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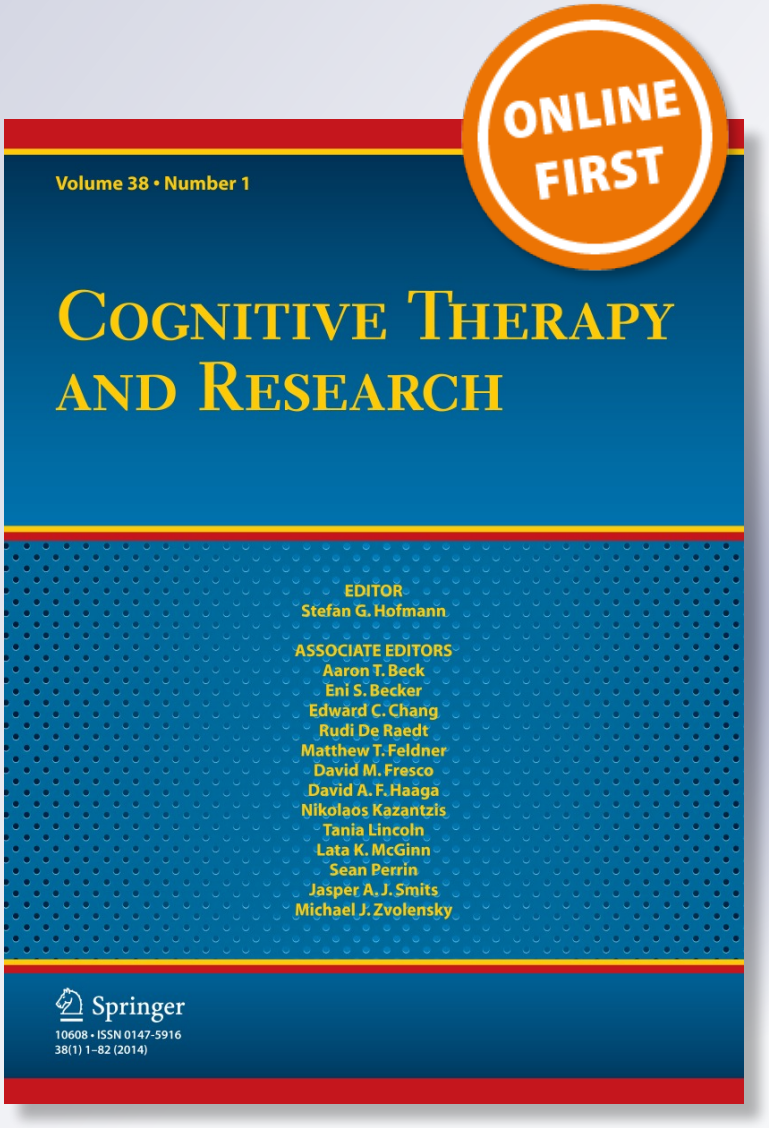

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ORIGINAL ARTICLE

Thought Acceleration Boosts Positive Mood Among Individuals with Minimal to Moderate Depressive Symptoms

Kaite Yang · Dara G. Friedman-Wheeler · Emily Pronin

Abstract Studies have found that accelerated thought speed induces positive mood. Positive mood and thought speed typically are abnormally low for individuals experiencing depression. Two experiments show that the positive mood of individuals with mild to moderate depressive symptoms is boosted by a manipulation accelerating thought speed. Participants read streaming text presented at a controlled rate in order to induce either fast-paced thinking or neutral-paced thinking. In both experiments, individuals with mild to moderate depressive symptoms (based on the Beck Depression Inventory-II) who were led to think fast reported more positive mood than those induced to think at a neutral pace. They also reported more positive mood at post-test relative to pre-test. Individuals with minimal or no depressive symptoms showed similar responses, whereas those with more severe depressive symptoms appeared unaffected. No effects emerged on measures of negative mood or general depressive symptoms. Future studies should investigate potential therapeutic effects of fast thinking in clinical samples and whether repeated inductions of fast thinking produce extended benefits.

Keywords Thought speed · Depression · Cognitive therapy · Fast thinking

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Introduction

In the 1960s–1970s, a cognitive revolution brought the dysfunctional content of depressed people's thoughts to the forefront in understanding etiology, symptomatology, and therapy for depression. Beck's (1963) cognitive conceptualization of depression called for its treatment in the amelioration of patients' negative thoughts about themselves, their present experiences, and their future (also Beck et al. 1979; Hofmann et al. 2012). The content of depressed thought is a hallmark of depressive symptomatology, and altering those thoughts is a mainstay of treatment for depression with cognitive behavioral therapy. The present experiments concern a different dimension of thinking that also characterizes depression and whose alteration also might contribute to its treatment: that is, the *speed* of depressed thought. Our research is motivated by the general hypothesis that accelerating thought speed in depressed individuals may improve their positive mood. In the present experiments, we begin an exploration of this hypothesis by testing whether a thought-acceleration manipulation improves the mood of individuals who report depressive symptoms on a standard depression inventory.

