When does it hurt to try? Effort as a mediator of the links between anxiety symptoms and the frequency and duration of unwanted thought recurrence

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A B S T R A C T

Evidence is mixed regarding the circumstances in which anxiety predicts more versus less unwanted thought recurrence. This study examined subjective, self-reported suppression effort as a mediator of the relationship between anxiety symptoms and both the frequency and duration of unwanted thought recurrence during a thought suppression paradigm. Additionally, a moderated mediation model examined whether initial instructions to suppress versus monitor thoughts, and state and trait differences in cognitive resources, moderated the mediating effects of effort. Amazon Mechanical Turk volunteers (N = 939) were instructed to either suppress or monitor an emotionally aversive thought for a one-minute period, followed by a second period during which all participants monitored. Trait cognitive resources were measured at baseline via a working memory task, and state cognitive resources were manipulated between-subjects via a depleting Stroop task. Results indicated that self-reported effort mediated the relationship between anxiety symptoms and both the frequency and duration of thought recurrence, but in opposite directions—such that anxious individuals’ greater effort predicted higher frequency (i.e., more initial activation) but lower duration (i.e., faster override) of the target thought. No moderation effects were found. Implications for the role of self-reported suppression effort as a “double-edged sword” in the context of anxiety are discussed.

1. Introduction

Perceived difficulty controlling the occurrence of negative unwanted thoughts (such as thoughts of harm to oneself or loved ones) has been identified as a causal and/or maintaining factor for many emotional disorders, including obsessive compulsive disorder (OCD), generalized anxiety disorder, posttraumatic stress disorder, and depression (see Purdon, 1999). One of the most widely used laboratory procedures for evaluating these difficulties is the “white-bear” thought suppression paradigm (originated by Wegner, Schneider, Carter, & White, 1987), in which participants are randomly assigned to either suppress (keep out of mind) or monitor the occurrence of a given thought, followed by a second period during which all participants are instructed to simply monitor the thought. Traditionally, participants are asked to indicate whenever the target thought recurs during either period (e.g., by pressing a button), thus providing an index of thought recurrence frequency.

Wegner et al.’s (1987) classic study, which has since been widely replicated, showed that those instructed to suppress (versus monitor) during the first period experienced a “rebound” effect, in the form of more frequent thought recurrence, during the second period.

Despite its popularity as a measure of thought suppression difficulty in anxious samples, this paradigm has yielded very mixed findings, with high (versus low) anxious individuals sometimes reporting greater difficulty suppressing negative thoughts (e.g., Harvey & Bryant, 1998), sometimes reporting relatively enhanced thought suppression performance (e.g., Purdon & Clark, 2000), and sometimes showing no differences (see Magee, Harden, & Teachman, 2012, for a review). While it is possible that limitations of the task may partly account for the mixed findings (e.g., asking people to self-report the occurrence of a thought may itself increase the thought’s occurrence), it is also likely that the traditional methods of conceptualizing and analyzing the task have partially contributed to these discrepant findings.

In particular, traditional versions of the “white-bear” paradigm have failed to distinguish between two potentially distinct thought suppression outcomes: 1) duration of thought recurrence (i.e., the average length of time a person spends engaging with the thought while it is activated), and 2) frequency of thought recurrence (i.e., how often the thought becomes consciously activated in the first place). These two outcomes closely parallel the two interrelated cognitive processes that have been theorized to underlie the classic “rebound” effect (Wegner et al., 1987): a consciously controlled “operating” process that actively attempts to suppress or disengage from the unwanted thought (e.g., by generating unrelated distractor thoughts), and an unconscious, automatic “monitoring” process that continuously scans for the to-be-
suppressed thought, and alerts consciousness to its presence (and thus the need to reengage the “operating” process) whenever the thought is detected (Wegner, 1994). According to this framework, the “operating” process is relatively more effortful and taxing on cognitive resources, and thus gets gradually depleted with ongoing suppression efforts, making these efforts less successful over time. By contrast, the “monitoring” process is relatively more efficient, and remains on “high alert” for the to-be-suppressed target thought regardless of diminishing cognitive resources. Moreover, Wegner posits, it is precisely the conscious effort of suppressing a given thought that makes the “monitoring” process more sensitive to that thought (by signaling to it, in effect, “this is a very important target to search and destroy!”), thus increasing the frequency with which that thought is automatically re-activated.

