*Empirical Research Paper*

# Lay Theories of the Wandering Mind: Control-Related Beliefs Predict Mind Wandering Rates in- and outside the Lab

Personality and Social Psychology Bulletin
1–18

DOI: 10.1177/0146167220949408
journals.sagepub.com/home/pspb
SAGE

**Claire M. Zedelius[1], John Protzko[1], and Jonathan W. Schooler[1]**

**Abstract**

People often fail to keep their mind from wandering. Here, we examine how the tendency to mind wander is affected by people's beliefs, or lay theories. Building on research on lay theories and self-regulation, we test whether differences in people's beliefs about the extent to which mind wandering is controllable affect thought control strategies and mind-wandering rates in daily life and the laboratory. We develop a new scale to assess control-related beliefs about mind wandering. Scores on the scale predict mind wandering (Study 1) and intrusive thoughts (Study 2) in everyday life, thought control strategies and dysfunctional responses to unwanted thoughts (Study 2), and mind wandering during reading in the laboratory (Studies 3–6). Moreover, experimentally induced lay theories affect mind-wandering rates during reading (Studies 4 and 5). Finally, the effectiveness of strategies people can use to reduce their mind wandering depends on their lay theories (Studies 2 and 6).

**Keywords**

lay theories, implicit theories, beliefs, mind wandering, intrusive thoughts, thought control, self-regulation

Received December 14, 2018; revision accepted July 17, 2020

The realization that you have missed what has been going on in front of your eyes because your thoughts have drifted off is an all too common experience. Studies suggest we spend 30% to 50% of the day "mind wandering," that is, engaged in thoughts unrelated to the here and now (also referred to as stimulus- or task-unrelated thoughts; for example, Klinger & Cox, 1987). Mind wandering is associated with a host of negative effects, including reduced academic performance (Lindquist & McLean, 2011; Mrazek et al., 2013; Schooler et al., 2011) and negative mood (Killingsworth & Gilbert, 2010). Given the pervasiveness and impact of mind wandering, surprisingly little is known about why we succeed or fail at regulating our task-unrelated thoughts. Here, we examine how mind wandering may be affected by people's *lay theories* about mind wandering.

Lay theories are beliefs (also called implicit theories) that determine how we interpret our own and other people's behavior (Molden & Dweck, 2006). When catching their mind wandering, some people may view it as the result of uncontrollable fluctuations of attention. Others may interpret it as a failure to control their thoughts. Do these lay theories predict people's efforts to regulate their thoughts and ultimately how much their mind wanders?

## Lay Theories About Thought Control

Lay theories predict self-regulatory behavior. For instance, lay theories about intelligence predict whether a person seeks or eschews challenges (e.g., Dweck, 2000; Molden & Dweck, 2006). Lay theories about emotions predict how people cope with negative emotions (Karnaze & Levine, 2018). Lay theories about self-control predict people's willingness to exert and sustain mental effort (Job et al., 2010; Mrazek et al., 2018).

Thus far, no research has examined beliefs about mind wandering. Research on intrusive thoughts, however, suggests people have different lay theories about the extent to which thoughts can be controlled. Intrusive thoughts, like mind wandering, are task-unrelated, but they are also unwanted and distressing (e.g., Rachman, 1981). Thus, intrusive thoughts are a sub-category of mind wandering. Interestingly, there is evidence that intrusive thoughts are influenced by lay theories. For instance, people who believe that thoughts are precursors to actions (a belief referred to as *thought–action fusion*; Shafran et al., 1996) tend to have more dysfunctional reactions to unwanted thoughts, such as worrying and self-judging (e.g., Wells & Davies, 1994). These dysfunctional beliefs and dysfunctional reactions can then reinforce each other through a feedback cycle (e.g., Magee et al., 2012).

[1]University of California, Santa Barbara, USA

**Corresponding Author:**
Claire M. Zedelius, Department of Psychological and Brain Sciences, University of California, Santa Barbara, Santa Barbara, CA 93106-9660, USA.
Email: claire.zedelius@psych.ucsb.edu

Via a similar mechanism, we predicted lay theories about the extent to which mind wandering is controllable or uncontrollable affect mind wandering. If a person believes their tendency to mind wander is largely outside their control, the person should have little motivation to even attempt to regulate their thoughts. If, on the contrary, a person believes mind wandering is controllable, they should make an effort to regulate their thoughts, for instance by refocusing their attention on the task at hand or otherwise disengaging from their thoughts. Lay theories may also shape people's reactions to unwanted thoughts. Individuals who believe they have little or no control over their spontaneous thoughts may worry or judge themselves when they have unwanted thoughts, whereas individuals who believe they can control their thoughts should have less reason to worry. As a result, we predict having a "controllable" lay theory should lead to fewer mind wandering episodes and reduced distress in response to unwanted thoughts.

Believing one can control one's thoughts can motivate a person to control their unwanted thoughts, but motivation alone is not enough. One also needs to know how to control one's thoughts. Effective strategies to disengage from distressing thoughts are distracting oneself or reappraising thoughts in a more positive way (Coles & Heimberg, 2005; Halvorsen et al., 2015). These strategies can be developed naturally (Scheibe et al., 2015) or explicitly taught, for instance, in therapy (Troy et al., 2013). We expect that individuals who believe they have control over their thoughts experience fewer unwanted task-unrelated thoughts if they regularly employ these strategies. In other words, we predict that lay theories and thought control strategies interact to shape mind wandering.

It is likely that the causal relationship between mind wandering and lay theories is bidirectional. Over time, mind wandering and lay theories could reinforce each other, such that those who effectively regulate their thoughts may be strengthened in their belief that they have control over their thoughts. In this way, mind wandering may both be affected by and, in the long run, affect control-related lay theories of mind wandering.

## Overview of the Present Studies

To investigate individual differences in lay theories about mind wandering, we first developed a novel instrument, the theories of mind wandering (TOMW) scale, and tested whether the scale predicts self-reported mind wandering. Next, we examined whether TOMW is associated with other lay theories about intrusive thoughts, as well as dysfunctional responses to unwanted thoughts and thought control strategies. Moreover, we investigated whether lay theories and thought control strategies interact in predicting unwanted thoughts. We then conducted a set of laboratory studies (Studies 3–6) to test whether TOMW predicts mind wandering during reading. To test the causal effects of lay theories on mind wandering, in Studies 4 and 5, we experimentally manipulated lay theories of mind wandering by providing participants with information supporting the view that mind wandering is controllable or not.[1] In Study 6, we examined whether the efficacy of several strategies we offered to help participants limit their mind wandering was greater for participants who believe mind wandering is controllable. Throughout the article, we report all dependent measures and exclusion criteria. A complete methods packet with instructions, scales and other stimuli for all studies is available in the Supplemental Material.

## Study 1

Our goals for Study 1 were to test (a) whether we can reliably measure lay theories of mind wandering and (b) whether these lay theories correlate with self-reported mind wandering. We constructed a novel measure, the "theories of mind wandering" scale. We administered the scale in a large sample, together with measures of mind wandering and another lay theory measures.

### Method

*Participants and procedure.* Participants were 505 adults (42% male; $M$ age = 35.0 years, $SD$ = 11.8) recruited through Mechanical Turk (MTurk). A desired sample size of 500 was determined prior to data collection based on practical considerations. For psychometric validation of a novel scale, a common recommendation is a rule of thumb, the "subject to item ratio," with 300 being considered "good" and 500 "very good" (e.g., Comrey & Lee, 2013). We wanted to have a sample that is considered large by most standards.

After filling out demographics, participants responded to five measures, presented in counterbalanced order.

*Measures*

1. The TOMW scale consisted of 12 items, six describing mind wandering as controllable and six reverse-scored items describing mind wandering as hard or impossible to control. A sample item is as follows: "How much my mind wanders is something about me that I can't change very much." The scale was modeled after existing lay theories scales (e.g., the Theories of Intelligence scale, see below) but referred to the ability to control how much one mind wanders. Items were scored on a 6-point Likert-type scale from "strongly disagree" to "strongly agree." After recoding reverse-scored items, higher scores reflect a greater belief in the controllability of mind wandering. Items are reported in Appendix A.
   Because we were interested in participants' *beliefs* about the extent to which *people in general* are able to control their mind wandering, rather than in participants' *assessment of their own skill* at controlling their thoughts, we also constructed a version of the

scale formulated in the third person (i.e., words such as "I" or "me" were replaced with "people" or "one"). This scale variation was administered among a subsample of 255 participants.

2. The Mind Wandering Questionnaire (Mrazek et al., 2013) is a five-item scale assessing the propensity for mind wandering in everyday life. A sample item is as follows: "I mind-wander during lectures or presentations."
3. The Mindful Attention and Awareness Scale (Brown & Ryan, 2003) is a 15-item scale developed to assess mindfulness but is frequently used as a measure of mind wandering (see Mrazek et al., 2012). A sample item is as follows: "I break or spill things because of carelessness, not paying attention, or thinking of something else." Higher scores indicate less mind wandering.
4. The Theories of Intelligence scale (Dweck, 2000) is an eight-item scale assessing lay theories about intelligence. A sample item is as follows: "People can learn new things, but they can't really change their basic intelligence." The scale was included to test whether the TOMW scale measures a distinct concept, rather than simply the extent to which mental capacities in general are subject to intentional control.
5. The Hong Psychological Reactance Scale (Hong & Faedda, 1996) is an 11-item scale assessing a person's aversion to limitations in their personal freedom. A sample item is as follows: "I resist attempts to influence me." The scale was included to test whether individuals scoring higher in reactance might be more likely to report they believe they can control their mind wandering simply because they have an aversion against acknowledging that they have limited control over their thoughts.