Slow thinking is a cardinal symptom of depression. Depressed thinking can slow to the point where thoughts seem to stop (e.g., Judd et al. 1994; Kraepelin 1921). This difficulty in thinking is a symptom of major depressive disorder (American Psychiatric Association 2013). The co-occurrence of mood symptoms and slow thinking in depression suggests a possible link. Pronin and Jacobs (2008) found further cases, beyond depression, in which thought speed and mood are correlated. Stimulant drugs accelerate thought pace and enhance mood. Caffeine, nicotine, cocaine, and amphetamines all have mood or pleasure-enhancing effects and thought accelerating properties

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(see Pronin and Jacobs 2008). Exercise is another example: it boosts mood and enhances reaction time and thought speed and efficiency (Brisswalter et al. 2002; Rocheleau et al. 2004). Finally, a prime case of the mood and thought-speed link involves mania, which is characterized by both racing thoughts and euphoria (American Psychiatric Association 2013; Goodwin and Jamison 1990).

More recently, we have identified a surprising causal link between mood and thought speed. Laboratory manipulations have shown that fast thought speed induces positive mood (see Pronin 2013, for a review). In one experiment, Pronin and Wegner (2006) accelerated undergraduate participants' thought speed by having them read a series of statements at a fast pace. The statements were taken in full from the Velten (1968) mood induction procedure, which involves reading self-statements that become increasingly elating or depressing. Participants who were induced to read quickly not only reported thinking faster than those induced to read slowly but also felt more positive mood. This was true regardless of whether the participants had read content designed to elate or depress them. In fact, the speed effect on mood was at least as strong as the effect of content. Subsequent studies among undergraduates and community adults have demonstrated positive-mood benefits of fast thinking as well as positive-mood costs of slow thinking, and boosts to positive mood have been found across a diversity of thought-speed manipulations including rapid brainstorming, rapidly generating lists of words, and narrating a fast-paced video (e.g., Pronin et al. 2008).

Although the mechanism underlying this effect has not been demonstrated, it has been theorized to involve a generalized response to the naturally occurring conditions that give rise to fast thinking (Pronin 2013). Thoughts are likely to speed up during circumstances in which a person must process rapidly changing stimuli or rapidly generate novel cognitions. The urgency of those circumstances may induce in the actor a state of increased excitement, motivation, and related action-oriented positive emotions. Given that depression is characterized by low positive mood and decreased energy and motivation, fast thinking may be beneficial for individuals experiencing depressive symptoms.

The Present Research

The experiments that we report here concern the hypothesis that accelerated thought speed will improve the dampened positive affect of individuals experiencing mild to moderate depressive symptoms.[1] We conducted two experiments examining the effect of a brief thought-speed manipulation that involved paced reading of trivia. Our primary prediction was that participants with mild to moderate depressive symptoms in the fast thought-speed condition would experience increased positive affect relative to a neutral-speed condition, and relative to baseline. Previous studies have shown that fast thinking enhances positive mood but does not generally influence negative mood (e.g., Pronin and Wegner 2006; Pronin et al. 2008); thus, our primary prediction concerned effects of thought speed on positive mood. We measured positive affect using a standard mood scale (Watson et al. 1988). For exploratory purposes—given that previous thought-speed studies have not involved participants screened for depressive symptoms—we also included pre and post scales measuring negative mood and depressive symptoms.

Both experiments included groups of participants with mild to moderate depressive symptoms, and with severe depressive symptoms, as well as individuals with minimal or no depressive symptoms. Inclusion of these three groups allowed us to examine two additional questions: Will improvements to the mood of individuals with mild to moderate depressive symptoms be smaller or larger than improvements for individuals with minimal or no depressive symptoms? Will individuals with more severe depressive symptoms show a response to the thought-speed manipulation? Experiment 1 was designed as an initial test of our predictions regarding the effect of thought speed on positive mood, while Experiment 2 sought to replicate these findings and to introduce two methodological improvements suggested by the results of Experiment 1. These improvements involved retaining participants' voice recordings in order to assess possible differences in success at the paced-reading task, and measuring participants' BDI status at the onset of the experiment (rather than relying on earlier scores) in order to ensure that BDI groupings were based on participants' current depressive symptomatology.