Of note, anxiety symptoms could plausibly exacerbate either or both of these interrelated “rebound” mechanisms: the decreased inhibitory effectiveness of the “operating” process due to cognitive depletion, which can follow from being anxious (e.g., Eysenck, Derakshan, Santos, & Calvo, 2007), and/or the increased salience and accessibility of the unwanted thought by the “monitoring” process due to heightened threat vigilance, which is heightened in anxious samples (see Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007). With respect to the former, anxiety symptoms have often been linked to deficits in the inhibition of unwanted thoughts or stimuli (e.g., Berggren & Derakshan, 2013; Derakshan, Ansari, Hansard, Shoker, & Eysenck, 2009), likely reflecting a dearth of executive control resources due to high levels of worry and threat-related processing. With respect to the latter, there is considerable evidence that anxious individuals’ heightened threat vigilance extends not only to external stimuli, but also to unwanted, internally generated thoughts (e.g., Purdon, 2008, Salkovskis, 1999). This hypervigilance, in turn, tends to prime the very thoughts one is attempting to avoid, such that they are more likely to become spontaneously activated (e.g., Tolin, Abramowitz, Przeworski, & Foa, 2002, Wenzlaff & Wegner, 2000).

Thus, it is particularly important to distinguish between the frequency with which participants become initially aware of the unwanted thought, on the one hand, and the length of time it takes for them to disengage from that thought, on the other hand. Assuming the latter is indeed partly a conscious, strategically controlled process, as Wegner (1994) posits, it should be possible for participants to report when they have successfully enacted it (e.g., by strategically shifting their attention to a distractor thought), even if some peripheral awareness of the target thought remains (as it initially must, for participants to be able to report that they are “no longer engaging” with that thought).

Yet only a few studies to date have separately examined both of these outcomes within a single thought suppression paradigm (e.g., Lambert, Hu, Magee, Beadel, & Teachman, 2014, Magee, Smyth, & Teachman, 2014). In this modified version of the classic task, participants are instructed to press a button whenever the negative thought occurs, and to release the button when they think about something else—thus allowing for separate indices of “frequency” and “duration” to be computed. Using this new format, Lambert et al. (2014) found that the frequency and duration of thought recurrence followed distinct patterns of change over the two thought periods that aligned with the purportedly automatic, uncontrolled nature of frequency and the more controlled, effortful nature of duration. Likewise, Magee et al. (2014) found that thought duration, but not frequency, was lower among participants who were given “suppress” (versus “monitor”) instructions, consistent with the idea that duration reflects a relatively more controlled, intentional process. No prior studies to our knowledge, however, have directly examined the link between anxiety symptoms and both the frequency and duration of unwanted thought recurrence.

Thus, to better understand the link between anxiety and thought recurrence, the present study tested whether individual differences in anxiety symptoms would predict the reported frequency and/or duration of negative thought recurrence during this modified “white-bear” thought suppression paradigm. The study also examined a theoretically-derived mediator of the anxiety–thought recurrence link: namely the self-reported effort to suppress, or keep out of mind, the unwanted thought (see Magee et al., 2012).

1.1. Mediation by self-reported suppression effort

Self-reported suppression effort was examined as a mediator of the link between anxiety and thought recurrence given that high (versus low) anxious individuals are likely to exert greater effort to suppress negative thoughts (e.g., due to beliefs about the unacceptability of such thoughts; Purdon & Clark, 2000). Critically, theoretical and empirical evidence suggests greater efforts to suppress intrusive thoughts are initially successful but become less effective over time (Abramowitz, Tolin, & Street, 2001; Magee et al., 2012). This leads to some competing hypotheses about the link between anxiety and thought recurrence.

On the one hand, given evidence for both enhanced activation of, and delayed disengagement from, negative cues as risk and maintaining factors in anxiety (see Bar-Haim et al., 2007), it is plausible that greater anxiety symptoms should predict greater frequency (reflecting enhanced activation) and/or duration (reflecting delayed disengagement) of negative thought recurrence. On the other hand, if anxious individuals do indeed exert greater effort to suppress negative thoughts, this heightened effort may translate into more successful thought suppression—at least with respect to outcomes that can be effortfully controlled. This suggests that anxiety symptoms should predict lesser duration (but not frequency) of negative thought recurrence, given that continued engagement with a thought is presumably more susceptible to effortful override than is its initial activation (Lambert et al., 2014).

We did not have a priori predictions regarding the differential prediction of thought recurrence by anxiety across the two periods of the thought suppression paradigm, given the mixed findings to date (see Magee et al., 2012). However, given evidence that self-reported suppression effort may be initially successful but then fail over continued suppression attempts, we expected that the mediating effect of effort would be stronger for Period 1 (the initial one-minute suppression/monitoring period) than Period 2 (the second one-minute monitoring period). Further, to test the possibility that greater initial suppression effort “backfires” in the form of larger rebound effects later on (e.g., Wenzlaff & Wegner, 2000), we also examined whether suppression effort during Period 1 mediates the link between anxiety symptoms and Period 2 thought recurrence, even when controlling for Period 2 suppression effort.