## Results

To assess the reliability of the TOMW scale, we computed ω, which allows computation of reliability of a factor when the items may not be unidimensional or complicated by a methods factor (Raykov & Marcoulides, 2016). We found excellent reliability (ω = .946). Reliability of the TOMW third-person scale was lower (ω = .66). For both scale variants, no single item increased the scale's reliability if deleted.

Next, an exploratory factor analysis of the TOMW scale using oblimin rotation suggested a two-factor structure. We explored this structure and found the second factor is entirely a methods factor arising from shared methods such as the wording of items. Only reverse-coded items loaded onto one factor, and non-reverse-coded items loaded onto the other. Furthermore, a parallel analysis (Horn, 1965) suggested a single latent variable instead of two. Therefore, we used the scale as a single factor. This was the case for the first-person and the third-person forms of the items. Model fit for this single factor was adequate (comparative fit index [CFI] = .86, root mean square error of approximation [RMSEA] = .115) and poor for the third-person scale (CFI = .676, RMSEA = .159), due to the presence of the complicating methods factor.

**Table 1.** TOMW Scale Items of the Final Seven-Item TOMW Scale, With Factor Loadings Shown for the Seven-Item Short Scale (First- and Third-Person Version).

| Items | Factor loadings | |
|---|---|---|
| | First-person short scale | Third-person short scale |
| Even in moments when it really matters, I can't do much to keep my mind from wandering. (R) | .753 | .794 |
| When my mind starts to wander, there is nothing I can do to stop it. (R) | .805 | .774 |
| How much my mind wanders is something about me that I can't change very much. (R) | .845 | .873 |
| How often I mind wander is an aspect of myself that I can't do much about. (R) | .742 | .841 |
| I have the capacity to change how much I tend to mind wander. | .795 | .841 |
| Over time, I could change how much control I have over my mind wandering. | .809 | −.77 |
| The amount of control I have over my mind wandering probably can't change very much. (R) | .817 | −.741 |

*Note.* Items marked with (R) are reverse-scored. TOMW = theories of mind wandering.

To create a better fitting scale for use in this and further investigations, we constrained all factor loadings to be the same and dropped items that produced worse fit. We dropped five items, leaving us with a seven-item scale with good psychometric fit (CFI = .94, RMSEA = .087). All subsequent analyses used this short scale. The fit for the short scale was less good for the third-person scale (CFI = .90, RMSEA = .11). Factor loadings for the seven items of the final short scale are shown in Table 1.

To investigate construct validity, we tested whether the TOMW scale correlated with related scales and was distinguishable from conceptually dissimilar scales. The results are shown in Table 2. The TOMW scale (first person) correlated significantly with the Mind Wandering Questionnaire and the Mindful Attention and Awareness Scale. It also correlated weakly with the Theories of Intelligence scale and the Psychological Reactance Scale. We also tested the partial correlation between TOMW and Mind Wandering Questionnaire controlling for Theories of Intelligence and Psychological Reactance. It remained significant, $r = -.458$,

**Table 2.** Correlations Between TOMW Scale and Other Dependent Variables: MWQ, MAAS, ToI, and HPRS.

| TOMW scale | MWQ | MAAS | ToI | HPRS |
|---|---|---|---|---|
| TOMW first person | $r = -.491$ $p < .001$ | $r = .554$ $p < .001$ | $r = .222$ $p < .001$ | $r = -.210$ $p = .001$ |
| TOMW third person | $r = -.255$ $p < .001$ | $r = .259$ $p < .001$ | $r = .238$ $p < .001$ | $r = -.128$ $p = .040$ |

*Note.* TOMW = theories of mind wandering; MWQ = Mind Wandering Questionnaire; MAAS = Mindful Attention and Awareness Scale; ToI = Theories of Intelligence Scale; HPRS = Hong Psychological Reactance Scale.

$p < .001$. The same is true for the partial correlation between TOMW and Mindful Attention and Awareness Scale controlling for Theories of Intelligence and Psychological Reactance ($r = .526$, $p < .001$). This suggests that the relationship between TOMW and mind wandering is neither driven by the general belief that one can control one's abilities, nor by reactance to the measure. For the third-person variant of the scale, correlations were similar (see Table 2).

### *Discussion*

The results indicate that the newly developed seven-item TOMW scale is reliable. Results for the original first-person and the alternative third-person scale were highly similar, suggesting that both scales measure beliefs about the extent to which people in general can exert control over how much they mind wander, rather than how skilled people think they *personally* are at controlling their mind.

The small correlation between the TOMW scale and the Theories of Intelligence scale suggests that individuals who believe mind wandering is controllable also tend to hold a growth mind-set, but the TOMW scale measures more than just a growth mind-set. Of particular relevance to the current investigation, correlations between the TOMW scale and the Mind Wandering Questionnaire and the Mindful Attention and Awareness Scale suggest the more participants believe mind wandering is controllable, the less mind wandering they report. This relationship remained unchanged even when controlling for other related measures. These findings help validate the TOMW scale and provide preliminary evidence for our hypothesis that lay theories of mind wandering are predictive of actual mind wandering.

## Study 2

In Study 2, we examined to what extent TOMW correlates with experiences of unwanted intrusive thoughts. Following our finding that TOMW predicts mind wandering, we expected that the same is true for unwanted intrusive (i.e., depressive and anxious) thoughts. If a person believes their tendency to mind wander is something they can control, they should make more of an effort to control unwanted thoughts and, as a result, experience fewer such thoughts. They may also have less dysfunctional responses (i.e., worry and self-judgment) to unwanted thoughts.

To more directly examine the mechanism through which lay theories affect the occurrence of unwanted thoughts, we further investigated whether lay theories predict participants' use of thought control strategies. Believing one has control over one's thoughts alone should not magically result in fewer unwanted thoughts. But the belief should motivate people to engage in strategies to regulate their thoughts. Distraction, reappraisal, and seeking support are generally considered effective thought control strategies (see Halvorsen et al., 2015). Thus, we predicted that a person should be more likely to use any or all of these strategies if the person believes that thought control is generally possible. In contrast, if a person believes that thoughts are hard or impossible to control, they should be less inclined to use any of these strategies, because this would seem futile. In other words, we predicted a main effect of lay theories on thought control strategies.

In addition, we examined how the interaction of lay theories and thought control strategies shapes experiences of unwanted thoughts. Believing one has control over one's thoughts may motivate a person to use strategies to regulate their thoughts, but to effectively regulate unwanted thoughts, the person also needs to understand which strategies work for what types of thoughts and how to employ them. Thus, having a "controllable" lay theory should be associated with fewer unwanted thoughts if a person frequently uses effective thought control strategies, but it should not have as much of an impact if the person does not use effective thought control strategies. In other words, we predict an interaction of lay theories and strategy use on the frequency of unwanted thoughts.

Finally, to better understand how lay theories of mind wandering relate to other lay theories about unwanted thoughts, we also examined whether TOMW is associated with thought–action fusion, a lay theory about the meaning and importance of thoughts, which has been linked to frequent intrusive thoughts.

### *Method*

*Participants.* The study was conducted online among a sample matching the demographics of American adults (using CriticalMix). Because we had found moderate to large correlations between TOMW scores and critical dependent variables (DVs) in Study 1, a desired sample size of 400 was determined prior to data collection based on practical considerations (see Schönbrodt & Perugini, 2013); 394 participants completed the study.

#### *Measures and procedure*

1. TOMW was assessed using the shortened TOMW scale from Study 1.
2. The frequency and intensity of unwanted intrusive thoughts were assessed with the Distressing Thoughts

Questionnaire (Clark & de Silva, 1985). This 12-item questionnaire assesses depressive thoughts (e.g., "Thoughts or images that my future is bleak") and anxious thoughts (e.g., "Thoughts or images that something is, or may in the future be, wrong with my health"). Participants first report how frequently they have these thoughts, then rate their intensity: Specifically, they indicate how sad, unhappy, and worried they feel when they have these thoughts, how much difficulty they have removing these thoughts from their mind, and how much they disapprove of them. Both unwanted thought frequency and intensity are rated on a 9-point Likert-type-scale.

3. Lay theories about the meaning of unwanted thoughts were assessed with the Thought–Action Fusion Scale (Shafran et al., 1996). It has three subscales. The Moral subscale focuses on the belief that thoughts can be immoral (e.g., "Thinking of making an extremely critical remark to a friend is almost as unacceptable to me as actually saying it"). The Likelihood-Self subscale (e.g., "If I think of myself being in a car accident, this increases the risk that I will have a car accident") and Likelihood-Other subscale ("If I think of a relative/friend losing their job, this increases the risk that they will lose their job") assess the belief that having negative thoughts leads to corresponding actions.
4. Dysfunctional responses to unwanted thoughts and the use of thought control strategies were assessed with the Thought Control Questionnaire (Wells & Davies, 1994). This 30-item questionnaire has five subscales: Distraction (e.g., "I think about something else"), Reappraisal (e.g., "I try a different way of thinking about it"), Seeking Support (e.g., "I ask my friends if they have similar thoughts"), Worry (e.g., "I focus on different negative thoughts"), and Self-Judging (e.g., "I get angry at myself for having the thought").
5. The Aberrant Salience Inventory (Cicero et al., 2010) was administered (at the end of the study) for an unrelated study. Responses were not analyzed for this study.

The Distressing Thoughts Questionnaire, Thought–Action Fusion Scale, and Thought Control Questionnaire were presented in that order. The TOMW scale was presented either before or after those measures (counterbalanced). This was done to rule out that TOMW might be correlated with the other measures because reading questions about distressing thoughts *first* may bias participants' interpretation of mind wandering toward these types of thoughts.