Experiment 1

Method

Participants and Prescreen

Participants were 128 English-speaking US residents recruited via Amazon.com's Mechanical Turk (MTurk) website in

[1] In these experiments we did not conduct interview-based clinical assessments of depression or engage in other comprehensive efforts to determine participants' clinical depression status. We assessed participants' degree of depressive symptoms—but not their actual depression status—via scores on the Beck Depression Inventory-II. Throughout this article, we therefore use the term *depressive symptoms* (rather than depression) as the more accurate characterization, since we cannot ascertain which (or what proportion) of our participants would receive a clinical diagnosis of depression.

exchange for pay. All participants indicated that they were above 18 years of age. MTurk is a website where people can participate for pay in online studies conducted by researchers, and the website subsequently delivers the participants' completed data to the researchers. Its participant population is diverse in terms of age, ethnicity, and socioeconomic status, and its participants exhibit levels of depression similar to those found in the general population (Buhrmester et al. 2011; Mason and Suri 2012; Shapiro et al. 2013). Participants were invited to enter the experiment based on their completing a separate Beck Depression Inventory-II (BDI-II; Beck et al. 1996) prescreen that was advertised as a brief "Self Survey" on MTurk. The BDI-II was modified to omit the item on suicidality and therefore contained 20 items. A total of 866 participants completed the prescreen and received monetary compensation.

Within 24 h of their completing the prescreen, individuals were invited via email to participate in the experiment. The invitation asked participants to complete a study on "reading and mood" and included a weblink to the study. The invitation did not inform participants of any connection between the prescreen and the experiment. To ensure that we had an adequate sample of individuals with depressive symptoms, invitations were emailed to all individuals who scored $\geq$12 on the BDI-II ($N = 360$), and to a randomly-selected subset of those with BDI-II scores $<$12 ($N = 393$). Of this total of 753 individuals who were invited to participate, 281 entered the experiment, and 128 successfully completed it (this difference between entering versus completing the experiment was attributable to 4 participants dropping out at the beginning of the study, and 149 dropping out at the point involving download and use of the online voice recorder). This resulted in 78 participants with minimal or no depressive symptoms (BDI-II $<$12), 35 participants with mild to moderate depressive symptoms ($12 \leq$ BDI-II < 29), and 15 participants with more severe depressive symptoms (BDI-II ≥ 29). The BDI-II cutoffs that we adopted were based on prior research studies indicating that a cutoff of 13 on the full scale (i.e., 12 on our scale) provides the best combination of sensitivity and specificity in distinguishing between people who are experiencing depression versus not (Lasa et al. 2000; Kendall et al. 1987), and that individuals with scores of 30+ (i.e., BDI = 29+ on our scale) are experiencing severe symptoms of depression (Beck et al. 1996).

Participants entered the experiment 68 min to 66 days (Median = 15 h) after being invited. Upon entering the experiment, participants were informed that they would be asked to read aloud trivia statements into an online voice recorder, that the experiment would take approximately 15 min, and that they would be asked to complete anonymous questionnaires regarding themselves and their feelings. They then were asked to provide their consent to participate. They received paid compensation that was separate from the earlier payment they received for completing the pre-screen. This research was approved by Princeton University's Institutional Review Board.

Baseline Measures

After providing consent to be in the study, participants rated their affect using the Positive and Negative Affect Schedule (PANAS; Watson et al. 1988), which measures positive affect via feelings such as *interested*, *excited*, *strong,* and negative affect via feelings such as *distressed*, *upset*, *guilty* (1 = *very slightly*, 5 = *extremely*). As a measure of depressive symptoms, participants completed the Center for Epidemiological Studies-Depression scale (CES-D, Radloff 1977), which asks about feelings during the previous week (e.g., "I was bothered by things that usually don't bother me"; 1 = *Rarely or none of the time*, 4 = *Most or all of the time*). We opted to use the CES-D rather than the BDI-II as a post-measure of depressive symptoms because the CES-D is sensitive to changes in current depressive symptomatology and, unlike the BDI-II, it is easily adaptable to address in-the-moment feelings of depressed mood (Radloff 1977).

Thought-Speed Manipulation

Participants then were told that they would be "reading aloud sentences as they appear" on their computer monitor and that they should "not pause or skip sections of the video." The videos that participants saw presented various trivia statements (e.g., "Oranges contain vitamin C"; "The three primary colors are red, yellow, and blue"), with each one presented on the screen one letter at a time until the entire sentence was visible. To ensure compliance with the reading manipulation, participants were given instructions for accessing an Internet-based voice recording program that used their computer's microphone. Participants read aloud, the program recorded them, and they submitted their recording along with their other experimental responses (those who did not submit a completed voice recording were not counted as participants).

