, Greene, & Nisbitt, 1973).

However, the conclusion that intrinsic motivation is universally more beneficial than extrinsic motivation is challenged by a number of findings that indicate that external incentives can lead to high levels of performance in certain contexts (Cerasoli et al., 2014, Higgins et al., 2010). In the previously mentioned meta-analysis, Cerasoli et al. (2014) postulated that the strength of the relation between intrinsic or extrinsic motives and performance depends on how performance is assessed. Specifically, Cerasoli et al. differentiated between tasks that emphasize performance quality versus those that emphasize performance quantity. Tasks characterized by an emphasis on quality typically require high levels of task-absorption and a broad focus. These tasks are generally evaluated by comparing performance to a standard that is distinct from the quantity of task output; examples include creative problem-solving or writing a research proposal. In contrast, tasks characterized by an emphasis on performance quantity tend to be relatively simple and repetitive. These tasks are evaluated based on indicators of the amount produced, such as total points or number of errors identified (Cerasoli et al., 2014). The meta-analysis by Cerasoli and colleagues focused on comparing studies where autonomous forms of motivation (including intrinsic task enjoyment) or extrinsic incentives (e.g., rewards, compensation) were present, and found that autonomous motivation predicted a greater unique proportion of variance in performance quality, whereas incentives predicted greater variance in performance quantity. In other words, performance on tasks emphasizing performance *quality* was facilitated by intrinsic enjoyment and other forms of autonomous motivation, while performance on tasks emphasizing performance *quantity* was facilitated by a controlled form of extrinsic motivation (see also Dalal & Hulin, 2008).

The notion that performance on tasks emphasizing performance quality—what is referred to as open-ended tasks—is enhanced by intrinsic motivation versus extrinsic incentives is further illustrated by a number of specific findings. For instance, Amabile, Hennessey, and Grossman (1986) examined the effect of external rewards during various creative tasks for children (e.g., create a story with a set of pictures) and undergraduate students (e.g., making a paper collage). Creativity was significantly reduced for children who completed the creative task in order to later engage in an outside activity as a reward, and for university students who completed the task for a financial reward (compared to groups who were given no reward or a non-contingent reward; cf. Eisenberger & Armeli, 1997; Friedman, 2009).

Similarly, the argument that performance on tasks emphasizing performance quantity—what is referred to as close-ended tasks—is enhanced by extrinsic (versus intrinsic) motivation is also supported by numerous other findings. Sansone and colleagues (1992) found that the use of interest-enhancing strategies led participants to copy fewer letters on a close-ended letter-

copying task in which the goal was to copy as many letters as possible during two-minute intervals. These interest-enhancing strategies (e.g., varying one's handwriting) worked against the performance criteria by increasing the time it took participants to copy each letter. Thus, while purposefully increasing intrinsic motivation benefits engagement, it can negatively affect some types of close-ended task performance assessments (see Sansone & Thoman, 2005).
In addition, Sansone et al. (2012) examined the use of an interest-enhancing strategy (exploring a class webpage to make studying more enjoyable) among online (vs. on-campus) undergraduate students. Results showed that among students studying online, those who reported high (vs. low) use of interest-enhancing strategies such as exploring the webpage reported greater interest while studying, but also received lower grades on a close-ended exam composed of short answer and multiple-choice questions. It is possible that intrinsic motivation made some participants particularly susceptible to "seductive details"—interesting, attention-grabbing pieces of information that can detract from a focus on the core information that will be assessed (Sansone & Thoman, 2005). In support of the idea that seductive details can undermine task performance, Garner, Gillingham, and White (1989) found that the presence of seductive details in an assigned text reduced participants' recall of the text's main ideas.

Based on the evidence reviewed above, the current thesis argues that there are context-specific trade-offs associated with intrinsic and extrinsic motivation that dictate which motivational state may be more effective for a given task. Consequently, rather than approaching every performance situation with either intrinsic or extrinsic motivation, it may be more adaptive to *flexibly regulate* between these states in order to bring one's motivation in line with the demands of the current task. Indeed, researchers have long argued that such flexibility is possible; Kruglanski and colleagues (2018) maintain that we can strategically approach any goal/task with an extrinsic or intrinsic orientation (see also Higgins & Trope, 1990). However, despite evidence suggesting that flexibly switching between intrinsic and extrinsic motivation may be both possible and adaptive, prior research has not investigated whether people are even cognizant of the performance trade-offs associated with each type of motivation. Examining this possibility, and how it might relate to performance, could shed light on when and why people are effective at regulating their goal pursuit.

Intrinsic and Extrinsic Metamotivational Knowledge

Integrating insights from prior work on metacognition (e.g., Flavell, 1979; Pintrich, 2002), a critical component of flexible motivation regulation is proposed to be an individual's metamotivational knowledge (Scholer & Miele, 2016). More broadly, metamotivation is conceptualized as the processes by which individuals monitor and control both the quantity and quality of their motivational states in order to achieve their goals (Miele & Scholer, 2018; Miele et al., 2020; Scholer & Miele, 2016; Scholer et al., 2018). The "motivation" element of metamotivation reflects the idea that, in contrast to other forms of self-regulation (e.g., emotion regulation), motivation is the target of monitoring and control (Scholer et al., 2018). Effective regulation of motivation is thought to require three forms of metamotivational knowledge: task knowledge (which includes people's knowledge about which types of motivations are optimal for particular types of tasks), strategy knowledge (including knowledge about the kinds of strategies that can be used to induce particular motivational states), and self-knowledge (which includes an understanding of what specific motivational states feel like and self-efficacy beliefs regarding the use of particular metamotivational strategies).

Previous metamotivational research has primarily focused on people's task and strategy knowledge (Jansen et al., 2020; Nguyen et al., 2019; Nguyen et al., 2020; Scholer & Miele,

2016) by examining people's beliefs about the adaptiveness of particular motivation-inducing strategies for different kinds of tasks—i.e., their beliefs about specific types of *task-motivation fit*. For example, in a series of studies by Scholer and Miele (2016), participants were presented with tasks that are best performed with the kind of processing associated with either a promotion or prevention orientation (Higgins, 1997): eager versus vigilant tasks (respectively). Eager tasks can be considered activities that are optimally performed when the individual is concerned with enthusiastically pursuing potential gains and consequently engages in divergent information-processing (e.g., brainstorming tasks). In contrast, vigilant tasks are activities that are optimally performed when the individual is concerned with carefully protecting against potential losses and engages in convergent information-processing (e.g., analytical tasks).

For each task, participants were asked how well they would expect to perform after having engaged in various promotion and prevention preparatory activities. The results revealed that participants were sensitive to which kind of task would theoretically benefit the most from a particular motivation (task-motivation fit), signifying accurate metamotivational knowledge about promotion and prevention motivation. Similarly, Nguyen et al. (2019) found that people could, on average, accurately identify when performance on a task would benefit from high-level versus low-level construal (Trope & Liberman, 2010). In both domains, however, there was variability in the accuracy of participants' beliefs. Furthermore, Scholer and Miele found evidence of a simultaneous bias in strategy selection, such that participants tended to endorse promotion strategies as especially effective across situations.

In the domain of intrinsic and extrinsic motivation, it is not yet known if individuals recognize that open-ended versus close-ended tasks differentially benefit from intrinsic versus extrinsic motivation (task knowledge) or if they recognize strategies that could be useful for upregulating these different motivational states (strategy knowledge) in order to establish task-motivation fit. It is also not yet known if these forms of metamotivational knowledge play a role in how successfully one performs on open-ended and close-ended tasks.

Although no prior research has directly investigated task-motivation knowledge in this domain, there are reasons to predict that individuals might exhibit both accuracies and inaccuracies in their metamotivational knowledge. Prior metamotivation research in other domains suggests that people may be quite sensitive to these trade-offs, just as they are sensitive to the trade-offs associated with other motivations (e.g., promotion and prevention; Scholer & Miele, 2016; high- and low-level construal; MacGregor et al., 2017; Nguyen et al., 2019). Furthermore, developmental research reveals that knowledge of intrinsic and extrinsic motivation-enhancing strategies exists in childhood, even as early as age 6 (Cooper & Corpus, 2009; see also Lepper & Gilovich, 1982; Mischel & Mischel, 1983; Xu & Corno, 1998). On the other hand, prior metamotivation research also reveals that individuals can simultaneously recognize task-motivation fit and have biased preferences and expectations for certain motivational strategies (Scholer & Miele, 2016). Further, research suggests that people may hold some erroneous beliefs about intrinsic and extrinsic motivation in particular, failing to recognize how some extrinsic incentives (e.g., rewards) can hurt intrinsic motivation (Murayama et al., 2016), or failing to appreciate the benefits of intrinsic motivation for task persistence (Woolley & Fishbach, 2015). Thus, given the importance of these qualitatively different motivational states in guiding self-regulation, and given research suggesting that both accuracies and inaccuracies in knowledge could exist, it is important to investigate people's beliefs in this domain and when such beliefs may facilitate or obstruct effective self-regulation.

Present Research

The current studies investigated whether individuals have accurate metamotivational knowledge regarding the performance trade-offs associated with intrinsic and extrinsic motivation on open-ended and close-ended tasks. Tests of these hypotheses provide the first examination of metamotivational knowledge about task-motivation fit in the domain of regulating intrinsic and extrinsic motivation. I hypothesized that participants would have awareness of task-motivation fit in this domain, recognizing the relative benefits of interest-enhancing strategies for open-ended tasks and reward strategies for close-ended tasks, given prior work revealing the ways in which individuals are attuned to subtle differences in qualitative motivations (Nguyen et al., 2019; Scholer & Miele, 2016). In addition, I was open to the possibility that individuals might simultaneously show a bias toward a particular type of strategy, given prior work demonstrating people's erroneous beliefs about intrinsic and extrinsic motivation (e.g., Murayama, Kitayami, Tanaka, & Raw, 2016; Woolley & Fishbach, 2015). Consistent with prior work, which has shown that contexts exist in which people perhaps over-value rewards (Boggiano et al., 1987; Heath, 1999; Murayama et al., 2016; Woolley & Fishbach, 2017) *and* perhaps over-value intrinsic motivation (DeVoe & Iyengar 2004; Sansone et al., 1992), I had no a priori predictions about the nature of the bias that might emerge.

Beliefs about self-relevance strategies were also examined (i.e., strategies designed to upregulate autonomous forms of extrinsic motivation; see Vansteenkiste et al., 2018). Although prior research does not allow strong claims about the normative accuracy of task-motivation fit for such strategies, autonomous forms of extrinsic motivation are thought to more closely resemble intrinsic motivation than are controlled forms of motivation. Thus, it may be that the more autonomous form of motivation associated with perceived self-relevance is more adaptive for open-ended tasks and less adaptive for close-ended tasks than the controlled form of motivation elicited by external rewards. It is less clear how the adaptiveness of autonomous forms of extrinsic motivation for open- and close-ended tasks might compare to adaptiveness of intrinsic motivation, as the relative benefits of these two types of motivation for open-ended versus close-ended tasks has not been thoroughly investigated. In fact, the previously mentioned meta-analysis by Cerasoli and colleagues (2014) included studies that appear to have grouped intrinsic motivation with autonomous forms of extrinsic motivation (e.g., studies that used the Relative Autonomy Index [Ryan & Connell, 1989] as a predictor of performance).

A second goal of the current research was to examine if people's metamotivational knowledge predicts important downstream outcomes, including consequential task preparation and task performance. Understanding the nature of people's metamotivational beliefs permits insight into one reason why people might be more or less effective at self-regulation, and suggests specific ways to target interventions (e.g., addressing bias in specific beliefs about the types of motivational strategies that benefit a given task). In this thesis, I provide an initial look at how metamotivational beliefs affect the way one approaches and performs on relevant tasks—a major advance on previous metamotivation studies.