## Results

*Do lay theories predict unwanted thoughts?* First, we tested whether TOMW predicts experiences of depressive and anxious thoughts. Correlations between TOMW scores and the Distressing Thoughts Questionnaire are in Table 3. As predicted, individuals who believe more strongly that mind wandering is controllable experience fewer depressive and anxious thoughts. They also experience them as less intense.

**Table 3.** Correlations Between TOMW and Items of the DTQ Subscales.

| DTQ subscale | TOMW |
|---|---|
| DTQ–Depressive–Frequency | $r = -.371$<br>$p < .001$ |
| DTQ–Depressive–Unhappy | $r = -.295$<br>$p < .001$ |
| DTQ–Depressive–Worried | $r = -.350$<br>$p < .001$ |
| DTQ–Depressive–Disapproving | $r = -.193$<br>$p < .001$ |
| DTQ–Depressive–Difficult-to-Control | $r = -.404$<br>$p < .001$ |
| DTQ–Anxious–Frequency | $r = -.394$<br>$p < .001$ |
| DTQ–Anxious–Unhappy | $r = -.230$<br>$p < .001$ |
| DTQ–Anxious–Worried | $r = -.385$<br>$p < .001$ |
| DTQ–Anxious–Disapproving | $r = -.252$<br>$p < .001$ |
| DTQ–Anxious–Difficult-to-Control | $r = -.460$<br>$p < .001$ |

*Note.* TOMW = theories of mind wandering; DTQ = Distressing Thoughts Questionnaire.

*Do lay theories predict reactions to unwanted thoughts and use of thought control strategies?.* Next, we tested whether TOMW predicts negative reactions to unwanted thoughts and use of thought control strategies. Correlations between TOMW scores and the Thought Control Questionnaire subscales are shown in Table 4. As predicted, believing that mind wandering is controllable correlated negatively with worry and self-judgment and positively with the thought control strategy distraction. TOMW scores did not predict using reappraisal or seeking support.

*Joint effects of lay theories and thought control strategies on unwanted thoughts.* Next, we tested the interactive effect of TOMW scores and strategy use on depressive and anxious thoughts.[2] To this end, we performed two regression analyses, one on the Depressive Thought Frequency subscale and one on the Anxious Thought Frequency subscale of the Distressing Thoughts Questionnaire. As predictors, we included TOMW scores, the three thought control strategies (distraction, reappraisal, support seeking), and three interaction terms (TOMW × Distraction, TOMW × Reappraisal, TOMW × Support Seeking). We mean-centered all predictors. The results for depressive thoughts are in Table 5. While

**Table 4.** Correlations Between TOMW, TCQ Subscales (TCQ–Distract, TCQ–Reappraise, TCQ–Social, TCQ–Worry, TCQ–Self-Judging), and TAF Subscales (TAF–Moral, TAF–Likelihood-Self, TAF–Likelihood-Other).

| TCQ and TAF subscales | TOMW |
|---|---|
| TCQ–Worry | $r = -.353$<br>$p < .001$ |
| TCQ–Self-Judging | $r = -.416$<br>$p < .001$ |
| TCQ–Distraction | $r = .159$<br>$p = .002$ |
| TCQ–Reappraisal | $r = .023$<br>$p = .648$ |
| TCQ–Social Support | $r = -.075$<br>$p = .136$ |
| TAF–Moral | $r = -.182$<br>$p < .001$ |
| TAF–Likelihood-Self | $r = -.204$<br>$p < .001$ |
| TAF–Likelihood-Other | $r = -.310$<br>$p < .001$ |

*Note.* TOMW = theories of mind wandering; TCQ = Thought Control Questionnaire; TAF = Thought–Action Fusion.

**Table 5.** Regression Predicting Depressive Thought Frequency From TOMW, Thought Control Strategies, and the Interactions of TOMW and Strategies From a Full Model Containing All Terms.

| Predictor | *b* | *t* | *p* | 95% CI |
|---|---|---|---|---|
| TOMW | −0.769 | −7.68 | <.001 | [−0.966, −0.572] |
| Distraction | −0.707 | −4.06 | <.001 | [−1.049, −0.365] |
| TOMW × Distraction | −0.095 | −0.61 | .542 | [−0.401, 0.211] |
| Reappraisal | 0.803 | 4.44 | <.001 | [0.447, 1.158] |
| TOMW × Reappraisal | −0.457 | −2.68 | .008 | [−0.793, −0.121] |
| Social support | −0.386 | −2.47 | .014 | [−0.693, −0.078] |
| TOMW × Social Support | −0.055 | −0.36 | .718 | [−0.356, 0.245] |
| Constant | 4.167 | 42.82 | <.001 | [3.976, 4.359] |

*Note.* TOMW = theories of mind wandering; CI = confidence interval.

there were main effects of distraction, reappraisal, and seeking social support, there was also a significant interaction between TOMW and reappraisal. To further inspect this interaction, we tested the effect of TOMW at three levels of reappraisal. The effect was negative and significant at all three levels, but it was weakest at low levels of reappraisal (i.e., one *SD* below the mean), $b = -0.506$, $t = -3.62$, $p < .001$, 95% confidence interval (CI) = [−0.781, −0.231]; stronger at average reappraisal, $b = -0.769$, $t = -7.68$, $p < .001$, 95% CI = [−0.966, −0.572]; and the strongest at high levels of reappraisal (i.e., one *SD* above the mean), $b = -1.031$ $t = -7.34$, $p < .001$, 95% CI = [−1.308, −0.755].

**Table 6.** Regression Predicting Anxious Thought Frequency From TOMW, Thought Control Strategies, and the Interactions of TOMW and Strategies From a Full Model Containing All Terms.

| Predictor | *b* | *t* | *p* | 95% CI |
|---|---|---|---|---|
| TOMW | −0.554 | −8.10 | <.001 | [−0.689, −0.420] |
| Distraction | −0.248 | −2.09 | .038 | [−0.482, −0.014] |
| TOMW × Distraction | −0.264 | −2.48 | .013 | [−0.473, −0.055] |
| Reappraisal | 0.372 | 3.01 | .003 | [0.129, 0.615] |
| TOMW × Reappraisal | −0.081 | −0.69 | .491 | [−0.310, 0.149] |
| Social Support | 0.098 | 0.91 | .361 | [−0.113, 0.308] |
| TOMW × Social Support | −0.117 | −1.12 | .265 | [−0.322, 0.089] |
| Constant | 4.138 | 62.18 | <.001 | [4.008, 4.269] |

*Note.* TOMW = theories of mind wandering; CI = confidence interval.

This means participants who more strongly endorse a controllable lay theory of mind wandering *and* more regularly engage in reappraisal report the fewest depressive thoughts.

The results for anxious thoughts are in Table 6. There were main effects of distraction and reappraisal but not support seeking. Moreover, there was a significant interaction between TOMW and distraction. To understand this interaction, we tested the effect of TOMW at three levels of distraction. The effect was negative and significant at all three levels, but it was weakest at low levels of distraction (i.e., one *SD* below the mean), $b = -0.398$, $t = -4.17$, $p < .001$, 95% CI = [−0.586, −0.211]; stronger at average distraction, $b = -0.554$, $t = -8.10$, $p < .001$, 95% CI = [−0.689, −0.420]; and the strongest at high levels of distraction (i.e., one *SD* above the mean), $b = -0.711$ $t = -7.85$, $p < .001$, 95% CI = [−0.889, −0.533]. Thus, participants who more strongly endorse a more controllable theory of mind wandering *and* more often use distraction to control anxious thoughts report the fewest anxious thoughts.

*Lay theories of mind wandering and thought–action fusion.* Finally, we tested if TOMW correlates with thought–action fusion, a lay theory that has been linked to frequent experiences of unwanted thoughts. We found small but significant negative correlations between TOMW scores and all subscales of the Thought–Action Fusion Scale (see Table 4). Thus, greater belief that mind wandering is controllable was associated with a reduced tendency to believe that negative thoughts are immoral or precursors to actions.

*Examining order effects.* To test whether the correlations between the TOMW scale and the other measures differed as a function of whether the TOMW scale was administered before or after the other questionnaires, we used Fisher's *r*-to-*z* transformation to compare correlation coefficients in the two counterbalancing conditions. As Table 7 shows, none

**Table 7.** Correlations Between TOMW, DTQ Subscales (DTQ–Depressive and DTQ–Anxious), TAF Subscales (TAF–Moral, TAF–Likelihood-Self, TAF–Likelihood-Other), and TCQ Subscales (TCQ–Distract, TCQ–Reappraise, TCQ–Social, TCQ–Worry, TCQ–Self-Judging) by Counterbalancing Condition (TOMW First vs. TOMW Last).

| DTW, TAF, TCQ subscales | TOMW first | TOMW last | Fisher's z |
|---|---|---|---|
| DTQ–Depressive | $r = -.420$ | $r = -.301$ | $z = -1.35$ |
| | $p < .001$ | $p < .001$ | $p = .177$ |
| DTQ–Anxious | $r = -.498$ | $r = -.318$ | $z = -2.14$ |
| | $p < .001$ | $p < .001$ | $p = .032$ |
| TAF–Moral | $r = -.259$ | $r = -.098$ | $z = -1.64$ |
| | $p < .001$ | $p = .170$ | $p = .101$ |
| TAF–Likelihood-Self | $r = -.186$ | $r = -.232$ | $z = 0.47$ |
| | $p = .009$ | $p = .001$ | $p = .638$ |
| TAF–Likelihood-Other | $r = -.265$ | $r = -.365$ | $z = 1.09$ |
| | $p < .001$ | $p < .001$ | $p = .276$ |
| TCQ–Worry | $r = -.351$ | $r = -.358$ | $z = 0.468$ |
| | $p < .001$ | $p < .001$ | $p = .936$ |
| TCQ–Self-Judging | $r = -.427$ | $r = -.406$ | $z = 0.401$ |
| | $p < .001$ | $p < .001$ | $p = .803$ |
| TCQ–Distraction | $r = .142$ | $r = .179$ | $z = -0.37$ |
| | $p = .046$ | $p = .012$ | $p = .711$ |
| TCQ–Reappraisal | $r = .060$ | $r = -.016$ | $z = 0.75$ |
| | $p = .401$ | $p = .826$ | $p = .453$ |
| TCQ–Social Support | $r = -.130$ | $r = -.023$ | $z = 0.145$ |
| | $p = .069$ | $p = .751$ | $p = .289$ |

*Note.* TOMW = theories of mind wandering; DTQ = Distressing Thoughts Questionnaire; TAF = Thought–Action Fusion; TCQ = Thought Control Questionnaire.

of the correlations were significantly different for the two groups.