1.2. Suppression instructions and cognitive resources as potential moderators

Additionally, to clarify the boundary conditions of effort mediating the anxiety—thought recurrence relationship, we also conducted a moderated mediation analysis. It is possible that any anxiety-related differences in the effort to suppress negative thoughts may be amplified by the explicit instruction to suppress (versus monitor) a negative thought during the paradigm, to the extent this instruction heightens suppression effort. Thus, we examined whether the “anxiety-to-effort” pathway of the mediation model was stronger among those assigned to “suppress” (versus “monitor”) instructions in Period 1. Of note, it is also plausible that effort may mediate the link between “suppress” versus “monitor” instructions and thought suppression outcomes, and that the “instructions-to-effort” pathway may, in turn, be moderated by anxiety. However, we chose to model anxiety as the independent predictor given the theoretical focus of the study, extensive prior work examining anxiety symptoms as a predictor of thought suppression outcomes (see Magee et al., 2012) that we wanted to extend, and past research suggesting that anxious individuals may be naturally
motivated to suppress unwanted thoughts, independent of “suppress” versus “monitor” instructions (e.g., Purdon, Rowa, & Antony, 2005).

Furthermore, we examined both trait and state differences in the availability of cognitive resources as moderators of the “effort-to-thought suppression” pathway, in light of past theory and research implicating experimentally induced differences in cognitive depletion (as well as individual differences in fluid intelligence) as potential constraints on the effectiveness of an individual’s efforts to suppress unwanted thoughts (see Magee et al., 2012; Wenzlaff & Wegner, 2000). For instance, lower working memory capacity predicted more intrusions when attempting to suppress an unwanted thought (Brewin & Smart, 2005), presumably because individuals with fewer working memory resources were less successful in their efforts to control the thought. Given that heightened anxiety is itself often accompanied by reduced cognitive resources (e.g., Eysenck et al., 2007), it is particularly important to examine when and how cognitive resource impairment might moderate the success of anxious individuals’ suppression efforts. Specifically, moderation was examined for a trait-like individual difference in cognitive resources (indexed by performance on a working memory task administered at baseline), and for an experimentally-induced state of cognitive depletion (via random assignment to a cognitively demanding task administered either shortly before or after the thought suppression paradigm).

2. Method

2.1. Participants

Participants (N = 939; 61.4% female) were adults aged 18–75 recruited via Amazon’s Mechanical Turk (MTurk; www.mturk.com), where volunteers participate in online tasks in exchange for a small monetary compensation (50 cents in the current study). See Table 1 for demographic characteristics. The use of MTurk allowed for the recruitment of a large enough participant sample to ensure adequate statistical power for our moderated mediation analyses (see Preacher, Rucker, & Hayes, 2007). Participants were randomly assigned to either the “monitor” or “suppress” instructions and to either the “deletion” or “no deletion” condition, resulting in a 2 × 2 design (Suppress/Depletion: N = 232; Suppress/NoDepletion: N = 232; Monitor/Depletion: N = 237; Monitor/NoDepletion: N = 238).

2.2. Materials

2.2.1. Emotionally aversive thought stimulus and thinking instructions

The Depression Anxiety Stress Scales–Anxiety subscale (DASS-A; Lovibond & Lovibond, 1995) is a seven-item self-report measure assessing the extent to which participants have experienced anxiety symptoms within the past week (e.g., “I felt I was close to panic”). The DASS-A was chosen as the measure of anxiety symptoms in the current study because it has good psychometric properties, correlates highly with other well-established trait anxiety measures (such as the Beck Anxiety Inventory), and differentiates well between anxiety and depression symptoms (e.g., Antony, Bieling, Cox, Enns, & Swinson, 1998, Lovibond & Lovibond, 1995). Cronbach’s alpha in the current study was .82.

2.2.2. Emotionally aversive thought stimulus and thinking instructions

Prior to starting the thought suppression paradigm, participants were asked to type the name of a “close friend” for use in the upcoming task. They were then introduced to the sentence, “I hope [name of friend] loses [her/his] wallet,” and were asked to type this sentence into a textbox, filling in their chosen friend’s name and gender. This thought parallels real-life intrusive thoughts in terms of unpleasantness and negative valence (Rachman, 1997), and produces similar rates of thought recurrence to the “friend in a car accident” thought that has successfully been used in several past studies (Magee, Smyth, & Teachman, 2013; Rachman, Shafran, Mitchell, Trant, & Teachman, 1996). Participants were then instructed to focus on this thought for an initial 20-second practice period, and were told to: “Press the spacebar and keep it pressed whenever you are thinking about the friend’s lost wallet thought. RELEASE the spacebar whenever you think about something else”.