In 3 studies, I adapted the paradigms used by Scholer and Miele (2016) and Edwards (2017) to examine these questions. Participants read descriptions of various tasks that were designed, based on past research, to capture the distinction between open-ended and close-ended tasks. For each task, participants made judgments about which strategies (interest-enhancing, self-relevance, external rewards) would be the most helpful in motivating them to perform well. These strategies were piloted to ensure that people see them as useful for enhancing intrinsic, identified (i.e., autonomous extrinsic), and extrinsic motivation (respectively) and use them in their daily lives (see Appendix A). Study 1 used a between-participant design wherein participants were assigned to read one of two versions of a similar task that differed only its assessment criteria (open-ended vs. close-ended), and participants rated the usefulness of interest-enhancing, self-relevance, and reward strategies. Study 2 assessed beliefs in the context of consequential behavioral choice to examine the extent to which general knowledge predicted consequential choice, as well as the accuracy of beliefs when participants were engaging in consequential behavior. Study 3 examined the relation of beliefs to actual task performance on open-ended and close-ended tasks.

Data Analysis Strategy

I applied a consistent strategy (i.e., for all studies) of excluding participants who completed less than 50% of the study materials. I report the number of participants excluded within the methods section for each study. Study 2 also included a bot-check (Winograd) question (Levesque, Davis, & Morgenstern, 2011), for which there was an a priori exclusion criteria to exclude participants who failed to answer the question correctly. Details about the Winograd exclusion criteria are presented in Study 2, but there is no change in the pattern and significance of the results if I do not apply these criteria. At the end of each study, there were questions assessing attention and engagement, but I did not exclude any participants for analysis based on these questions.[1]

[1]Study 2 was the only study in which there was an a priori intention to exclude participants using these attention/engagement questions. However, because these questions were not the same as those used in the other studies, I decided to retain all participants for data analysis to be consistent across studies. Importantly, there is no change in the pattern or significance of results if I apply the a priori exclusion criteria for these questions.

CHAPTER TWO: METAMOTIVATIONAL KNOWLEDGE

Study 1

In Study 1, a between-subjects design was used in which participants were randomly assigned to read about a text-analysis task that emphasized either open- or close-ended performance criteria. In both conditions, the task involved closely reading a text, although the focus of analysis was different depending on whether the performance criteria were open-ended or close-ended. Participants were then asked to rate the effectiveness of interest-enhancing, self-relevance-enhancing, and reward strategies for the task to which they were assigned. I predicted that for the open-ended task, participants would rate interest-enhancing strategies as more helpful than other types of strategies, whereas for the close-ended task, I expected participants to view reward strategies as most helpful. The results regarding the perceived utility of self-relevance strategies were viewed as more exploratory, given that task-motivation fit regarding these strategies is less clear. A study by Edwards (2017) found initial support for these hypotheses using a similar design, but included multiple open- and close-ended tasks, which differed in a number of ways. Although the task descriptions differed systematically in terms of performance criteria (open- vs. close-ended), the focal activities involved in the tasks were also different (e.g., giving a presentation vs. taking a multiple-choice exam). It is possible, therefore, that participants were responding to other features of the tasks in assessing the utility of motivational strategies, or that other general features of the task descriptions made it easier for participants to detect the appropriate motivational strategy. By contrast, the current study employs a more rigorous design in which participants are presented with one of two versions of the same task that differed *only* in terms of their performance criteria. This allowed a more careful assessment of metamotivational knowledge.

Method

Participants and Design. Participants (N = 394) were recruited on MTurk in exchange for $1.00 USD (180 female, 210 male, 2 "other", 2 did not report; M_{age} = 34.9 years, SD_{age} = 10.0 years; 75.6% White, 10.4% Black; the remaining 14% consisted of multiple groups including Hispanic, Asian, Mixed Race, Middle Eastern, and Aboriginal/Native, but none of which constituted at least 10%). All participants were located in the United States and had an approval rating on MTurk of at least 95%. In total, 439 responses were obtained, but data for 28 participants were excluded because they completed less than 50% of the study. Another 17 were excluded because they failed to correctly respond to a Winograd question (see Levesque, Davis, & Morgenstern, 2011). Task type (open-ended, close-ended) was manipulated between-subjects and strategy type (interest-enhancing, self-relevance, reward) was manipulated within-subjects. The study sample size provided greater than 99% power to detect a between-within interaction effect of $\eta_p^2 = .035$ (the estimated median effect size in social psychological research; Lovakov & Agadullina, 2017), with assumed correlation among repeated measures of .50.

Procedure and Materials. Participants were told that they would be presented with a description of a task and would have to imagine that they were trying to motivate themselves to perform well on the task described. Then, they were randomly assigned to read either the open-ended (n = 200) or the close-ended task description (n = 194). Both versions of the task asked participants to "closely read and review a text." For the open-ended condition, participants were told that the task required them to "focus on analyzing the validity of the arguments in this text, while ignoring any spelling or grammatical errors" and that they would receive feedback about the quality of their analysis. Participants in the close-ended condition were asked to "focus on identifying spelling and grammatical errors, while ignoring the ideas that are expressed," and were told that task feedback would be provided in terms of the number of errors identified. Full task descriptions are in Table 1.

Table 1.

Task descriptions used in Study 1.

Task Type Condition	
Open-ended	Close-ended
You are asked to closely read and review a text. You will focus on *analyzing the validity of the arguments* in this text, while ignoring *any spelling or grammatical errors*. You are asked to *evaluate the strength of* the text**.** For example, you might *comment on central themes* in the text. At the end of the task, you will be told *how much your analysis reflected an understanding of the underlying ideas and arguments***.** For this task, careful attention to the *underlying ideas* is particularly important. You do not need to pay attention to *any typos or grammatical mistakes.* You will receive feedback in the form of *comments about your ability to provide a high-quality analysis of the text.*	You are asked to closely read and review a text. You will focus on *identifying spelling and grammatical errors* in this text, while ignoring *the ideas that are expressed*. You are asked to *correct every spelling and grammatical mistake in* the text**.** For example, you might *identify incorrect uses of punctuation* in the text. At the end of the task, you will be told *how many of the errors you were able to identify.* For this task, careful attention to the *surface-level details* is particularly important. You do not need to pay attention to *the content of the text.* You will receive feedback in the form of *a score reflecting the number of errors you identified.*

Note. Italics have been added to highlight differences between the open- and close-ended conditions, but were not present in the descriptions given to participants.

Following the task description, participants were presented with a set of 6 strategies (2 interest-enhancing, 2 reward, and 2 self-relevance; see Table 2), presented in random order. They rated each strategy on a Likert-type scale from 1 (*not at all helpful*) to 8 (*very helpful*). Specifically, participants received the following instructions: *"In order to motivate yourself to perform well on this task, how helpful is it to…"* The strategies were developed based on previous studies in which participants were asked to focus on certain aspects of a goal (e.g., Sheldon et al., 2010) or report their intrinsic and extrinsic motives for engaging in a task (e.g., Ryan & Connell, 1989). Following the strategy ratings for their assigned task, participants reported demographic information and responded to a quality check (Winograd) question.

Table 2.

Motivation strategies used in Study 1.

Strategy
Interest-enhancing
Consider the aspects of the task that make it interesting.
Focus on how you can make the task enjoyable.
Self-relevance
Consider the aspects of the task that make it important to you.
Focus on how you can make this task feel important to you.
Reward
Consider the rewards you might receive from completing this task.
Focus on how you can reward yourself for successfully completing the task.

Results

Figure 1 displays the ratings for each strategy type by task condition. A mixed 2 (task type; between-subjects; open-ended, close-ended) × 3 (strategy type; within-subjects; interest-enhancing, reward, self-relevance) factorial ANOVA found a significant main effect of strategy type, $F(2, 1.86)$[2] = 4.84, $MSE = 1.40$, $p = .008$, $\eta_p^2 = .01$, and a task type condition × strategy type, $F(2, 1.86) = 11.51$, $MSE = 1.40$, $p < .001$, $\eta_p^2 = .03$. Overall, interest-enhancing strategies ($M = 5.77$, $SD = 1.72$) were viewed as significantly less helpful than reward strategies ($M = 5.99$, $SD = 1.68$), $p = .011$, but there was no significant difference between interest-enhancing

[2] Mauchly's test of sphericity was significant for the repeated-measures effect of strategy type, therefore Greenhouse-Geisser statistics are reported for the strategy and task × strategy effect.

strategies and self-relevance strategies (*M* = 5.78, *SD* = 1.70), *p* = .933. Self-relevance strategies were also viewed as significantly less helpful than rewards strategies, *p* = .013.

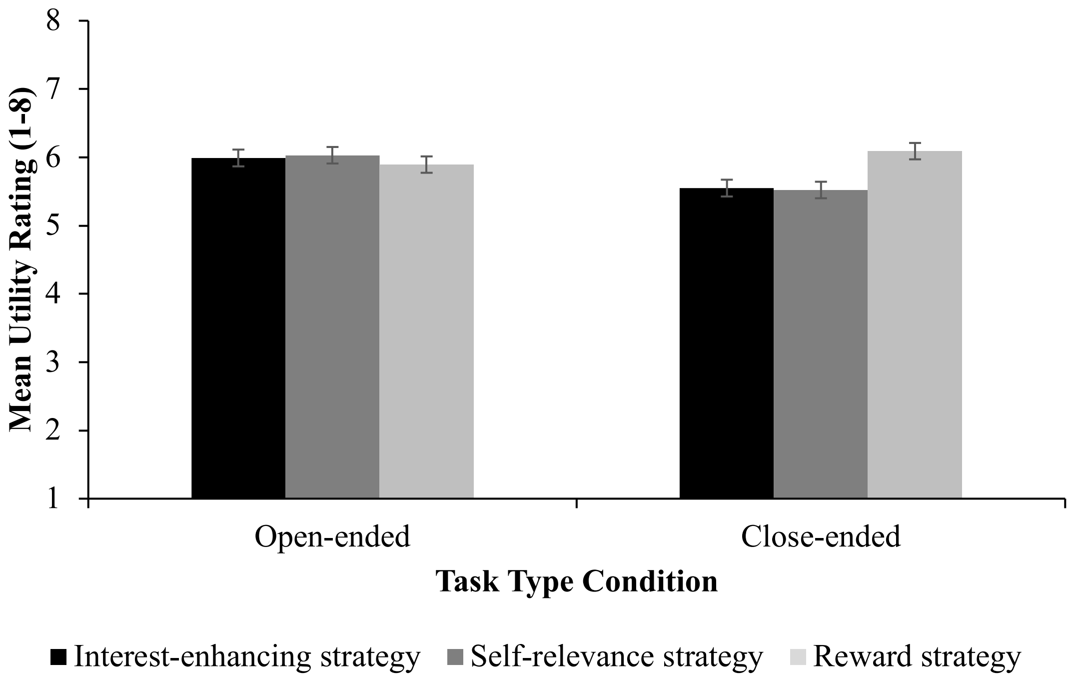

Figure 1. Utility ratings as a function of strategy type and task type condition (Study 1). Error bars represent ± 1 pooled standard error.

Further follow-up t-tests examined the perceived utility of each strategy type within task type. For the open-ended version of the task, none of the strategy type means significantly differed from each other. However, for the close-ended task, there was no significant difference between interest-enhancing and self-relevance strategy ratings, $t(193) = 0.25$, $p = .800$, $d = .02$, but reward strategies were rated as significantly more effective than both interest-enhancing strategies, $t(193) = 4.17$, $p < .001$, $d = .30$, and self-relevance strategies, $t(193) = 4.86$, $p < .001$, $d = .35$.