### Discussion

These results show that a person's lay theory of mind wandering has relevance beyond ordinary mind wandering. It also shapes their experiences with unwanted intrusive thoughts. For one, individuals with a stronger belief that mind wandering is controllable experience fewer depressive and anxious thoughts, and are less distressed when they have such thoughts. Moreover, they worry and judge themselves less and more frequently distract themselves to control unwanted thoughts. This is in line with our idea that lay theories predict unwanted thoughts because they shape how people respond to and regulate such thoughts.

This is further illustrated by our finding that lay theories and thought control strategies interactively predict experiences of unwanted thoughts. Among individuals who do not often use effective thought control strategies, lay theories are not as predictive of unwanted thoughts as among individuals who regularly deal with depressive and anxious thoughts by reframing them or distracting themselves.

We also found that individuals who believe more strongly that mind wandering is controllable are less inclined to show thought–action fusion, or the tendency to ascribe inflated meaning and importance to one's thoughts (Berle & Starcevic, 2005). This suggests individuals who experience their spontaneous thoughts as hard to control also ascribe inflated meaning and importance to them.

## Study 3

Study 3 investigated whether TOMW are predictive of mind wandering during reading. Reading is one of the most commonly used tasks for studying mind wandering in the laboratory (e.g., Schooler et al., 2004). We hypothesized that the less individuals believe mind wandering to be controllable, the more they would mind wander during reading.

To rule out that participants' reported TOMW would be a mere inference based on how often they found themselves mind wandering during the reading task, we counterbalanced the order of the reading task and the TOMW measure. If TOMW were inferred from recent mind wandering episodes during reading, we would expect a stronger relationship between the two variables when the reading task precedes the TOMW measure. We predicted the relationship would be found regardless of task order.

### Method

*Participants.* Participants were 58 psychology students (24% male; *M* age = 19.0 years, *SD* = 1.3). A desired sample size of 60 was determined prior to data collection, and we decided to stop at the end of the academic quarter. The sample size was based on practical considerations. Based on Study 1, we expected a moderate to large correlation between TOMW and mind wandering. Participants did the study in exchange for course credit.

*Measures and procedure.* Lay theories of mind wandering were assessed using the TOMW scale. As in Study 1, we also assessed trait mind wandering using the Mind Wandering Questionnaire and the Mindful Attention and Awareness Scale.

Before or after completing the scales (order counterbalanced), participants performed a reading task in which they read a shortened Sherlock Holmes story (see Smallwood et al., 2008). The story was presented on the computer one page at a time. Participants read at a self-paced tempo but could not advance to the next page before 1 min had passed. Thought probes were presented at pseudo-random moments during the reading task, at the average rate of one probe per minute. Thought probes displayed the question "Just now, were you mind wandering?" to which participants responded yes or no. Participants received on average 26 thought probes (*SD* = 7.6). After reading, participants answered 23 multiple-choice reading comprehension questions.

**Table 8.** Correlations Between TOMW, Probe-Caught Mind Wandering, Reading Comprehension, Mind Wandering Questionnaire, and Mindful Attention and Awareness Scale (Study 3).

| Mind wandering and reading measures | TOMW |
|---|---|
| Probe-caught mind wandering | $r = -.507$<br>$p < .001$ |
| Reading comprehension | $r = .179$<br>$p = .17$ |
| Mind Wandering Questionnaire | $r = -.435$<br>$p < .001$ |
| Mindful Attention and Awareness Scale | $r = .384$<br>$p < .001$ |

*Note.* TOMW = theories of mind wandering.

Finally, participants answered demographic questions and we asked two questions—"How interested were you in the study?" and "How motivated were you to perform well on the reading task?"—using a 4-point Likert-type-scale from "not at all" to "very much."

### *Results and Discussion*

Our main prediction was that TOMW would correlate with probe-caught mind wandering. Responses to thought probes (coded as 1 = yes, 0 = no) were averaged to compute mind-wandering rates. Correlation results are shown in Table 8. In line with our hypothesis, TOMW scores significantly predicted mind-wandering rates. Participants who believed more strongly in the controllability of mind wandering reported mind wandering less when probed during reading. A multiple regression with TOMW scores, task order, and the interaction term showed there was no main effect of task order and no interaction (both $p$s $> .48$).

We further replicated our finding from Study 1 that TOMW scores predicted scores on the Mind Wandering Questionnaire and the Mindful Attention and Awareness Scale.

TOMW scores showed only a small, non-significant prediction of reading comprehension ($\beta = .179$, $p = .17$). There was, however, a significant indirect effect of TOMW on comprehension, mediated through probe-caught mind wandering. Namely, the more someone believed they could control their mind wandering, the less they mind wandered ($\beta = -.503$, $p < .001$, 95% CI = [−0.669, −0.311]). The less someone mind wandered, the better their reading comprehension ($\beta = -.475$, $p < .001$, 95% CI = [−0.699, −0.255]). The overall indirect effect showed that the more they believed they could control their mind wandering, the better their reading comprehension due to less mind wandering ($\beta = .239$, $p = .003$, 95% CI = 0.413, 0.101; see Figure 1).[3] There was no remaining direct effect of TOMW on comprehension, $\beta = -.060$, $p = .664$.

Finally, TOMW scores did not predict participants' interest in the study ($\beta = .141$, $p = .292$) or their motivation to perform well ($\beta = .111$, $p = .405$).

In sum, Study 3 provides first evidence that lay theories of mind wandering predict how much people mind wander during reading, and thereby, indirectly, how well they comprehend what they read.

## Study 4

Thus far, we have presented correlational evidence for the hypothesis that lay theories of mind wandering predict how much individuals mind wander. To test whether lay theories of mind wandering causally affect mind-wandering rates, we aimed to experimentally manipulate lay theories of mind wandering.

Past research has used fairly explicit procedures to induce different lay theories, mostly by giving individuals persuasive information supporting different lay theories (e.g., Dweck et al., 1995; A. J. Mrazek et al., 2018). We followed a similar approach here by subtly embedding the theory induction in the instructions for the experimental task. Participants were assigned to one of three conditions: a "controllable" condition, an "uncontrollable" condition, and a "neutral" condition. Next, participants performed the same reading task as in Study 3. We predicted participants led to believe mind wandering is controllable would show reduced mind wandering compared with those led to believe mind wandering is hard or impossible to control.

### *Method*

*Participants.* A desired sample size of 120 was determined before data collection based on how many participants we expected we could recruit by the end of the academic quarter. Every attempt was made to maximize the number of participants. We removed 18 participants for taking the experiment twice accidentally, guessing the hypothesis, or acknowledging they did not read the instructions. We were left with 100 psychology students (48% male; $M$ age = 19.3 years, $SD$ = 1.1). Participants were randomly assigned to conditions.

*Measures and procedure.* Participants first read instructions introducing the concept of mind wandering next to a graphic showing a brain in which regions associated with mind wandering were highlighted. Next, participants in the controllable condition received further instructions presenting mind wandering as controllable ("People are remarkably good at controlling how much they mind wander [. . .] due to considerable overlap between the default network and areas responsible for exerting conscious control over one's behavior"). In the uncontrollable condition, participants read instructions presenting mind wandering as hard to control ("People are remarkably bad at keeping themselves from mind wandering [. . .] because the default network has virtually no overlap with areas responsible for exerting conscious control over one's behavior"). The full instructions are in Appendix B.

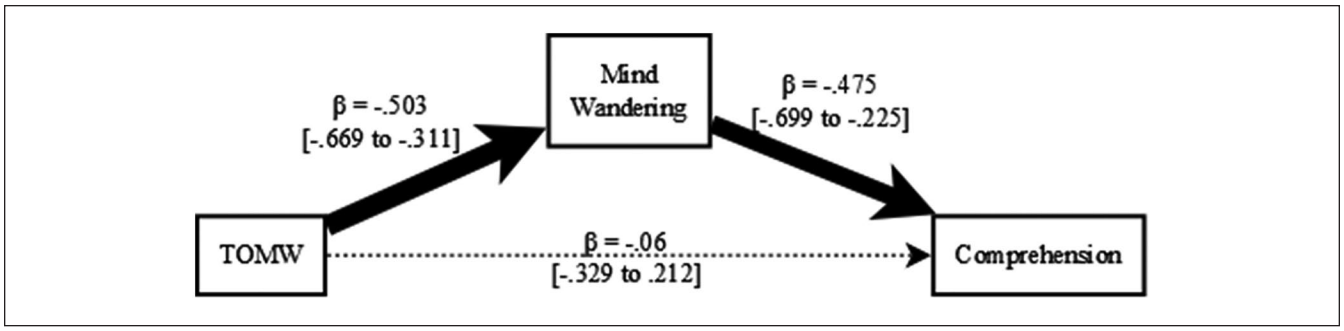


**Figure 1.** Mediation model from Study 3.
*Note.* Brackets contain 95% CI from 10,000 bootstraps; lines in the figure weighted by the strength of their standardized path coefficient and dashed line represents statistical non-significance. Overall indirect effect showed the more someone believed they could control their mind wandering, the better their text comprehension mediated through actual mind-wandering rates (β = .239, $p$ = .003, 95% CI = [0.413, 0.101]). TOMW = theories of mind wandering; CI = confidence interval.