Following this initial focus period, all participants began a new, 60-second thinking period. Participants who were randomly assigned to the “suppress” condition were given standard thought suppression instructions (e.g., Abramowitz et al., 2001): “Your task is now to NOT THINK ABOUT the thought [friend lost wallet thought shown].” Participants assigned to the “monitor” condition were given standard

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1 This investigation was part of a larger study examining multiple cognitive and emotional variables potentially tied to thought suppression, including differences in suppression outcomes for a neutral versus emotionally aversive thought. Only those materials and procedures relevant to the current investigation are reported here, but a complete list of measures from the larger study is available from the first author.

2 1766 participants provided informed consent for the study, but 12 participants’ data were excluded because they reported being under 18 years of age, and 815 (46%) of the consented participants dropped out before completing the first period of the thought suppression paradigm, leaving N = 939. While this attrition rate is not atypical in online research (Dillman et al., 2009), it is high for an mTurk sample and may be due to either the negative content of the intrusive thought used in the study or the frustration experienced during the working memory task, which can be quite challenging. Note, participants (N = 28) who completed the first but not the second thought period were retained for Period 1 analyses. These 28 participants did not differ from the remaining participants on self-reported anxiety symptoms, age, or Period 1 suppression effort (all t < 1.7, all p > .10), and dropout rates did not differ across “suppress” versus “monitor” (χ² = 1.50, p = .252) or across “deletion” versus “no-deletion” (χ² = 0.0, p = 0.995) conditions.

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Table 1
Demographic characteristics of 939 Amazon Mechanical Turk (MTurk) participants.

<table>
<thead>
<tr>
<th>Demographic</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>31.38</td>
<td>11.44</td>
</tr>
<tr>
<td>Gender</td>
<td>♂</td>
<td>♀</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>Caucasian: 743 (79.1%)</td>
<td>African-American: 60 (6.4%)</td>
</tr>
<tr>
<td></td>
<td>Asian: 51 (5.4%)</td>
<td>More than one race: 49 (5.2%)</td>
</tr>
<tr>
<td></td>
<td>N/A: 570 (60.8%)</td>
<td>Other/unspecified: 34 (3.6%)</td>
</tr>
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Education:

<table>
<thead>
<tr>
<th>Level</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some high school</td>
<td>15</td>
<td>1.6</td>
</tr>
<tr>
<td>Graduated high school</td>
<td>120</td>
<td>12.8%</td>
</tr>
<tr>
<td>Some college</td>
<td>437</td>
<td>46.3%</td>
</tr>
<tr>
<td>Graduated 4-year college</td>
<td>219</td>
<td>23.3%</td>
</tr>
<tr>
<td>Some graduate school</td>
<td>37</td>
<td>3.9%</td>
</tr>
<tr>
<td>Advanced graduate degree</td>
<td>106</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

Religiousness:

<table>
<thead>
<tr>
<th>Level</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all religious</td>
<td>415</td>
<td>44.4%</td>
</tr>
<tr>
<td>Somewhat religious</td>
<td>262</td>
<td>28.0%</td>
</tr>
<tr>
<td>Moderately religious</td>
<td>172</td>
<td>18.3%</td>
</tr>
<tr>
<td>Very religious</td>
<td>86</td>
<td>9.2%</td>
</tr>
</tbody>
</table>

Citizenship:

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>908</td>
<td>96.7%</td>
</tr>
<tr>
<td>India</td>
<td>12</td>
<td>1.3%</td>
</tr>
<tr>
<td>Philippines</td>
<td>5</td>
<td>.5%</td>
</tr>
<tr>
<td>Other</td>
<td>14</td>
<td>1.4%</td>
</tr>
</tbody>
</table>
monitoring instructions: “You can now think about anything. It can be
the thought you focused on in the last thinking period [friend lost wallet
thought shown] or it can be anything else.” All participants were again
instructed to press and hold the spacebar anytime they were having
the “friend lost wallet” thought, and to release the spacebar when
they were thinking about something else.

Following the first 60-second thinking period (referred to as Period
1), all participants were instructed to monitor the “friend lost wallet”
thought for another 60-second period (Period 2), and given the same
instructions as those used for the “Monitor” condition above. Through-
out each thinking period, the computer screen remained blank with a
yellow background. The frequency of thought intrusions was indexed
by the number of unique spacebar presses during each time period,
whereas duration was indexed by the percentage of the 60-second
period during which the spacebar was pressed (following Magee et al.,
2014). Note, while anxiety disorders certainly can be marked by
intrusive thoughts whose duration lasts longer than a minute, many
intrusive thoughts are quite brief, and the 60-second timeframe was
selected because of concerns about attrition and about excessively
fatiguing participants.