Discussion

Study 1 revealed that participants had some insight into the effectiveness of these motivational strategies as a function of task type. Specifically, participants recognized that interest-enhancing strategies were more effective for open-ended than close-ended tasks, and that reward strategies were more effective than interest-enhancing strategies for close-ended tasks. Participants also viewed self-relevance strategies as more useful for open-ended tasks than close-ended tasks. It is notable that participants appeared to view self-relevance strategies as more closely aligned with interest-enhancing strategies than with reward strategies in terms of their utility for open- versus close-ended tasks. This belief mirrors theorizing and empirical evidence indicating that autonomous forms of extrinsic motivation are more closely aligned with intrinsic motivation than with controlled forms of extrinsic motivation (Black & Deci, 2000; Ryan & Deci, 2000b; Miserandino, 1996).

The study also revealed a general bias regarding the utility of reward strategies. Overall, participants saw reward strategies as more effective than interest-enhancing or self-relevance strategies. In other words, participants did not differ in their endorsement of reward strategies across task types. Thus, Study 1 suggests ways in which participants may hold both accurate and inaccurate metamotivational beliefs in this domain.

While Study 1 provides insight into people's metamotivational beliefs about intrinsic and extrinsic strategies for open- and close-ended tasks, a limitation of the study is that beliefs were assessed on purely hypothetical tasks. It is important to examine these beliefs when participants are making consequential choices, especially considering that some participants may have competing metamotivational beliefs (i.e., they may be sensitive to task-motivation fit but also find reward strategies particularly effective, as Study 1 suggests). Study 2 therefore investigated consequential behavioral choices.

CHAPTER THREE: BEHAVIORAL OUTCOMES OF METAMOTIVATIONAL KNOWLEDGE

Study 2

Study 2 was designed to test whether people exhibit accurate beliefs about how interest-enhancing and reward strategies affect performance on open- and close-ended tasks when making a consequential choice (i.e., selecting a strategy for what they believed was an actual upcoming task). In addition, Study 2 was designed to assess whether individual differences in metamotivational knowledge (measured in Part 1 of this study) predicted the accuracy of these consequential choices.

Method

Participants and Design. Two hundred and thirteen undergraduate students were recruited online through the study participant pool at the University of Waterloo, and received 0.50 credits as compensation. I set a target sample size of 200 based on a power analysis from a prior metamotivation study that used a similar design (see Nguyen et al., 2019, Experiment 6). The analysis showed that a sample of 200 provides 80% power to detect an odds ratio (OR) of 1.78 and 90% power to detect an OR of 1.95 for the McNemar test reported below. For reference, the estimated median effect size in social psychological research ($\eta_p^2 = .035$) is equivalent to OR = 1.99 (Lovakov & Agadullina, 2017). Eleven participants were excluded for completing less than 50% of the study, leaving 202 for data analysis (146 females, 51 males, 5 unspecified; M_{age} = 19.8 years; SD_{age} = 3.8 years; 36.5% White, 32.5% Asian; the remaining 31% consisted of multiple groups including East Indian, Middle Eastern, Hispanic, Black, and Mixed Race, but none of which constituted at least 10%).

Procedure and Materials. The study was presented as an investigation of motivation for various tasks. Participants were told they would be asked how they would prepare themselves for different tasks, complete some personality questionnaires, and be randomly assigned to complete a short task. In reality, participants were never assigned to complete a task. This cover story was used to ensure that participants believed they were selecting a strategy for a real upcoming task. The design was completely within-subjects. The personality questionnaires were presented in a counterbalanced order to serve as a filler measure and for exploratory purposes; analyses have not yet been conducted with these variables.[3]

Domain-general metamotivational knowledge assessment. After providing informed consent, participants saw four hypothetical task descriptions, in counterbalanced order. Two of these were open-ended task scenarios—emphasizing that performance would be evaluated based on *qualitative* aspects like creativity, and the other two were close-ended task scenarios—emphasizing that performance would be evaluated based on *quantitative* aspects like speed. These task descriptions are the same as those used by Edwards (2017), and can be found in Table 3. For each task, participants were asked to rate the usefulness of four motivational strategies: two interest-enhancing and two reward strategies. These ratings constituted the domain-general knowledge assessment. Self-relevance strategies were not included because our main goal was to predict behavioral choice from accurate beliefs, and normative accuracy for self-relevance strategies cannot adequately be assessed.

[3] The following personality traits were measured: Lay beliefs about motivation (King, *unpublished*), proactive personality (PPS; Bateman & Crant, 1993), Big 5 personality (BFI; John & Srivastava, 1999), mood awareness (Swinkels & Giuliano, 1995), body awareness (Shields, Mallory, & Simon, 1989), and chronic motivational orientation (GCOS; Deci & Ryan, 1985).

Table 3.

Task descriptions used in Study 2 domain-general metamotivational knowledge assessment.

Task Type	
Open-ended	Close-ended
You are asked to complete a task to assess your divergent (creative) thinking skills. The interviewer asks you to pull out an everyday item - such as a newspaper, a cup, or a mirror - from a bag that he/she gives you. Once you select an item, you are given time to generate as many new uses for it as you can, stopping only when you feel that you cannot come up with any more. You will be evaluated in terms of how original your responses are. This task is assessed in terms of creativity and there are no time restraints. You will receive feedback about the quality of your response.	You are asked to copy a series of 50 randomly-generated letter matrices. This task is designed to test your ability to be attentive to detail without sacrificing productivity. Therefore, your supervisor asks you to complete this task as quickly and accurately as possible. At the end of the task, the supervisor will check your work, then he/she will let you know how long you took and how many errors you made. This task is assessed in terms of speed and accuracy. You will receive a numeric score for each. *(Instructions included sample image).*
Your work supervisor has asked you to deliver a 20-minute presentation on a topic of your choice. The presentation will be evaluated on how creative and engaging it is for your colleagues. In order to deliver this presentation, you must gather information related to the topic. You can explore any avenues that you find particularly interesting so that you can deliver a thought-provoking presentation. This task is assessed in terms of creativity and presentation quality. You will receive feedback in the form of comments from your audience.	You are applying for a new job. In order to demonstrate your competence in the field and your knowledge of the job requirements, you are asked to take a multiple-choice exam of about 60 questions. You will be given 60 minutes to complete the test. After taking the test, you will be told what percentage of questions you got correct. The candidate with the highest score will be offered the job. This task is timed and assessed based on accuracy compared to other candidates. You will receive feedback in the form of a numeric score and a percentile ranking.

Preview of open-ended and close-ended task. Participants then read that they would preview two tasks, and for each, they would be asked to choose a preparatory exercise to motivate themselves in order to perform well. Importantly, these two tasks were not among those included in the domain-general knowledge assessment. Participants were told that depending on their condition, they could be assigned to perform one of these two tasks and complete the preparatory exercise that they chose for it later in the study.

Both task descriptions involved problem-solving, with differences in how performance would be assessed (open-ended vs. close-ended). The tasks were presented in a counterbalanced order. The open-ended version described a task in which participants would have to generate innovative solutions to a problem and would be assessed according to the quality of performance—how much their responses revealed deep thinking and imagination. The close-ended version described a task in which participants would have to generate the most suitable and logical solutions to a problem and would be assessed quantitatively—how quick and accurate their response was. The full task descriptions can be found in Table 4. For each of these tasks, participants were asked to make a binary choice between two preparatory exercises: *Focus on how you can make the task enjoyable* (interest-enhancing strategy) vs. *Focus on the rewards you might receive for completing the task* (reward strategy).

Table 4.

Task descriptions for behavioral choice paradigm in Study 2.

Task Type	
Open-ended	Close-ended
You will be presented with a certain hypothetical problem that needs to be solved. You will be asked to *describe an array of* possible solutions to the problem. You will focus on *generating novel and creative* solutions to the problem. For example, you might develop a solution that involves drawing a connection between two things that is *unconventional or uncommon.* The solutions you come up with should build *off of each other*, and involve *"thinking outside the box"*.	You will be presented with a certain hypothetical problem that needs to be solved. You will be asked to *determine the best* possible solutions to the problem. You will focus on identifying the *most suitable* solutions to the problem. For example, you might choose a solution that involves drawing a connection between two things that is *logical and sound.* The solutions you choose should build *from established information,* and involve *practicality*.
For this task, being *innovative* and *original* is particularly important, and *there is no time limit.* You do not need to think about whether *your solutions are logical or which is best.* Your performance on this task will be evaluated based on *depth of thinking and imagination.* You will receive *comments on how much your response showed these qualities.*	For this task, being *quick* and *precise* is particularly important, and *you will be timed.* You do not need to think about whether *the solutions you choose are original or creative.* Your performance on this task will be evaluated based on *speed and accuracy.* You will receive *a numeric score for each.*

Note. Italics have been added to highlight key differences between the open- and close-ended tasks and were not present in the descriptions given to participants.

Continuous ratings. After participants made each binary choice, they were also asked to rate how much they would prefer to use each of the strategies on a Likert scale from 1 (*not at all prefer*) to 5 (*extremely prefer*). They also rated how useful they thought each preparatory exercise would be on a scale from 1 (*not at all useful*) to 5 (*extremely useful*).

Participants were then informed that they would not be asked to complete a task or preparatory exercise. To conclude, participants answered a few demographic questions (e.g., age, gender, education, ethnicity), then were fully debriefed and received their compensation.

Results

Metamotivational knowledge. A 2 (task type; open-ended, close-ended) × 2 (strategy type; interest-enhancing, reward) repeated-measures ANOVA revealed a significant main effect of task type, $F(1, 201) = 61.20$, $MSE = 0.77$, $p < .001$, $\eta_p^2 = .23$. This was qualified by a significant task × strategy interaction, $F(1, 201) = 192.64$, $MSE = 0.92$, $p < .001$, $\eta_p^2 = .49$ (see Figure 2). Paired-samples t-tests showed that participants rated interest-enhancing strategies as significantly more useful for open-ended tasks ($M = 5.49$) than close-ended tasks ($M = 4.07$), $t(201) = 13.78$, $p < .001$, $d = .98$, and reward strategies as significantly more useful for close-ended tasks ($M = 5.08$) than open-ended tasks ($M = 4.62$), $t(201) = 5.77$, $p < .001$, $d = .42$. Utility ratings for interest-enhancing and reward strategies also significantly differed within each task type. The interest-enhancing strategies were seen as significantly more useful for the open-ended tasks than the reward strategies, $t(201) = 8.31$, $p < .001$, $d = .59$, and the reward strategies were seen as significantly more useful for the close-ended tasks than the interest-enhancing strategies, $t(201) = 9.59$, $p < .001$, $d = .68$. These results suggest that participants in this sample did have accurate metamotivational knowledge in the intrinsic and extrinsic motivation domain. Participants were able to appropriately differentiate whether intrinsic or extrinsic motivational strategies would be more helpful depending on the nature of the task as open- or close-ended.