Next, participants were given the same reading task used in Study 3. The TOMW scale was administered as a manipulation check, followed by demographic questions and the same questions used in Study 3 to assess interest in the study and motivation to perform well.

### *Results and Discussion*

First, we tested whether our manipulation had been successful at inducing the corresponding lay theories. Analysis of variance (ANOVA) with the factor condition yielded no overall differences in TOMW scores, $F(2, 97) = 1.490$, $p = .230$, but TOMW scores tended to be higher in the controllable ($M = 4.23$, $SD = 0.75$) versus the uncontrollable condition ($M = 3.94$, $SD = 0.65$), $F(1, 64) = 2.952$, $p = .091$, **d** = .413 (95% CI = [0.905, −0.078]). The neutral condition ($M = 4.02$, $SD = 0.75$) fell in between and did not differ from either experimental condition (both $p$s $> .247$).

Despite the trending result from the manipulation check, we went on to test our hypothesis regarding differences in mind wandering during reading. ANOVA with the factor condition yielded no overall differences in probe-caught mind wandering, $F(2, 97) = 1.322$, $p = .271$. However, there was again a trend indicating lower mind-wandering rates in the controllable ($M = 0.31$, $SD = 0.19$) than the uncontrollable condition ($M = 0.39$, $SD = 0.17$), $F(1, 64) = 3.529$, $p = .065$, **d** = .463 (95% CI = [−0.03, 0.95]). While only trending, this is in line with our prediction. Mind-wandering rates in the neutral condition ($M = 0.35$, $SD = 0.26$) did not differ from those in the other conditions (both $p$s $> .373$).

We also explored whether the manipulation had an effect on reading comprehension. ANOVA with the factor condition yielded a significant effect on comprehension, $F(2, 97) = 3.953$, $p = .022$, $= .075$, which was significantly increased in the controllable ($M = 0.49$, $SD = 0.14$) compared with the uncontrollable condition ($M = 0.41$, $SD = 0.16$), $F(1, 64) = 4.507$, $p = .038$, **d** = .523, 95% CI = [0.03, 1.01], and in the neutral ($M = 0.51$, $SD = 0.17$) compared with the uncontrollable condition, $F(1, 66) = 6.429$, $p = .041$, **d** = .624; 95% CI = [0.13, 1.10]. The neutral condition did not differ from the controllable condition, $F(1, 64) = 0.362$, $p = .549$.

There were no differences in participants' interest in the study—$F(2, 97) = 0.168$, $p = .854$; controllable versus uncontrollable condition, $F(2, 64) = 0.002$, $p = .965$—or motivation to perform well—$F(2, 97) = 1.534$, $p = .221$; controllable versus uncontrollable condition: $F(2, 64) = 2.556$, $p = .115$.

Overall, the current results are encouraging but far from definitive. Instructions intended to induce a controllable versus uncontrollable lay theory led to nominally reduced probe-caught mind wandering and significantly increased reading comprehension. However, the non-significant manipulation check suggests our manipulation was not maximally effective. Perhaps our instructions were not persuasive enough to overrule preexisting beliefs. If this was the case, TOMW scores assessed at the end of the experiment should reflect a combination of experimentally induced and preexisting beliefs. In line with this possibility, we found TOMW scores assessed at the end of the study predicted probe-caught mind-wandering rates ($r = −.324$, $p = .001$), as in Study 3. Reasons for why our experimental instructions were not effective could be that they were difficult to understand. In the following study, we tried to improve on the current manipulation by simplifying our instructions.

## Study 5 and Combined Results

Study 5 was a near replication of Study 4. This time, shortened and simplified instructions designed to induce lay theories were first communicated by the experimenter and then repeated in writing. We also used a larger participants' sample to have a greater chance to detect a small to medium effect. As before, our hypothesis was that participants led to believe mind wandering is controllable (vs. uncontrollable) would mind wander less.

## Method

*Participants.* We removed six participants for skipping pages in the reading task, interruptions during the experiment, and for comprehension problems due to English being their secondary language. We were left with 196 students (29% male; *M* age =18.4 years, *SD* = 0.9). A desired sample size of roughly 200 was determined before data collection. This was the maximum number of participants we expected we could recruit in one academic quarter. Blocked randomization was applied to assign participants to conditions due to the orally administered instructions.

*Measures and procedure.* Participants arrived at the lab in groups of up to seven. First, the experimenter explained the rules of the experiment and gave specific instructions to induce a controllable, uncontrollable, or no particular (neutral condition) lay theory, respectively (see Appendix C). Next, participants were seated in separate rooms, where they read instructions to reinforce the instructions by the experimenter (see Appendix C). Participants then performed the same reading task as in Study 3. Next, the TOMW scale was administered, followed by demographic questions and the same questions about interest and motivation.

## Results and Discussion

First, we examined whether the improved manipulation was successful at inducing corresponding lay theories. ANOVA with the factor condition yielded no significant effect on TOMW scores, $F(2, 193) = 1.267$, $p = .284$, and no differences between the uncontrollable ($M = 3.87$, $SD = 0.75$, $n = 67$) and the controllable condition, $M = 4.09$, $SD = 0.80$, $n = 67$; $F(1, 127) = 2.406$, $p = .123$, $\mathbf{d} = -.28$, 95% CI = [−0.63, 0.06]. The neutral condition ($M = 3.99$, $SD = 0.72$, $n = 62$) again scored between the experimental conditions and did not differ significantly from either (both $p$s $> .382$).

We also performed mini meta-analytic analyses of the results of Studies 4 and 5, because we suspected that Study 4 was underpowered. (Note the meta-analytic analyses were not planned a priori.) The combined results indicated a significant effect of the manipulation in that participants in the controllable condition believed mind wandering was under their control more than in the uncontrollable condition (**d** = .327, 95% CI = [0.611, 0.043]).

Next, we tested whether the instructions caused differences in mind wandering. ANOVA with the factor condition yielded a marginally significant effect on mind wandering, $F(2, 191) = 2.593$, $p = .077$, $= .026$, and mind wandering was significantly reduced in the controllable ($M = 0.26$, $SD = 0.21$) compared with the uncontrollable condition, $M = 0.35$, $SD = 0.22$; $F(1, 127) = 5.081$, $p = .036$, $\mathbf{d} = -.418$; 95% CI = [−0.767, −0.069]. Mind-wandering rates in the neutral condition ($M = 0.32$, $SD = 0.22$) did not significantly differ from those in the other conditions (both $p$s $> .131$). These results start to confirm our prediction that lay theories of mind wandering affect how much people actually mind wander. Combining the results from Studies 4 and 5 meta-analytically also showed significant effects of the manipulation on mind wandering. Participants in the controllable condition, across both studies, mind wandered less than in the uncontrollable condition (**d** = −.38, 95% CI = [−0.66, −0.10]).

Next, we again tested effects on reading comprehension. No overall effect of condition was found, $F(2, 193) = 1.835$, $p = .162$. While the controllable condition ($M = 0.48$, $SD = 0.16$) and the neutral condition ($M = 0.48$, $SD = 0.15$) seemed to score slightly higher on reading comprehension than the uncontrollable condition ($M = 0.44$, $SD = 0.14$), neither were significantly different from it (both $p$s $> .114$). Combining the results from Studies 4 and 5, however, showed significant effects of the experimental manipulation on comprehension. Participants in the controllable condition, across studies, performed significantly better than in the uncontrollable condition (**d** = .35, 95% CI = [0.07, 0.63]).

There were no differences between the conditions in participants' interest in the study ($F < 1$). There was an effect on motivation to perform well on the reading task, $F(2, 193) = 6.400$, $p = .002$, $= .062$, in that participants in the controllable condition ($M = 3.34$, $SD = 0.79$) were more motivated than those in the neutral ($M = 3.00$, $SD = 0.89$) condition, $F(1, 132) = 5.220$, $p = .024$, and those in the uncontrollable condition, $M = 2.81$, $SD = 0.88$, $F(1, 127) = 13.135$, $p < .001$. The latter two did not differ from each other, $F(1, 132) = 1.625$, $p = .205$.

In sum, the results are largely consistent with those of Study 4, and the combined results are in line with our hypothesis that a person's lay theories of mind wandering can affect their tendency to mind wander. Moreover, while the effects on reading comprehension were not as clear in this study as in Study 4, the combined results suggest lay theories of mind wandering can have downstream effects on comprehension. We interpret this result cautiously, acknowledging reading comprehension can be determined by a host of factors besides mind wandering.