2.2.3. Self-reported suppression effort
Following completion of each thought period, participants complet-
ed three items that assessed their subjective effort during the preceding
period (e.g., “How much energy did you put into keeping this thought
out of your mind?”). Each item was rated on a 5-point Likert-type
scale, with higher scores indicating greater effort. Cronbach’s alpha in
the current study was .83.

2.2.4. Trait cognitive resource measure
Individual differences in cognitive resources were assessed using an
abbreviated version of the automated Operation Span (OSPAN;
Unsworth, Heitz, Schrock, & Engle, 2005) task, which is a widely used
measure of working memory capacity that has previously been shown
to correlate with the ability to suppress unwanted thoughts (e.g.,
Brewin & Smart, 2005). The task involves keeping in mind strings
of letters while trying to solve math problems. Complete details regard-
ing administration procedures, as well as psychometric results from an
earlier validation study on the abbreviated version, are available from
the first author.

2.2.5. State cognitive resource manipulation
To examine whether cognitive depletion moderates the link
between effort and thought recurrence, participants were randomly
assigned to complete an online version of the traditional color-word
Stroop task (Stroop, 1935) either before (“depletion” condition) or
after (“no-depletion” condition) the thought suppression paradigm.
The task included a total of 144 Stroop color-naming trials, of which
108 (75%) were incongruent color-word trials (e.g., the word “red”
printed in green ink). Participants were instructed to press the key
responding to the color of the ink each word was printed in (“1”
for “blue,” “2” for “green,” and “3” for “red”), while ignoring the word
itself. The Stroop task has often been successfully used to induce cogni-
tive depletion in past studies (e.g., Vohs, Baumeister, & Schmeichel,
2012). Color-naming latencies (in milliseconds) were significantly
longer for incongruent ($M = 712.13$, $SD = 173.10$) than congruent ($M =
663.06$, $SD = 150.93$) color-naming trials ($t(932) = 17.37$, $p < .001$),
similar to the pattern of Stroop latencies observed in past laboratory-
administered versions of the task (e.g., Kane & Engle, 2003).

2.3. Procedure
MTurk visitors who clicked on the study link were directed to an in-
formed consent page on the Project Implicit website (http://implicit.
harvard.edu/), the web-based infrastructure used to administer the
study. The consent page informed them that they would be completing
a variety of tasks examining their thoughts and feelings, and that un-
pleasant thoughts would be involved. Following consent, participants
completed baseline measures (DASS-A and OSPAN) in randomized
order. Participants in the “depletion” condition then completed the
Stroop task, and all participants subsequently completed the thought
suppression paradigm. At the end of the study, participants were
debriefed and compensated $.50 via MTurk for their participation.

3. Results

3.1. Data preparation and descriptive statistics
Participants ($N = 215$) whose OSPAN math accuracy was less than
80% were excluded from analyses involving the OSPAN task, in line
with past research (see Turner & Engle, 1989). The thought frequency
variables were log-transformed to reduce positive skew; all other
continuous variables were approximately normally distributed.
Extreme outliers, defined as values deviating by more than three
times the interquartile range from the lower or upper quartile of a
variable’s distribution, were removed from all continuous measures.
No more than two outliers had to be removed for any single variable.
Table 2 displays the means, standard deviations, and zero-order
correlations between all continuous measures.

3.2. Thought suppression instruction manipulation
Independent-samples $t$-tests confirmed that the thought suppres-
sion instruction manipulation was successful, in that participants in
the “suppress” (vs. “monitor”) condition reported putting greater effort
into thought suppression ($t(933) = 12.21$, $p < .001$) during Period 1. They
also exhibited lower thought frequency ($t(937) = 3.24$, $p =
.001$) and shorter thought duration ($t(937) = 17.66$, $p < .001$),
suggesting the efforts were effective. Most of these differences
remained significant (in the same direction) during Period 2, though
period 2 suppression effort was only marginally greater in the Suppress
(vs. Monitor) condition ($t(910) = 1.75$, $p = .081$).