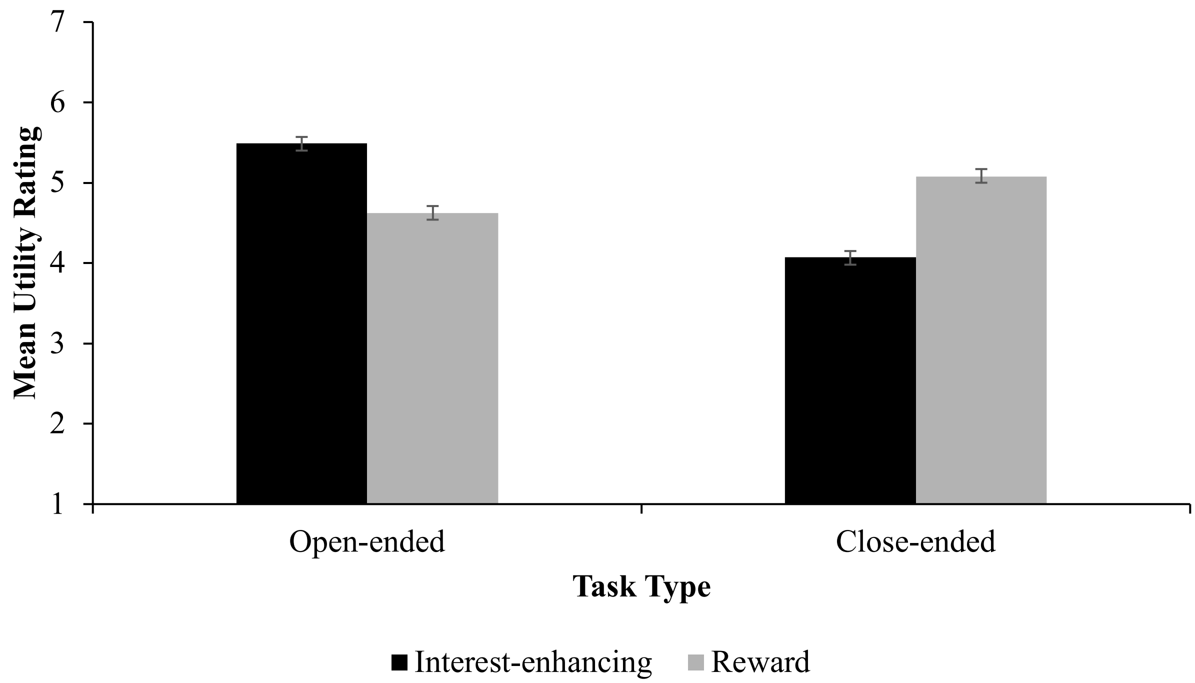

Figure 2. Utility ratings as a function of strategy type and task type (Study 2). Error bars represent ± 1 standard error.

Behavioral choice. Next, I examined metamotivational knowledge in the behavioral choice paradigm. Two participants did not complete the behavioral choice measure, and were therefore excluded from the analyses involving behavioral choice (in addition to the original eleven excluded participants who completed less than 50% of the study). First, frequencies were run on participants' choices. A McNemar test was run to compare the percentage of participants who chose a particular strategy for the open-ended task to the percentage who chose the same strategy for the close-ended task. This test revealed that participants' choices of the interest-enhancing (vs. reward strategy) differed significantly as a function of the task, $p = .001$ (see Figure 3). As expected, for the open-ended task, participants chose the interest-enhancing strategy (62.5%) more often than the reward strategy (37.5%); whereas, for the close-ended task, participants chose the reward strategy (54.0%) more often than the interest-enhancing strategy

(46.0%). I then ran nonparametric binomial tests to assess whether people's strategy choices for each task differed significantly from chance (i.e., 50%). The likelihood of choosing the interest-enhancing strategy for the open-ended task (62.5%) significantly differed from chance, $p = .001$, but the likelihood of choosing the reward strategy for the close-ended task (54.0%) did not significantly differ from chance, $p = .289$. Therefore, participants seemed more sensitive to task-motivation fit for the open-ended task scenario.

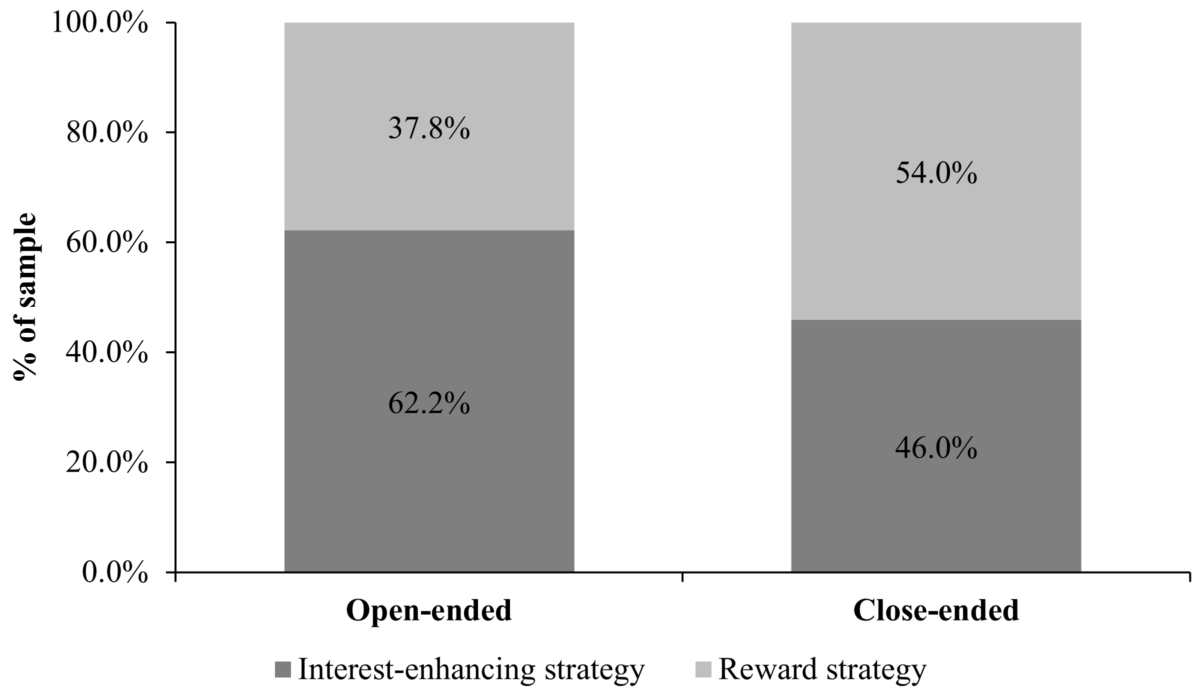

Figure 3. Binary choice frequencies for each task type (Study 2).

Participants' choices also revealed significant variability in metamotivational accuracy: 30.5% of the sample made the normatively appropriate choice for both tasks, while 14.0% made the inappropriate choice for both tasks and 55.5% made the appropriate choice for one task, but not the other. From these choice frequencies, I could also determine proportions of the sample that overgeneralized one specific form of motivation (i.e., chose the same strategy for both tasks): 32.0% of the sample chose the interest-enhancing strategy for both tasks, and 23.5% chose the reward strategy for both tasks (see Table 5).

Table 5.

Behavioral choice frequencies (Study 2).

		Close-ended task		
		Interest-enhancing	Reward	Total
Open-ended task	Interest-enhancing	64 (32.0%)	61 (30.5%)	125 (62.5%)
	Reward	28 (14.0%)	47 (23.5%)	75 (37.5%)
	Total	92 (46.0%)	108 (54.0%)	200 (100%)

Continuous preference and utility ratings. As previously stated, during the behavioral choice portion of the study, participants provided continuous preference ratings for each strategy (i.e., how much they would prefer doing the strategy) and utility ratings (i.e., how useful they thought each strategy would be for the task), both on a 1 to 5 Likert scale. For continuous preferences, a 2 (task type; open-ended, close-ended) × 2 (strategy; interest-enhancing, reward) repeated-measures ANOVA revealed a main effect of task, $F(1, 199) = 6.32$, $MSE = 0.24$, $p = .013$, $\eta_p^2 = .03$, and a marginal main effect of strategy, $F(1, 199) = 3.70$, $MSE = 1.80$, $p = .056$, $\eta_p^2 = .02$. These effects were qualified by a significant task × strategy interaction, $F(1, 199) = 23.69$, $MSE = 0.65$, $p < .001$, $\eta_p^2 = .12$. Paired samples t-tests revealed that people preferred the interest-enhancing strategy more for the open-ended task ($M = 3.73$) than the close-ended task ($M = 3.37$), $t(199) = 5.45$, $p < .001$, and the reward strategy for the close-ended task ($M = 3.46$) more than the open-ended task ($M = 3.27$), $t(199) = 2.85$, $p = .005$. Within the open-ended task, people preferred the interest-enhancing strategy more than the reward strategy, $t(200) = 4.21$, $p < .001$. However, strategy preferences did not significantly differ within the close-ended task, $t(199) = 0.84$, $p = .403$.

For utility ratings, the 2 (task type; open-ended, close-ended) × 2 (strategy; interest-enhancing, reward) repeated-measures ANOVA revealed a main effect of task, $F(1, 199) = 12.68$, $MSE = 0.46$, $p < .001$, $\eta_p^2 = .06$, and a main effect of strategy, $F(1, 199) = 5.07$, $MSE = 1.42$, $p = .025$, $\eta_p^2 = .03$. These effects were qualified by a significant task × strategy interaction, $F(1, 199) = 48.83$, $MSE = 0.89$, $p < .001$, $\eta_p^2 = .20$. Paired samples t-tests revealed that people thought the interest-enhancing strategy was more useful for the open-ended task ($M = 3.91$) than the close-ended task ($M = 3.28$), $t(199) = 7.17$, $p < .001$, and the reward strategy was more useful for the close-ended task ($M = 3.55$) than the open-ended task ($M = 3.26$), $t(199) = 3.95$, $p < .001$. Within the open-ended task, the interest-enhancing strategy was rated as significantly more useful than the reward strategy, $t(200) = 6.34$, $p < .001$. Within the close-ended task, the reward strategy was rated as significantly more useful than the interest-enhancing strategy $t(199) = 2.44$, $p = .015$. This finding within the close-ended task is notable because the effect was not significant on the binary choice measure. Thus, participants seemed to be sensitive to task-motivation for the close-ended scenario, but this did not translate into their binary choices.

Predicting behavioral choice from domain-general knowledge. I then examined whether choices could be predicted from domain-general knowledge of the benefits of intrinsic motivation for open-ended tasks and the benefits of extrinsic incentives for close-ended tasks (i.e., metamotivational knowledge). The knowledge index was created based on the domain-general knowledge assessment, with the following equation, following Scholer & Miele (2016) and Nguyen et al. (2019): [(Interest-enhancing strategy ratings for open-ended tasks – Reward strategy ratings for open-ended tasks) + (Reward strategy ratings for close-ended tasks – Interest-enhancing strategy ratings for close-ended tasks)]. Higher scores on this index reflected greater metamotivational awareness of the performance trade-offs of intrinsic and extrinsic motivation across open- and close-ended tasks.

A mixed effects logistic regression was conducted with an unstructured covariance matrix. Binary choice (dummy-coded; 0 = interest-enhancing, 1 = reward) was regressed on task type (effects-coded; -0.5 = open-ended, 0.5 = close-ended), knowledge (standardized), and the task × knowledge interaction; participant was modeled as the only random effect and all other variables were added as fixed effects. The analysis revealed a significant main effect of task type, $b = .74$, $SE = .22$, $z = 3.33$, $p = .001$, OR = 2.10, 97.5% CI [1.37, 3.31], qualified by a task type × knowledge interaction, $b = .54$, $SE = .22$, $z = 2.42$, $p = .016$, OR = 1.72, 97.5% CI [1.12, 2.71]. To probe the interaction, I first examined the simple effect of domain-general knowledge within each task. Knowledge negatively predicted choosing the reward strategy for the open-ended task, $b = -.34$, $SE = .17$, $z = -2.04$, $p = .042$, OR = 0.71, 97.5% CI [0.50, 0.98], but there was no significant effect of knowledge for the close-ended task, $b = .20$, $SE = .16$, $z = 1.24$, $p = .213$, OR = 1.72, 97.5% CI [1.12, 2.72].