Our manipulation checks suggest the experimental manipulation, though significant in a meta-analysis across experiments, was very weak. Thus, it is not surprising that it has small effects on the DVs. Although we attempted to simplify and strengthen our manipulation in the current study, it is possible it was too complicated to be persuasive. Another reason why the effects of induced lay theories on both mind wandering and reading comprehension are small might be that the causal path from lay theories to mind wandering is only one part contributing to the correlation between lay theories and mind wandering. A second causal path, from mind wandering to lay theories, may contribute to the correlation as well. This might explain why the correlational results are more robust than the effects of the experimental manipulation. Another reason why our experimental manipulation did not have stronger effects could be that believing

you *can* control your mind wandering alone is not enough to drive down mind-wandering rates. We already showed in Study 2, in the context of intrusive thoughts, that effective regulation of these thoughts depends on a combination of the right beliefs and the right thought control strategies. We think the same applies to ordinary mind wandering. We tested this account in Study 6.

## Study 6

This study examined whether beliefs about mind wandering interact with strategies to regulate mind wandering. To do so, we once again measured lay theories and mind wandering during reading, but this time we instructed participants to use strategies to keep their mind from wandering. We predicted that these strategies would reduce mind wandering and, indirectly, improve reading comprehension, but that this would depend on individuals' lay theories. For individuals with a controllable lay theory, our strategies should be more effective than for those with an uncontrollable theory. We chose not to experimentally manipulate lay theories because telling participants you cannot control how much you mind wander and then telling them a strategy to regulate how much they mind wander would be contradictory and undermine the manipulation.

While a large literature describes strategies to control distressing thoughts, no strategies have been documented that reduce ordinary mind wandering. Mind-wandering rates are affected by contextual factors such as how interesting a text or task is (e.g., Fulmer et al., 2015; Smallwood et al., 2009), but these factors are not typically within a person's control. Therefore, we developed two strategies we thought had the potential to reduce mind wandering. Based on the finding that people mind wander less when they find a text more interesting, our first strategy focused on fostering curiosity about the text. Our second strategy came out of a pilot study in which we asked participants about the strategies they used to keep their mind on the text. Informed by participants' responses, our second strategy focused on encouraging participants to engage deeply with the contents rather than superficial characteristics of the text.

### Method

*Participants.* Participants were 316 university students (27% male, $M$ age = 19.0, $SD$ = 1.3). A desired sample size of 300 was determined before data collection, based on how many participants we expected we could recruit in the academic quarter (although data collection ultimately took place over two quarters).

*Measures and procedure.* To test how the combination of strategies and lay theories affect mind wandering and reading comprehension, we assigned participants to three conditions: two experimental conditions, in which participants were taught strategies to mind wander less, and a control condition. To assess the effects of the strategies, we had participants complete two reading tasks. The first served as a baseline measure. Then participants received different sets of instructions depending on the condition.

For the reading tasks, participants read two chapters from Bill Bryson's book *A short history of nearly everything* ("The rise of life" and "Life goes on," edited for length). During reading, participants were probed to assess mind wandering at predetermined moments (ca. 1–2 probes per minute). After each chapter, participants answered 12 multiple-choice comprehension questions.

Between reading tasks, participants in the control condition were simply told: "Next, you will read another text, and we will once again interrupt you at random moments and ask you if you were mind wandering." In the experimental conditions, participants were further told: "This time, however, we want you to try to mind wander less than you did during the last text." In the "curious" condition, we explained, "people mind wander less when they engage in a task that is interesting to them. So, as a strategy to mind wander less, we encourage you to approach the reading task with an attitude of curiosity." We highlighted the benefits of curiosity and stated that

> almost every situation in life can be approached with this kind of attitude. [. . .] While any situation can be an opportunity to engage your curiosity, right now, we want you to try to be curious about the text you are going to read. If you notice your thoughts drifting off towards other things, try to re-focus your curiosity on the text.

Complete instructions are in Appendix D.

In the "engaged" condition, we explained that suppressing unwanted thoughts often fails, but engaging deeply with something else external—in this case the text—is more effective. We explained,

> We want you to focus on the *content* of the text. Make sure you understand what you're reading. Try to really "see" the people, the objects, and the scenery that are being described in your mind's eye. Try to really grasp what is going on.

Complete instructions are in Appendix D. To ensure participants understood the instructions, we asked them to summarize them and articulate how they would use them during reading.

After the second reading task and accompanying comprehension questions, we assessed how immersed participants felt in the text. We used a scale adapted from Green & Brock (2000). An example item is as follows: "While reading the text, I could easily picture the events and the people described." Participants responded on a scale from 1 = "strongly disagree" to 6 = "strongly agree." We further asked participants whether they used any strategies to keep their mind from wandering during reading, and whether they

followed the strategy we taught them. Participants could answer "yes" or "no"; if they answered "no," they were asked to explain why not. Finally, participants responded to the TOMW scale and demographic questions.

### Results

*Manipulation check.* In the control condition, the majority reported they did not use strategies to keep their mind from wandering (28 responded "yes," 77 "no"), whereas in the experimental conditions, most reported they did use strategies (Curious condition: 73 "yes," 32 "no"; Engaged condition: 82 "yes," 24 "no"; $\chi^2 = 64.311$, $p < .001$) and most responded they used *our* strategies (Curious condition: 93 "yes," 12 "no"; Engaged condition: 96 "yes," 10 "no"). Of the participants who reported they did not use our strategies, some reported they were not interested in the strategies or the reading, others explained they were so interested in the text they did not need strategies to stay engaged.

*Effect of the strategy use manipulation on mind wandering.* Next, we tested whether our strategies were effective in reducing mind wandering. A mixed ANOVA with the within-subjects factor time (first vs. second reading task) and the between-subjects factor condition (control vs. curious vs. engaged) yielded a significant interaction, $F(2, 313) = 47.731$, $p < .001$. In the control condition, mind wandering went up from Time 1 ($M = 0.36$, $SD = 0.21$) to Time 2 ($M = 0.48$, $SD = 0.24$), $F(1, 104) = 42.247$, $p < .001$, $\mathbf{d_z} = .634$. In the curious condition, mind wandering went down from Time 1 ($M = 0.36$, $SD = 0.20$) to Time 2 ($M = 0.24$, $SD = 0.18$), $F(1, 104) = 35.455$, $p < .001$, $\mathbf{d_z} = .581$. In the engaged condition, it likewise went down from Time 1 ($M = 0.39$, $SD = 0.19$) to Time 2 ($M = 0.31$, $SD = 0.20$), $F(1, 105) = 22.455$, $p < .001$, $\mathbf{d_z} = .46$.

*Moderated indirect effect on reading comprehension.* Next, we tested our main predictions. We predicted that using strategies (vs. not) would reduce mind wandering and (indirectly) improve reading comprehension. Moreover, we predicted that this effect would be more pronounced for individuals who believe more strongly that mind wandering is controllable. This invokes a moderated mediation model with the group assignment as the independent variable, mind wandering as the mediator, comprehension as the DV, and TOMW scores as a moderating variable. As mind-wandering rates were positively skewed and text comprehension negatively skewed, we used robust Huber–White estimation in the mediation model with 10,000 bootstraps (e.g., Hayes, 2018).

Consistent with the prediction, we found a significant moderated indirect effect of the strategies on text comprehension mediated through mind wandering. This indirect effect was larger at higher levels of TOMW. That is, those scoring higher in the belief that mind wandering is controllable showed larger indirect effects of strategies. In fact, the indirect effect was only significant for those who believed mind wandering is at least somewhat controllable (moderated mediation explored at TOMW = Disagree, Neutral, and Agree scale points). For participants who disagreed that mind wandering is controllable, there was no significant indirect effect of either the engaged ($n = 105$; $b = 0.011$, $p = .699$, 95% CI = [0.09, −0.029]) or curious strategies ($n = 104$; $b = 0.022$, $p = .652$, 95% CI = [0.119, −0.079]) through mind-wandering rates on comprehension. For people who were neutral about whether mind wandering is controllable, there was a significant indirect effect of both the engaged ($b = 0.038$, $p = .016$, 95% CI = [0.076, 0.013]) and curious ($b = 0.061$, $p = .003$, 95% CI = [0.105, 0.024]) strategies. For those who agreed that mind wandering is controllable, the effects were even stronger (engaged: $b = 0.065$, $p = .002$, 95% CI = [0.112, 0.029]; curious: $b = 0.077$, $p = .001$, 95% CI = [0.13, 0.038]). These indirect effects were qualitatively the same in the different conditions, with the curiosity condition causing less mind wandering than the engaged condition as well (see Appendix E for full results broken down for the two conditions).

### Discussion

To our knowledge, this is the first study demonstrating effective strategies to reduce mind wandering. Both approaching a text with curiosity and engaging deeply with the contents of the text reduced mind wandering and improved comprehension (at least for those who believe they have some control), although the curious condition was more effective.

More important to the current investigation, we found that lay theories of mind wandering moderate the effectiveness of these strategies. The strategies are effective only as long as a person believes that they have at least some control over their mind wandering. This is in line with our earlier findings that lay theories and thought control strategies interact in shaping unwanted thoughts. It highlights the importance of lay theories, and is further evidence that lay theories affect our attempts to regulate spontaneous thoughts.

## General Discussion

While mind wandering has been receiving increasing attention, to date, no research has investigated how ordinary people think about this common experience, and how what they think may affect their task-unrelated thoughts.

We developed a novel and highly reliable scale to assess lay theories of mind wandering and showed that the scale predicts established measures of dispositional mind wandering and intrusive thoughts (Studies 1–3), and mind wandering during reading (Studies 3–5). We further found that individuals who more strongly believe that mind wandering is controllable reported fewer dysfunctional reactions to unwanted thoughts and more frequent use of distraction as a thought control strategy. Moreover, lay theories and thought control strategies interacted to predict how often people experience unwanted thoughts.