3.3. Simple and moderated mediation analyses
Mediation analyses were conducted via the PROCESS macro in SPSS
(developed by Preacher & Hayes, 2008), using a bootstrapping pro-
dure with 1000 re-samples to compute 95% confidence intervals around
the standardized indirect effect of anxiety symptoms on each thought
recurrence outcome via suppression effort. To provide a standardized
effect size for any significant mediation effects, we report the $k^2$ statistic
recommended for estimating “the proportion of the maximum possible
indirect effect that could have occurred” (Preacher & Kelley, 2011,
p. 106). Separate analyses were conducted for Period 1 and 2 frequency
as well as for Period 1 and 2 duration of thought recurrence. For each
analysis in which frequency was the outcome, we covaried the effect
of the corresponding duration measure, and vice versa, to control for
the potentially confounding properties of these measures (e.g., a very
long thought duration means less opportunity for frequent recurrences;
following Lambert et al., 2014). Given our primary focus was on testing
the relationship between anxiety symptoms and each thought
recurrence outcome (as mediated by effort), we collapsed across “in-
struction” and “depletion” condition for these simple mediation
analyses (conducted via Model 4 in PROCESS). However we also tested
our moderated mediation hypotheses regarding the potential
moderating role of instructions and both trait and state cognitive re-
sources using model 35 in PROCESS. Finally, we tested the same
simple and moderated mediation models with Period 1 effort as the
mediator of the link between anxiety symptoms and Period 2 thought
recurrence, while controlling for Period 2 effort.
3.3.1.1. Simple mediation by effort

With respect to Period 1, suppression effort partially mediated the effect of anxiety symptoms (DASS-A) on thought frequency, such that higher anxiety symptoms predicted greater effort, which in turn predicted higher thought frequency (see Fig. 1A). With respect to Period 2, there was no indirect effect of anxiety symptoms (DASS-A) on frequency through effort (see Fig. 1B).

3.3.2. Duration of thought recurrence

With respect to Period 1, suppression effort partially mediated the effect of anxiety symptoms (DASS-A) on thought duration, such that higher anxiety symptoms predicted greater effort, which in turn predicted shorter thought duration (see Fig. 1C). With respect to Period 2, effort again partially mediated the “anxiety-to-thought duration” pathway, in the same direction as for Period 1 (see Fig. 1D).

**Table 2**

Descriptive statistics and zero-order correlations between all continuous predictor, moderator, mediator, and outcome measures.

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anxiety symptoms (DASS-A)</td>
<td>4.10</td>
<td>4.04</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2. Trait working memory (OSPA)</td>
<td>44.43</td>
<td>15.19</td>
<td>–.02</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3. Per 1 effort</td>
<td>2.76</td>
<td>1.17</td>
<td>.07*</td>
<td>.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>4. Per 2 effort</td>
<td>2.41</td>
<td>.94</td>
<td>.13**</td>
<td>–.09*</td>
<td>.50***</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<td>5. Per 1 frequency</td>
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<td>7.24</td>
<td>.07</td>
<td>0.06</td>
<td>.10***</td>
<td>0.04</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>6. Per 2 frequency</td>
<td>3.59</td>
<td>6.45</td>
<td>.09**</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>.61***</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>7. Per 1 duration</td>
<td>42.34</td>
<td>40.20</td>
<td>–.05†</td>
<td>0.06</td>
<td>–.17***</td>
<td>–0.05</td>
<td>.18***</td>
<td>.16***</td>
<td>–</td>
</tr>
<tr>
<td>8. Per 2 duration</td>
<td>58.03</td>
<td>39.81</td>
<td>–.11***</td>
<td>.10**</td>
<td>–0.01</td>
<td>–0.05</td>
<td>.13***</td>
<td>.23***</td>
<td>.54***</td>
</tr>
</tbody>
</table>

Note. DASS-A = Depression Anxiety Stress Scales – Anxiety subscale. OSPAN = automated Operation Span. Per 1 = Period 1; Per 2 = Period 2. Means and standard deviations of frequency variables are shown prior to log-transformation.

† p < .10.
* p < .05.
** p < .01.
*** p < .001.

**Fig. 1.** Standardized regression coefficients and effect sizes for each simple mediation effect (collapsed across instruction and depletion conditions).
3.3.3. Moderated mediation by effort, instructions, and cognitive resource variables

For each of the mediation models tested above, we further examined the moderation of the “anxiety-to-suppression effort” pathway by instructions ("suppress" vs. “monitor”) and the “suppression effort-to-thought recurrence” pathway by state (“depletion” vs. “no-depletion”) and trait (OSPA) cognitive resources. None of the model-predicted interactions were significant for either frequency or duration during either thought period (all p > .05), suggesting there were no moderation effects.

3.3.4. Period 1 effort as a mediator of period 2 thought recurrence

When examining Period 1 effort as a mediator of the link between anxiety symptoms and Period 2 thought recurrence, while controlling for Period 2 effort, the mediation effect was not significant for either frequency or duration (CIs around indirect effect include 0), either for the simple or moderated mediation models.