Lastly, I examined the simple effect of task type within different levels of domain-general knowledge. As expected, there was a significant effect of task type at high (+1 *SD*) levels of domain-general knowledge, $b = 1.29$, $SE = .33$, $z = 3.90$, $p < .001$, OR = 3.63, 97.5% CI [1.94, 7.14], but not at low (-1 *SD*) levels, $b = .20$, $SE = .30$, $z = 0.67$, $p = .502$, OR = 1.22, 97.5% CI [0.68, 2.23]. For people high in domain-general knowledge, the odds of choosing the reward strategy for the close-ended task were 3.63 times the odds of choosing the same strategy for the open-ended task (see Figure 4).

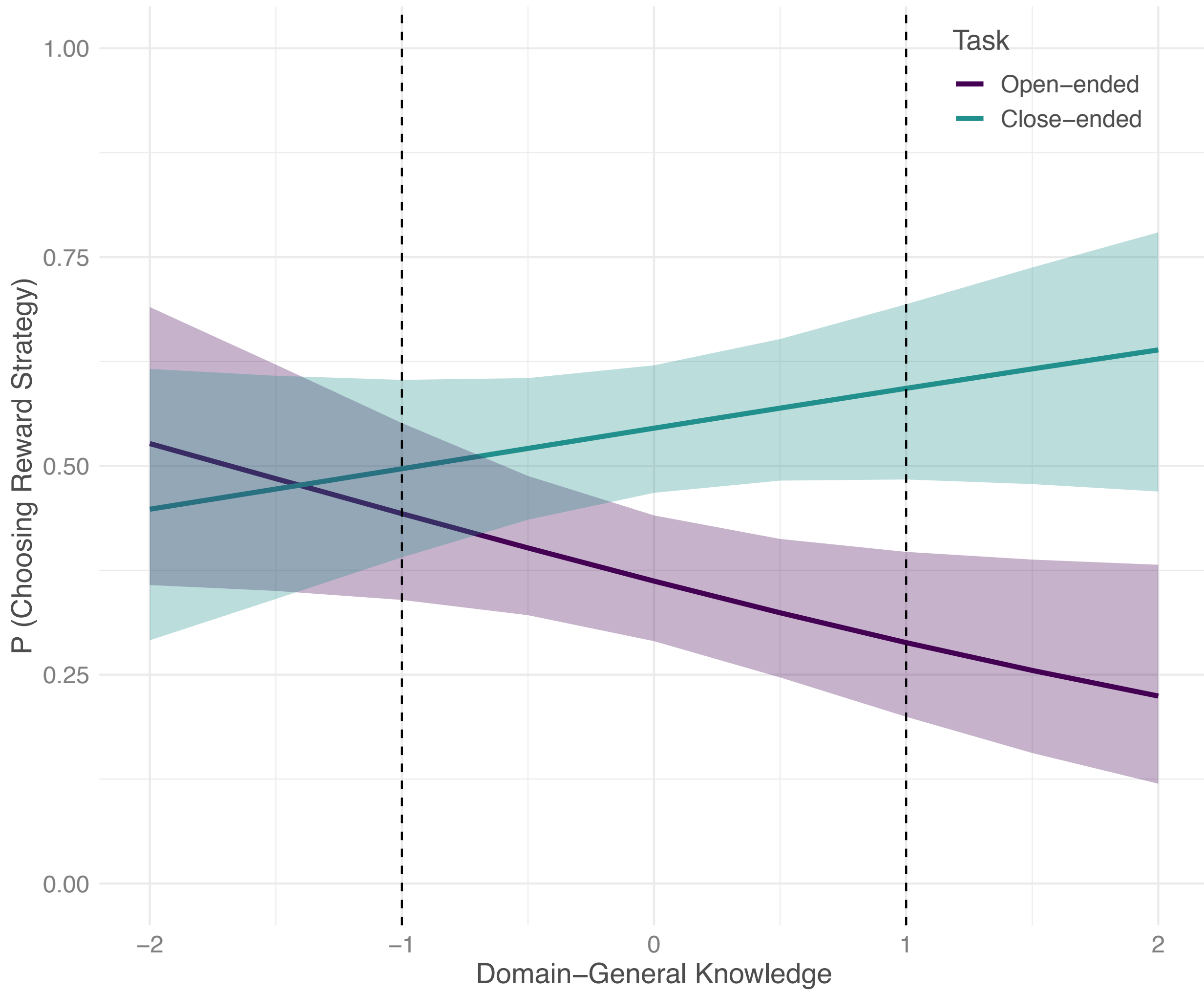

Figure 4. Task × domain-general knowledge on probability of choosing the reward (vs. interest-enhancing) strategy (Study 2). Confidence bands represent 95% CIs.

Discussion

The results of Study 2 provide evidence that even when participants are making consequential choices, they exhibit accurate metamotivational knowledge in this domain, selecting, on average, an interest-enhancing strategy for an open-ended task, but not for a close-ended task. Thus, Study 2 extends Study 1 by illustrating that such beliefs are evident in behavior.

However, Study 2 highlights in particular that there was important variability in these consequential choices. While 30.5% of the sample made the accurate choice for both tasks, the rest of the participants either chose incorrectly each time or overgeneralized the utility of a particular strategy. There was no evidence from the consequential choice or perceived utility measures of participants being particularly partial to the reward strategy (contrary to Study 1). One potential explanation for these different findings, at least for the consequential choice measure, is the relatively abstract description of the strategy ("focus on the rewards you might receive for completing the task"). Participants might have preferred to choose the reward strategy overall if it was more specific (as it often is in the real world). In future work it would be interesting to investigate if people's insights regarding the trade-offs of reward strategies are affected by whether participants are thinking of rewards in general or some very specific reward (i.e., $10 for good performance). If anything, the results from the behavioral choice paradigm suggest that participants generally preferred the interest-enhancing strategy over the reward strategy. Indeed, the intercept in our mixed model (where the outcome is choosing the reward strategy) is negative, $b = -.19$, $SE = .12$, $p = .104$, and while not statistically significant, participants tended (irrespective of task type) to choose the interest-enhancing strategy (55%) more often than the reward strategy (45%). It is possible that when explicitly choosing how to prepare for a task, the desire to experience the enjoyment associated with enhancing one's interest counteracts the perceived utility of using a reward strategy. This would explain why participants did not prefer the reward strategy over the interest-enhancing strategy for the close-ended task, despite believing that the reward strategy would be more useful in this case.

Importantly, Study 2 showed that individual variation in the accuracy of metamotivational knowledge of task-motivation fit was related to consequential choice. Those with a relatively high degree of accurate knowledge were more likely to select an interest-enhancing strategy for the open-ended task than for the close-ended task, whereas those with a low degree of knowledge did not exhibit this difference. This finding suggests that accurate beliefs might lead people to actively upregulate the more effective type of motivation when performing relevant tasks. If this is the case, metamotivational knowledge might also relate to actual task performance. I conducted a third study to address this possibility, by examining whether metamotivational knowledge accuracy was associated with performance on open- and close-ended tasks.

Study 3

Study 3 investigated whether having accurate metamotivational knowledge of task-motivation fit in the domain of intrinsic/extrinsic motivation benefits performance on open- and close-ended tasks. A between-subjects design was used such that participants were either assigned to complete an open-ended task or a close-ended task. As with Study 3, overall metamotivational knowledge was assessed initially, but this time in a separate session (Part 1), to avoid participant fatigue and carry-over effects. I hypothesized that participants with more accurate knowledge of normative task-motivation fit assessed in Part 1 would perform better on the task to which they were assigned in Part 2.

Method

Participants and Design. Three hundred participants were recruited through MTurk in exchange for $1.50 USD. All participants were residents of the United States and had an approval rating of at least 90%. The study was conducted in two online sessions. Participants received $0.50 USD for participating in the first session (Part 1) and $1.00 USD for participating in the second session (Part 2). Forty-one people did not complete Part 2, leaving 259 that completed both sessions. One participant signed up to participate in Part 2, but did not complete any materials. This participant was excluded, leaving 258 for data analysis (M_{age} = 39.36, SD_{age} = 13.20; 150 female, 104 male, 4 unspecified; 71.3% White, 11.7% Black; the remaining 16.7% consisted of multiple groups including Asian, Hispanic, Mixed Race, and Middle Eastern, but none of which constituted at least 10%).[4] A sensitivity analysis was conducted in G*Power, which determined that a sample of 258 provides 80% power in detecting a significant regression coefficient with an effect size of f^2 = .031 in a fixed linear multiple regression model with three predictors (our main analysis). For reference, Cohen (1988) stipulated that f^2 values of .02, .15, and .35 can be described as "small," "medium," and "large" effects, respectively (as cited in Faul, Erdfelder, Buchner, and Lang, 2009).

Materials and Procedure. The study was presented as a two-part study investigating motivation and task performance. Part 1 and Part 2 were arranged as two separate surveys on MTurk. Part 2 was made available (only to the 300 people who completed Part 1) approximately 24 hours[5] after launching Part 1. At that time, participants were contacted through email and notified that Part 2 was available.

Part 1. After providing informed consent,[6] participants completed the metamotivational knowledge assessment, answered some personality[7] and demographic questions, and then were debriefed and received their compensation.

[4]All 258 participants completed > 50% of the study, thus no additional exclusions were made. Results for Part 1 analyses remain the same if all initial 300 participants are included in the analyses.
[5] The average time between sessions was 37.6 hours, and Part 2 was closed approximately 30 days after Part 1 was launched. Time spent between sessions did not moderate study results.
[6] The consent form included informed consent for Part 2 as well.
[7] The following personality questionnaires were completed after the knowledge assessment: Lay beliefs about motivation (King, *unpublished*), proactive personality (PPS; Bateman & Crant, 1993), body awareness (Shields, Mallory, & Simon, 1989), and mood awareness (Swinkels & Giuliano, 1995).

Metamotivational knowledge assessment. Participants were presented with descriptions of four hypothetical tasks in randomized order. Two of these described open-ended tasks and two described close-ended tasks. Two of these task descriptions were those used in Study 2's domain-general knowledge assessment (the open-ended work presentation task and the close-ended multiple-choice task). The other two were an open-ended problem-solving task (the one used in Study 2) and a close-ended text-analysis task (the one used in Study 1). I replaced the other two task descriptions originally used in Study 2 because participants were performing tasks that were very similar to them in Part 2 (an alternate uses task and a letter-copying task; described below) and I wanted to avoid any carry-over effects. For each task, participants were asked to rate six strategies (2 interest-enhancing strategies, 2 reward strategies, and 2 self-relevance strategies) based on how useful they thought each would be for performing well (on a 5-point Likert scale; 1 = *not at all useful*; 5 = *extremely useful*).

Part 2. After reviewing the original consent form,[8] participants were randomly assigned to complete one of two tasks (open-ended vs. close-ended), answered a few questions about their experience with the task, and then were fully debriefed and compensated.

Open-ended vs. close-ended task conditions. Participants were told that they were assigned to either a task that assesses creative thinking (open-ended task condition) or speed and accuracy (close-ended task condition). The open-ended task entailed generating creative uses for an everyday object (a brick; see Guilford, 1950; Torrance, 1974) and the close-ended task entailed copying random strings of letters (see Sansone et al., 2012 for a similar task). Participants read task instructions and were asked to perform as best as they could and then

[8] Before viewing the consent form, participants were instructed to complete the online survey on a computer, not a hand-held device, to avoid related factors that might influence performance (e.g., reduced speed when copying letters on a cell phone). Nineteen (6.7%) of the participants did not comply with this request; however, excluding these participants does not meaningfully influence the results.

completed the task (participants were given 3 minutes for the open-ended task condition and 2 minutes for the close-ended task condition, following past work). The tasks, including their full instructions, can be found in Table 6.

Table 6.

Open-ended and close-ended tasks performed in Study 3.

<table>
<tr><th>Open-ended</th><th>Close-ended</th></tr>
<tr>
<td>

You were assigned to a task that assesses creative thinking.