To experimentally manipulate lay theories of mind wandering, we followed an approach often used in the field and gave participants information that portrayed mind wandering as controllable or uncontrollable. In Study 4, manipulation checks indicated our manipulation was not maximally successful in changing beliefs, although we nevertheless found evidence that they affected mind wandering. In Study 5, simplified and reinforced instructions affected mind wandering in line with our predictions. Together, the results are consistent with the hypothesis that lay theories about the extent to which mind wandering is controllable can affect people's actual tendency to mind wander in a way consistent with their theories.

Finally, Study 6 showed that lay theories moderate the effectiveness of newly learned strategies to regulate one's mind wandering. Instructions encouraging participants to approach a text with curiosity or engage more deeply with the text were effective at driving down mind-wandering rates and improving comprehension, but only for participants who believe mind wandering is controllable. This highlights the importance of taking into account people's beliefs as one factor that explains individual differences in mind wandering.

### *Implications*

The current findings have implications for interventions aimed at reducing mind wandering. To be maximally effective, any such intervention should pay attention to people's beliefs. The most effective interventions may already be doing this implicitly. Studies have shown benefits of mindfulness practice (e.g., Mrazek et al., 2012, 2013, 2016; Troy et al., 2013). This involves learning to focus attention (e.g., on one's breath) for extended periods of time but typically also encompasses instructions aimed at changing individuals' attitudes toward the ebb and flow of their thoughts and encouraging thought control strategies (e.g., disengaging) (Wells, 2005). Thus, mindfulness training may implicitly teach a more controllable theory of mind wandering, and reductions in mind wandering may in part be a consequence of this belief change.

Our results also have implications for educational settings. Mind wandering during lectures has a host of negative consequences (e.g., Lindquist & McLean, 2011; Mrazek et al., 2012; Seli et al., 2016). In addressing this problem, educators could make an effort to communicate to students that they have control over their unwanted thoughts. Then, they should teach students strategies and in particular focusing on cultivating their own curiosity.

### *Limitations and Future Directions*

The current studies provide insights into the way people make sense of their tendency to mind wander but also have their limitations. For one, it is possible that a person's lay theories of mind wandering may affect metacognitive judgments about task-unrelated thoughts (see Seli et al., 2015; Zedelius et al., 2015). Participants in the "controllable" condition may, for instance, have reported less mind wandering in part because they were more critical of their failure to control task-unrelated thoughts. Future research should address this by exploring how lay theories of mind wandering relate to both self-report measures and more objective (albeit indirect) measures of attentional lapses (e.g., errors on tasks). Although the current studies have not examined this relationship, we have set an important starting point by developing and validating a measure of TOMW that predicts self-reported mind wandering and intrusive thoughts.

Another limitation is we did not differentiate between intentional and unintentional mind wandering. While studies suggest that we more often than not mind wander unintentionally (e.g., Robison & Unsworth, 2018; Seli et al., 2019; Seli, Risko, & Smilek, 2016; Seli, Wammes, et al., 2016), some portion of mind wandering is intentional (e.g., Seli et al., 2015; Seli, Risko, Smilek, & Schacter, 2016). We do not think controllability-related lay theories about mind wandering are likely to affect intentional mind wandering, which is by definition under voluntary control. Had we assessed intentional and unintentional mind wandering separately, we might have found an exclusive relationship between TOMW and unintentional mind wandering, and our experimental results in Studies 4 and 5 might have been stronger. However, previous studies found that unintentional mind wandering is more predominant in a range of tasks (Robison & Unsworth, 2018; Seli et al., 2019; Seli, Risko, & Smilek, 2016; Seli, Wammes, et al., 2016), including a reading task similar to ours (Phillips et al., 2016). This probably explains why we find a relationship between TOMW scores and mind wandering even without parsing out intentional mind wandering.

The conflation of intentional and unintentional mind wandering also poses questions for Study 6, in which participants were encouraged to use strategies to mind wander less. One might ask whether the improvements in mind wandering and reading comprehension were due simply to less intentional mind wandering. We do not think this would be consistent with the finding that only participants who believed that mind wandering is controllable improved. While our strategies could have motivated people not to mind wander on purpose, there is no reason why this should only be the case for participants with a controllable lay theory. Moreover, the "curiosity" strategy was more effective than the strategy to engage more deeply, even though both presumably motivated participants to control their mind wandering. This suggests the improvements are not merely due to a reduction in deliberate mind wandering. Future research should examine this more directly.

The current research also has potentially important implications deserving further exploration. One question worth studying is what lay theory of mind wandering is the most productive overall. The current research suggests that a "controllable" theory of mind wandering is beneficial for regulating unwanted thoughts. But could there be a trade-off? Clinical research suggests that a strong belief that one can *and* must control unwanted thoughts can backfire, because perfect control over unwanted thoughts cannot be achieved. For

individuals who demand such control of themselves, failure at controlling all unwanted thoughts can be harshly interpreted as personal failing (Abramowitz et al., 2001; Wells, 2005). While the "controllable" theory of mind wandering does not encompass this imperative that one must control all task-unrelated thoughts, it is possible that a strong "controllable" theory can lead to the perception of personal failing in situations where people are known to mind wander a lot.

In conclusion, the present research provides a first step toward understanding how a person's beliefs or lay theories can shape their experiences with the common experience of finding one's mind wandering toward task-unrelated or unwanted thoughts. Our results suggest that the belief that mind wandering is controllable is associated with more productive thought control strategies and greater success regulating unwanted thoughts. Further research should explore the broader implications of these types of lay theories, for instance, for health and education.

## Appendix A

### *TOMW Scale Instructions*

The next questionnaire is about the phenomenon of mind wandering. When you mind wander, your attention drifts away from your main task and toward task-unrelated thoughts. For instance, rather than focusing all your attention on the task you are doing at the moment, you may find yourself thinking about things that happened earlier in the day or things you plan on doing later. In this questionnaire, you will be shown a number of statements with regard to mind wandering. Please indicate your agreement with each statement by clicking on the number that best represents your answer on the scale presented below the statement.

## Appendix B

### *Written Instructions in All Conditions*

This study is about the phenomenon of mind wandering. When you mind wander, your attention drifts away from your main task and toward task-unrelated thoughts. For instance, rather than focusing all of your attention on the task you are doing at the moment, you may find yourself thinking about things that happened earlier in the day or things you plan on doing later.

### *Additional Condition-Specific Instructions (Underlined Parts Differ Between Conditions)*

*Neutral condition*

Mind wandering involves a part of the brain called the default network (see Figure 1). As the name implies, this part of the brain is responsible for brain functions that are involved in all kinds of different tasks; the brain's default way of behaving. This is why mind wandering can occur during various different activities, such as reading a text, listening, or doing a task. The purpose of this study is to better understand the nature of mind wandering, and the individual differences that exist in people's tendency to mind wander during simple tasks such as reading.

*"Controllable" condition*

Mind wandering involves a part of the brain called the default network (see Figure 1). As the name implies, this part of the brain is responsible for brain functions that are involved in all kinds of different tasks; the brain's default way of behaving. This is why mind wandering can occur during various different activities. When your mind wanders, this process does not always arise from a conscious intention, but can sometimes occur automatically, and even when one is highly motivated to focus on reading a text, listening, or doing a task.

People sometimes start to mind wander even during important tasks, such as flying an airplane or performing a medical operation. Most of the time, however, people notice quickly that their mind is wandering, which enables them to focus their attention back on their main task and keep themselves from wandering off again. In fact, research has shown that people are remarkably good at controlling how much they mind wander. This is due to considerable overlap between the default network and areas responsible for exerting conscious control over one's behavior. The purpose of this study is to better understand the controllable nature of mind wandering, and the individual differences that exist in people's control over how much they mind wander during simple tasks such as reading.

*"Uncontrollable" condition*

Mind wandering is controlled by a part of the brain called the default network (see Figure 1). As the name implies, this part of the brain is responsible for unconscious aspects of brain function that are not under conscious control, the brain's default way of behaving. Thus, when your mind wanders, this process usually does not arise out of conscious control but is instead highly automatic. This is why mind wandering often occurs unintentionally, and even when one is highly motivated to focus on reading a text, listening, or doing a task.

People often mind wander even during important tasks, such as flying an airplane or performing a medical operation. Most of the time, even in such critical situations, it takes a long time before people notice that their mind is wandering. In fact, research has shown that people are remarkably bad at focusing their attention on their main task and keeping themselves from mind wandering. This is because the default network has virtually no overlap with areas responsible for exerting conscious control over one's behavior.

The purpose of this study is to better understand the automatic nature of mind wandering, and the individual differences that exist in how much people mind wander during simple tasks such as reading.

## Appendix C

### *Oral Instructions by the Experimenter (Underlined Parts Differ Between Conditions)*

*Neutral condition*

This study is about mind wandering. Mind wandering is when your attention drifts away from what you are doing and towards unrelated thoughts. For instance, rather than focusing all your

attention on the task you are doing at the moment, you may find yourself thinking about things that happened earlier in the day or things you plan on doing later. In today's study, we are going to test mind wandering during reading. You will each read a short story, and then follow it with a brief survey. You will get more specific instructions on the computer.

*Controllable condition*

This study is about mind wandering. Mind wandering is when you chose to no longer pay attention to what you are doing and you move your attention towards unrelated thoughts. For instance, rather than focusing all your attention on the task you are doing at the moment, you may find yourself thinking about things that happened earlier in the day or things you plan on doing later. Most of the time, people notice quickly that their mind is wandering, and that enables them to focus their attention back on their main task, and avoid wandering off again. In fact, we have found that people are remarkably good at controlling how much they mind wander. In today's study, we are going to test mind wandering during reading. You will each read a short story, and then follow it with a brief survey. You will get more specific instructions on the computer.