4. Discussion

The current study examined whether self-reported suppression effort would mediate the link between anxiety symptoms and the duration and/or frequency of unwanted thought recurrence. Indeed, suppression effort mediated the link between anxiety symptoms and frequency of thought recurrence during Period 1, as well as the link between anxiety symptoms and duration of thought recurrence during both Periods 1 and 2. Interestingly, however, effort had opposite effects on frequency and duration, such that greater effort predicted greater frequency but lesser duration of thought recurrence. Additionally, “suppress” versus “monitor” instructions and trait and state differences in cognitive resources were examined as potential moderators of the mediation effects, though no moderation effects were significant, suggesting effort had the same mediating effects regardless of suppression instructions or available cognitive resources.

The novel finding that self-reported effort mediates the links between anxiety and both frequency and duration, but in opposite directions, helps shed light on prior mixed findings from paradigms that did not separate the two outcomes. Specifically, it appears that greater effort to control unwanted thoughts predicts greater success at overriding such thoughts once they are activated (as indexed by shorter duration), but this same volitional effort may be detrimental to controlling the initial activation of unwanted thoughts (as indexed by frequency). This pattern is consistent with (though does not provide direct evidence for) Lambert et al.’s (2014) proposal that duration reflects a relatively controlled, effortful override process, whereas frequency reflects the relatively more automatic, unintentional process of initial activation. Indeed, the positive association between self-reported suppression effort and thought frequency, and, in turn, between anxiety symptoms and thought frequency, is consistent with past research suggesting that greater suppression effort can “backfire” in the context of a relatively automatic cognitive process, perhaps by making more salient and accessible the very thought one is trying to suppress (e.g., Wenzlaff & Wegner, 2000). Interestingly, whereas past research has typically highlighted the role of initial suppression effort in heightening later rebound effects (see Abramowitz et al., 2001; Wenzlaff & Wegner, 2000), it was Period 1 effort that was associated with increased Period 1 (but not Period 2) frequency in the current study. Though this finding needs to be replicated, it raises the possibility that deliberate suppression effort may have even immediate “backfiring” effects on the automatic activation of unwanted thoughts (consistent with similar findings in the emotion suppression domain; e.g., Richards & Gross, 1999). Of course, such causal relationships cannot be inferred from this correlational study, and it is equally possible that anxious participants reported greater suppression effort in response to their observed lack of success in keeping the thought out of mind in the first place. These competing accounts are ripe for experimental testing in future research, via experimental manipulations of suppression effort, anxiety, and/or thought recurrence.

The lack of moderation findings for our cognitive resource variables, and the general lack of pronounced differences between Periods 1 and 2, could reflect the relatively short length of the thought suppression paradigm used in the current study (one minute per thought period, compared to the four minutes or longer typically used in laboratory thought suppression research). The shorter thinking periods were chosen to minimize attrition in this online study, in line with earlier versions of the same web-based paradigm (e.g., Magee et al., 2014); however, these shorter time intervals may have precluded the eventual resource depletion and rebound effects that can be observed over longer intervals.

Note of the shorter thinking periods cannot entirely account for the lack of moderation effects for our cognitive depletion manipulation, given past evidence that the presence of a cognitive load can enhance target thought recurrence even during initial suppression attempts (see Wenzlaff & Wegner, 2000, for a review). A more likely explanation is that cognitive depletion from a prior task (as in the present study) operates differently than a cognitive load imposed by a simultaneously administered dual task (as in past studies), such that it does not impose the same constraints on suppression effort. An alternative possibility is that all participants had become somewhat cognitively depleted by the working memory task and other study measures they completed at baseline, such that the further addition of the Stroop task in the “depletion” condition made no incremental difference. A direct comparison of prior cognitive depletion versus concurrent load manipulations as predictors of suppression effort and its impact on thought recurrence outcomes would be fruitful in testing these possibilities.

Another possibility is that the suppression of distressing, personally relevant thoughts may be less sensitive to cognitive resource constraints than is the suppression of neutral “white bear”-type thoughts, perhaps due to people’s greater motivation and practice with suppressing these thoughts. Indeed, the absence of pronounced rebound effects during Period 2 in this study is consistent with prior findings that the suppression of personally salient, emotionally aversive thoughts does not reliably lead to the later rebound effects often observed for more neutral thoughts (see Kelly & Kahn, 1994). Likewise, the lack of moderation by trait working memory capacity in this study is in line with past findings that working memory was unrelated to intrusion frequency when suppressing thoughts of a personal traumatic experience (Nixon et al., 2008). This motivated, overlearned suppression account may also help explain the lack of moderation by suppression instructions in the current study. Given that many (though not all) anxious individuals are habitually motivated to suppress negative thoughts (see Magee et al., 2012; see also Mobini & Grant, 2007, for a review), they are likely to exert effort toward suppressing such thoughts regardless of the explicit task instructions (as previously observed in studies with clinically diagnosed OCD samples; e.g., Purdon et al., 2005).