You will be presented with an object. Please try your best to list as many creative uses of that object as possible. Try to think of new uses—uses you haven't seen or heard about before. Performance on this task is measured based on how original the uses you come up with are.

Please list as many creative ways to use a BRICK as possible. The ideas you write down should be neither typical nor virtually impossible.

You have 3 minutes to work on the task. After 3 minutes, the program will automatically advance you to the next page.

</td>
<td>

You were assigned to a task that assesses speed and accuracy.

You will be presented with rows of randomly-generated letters. Please copy as many of these as you can. Performance on this task is measured based on how many accurate letters you type in the time provided.

Type each row of letters into its accompanying box, as quickly and as accurately as you can.

You have 2 minutes to work on the task. After 2 minutes, the screen will automatically advance you to the next page.

<table>
<tr><td>C L E A Z Z H D W U R</td><td></td></tr>
<tr><td>F A M V E C Q E T B D</td><td></td></tr>
<tr><td>D G Z C X C F V L P H</td><td></td></tr>
<tr><td>B S E D W O L O F S K</td><td></td></tr>
<tr><td>V Z Q V A K G W C J M</td><td></td></tr>
<tr><td>A R Z I K X T L L H E C</td><td></td></tr>
<tr><td>I I O X P C M Q Y O C</td><td></td></tr>
<tr><td>V G I W C E R R S M Z</td><td></td></tr>
<tr><td>E L A B V M E P S C B</td><td></td></tr>
<tr><td>O D N Z S G K A X O S</td><td></td></tr>
<tr><td>Y K S F W T U I R F V</td><td></td></tr>
<tr><td>T V M C D R G H P E F</td><td></td></tr>
<tr><td>H D E Y I P P V G G X</td><td></td></tr>
<tr><td>F F M A J R T S S E C</td><td></td></tr>
<tr><td>B O I X E L K S P Q N</td><td></td></tr>
<tr><td>V E C A J B D R T U H</td><td></td></tr>
<tr><td>J R D B X Y U P L Q S</td><td></td></tr>
<tr><td>W H D B X O F G M A C</td><td></td></tr>
<tr><td>G R R K M C V A B C P</td><td></td></tr>
<tr><td>S T G N Z C W E I F D</td><td></td></tr>
<tr><td>X K R V B W D G E M M</td><td></td></tr>
<tr><td>Q G X K A X F A U Y R</td><td></td></tr>
</table>

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Task experience and perception questions. Participants were then asked a series of questions about their personal experience with the task they were assigned and their perceptions associated with performing the task, which were included to be used as control variables when testing the hypothesis that metamotivational knowledge predicts task performance. The task experience questions were answered on 6-point Likert-type scales and captured task skill: *"How good are you at brainstorming/copying tasks?,"* and task frequency: *"How often do you engage in brainstorming/copying tasks?."* The task perception variables (rated on a 5-point Likert scale) were confidence: *"How confident were you that you could complete the task?,"* enjoyment: *"How much did you enjoy the brainstorming/copying task?,"* perceived success: *"How successful do you think you were on the task?,"* and engagement: *"How likely would you be to engage in the task again if you had the chance?."*

Results

Metamotivational knowledge. A 2 (task type; open-ended, close-ended) × 3 (strategy type; interest-enhancing, self-relevance, reward) repeated-measures ANOVA was conducted to assess metamotivational knowledge. This analysis revealed a main effect of task type, $F(1, 257) = 49.50$, $MSE = 0.35$, $p < .001$, $\eta_p^2 = .16$, a main effect of strategy type, $F(1.60, 410.85) = 9.34$, $MSE = 0.81$, $p < .001$, $\eta_p^2 = .04$, and as with Studies 1 and 2, the predicted task × strategy interaction, $F(1.75, 450.69)$[9] = 116.75, $MSE = 0.35$, $p < .001$, $\eta_p^2 = .31$ (see Figure 5). Within the open-ended tasks, participants rated the interest-enhancing strategies as more useful ($M = 3.98$) than reward strategies ($M = 3.29$), $t(257) = 9.82$, $p < .001$, $d = .61$, and the self-relevance strategies ($M = 3.76$), $t(257) = 5.28$, $p < .001$, $d = .33$. In turn, the self-relevance strategies were

[9] Mauchly's test of sphericity was significant, therefore Greenhouse-Geisser statistics are reported for the strategy and task × strategy effects.

seen as more useful than reward strategies within the open-ended tasks, $t(257) = 6.81$, $p < .001$, $d = .43$. For the close-ended tasks, participants rated the reward strategies as more useful ($M = 3.60$) than the interest-enhancing strategies ($M = 3.23$), $t(257) = 5.53$, $p < .001$, $d = .34$, and the self-relevance strategies ($M = 3.55$) as more useful than interest-enhancing as well, $t(257) = 6.22$, $p < .001$, $d = .39$. The difference between self-relevance and reward strategies was not significant within the close-ended tasks, $t(257) = 0.88$, $p = .378$, $d = .05$. All differences were significant when comparing the strategies across task type. Interest-enhancing strategies were rated as significantly more useful for the open-ended tasks than the close-ended tasks, $t(257) = 12.74$, $p < .001$, $d = .80$, and reward strategies were rated as significantly more useful for the close-ended tasks than the open-ended tasks, $t(257) = 7.09$, $p < .001$, $d = .45$. As in Study 1, the self-relevance strategies were seen as more useful for the open-ended tasks compared to the close-ended tasks, $t(257) = 4.46$, $p < .001$, $d = .28$.

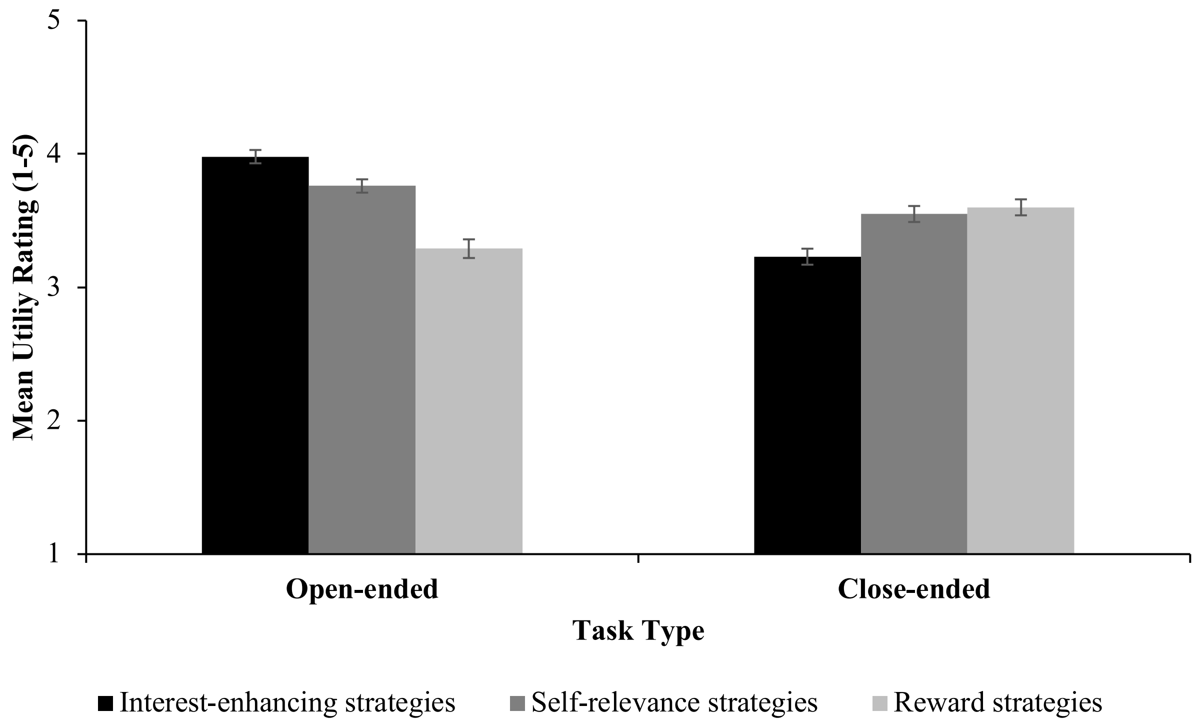

Figure 5. Utility ratings as a function of strategy type and task type (Study 3). Error bars represent ± 1 standard error.

Predicting task performance from metamotivational knowledge. Next, I tested the main hypothesis that metamotivational knowledge would predict task performance. Performance was calculated based on the demands of each task. Performance on the open-ended task was assessed, by three independent coders, based on the total number of uses participants generated in the time provided (i.e., creative generation), and how creative those uses were (i.e., creative insight; see Friedman & Forster, 2001). While creative generation is relatively objective, there was still some room for subjectivity between coders (e.g., interpreting a use as distinct vs. directly connected to another). Indeed, there was very slight variability between the three coders (α = .99). Thus, the three coders' scores were averaged to create a creative generation score for each participant. Each generated use was also rated by each coder in terms how much creative insight it exhibited (7-point Likert scale; 1 = *not at all creative*, 7 = *extremely creative*) and these ratings were then averaged to create a creative insight score for each participant. Inter-rater reliability was high (Cronbach's $\alpha = .85$).

Performance on the close-ended task was calculated based on the total number of letters participants copied in the time provided (i.e., speed), and the number of correctly copied letters divided by the total number copied (i.e., accuracy). The number of correctly copied letters was calculated using the R package 'stringdist' (van der Loo, 2014), which conducts string matching. This package allowed me to quantify the similarity between each string of letters that the participant was instructed to copy, and the string that they copied themselves. In reference to each original string (e.g., "CLEAZZHDWUR"), an error was recorded if there was a transposition of two adjacent letters (e.g., "CELAZZHDWUR"), there was an extra letter (e.g., "CLEAZZHUDWUR"), or the wrong letter was copied (e.g., "CKEAZZHDWUR"). For each original string, the number of errors was subtracted from the total number, and the resulting twenty-two scores were then summed to create the number of correctly copied letters score for each participant. These scores were then divided by the total number copied (i.e., number of letters in each copied string added together) to create an accuracy score for each participant. Descriptive statistics for these performance variables can be found in Table 7. For the following regression analyses, an overall performance score was computed for each participant by averaging standardized versions of the two performance variables that corresponded to the particular task the participant was assigned to complete.

Table 7.

Descriptive statistics for performance variables.

Task	Performance Variable	Min.	Max.	*M*	*SD*
Open-ended (n = 127)	Creative generation	1	16	7.22	3.14
	Creative insight	1	6	3.47	0.90
	Overall open-ended performance	-3.14	2.15	0.00	1.00
Close-ended (n = 131)	Speed	14	244	148.08	54.16
	Accuracy	0.71	1.00	0.99	0.03
	Overall close-ended performance	-7.46	1.34	0.00	1.00

Note. Overall open-ended performance = average of standardized creative generation and creative insight; Overall close-ended performance = average of standardized speed and accuracy.

Metamotivational knowledge was calculated using the same method as Study 2: [(Interest-enhancing strategy ratings for open-ended tasks – Reward strategy ratings for open-ended tasks) + (Reward strategy ratings for close-ended tasks – Interest-enhancing strategy ratings for close-ended tasks)].[10] Metamotivational knowledge was significantly correlated with overall performance, $r(257) = .24$, $p < .001$ (see Table 8 for correlations with each specific performance variable). Interestingly, knowledge was significantly correlated with the creative insight index of the open-ended performance score and the speed index of the close-ended performance score, but not with the creative generation index or the accuracy index. I return to this issue in the study discussion.

[10] While self-relevance strategies were included in the knowledge assessment for Study 3, I did not incorporate them into our knowledge index variable, consistent with Study 2.

Table 8.

Bivariate correlations between metamotivational knowledge and performance variables.