*Uncontrollable condition*

This study is about mind wandering. Mind wandering is when your brain spontaneously and uncontrollably shifts attention away from what you are doing and towards unrelated thoughts. For instance, rather than focusing all your attention on the task you are doing at the moment, you may find yourself thinking about things that happened earlier in the day or things you plan on doing later. Most of the time, mind wandering happens spontaneously and people often aren't even aware that they are mind wandering. So, people aren't really in control of when they mind wander. In today's study, we are going to test mind wandering during reading. You will each read a short story, and then follow it with a brief survey. You will get more specific instructions on the computer.

### *Instructions Presented on the Computer (Underlined Parts Differ Between Conditions)*

*Neutral condition*

Mind wandering is something that happens often spontaneously during all kinds of dull or important attention-demanding tasks (e.g., when studying for an exam). This is why it is important to understand when people are most vs. least likely to mind wander. This study examines mind wandering during reading. In the following part of the experiment, you will get a reading task, during which we will probe you at random moments and ask you to report whether you were mind wandering.

*Controllable condition*

Mind wandering is something that happens often spontaneously. We used to think that it is largely outside of our control, but it turns out people really have much more control over it than assumed. People are surprisingly good at controlling their mind wandering, even during dull attention-demanding tasks simply by deciding to focus (e.g., when studying for an exam). This is why it is important to understand when people are most vs. least likely to mind wander. This study examines mind wandering during reading. In the following part of the experiment, you will get a reading task, during which we will probe you at random moments and ask you to report whether you were mind wandering.

*Uncontrollable condition*

Mind wandering is something that happens often spontaneously. We used to think that we have a fair amount of control over it, but it turns out that mind wandering is really very hard if not impossible to control. People often mind wander, even during important attention-demanding tasks, and despite trying very hard to focus (e.g., when studying for an exam). This is why it is important to understand when people are most vs. least likely to mind wander. This study examines mind wandering during reading. In the following part of the experiment, you will get a reading task, during which we will probe you at random moments and ask you to report whether you were mind wandering.

## Appendix D

### *Instructions in the "Curious" Strategy Condition*

Next, you will read another text, and we will once again interrupt you at random moments and ask you if you were mind wandering. This time, however, we want you to try to mind wander less than you did during the last text. We don't expect that you won't mind wander at all. The goal is simply to mind wander a little bit less, or "beat your own score." Please give it a try! To help you do that, we have a specific strategy we want you to try.

Here is a strategy we would like you to use to mind wander less.

*Use your curiosity.* People mind wander less when they engage in a task that is interesting to them. So, as a strategy to mind wander less, we encourage you to approach the reading task with an attitude of curiosity.

Curiosity has many benefits. It has been linked to happiness, health, creativity, academic success, satisfying intimate relationships, and greater meaning in life. Those are just some of the benefits.

- A 2014 study found that curiosity alters brain activity in a way that makes it easier to remember new information.
- Individuals who are more curious report higher job satisfaction and lower burnout rates.
- One study of 2,000 older men and women found that highly curious people had lower mortality rates over a 5-year follow-up period.

Curiosity is also associated with reduced mind wandering. Therefore, we encourage you to approach the next reading task with an attitude of curiosity.

We often speak of "childlike" curiosity, because children are known for incessantly asking "why" questions about

things adults have simply learned to accept without questioning. But curiosity is not reserved for children. You never lose the ability to wonder why, explore, be surprised, learn, and discover new information. Almost every situation in life can be approached with this kind of attitude. Try a new food. Talk to a stranger. Stay curious about the people you know. Do they have hidden sides, unexpected likes and dislikes, hopes and dreams? Question your routines at work or at home. Can you do familiar tasks in a different way? Read as much as you can. Books, labels, articles—especially about unfamiliar topics. Challenge your intuitions. Keep learning new things even when it is not immediately apparent that you can use the knowledge for something practical.

While any situation can be an opportunity to engage your curiosity, right now, we want you to try to be curious about the text you are going to read. If you notice your thoughts drifting off toward other things, try to refocus your curiosity on the text.

### *Instructions in the "Engaged" Strategy Condition*

Next, you will read another text, and we will once again interrupt you at random moments and ask you if you were mind wandering. This time, however, we want you to try to mind wander less than you did during the last text. We don't expect that you won't mind wander at all. The goal is simply to mind wander a little bit less, or "beat your own score." Please give it a try! To help you do that, we have a specific strategy we want you to try.

Here is a strategy we would like you to use to mind wander less.

*Get absorbed in the text.* To regulate a craving or impulse, one of the best strategies is *replacement*. Are you craving chocolate? Eat a piece of apple or mango instead. Feel a desire to bite your fingernails? Twiddle your thumbs or play with a rubber ball instead. When we try to suppress a behavior, we are often unsuccessful. Replacing it with something else is easier and much more effective.

It works the same way with our thoughts. Instead of trying to suppress distracting thoughts, a better strategy is to focus on something else and get absorbed in it.

Here are two examples.

Sometimes a funny thought shoots into your head in a situation where it would be highly inappropriate or embarrassing to burst into laughter. To let go of the thought, it helps to focus on something external. For instance, closely examine a painting on the wall, or intensely listen to what someone is saying. It gets easier the more deeply you engage with this external thing.

If someone asked you, for the next 10 min, to think of anything you want, anything at all, except a white bear, it would suddenly become hard not to think of a white bear. Studies have shown that simply suppressing the thought does not work so well. But thinking of something else works, especially if it is something engaging that you can get absorbed in.

These are two very different examples, but the idea is the same: To prevent a distracting thought, it helps to focus your attention intently on something else.

We want you to apply this strategy to prevent yourself from mind wandering during reading.

We do not want you to try as hard as you can to suppress any task-unrelated thoughts that may come up while reading. Do not even worry or think about task-unrelated thoughts at all. Instead, think only about the text. The text will be your replacement.

To focus your attention as intently as possible on the text, do not focus on each individual word. Closely examining each word is not the best way to comprehend whole sentences and paragraphs. We want you to focus on the *content* of the text. Make sure you understand what you are reading. Try to really "see" the people, the objects, and the scenery that are being described in your mind's eye. Try to really grasp what is going on and what it all means.

If you notice that your attention slips away from the content of the text and you are mindlessly reading the words without really understanding their meaning, that is the moment when you need to stop reading, go back in the text and re-read, starting at a point where you could still follow what was going on.

If you start to mind wander, redirect your attention to the events described in the text.

## Appendix E

### *Results of the Moderated Mediation by Experimental Condition*

*Curiosity condition.* Participants told to approach the second reading with a curious attitude mind wandered less ($M = 0.245$, $SD = 0.18$) than those given no specific instructions ($M = 0.482$, $SD = 0.244$, $n = 105$, $\beta = -.634$, $p < .001$, 95% CI = [−0.741, −0.323]). There was no statistically significant residual effect of the curiosity instructions directly on text comprehension ($b = -0.104$, $p = .087$, 95% CI = [−0.241, 0.002]). Moreover, the indirect effect of strategies on comprehension is present for those who agree that mind wandering is controllable ($b = 0.08$, 95% CI = [0.04, 0.13]) and those who respond neutral ($b = 0.06$, 95% CI = [0.02, 0.11]), but not for those who disagree with statements that mind wandering is controllable ($b = 0.02$, 95% CI = [−0.08, 0.12], note here the CI crosses zero). This fits with our theory that those who do not believe mind wandering is controllable mind wander more because they fail to enact strategies that could help them keep their mind from wandering.

*Engaged condition.* Participants told to engage more deeply with the text did not mind wander less ($M = 0.308$, $SD = 0.199$) than if they were given no specific instructions ($M = 0.482$, $SD = 0.244$, $n = 105$, $\beta = -.235$, $p = .301$, 95% CI = [−0.563, 0.292]). If there was a statistically significant residual effect of the *engaged* instructions directly on text

comprehension, it was weak (β = −.108, $p$ = .06, 95% CI = [−0.238, −0.008]). We also once again found that the indirect effect of strategies on comprehension is present for those who believe mind wandering is controllable ($b$ = 0.07, 95% CI = [0.03, 0.11]) and those who respond neutral ($b$ = 0.04, 95% CI = [0.01, 0.08]), but not for those who disagree ($b$ = −0.01, 95% CI = [−0.03, 0.09]).

Furthermore, the *engaged* instructions were less effective at reducing mind wandering than the *curiosity* instructions ($M$ diff = 0.063, $p_{LSD}$ = .03, 95% CI = [0.12, 0.01]). This weaker effect on probe-caught mind wandering, however, did not lead to a statistically significantly weaker indirect effect (as seen by the overlap of indirect coefficients with the 95% CI of the other indirect effect).

## Authors' Note

The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Imagination Institute, the John Templeton Foundation, or the Fetzer Franklin Fund.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by Grants from the Imagination Institute (RFP-15-09), the John Templeton Foundation (#60844), and the Fetzer Franklin Fund (#44069-59380).

## ORCID iD

Claire M. Zedelius https://orcid.org/0000-0001-8367-4489

## Supplemental Material

Supplemental material is available online with this article.

## Notes

1. Studies 1 to 4 were pre-registered on the Open Science Framework (OSF; https://osf.io/c3ezk/; Center for Open Science, n.d.). Accidentally, Study 2 pre-registration was not made public. As Study 5 was a near replication of Study 4 with slightly modified instructions, the study was not pre-registered.
2. We thank the editor for asking us to explore these interactions.
3. We thank one of the reviewers for asking us to explore this option.

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