4.1. Clinical implications

Past research indicates that anxious individuals report being distressed and impaired by their intrusive thoughts, and consequently putting great effort into trying to suppress them (e.g., Clark, 2004; Purdon et al., 2005; see also Najmi & Wegner, 2009, for a review). The novel findings of the current study suggest that this self-reported suppression effort may have opposite effects on the frequency versus duration of unwanted thoughts, thus acting as a double-edged sword. On the one hand, exerting effort to suppress an already-activated intrusive thought may provide a source of renewed control and mastery in situations where faster override is particularly adaptive (e.g., during a high-stakes college exam or job interview). On the other hand, such experiences may positively reinforce an anxious individual’s more chronic investment of effort in the hypervigilant monitoring of intrusive thoughts, which in turn may lead to the more frequent activation of those very
thoughts (in line with the present “frequency” findings). This chronic hypervigilance also has a host of other, more long-term maladaptive consequences, such as greater cognitive depletion when attempting non-anxiety-related tasks (Eysenck et al., 2007) and greater maintenance of negative moods, cognitions, and avoidance behaviors tied to anxiety (Clark & Beck, 2010, pp. 97-98). Thus, an effective therapeutic approach may be to promote a general “letting go” of habitual, proactive suppression effort, paired with a readiness to exert time-limited, reactive “bursts” of effort to override intrusive thoughts when they arise in situations where they are particularly interfering. Educating anxious clients about the relatively automatic, effort-resistant nature of initial thought activation may itself help combat anxious individuals’ self-defeating metacognitive belief that intrusive thoughts can and must be controlled, and that the failure to prevent their occurrence is a sign of mental weakness (e.g., Purdon & Clark, 2000). Further, examining how the anxiety—effort relationship varies across different anxiety disorders may provide valuable clues about disorder-specific problems with intrusive thoughts and their suppression across anxious populations (though see Magee et al., 2012).

4.2. Limitations and conclusions

The current results should be considered in light of several limitations. First, as noted, the one-minute thought periods used in the current study were relatively brief (though clearly still allowed for variability in suppression outcomes). Second, the use of an unselected sample of Mturk participants with varying anxiety symptom levels may limit our findings’ generalizability to clinically anxious samples. It should be noted, however, that over a third of our sample (N = 366; 36.2%) scored above a previously published DASS-Anxiety subscale mean in a diagnosed OCD sample (Antony et al., 1998), suggesting our sample provided a suitable range of clinical severity. Relatedly, this study did not include an explicit assessment of whether participants were native English speakers, which could have impacted results to some extent given the high verbal demands of the study. The vast majority of participants did report being United States citizens, however (96.7%; see Table 1), making it unlikely that they lacked a basic level of English proficiency. Third, the correlations between the predictor, mediator, and outcome measures in the current study were reliable but small (see Table 1), as were the mediating effects of effort on the anxiety—thought recurrence relationship (see Fig. 1). Thus it will be important to replicate these findings in a more tightly controlled laboratory setting in order to ascertain their clinical significance.

Finally, one limitation common to thought suppression paradigms like the present one is the difficulty of asking participants to report when they are no longer thinking about a target thought, given the metacognitive awareness of the thought that is needed to make this judgment. Having participants release the spacebar “whenever [they] think about something else” helps address this issue to some extent, because it shifts the focus to the presence of an alternate thought versus the absence of a target thought. Another question raised with this class of paradigms concerns the impact of differences in how participants define the “onset” and “offset” of a target thought, and whether these differences systematically impact their reported thought recurrence frequency and duration. The development of measures that explicitly probe or manipulate these differences (e.g., by defining the occurrence of a thought in narrower versus wider terms) is an important direction for future research, as is the inclusion of additional, more objective measures of effort to complement the current interest in subjective effort. Despite these limitations, our novel findings that self-reported suppression effort has dissociable effects on the frequency (initial activation) versus duration (subsequent override) of intrusive thoughts provide new insights into the nature and controllability of these distinct features of thought recurrence. They also help clarify prior mixed findings regarding the role of anxiety in thought recurrence, with important clinical implications for helping anxious individuals develop more nuanced strategies for deciding when to suppress versus accept their unwanted thoughts. Finally, these results pave the way for future research to address how anxious individuals’ perceived suppression efforts become more helpful or harmful over time and with increasing cognitive demands.

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