			Metamotivational knowledge
Performance			.24**
(n = 258)	Open-ended performance		.22*
	(n = 127)	Creative generation	.10
		Creative insight	.23**
	Close-ended performance		.26**
	(n = 131)	Speed	.32**
		Accuracy	.09

Note. *$p < .05$; **$p < .01$; Open-ended performance = standardized average of creative generation and insight; close-ended performance = standardized average of speed and accuracy.

A multiple regression analysis was then conducted to test whether metamotivational knowledge predicts performance, while controlling for effects of task type. Overall performance (i.e., performance standardized for each task and then combined into a single column)[11] was regressed on task type (effects-coded; 1 = close-ended; -1 = open-ended), metamotivational knowledge (mean-centred), and their interaction. Consistent with hypotheses, the only significant predictor was metamotivational knowledge, $b = .19$, $SE = .05$, $t(254) = 4.02$, $p < .001$ (see Table 9 for full regression results).

[11] In other words, overall open-ended task performance and overall close-ended task performance were transformed into standardized variables, which were then used to create a single column for overall performance.

Table 9.

Multiple regression summary for main predictor variables.

Predictor	*b*	*SE*	*β*	*t*	*p*	R^2	*adj.* R^2	*F*
Intercept	-.00	.06		0.00	.999	.06	.05	$F(3, 254) = 5.41, p = .001$
Task type	-.00	.06	-.00	0.05	.962			
Knowledge	.19	.05	.24	4.02	<.001			
Task × knowledge	.02	.05	.02	0.40	.690			

Note. Outcome variable is overall performance.

Controlling for task experience and perception variables. I also conducted two additional multiple regression analyses to further test our hypothesis that knowledge predicts task performance: One predicting performance from knowledge while controlling for the effects of participants' general experience with the type of task to which they were assigned, and one predicting performance from knowledge while controlling for participants' specific perceptions of performing the task. Descriptive statistics for these variables can be found in Table 10.

Table 10.

Descriptive statistics for task experience and perception variables.

		M	*SD*
Task Experience Variables	Task skill	3.66	1.28
	Task frequency	3.16	1.46
Task Perception Variables	Confidence	3.16	1.13
	Enjoyment	3.59	1.50
	Success	2.85	1.05
	Engagement	3.21	1.32

First, I regressed overall performance on knowledge (mean-centred) and self-reported task skill and task frequency. Knowledge was significantly related to performance in this model, $b = .17$, $SE = .05$, $t(253) = 3.68$, $p < .001$, in addition to task skill, $b = .14$, $SE = .06$, $t(253) = 2.46$, $p = .014$ (full results can be found in Table 11). Thus, metamotivational knowledge was associated with better task performance even when controlling for participants' general skill and familiarity with these types of tasks. Next, I regressed overall performance on knowledge (mean-centred) and perceived confidence, perceived success, enjoyment, and engagement in regards to the task. Knowledge was the only significant predictor of performance in this model, $b = .19$, $SE = .05$, $t(251) = 4.08$, $p < .001$ (full results in Table 12). In other words, knowledge was also associated with task performance when controlling for participants' specific feelings of confidence, success, enjoyment, and engagement while completing the task.

Table 11.

Multiple regression summary for knowledge and task experience variables.

Predictor	*b*	*SE*	*β*	*t*	*p*	R^2	adj. R^2	*F*
Intercept	-.28	.19		1.49	.136	.08	.07	$F(4, 253) = 5.62, p < .001$
Task type	-.06	.07	-.06	0.90	.371			
Knowledge	.17	.05	.23	3.68	< .001			
Task skill	.14	.06	.18	2.46	.014			
Task frequency	-.07	.05	-.11	1.38	.168			

Note. Outcome variable is overall performance.

Table 12.

Multiple regression summary for knowledge and task perception variables.

Predictor	*b*	*SE*	*β*	*t*	*p*	R^2	adj. R^2	*F*
Intercept	-.68	.21		3.19	.002	.08	.06	$F(6, 251) = 3.79, p = .001$
Task type	.01	.06	.01	0.20	.844			
Knowledge	.19	.05	.25	4.08	< .001			
Confidence	.10	.08	.11	1.25	.211			
Enjoyment	.02	.06	.03	0.35	.726			
Perceived success	-.01	.08	-.01	0.06	.955			
Engagement	.03	.07	.04	0.50	.617			

Note. Outcome variable is overall performance.

Discussion

Study 3 found that metamotivational knowledge of task-motivation fit between intrinsic versus extrinsic motivation and open-ended and close-ended tasks predicted performance, both in terms of open-ended task demands and close-ended task demands. Importantly though, these effects seem to be driven by certain performance outcomes more than others. When breaking down each task's performance criteria into its individual components (creative generation and insight for the open-ended task, speed and accuracy for the close-ended task), knowledge was significantly correlated with only one component in each case. Knowledge was associated with creative insight on the open-ended task, but not creative generation. Likewise, knowledge was associated with speed on the close-ended task, but not accuracy. This pattern of findings on the close-ended task may have a rather mundane explanation: Most participants were highly accurate in terms of the letters they copied (with the sample mean being 99% accuracy), and there was a restricted range (71-100% accuracy). Due to this lack of variance, the effect of metamotivational knowledge on accuracy might have been difficult to detect. For the open-ended task, however, I speculate that this pattern may reveal something more interesting about the nature of metamotivational knowledge in this domain. The task instructions emphasized that performance would be assessed based on creative insight: "Performance on this task is measured based on how original the uses you come up with are." Thus, participants who were higher in metamotivational knowledge and, consequently, more attuned to the task demands may have been more likely to focus on the *quality* versus quantity of their answers, as open-ended tasks call for. In addition, as highlighted throughout, upregulating intrinsic motivation is likely to have a stronger effect on depth of thinking than on the number of alternatives generated within a brief period of time (in contrast to an eager motivational state, for instance; Crowe & Higgins, 1997).

Overall, Study 3 extends the current work in a significant way, by showing that variability in the accuracy of an individual's beliefs can have a tangible impact on how well that individual performs on relevant tasks. The results from Study 3 also implicate metamotivation in effective self-regulation, as they provide initial support for the idea that developing and fostering metamotivational knowledge could help people attain better self-regulation outcomes.

CHAPTER FOUR: GENERAL DISCUSSION

The present studies reveal new insights regarding people's metamotivational beliefs about intrinsic and extrinsic motivation. I obtained evidence that people are metamotivationally aware of the fit between task performance demands and strategies that enhance intrinsic motivation (i.e., interest-enhancing strategies) versus more controlled forms of extrinsic motivation (i.e., reward strategies). Overall, participants tended to believe that strategies aimed at bolstering autonomous forms of motivation (interest-enhancing and/or self-relevance strategies) were more useful for open-ended tasks than for close-ended tasks. This pattern was observed in both within- (Studies 2 and 3) and between-participant (Study 1) designs, including when the demands of each task type were rigorously controlled (Study 1). Participants also tended to believe that controlled motivational strategies (reward strategies) were more useful for close-ended tasks than for open-ended tasks (except in the between-subject Study 1 design). Further, I found that the normative accuracy of participants' metamotivational knowledge predicted the accuracy of their consequential choices (Study 2) and their task performance (Study 3).

Theoretical Implications

The current findings contribute to the literature on self-determination theory (SDT), metamotivation, and self-regulation. First, participants' beliefs in the current studies largely aligned with the continuum of motivation proposed by SDT, which specifies different forms of motivation ranging from fully controlled to fully autonomous (Ryan & Deci, 2000). Specifically, the current studies suggest that that an autonomous form of extrinsic motivation (assessed through ratings of self-relevance strategies) falls between controlled extrinsic motivation and intrinsic motivation in terms of its perceived utility for open- and close-ended tasks, which is consistent with where it falls on the SDT continuum. Moreover, although participants treated autonomous extrinsic motivation as distinct from both controlled extrinsic and intrinsic motivation, they seemed to view it as being more suited for open-ended tasks compared to close-ended tasks, just as they tended to view intrinsic strategies as more suited for open-ended tasks than for close-ended tasks. This finding is consistent with SDT's claim that certain forms of extrinsic motivation (e.g., wanting to engage in an activity because it is perceived as relevant to the self) resemble intrinsic motivation to the extent that they are experienced as autonomous (Ryan & Connell, 1989), and that "it is typically the degree to which an action is experienced as autonomous that functionally matters most" (Ryan & Deci, 2017, p. 197).

The current work also adds to the growing metamotivation literature that shows that people have knowledge about qualitatively different motivational states. Past research has compared people's beliefs about interest-enhancing and reward strategies (e.g., Sansone et al., 1992), but not in terms of their perceived utility for performing well. Furthermore, our studies are the first to assess the normative *accuracy* of people's beliefs about the utility of these strategies for different types of tasks (Cerasoli et al., 2014).

People, on average, seem to recognize when it would be beneficial to upregulate intrinsic versus extrinsic motivation based on the task demands. While I considered the possibility that people could have a biased preference for reward strategies (which foster controlled extrinsic motivation), I only found evidence of this in Study 1, which assessed beliefs about two versions of the same task as part of a between-participants design. Specifically, the perceived utility of reward strategies did not differ as a function of condition in Study 1 (while the utility of interest-enhancing and self-relevance strategies did). This finding is most likely a result of the particular materials employed in Study 1, given that it was not observed in our other studies. However, it is possible that certain differences in task demands were less salient in Study 1 (in which more elements of the task were held constant across conditions), and an awareness of these differences may be necessary for people to recognize that reward strategies are less useful for open-ended tasks compared to interest-enhancing strategies. Recognition of a task's demands (e.g., open- or close-ended performance criteria) could be facilitated by comparing it to a task that has the opposing demands, which could have occurred in the other (within-participant) studies, including Study 3 which found correlations between accurate beliefs and task performance. Yet, it is also possible that due to the design of the within-participant knowledge assessments, the salience of certain task features that were irrelevant to performance criteria (i.e., whether the task is open-ended or close-ended) ended up masking a general bias toward reward strategies in those studies. Next, I discuss how knowledge accuracy may vary between individuals and how this variability might relate to task performance.

Assessing the Accuracy of Metamotivational Knowledge

The current work found that on average, participants held normatively accurate knowledge about task-motivation fit in the domain of intrinsic and extrinsic motivation. However, there was significant variability in the accuracy of this knowledge, and to the extent that individuals had more accurate knowledge, they made more accurate consequential choices (Study 2) and performed better on relevant tasks (Study 3). This suggests that an understanding of task-motivation fit in this domain can facilitate self-regulatory success. At the same time, I acknowledge the need to better understand how metamotivational knowledge develops and to further examine the nuances of "accuracy" in this arena (see Miele et al., 2020).

In Study 2, I observed that a significant proportion of the sample believed in the general utility of either interest-enhancing or reward strategies, regardless of task type, as more than half of the sample chose the same strategy for both tasks in a consequential choice paradigm. It is possible that these individuals are insensitive to the varying demands of qualitatively distinct tasks, and thus likely to make sub-optimal decisions about motivation regulation when encountering tasks that do not fit their preferred approach. Consistent with this argument, Study 3 provided initial evidence that people who are aware of which motivation regulation strategies are generally beneficial for the type of task that they have been assigned to complete tend to perform better on the task than people who lack this awareness. Thus, it appears that when the accuracy of metamotivational beliefs is assessed in this way—relative to normative and theory-based standards—it can help explain why people experience self-regulatory success or failure. At the same time, it is possible to assess accuracy using other standards. For example, in the metacognition literature, it is common to use a person's own performance as the standard for assessing the accuracy of their beliefs (see Dunlosky & Metcalfe, 2009). Exploring such approaches is an important direction for future research.

When considering the limits of assessing metamotivational accuracy in terms of normative standards, it is important to keep in mind that the efficacy of a given motivational strategy likely depends not only on the fit between the strategy and the task, but also on the fit between the strategy and the person. There may be a number of factors that influence the effectiveness of a given strategy for a particular individual. For example, Tice and Baumeister (1997) suggest that procrastinators may rely more heavily on the pressure of deadlines because they find it more difficult to motivate themselves intrinsically. Similarly, upregulating interest might simply be unrealistic for certain people, such as those lower in creative cognition (Dygert

& Jarosz, 2019), who might struggle to adapt the inner-workings of a task or change how they approach it. Individuals who are unable to upregulate intrinsic motivation may be better off using other strategies on open-ended tasks, even if on average, people excel when they select a motivational strategy based on task-motivation fit.

It may also be possible that situational factors constrain the strategies that can be effectively employed. For instance, sometimes one has more tools at one's disposal to make a task more enjoyable (e.g., listening to music, drinking a beer). Sometimes it is easier to immerse oneself in the task because the content has a compelling hook (e.g., many individuals might find the history of theme parks in the US more gripping than the history of toothpaste). Interest researchers have described such situational factors as those that "catch" interest (e.g., compelling instructions) and contrast them with those that "hold" interest (e.g., active learning; Durik & Harackiewicz, 2007). Conversely, sometimes one has access to meaningful rewards (a coffee date with a good friend, the promise of a new book, or time to take a nap) and sometimes one does not. Thus, in the complex and noisy world in which people regulate their motivation, all of these factors must be considered when assessing what the "right" choice is. This idea likely involves further exploration of the role of self-knowledge in metamotivational accuracy—the extent to which individuals recognize their own motivational states and understand which strategies are most effective for them personally (see Miele et al., 2020).

Metamotivational Knowledge About Self-Relevance Strategies

The current investigation of people's metamotivational knowledge also provides insight into what people understand about the varieties of extrinsic motivation posited by self-determination theory (Deci & Ryan, 2000). Although strategies that bolster autonomous forms of extrinsic motivation (rather than controlled forms of extrinsic motivation or intrinsic motivation) may be important for establishing task-motivation fit, less is known about when these strategies (such as enhancing the perceived self-relevance of the task) are most effective for supporting task performance. In the current work, self-relevance strategies were generally viewed as more helpful for open-ended tasks than close-ended tasks. At the same time, strategies for inducing autonomous extrinsic motivation tended (across studies) to fall in between strategies for inducing intrinsic and controlled extrinsic motivation in terms of perceived utility. This suggests that participants may have perceived self-relevance strategies as being relatively useful for the performance of both open- *and* close-ended tasks. Because students tend to work on a combination of open- and close-ended tasks within a particular course, and even sometimes within the same assessment (e.g., tests that begin with multiple-choice and end with a long-answer question), they may at times benefit from relying on self-relevance strategies as their default metamotivational approach in educational contexts.

That being said, contexts involving both open- and close-ended tasks might be those where it is particularly helpful for people's beliefs to reflect the trade-offs associated with different motivational states. Such nuanced beliefs might predict *motivational flexibility*, which involves switching between different motivational strategies in order to address changes in task demands (e.g., switching from an interest-enhancing to a rewards strategy as the context shifts from an open-ended to a close-ended task). In Study 3, I only assigned participants to complete one task type, thus future research will need to assess how knowledge of task-motivation fit translates into motivational flexibility (e.g., by asking each participant to complete both an open-ended and a close-ended task). An individual who is sensitive to the trade-offs associated with intrinsic and extrinsic motivation would be expected to engage in flexible behavior (e.g., switching strategies between tasks), which would in turn maximize performance across tasks (e.g., if their performance was averaged across an open-ended and close-ended task). However, if there are constraints preventing someone from switching strategies (e.g., high cognitive demands of the assessment), adopting a single strategy that enhances autonomous extrinsic motivation might be a good approach. This idea requires significant further investigation, but to the extent that autonomous extrinsic motivation strikes a balance between different task demands, focusing on self-relevant aspects or increasing self-relevance could be an appropriate choice in dynamic performance situations.

More work in this area is needed to determine the specific contexts in which autonomous extrinsic motivation is most beneficial, as well as the contexts in which it might be easier to upregulate than other types of motivation. For example, people may find it relatively simple to increase the perceived self-relevance of a task when it can easily be contextualized within a long-term, personally important goal, such as advancing one's career. Past research on utility-value interventions could be especially informative for examining these questions (e.g., Priniski et al., 2019). Future research should continue to examine the performance trade-offs associated with autonomous extrinsic motivation and other types of motivation alongside "purely" intrinsic and extrinsic forms of motivation.

The Role of Task Signal Strength in Metamotivational Beliefs

An assumption of the current framework is that tasks differ in their motivational affordances, such that performance on open-ended tasks is best supported by more intrinsic forms of motivation and performance on close-ended tasks is best supported by more extrinsic forms of motivation. What is not yet well understood is exactly what features of these tasks signal these motivational affordances, and how features might differ in the extent to which they clearly and unambiguously call for a given type of motivation. This is an interesting direction for future work.

One of the limitations of the current studies is that intrinsic and extrinsic strategies were provided for participants (i.e., participants simply endorsed the effectiveness of strategies, rather than generating the strategies themselves). To more fully understand the extent of people's metamotivational knowledge and the role of task signal strength, future research should examine whether people have the ability to generate the strategies themselves, and how any spontaneously generated strategies differ as a function of tasks that are more prototypically open versus closed-ended. If people spontaneously generate more intrinsic strategies for open-ended tasks and more extrinsic strategies for close-ended tasks, this could imply an ability to pick up on task signals even more advanced than what the current studies show. It may also be the case that the use of spontaneously generated strategies versus knowledge based on ratings of provided strategies, or knowledge generated when task signals are relatively strong versus weak, may be differentially related to performance.

The Importance of Metamotivation in the Intrinsic/Extrinsic Domain

In contrast to prior research indicating that people may hold erroneous beliefs about the nature of intrinsic motivation and its relation to extrinsic motivation (Murayama et al., 2016; Woolley & Fishbach, 2015), the present findings demonstrate that people have awareness of the performance trade-offs associated with intrinsic and extrinsic motivations in specific task contexts. The accuracy of metamotivational beliefs may help individuals self-regulate more effectively and attain more positive outcomes (Studies 2 and 3). Individuals with more accurate metamotivational awareness may detect when an intrinsic or extrinsic motivational state is hindering their performance, and be able to induce the appropriate state in themselves. These individuals may also have a broader repertoire of motivational strategies to use when faced with more complex task demands (e.g., tasks with both open- and close-ended elements). Continuing to explore how people's beliefs about motivation impact their effective harnessing of it remains a pressing question for self-regulation research.

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Appendix A

Methods and results of the pilot study used to ensure that people see the employed strategies as useful for enhancing intrinsic, identified (autonomous extrinsic), and controlled extrinsic motivation and use them in their daily lives.

Participants and Design

Data from 51 participants were collected through MTurk in exchange for $0.50 USD. All 51 participants completed more than 50% of the study, but three were excluded for failing a bot-check (Winograd) question, leaving 48 for analyses (M_{age} = 33.6 years, SD_{age} = 10.4 years; 36 male, 11 female, 1 "other").

Procedure and Materials

After providing informed consent, participants reported the frequency with which they use strategies taken from those used in Study 1 (two interest-enhancing, two self-relevance enhancing, and two reward) on a Likert scale from 1 to 5 (1 = *never*; 3 = *sometimes*; 5 = *very often*). Participants then reported how likely each strategy would be for making a task feel more enjoyable, important, and rewarding on a 7-point Likert scale (1 = *extremely unlikely*; 7 = *extremely likely*). They were then fully debriefed and compensated.

Results

Frequency of strategy use. The means for all strategies were above 3 ("sometimes") on the scale, except for the strategy "Focus on how you can make a task feel important to you" (M = 2.67). The means and standard deviations for all six strategies can be found in Table A. In light of the mean use of this strategy being below the midpoint, each strategy was tested against the midpoint, to see if any of them significantly differed (i.e., were significantly higher or lower than "sometimes" on the scale). The strategy "Focus on how you can make a task feel important to you" did not significantly differ (i.e., was not significantly lower than) from the midpoint, $t(47) = -1.86$, $p = .070$, suggesting that people do use this strategy in their daily lives. The two reward strategies were significantly higher than the midpoint; *"Focus on how you can reward yourself,"* $t(47) = 3.50$, $p < .001$; *"Consider the rewards you might receive,"* $t(47) = 3.60$, $p < .001$. The other self-relevance strategy, *"Consider the aspects of the task that make it important to you,"* was significantly higher than the midpoint as well, $t(47) = 2.23$, $p = .031$.

Table A.

Strategy use frequencies.

Strategy	*M*	*SD*
Consider the aspects of a task that make the task interesting.	3.02	1.00
Focus on how you can make a task enjoyable.	3.13	1.14
Consider the aspects of a task that make it important to you.	3.31	0.97
Focus on how you can make a task feel important to you.	2.67	1.24
Focus on how you can reward yourself for successfully completing a task.	3.50	0.99
Consider the rewards you might receive from completing a task.	3.48	0.92

Frequencies were then analyzed collapsing them into categories of interest-enhancing, self-relevance, and reward strategies (see Table B). A repeated-measures ANOVA revealed a main effect of strategy type, $F(1.68, 78.92)$[12] $= 6.85$, $p = .003$. LSD post-hoc tests showed that reward strategies were reported to be used significantly more frequently than interest-enhancing, $p = .020$, and self-relevance, $p < .001$. The frequency of interest-enhancing and self-relevance did not significantly differ from one another.

[12] Mauchly's test of sphericity was significant, therefore Greenhouse-Geisser correction was used to interpret the ANOVA. The main effect reported here was still significant with sphericity assumed, $F(2, 94) = 6.85$, $p = .002$.

Table B.

Strategy use frequencies collapsing into motivation type.

	M	SD
Intrinsic	3.07	0.96
Extrinsic	3.49	0.82
Identified	2.99	0.91

Anticipated strategy effects. A repeated-measures ANOVA revealed a main effect of strategy type on anticipated task enjoyment, $F(2, 94) = 8.96$, $p < .001$. Paired-samples t-tests showed no significant difference between interest-enhancing and reward, $t(47) = 1.28$, $p = .207$. However, interest-enhancing strategies were significantly higher than self-relevance strategies, $t(47) = 2.82$, $p = .007$, and reward strategies were as well, $t(47) = 4.54$, $p < .001$.

There was also a main effect of strategy type on anticipated task importance, $F(2, 94) = 14.94$, $p < .001$. There was no significant difference between reward and self-relevance, $t(47) = 1.37$, $p = .179$, however, reward strategies were significantly higher than interest-enhancing, $t(47) = 3.84$, $p < .001$, and self-relevance strategies were significantly higher than reward strategies, $t(47) = 5.19$, $p < .001$.

Finally, there was a main effect of strategy type on anticipated task reward, $F(2, 94) = 9.90$, $p < .001$. Reward strategies were thought to make a task significantly more rewarding compared to interest-enhancing, $t(47) = 3.98$, $p < .001$ and self-relevance strategies, $t(47) = 2.33$, $p = .024$. Self-relevance strategies were thought to make a task significantly more rewarding than interest-enhancing, $t(47) = 2.43$, $p = .019$. Descriptive statistics for these effects are summarized in Table C.

Table C.

Beliefs about anticipated strategy effects.

	Enjoyment		Importance		Reward	
Strategy Type	*M*	*SD*	*M*	*SD*	*M*	*SD*
Interest-enhancing	5.19	1.45	4.65	1.55	4.72	1.51
Reward	5.45	1.26	5.37	1.65	5.60	1.18
Self-relevance	4.68	1.43	5.61	1.46	5.19	1.40