The experiment was a between-subjects design with participants randomly assigned to one of two video speeds. In the fast-speed condition, participants read a series of trivia statements, each of which streamed onto the screen one letter at a time, at a rate of 40 ms per letter, until the sentence appeared in full. The entire sentence then remained on the screen for an additional 500 ms before it disappeared and the next sentence was presented in the same fashion. The presentation speeds were adapted from Pronin and Wegner's (2006) research with college undergraduates. In the neutral thought-speed condition, the rate

was 390 ms per letter, with 1,000 ms between statements. That speed was determined via pilot-testing with Mturk participants ($N = 15$) to find a pace that participants would rate as inducing them to think at a neutral speed (Pronin and Wegner did not have a neutral-speed condition). Each speed-induction video was approximately 2 min 45 s. Participants in the neutral speed condition were randomly assigned to one of four versions of the neutral-speed video, with each version containing a random (but non-overlapping) subset of statements from the fast condition.

Post-measures

Upon completing the speed induction, participants rated their thought speed (1 = *very slow*, 9 = *very fast*), after first reading that "sometimes people have the feeling that their thoughts are coming slowly, and other times people feel that their thoughts are 'racing.'" They then rated their positive and negative affect using the PANAS. Finally, they rated their depressive symptoms, with a CES-D scale modified by us in order to address current feelings (e.g., "I am bothered by things that usually don't bother me"; 1 = *Not at all*, 4 = *Very much or completely*).

Results

Thought Speed

Participants with mild to moderate depressive symptoms reported faster thinking in the fast thought-speed condition than they did in the neutral thought-speed condition ($M_{fast} = 6.93$, $SD = 2.31$; $M_{neutral} = 3.80$, $SD = 2.63$), $t(33) = 3.67$, $p = .001$. Participants with minimal or no depressive symptoms also reported faster thinking in the fast condition ($M_{fast} = 7.06$, $SD = 1.53$; $M_{neutral} = 4.35$, $SD = 2.49$), $t(76) = 5.63$, $p < .001$. Participants with severe depressive symptoms did not show a speed effect, though the pattern was in the same direction ($M_{fast} = 5.88$, $SD = 3.31$; $M_{neutral} = 4.43$, $SD = 2.07$), $t(13) = 1.00$, $p = .34$.

Positive Affect

Our primary hypothesis in this experiment was that participants with mild-to-moderate depressive symptoms in the fast condition would report greater positive mood than their counterparts in the neutral condition. We tested this hypothesis using ANCOVA on participants' post-test positive affect, controlling for any differences in pre-test positive affect (the data we report are estimated marginal means, and the associated standard errors). Our hypothesis was supported. Participants with mild to moderate depressive symptoms reported more positive affect in the fast condition ($M_{fast} = 3.29$, $SE = .13$) than the neutral condition ($M_{neutral} = 2.85$, $SE = .11$), $F(1,32) = 6.30$, $p = .02$, $\eta p^2 = .17$ (Fig. 1).

To follow up, we next tested the hypothesis that participants with mild to moderate depressive symptoms experienced a significant boost in positive mood from pre-test to post-test in the fast condition. We examined those participants' positive affect before versus after the thought-speed manipulation using repeated measures ANOVA. As predicted, they reported more positive affect after being induced to think fast than before ($M_{pre} = 2.82$, $SD = .74$; $M_{post} = 3.31$, $SD = .79$), $F(1,14) = 13.10$, $p = .003$. By contrast, they showed no pre-to-post change in the neutral condition ($M_{pre} = 2.78$, $SD = .81$; $M_{post} = 2.84$, $SD = .83$), $F(1,19) = .28$, $p = .61$.

Based on prior research, we expected the thought-speed manipulation to impact the positive affect of participants with minimal or no depressive symptoms. Indeed, controlling for pretest positive affect using ANCOVA, those in the fast condition experienced greater positive affect ($M_{fast} = 3.26$, $SE = .08$) than those in the neutral condition ($M_{neutral} = 2.97$, $SE = .07$), $F(1,75) = 7.55$, $p = .008$, $\eta p^2 = .09$. Follow-up analyses revealed that those in the fast condition showed a marginal tendency to report more positive affect after the manipulation than before it ($M_{pre} = 3.18$, $SD = .92$; $M_{post} = 3.30$, $SD = .98$), $F(1,34) = 3.36$, $p = .08$. They also reported *less* positive affect after the neutral manipulation than before it, perhaps indicating that the neutral condition was slow for them ($M_{pre} = 3.10$, $SD = .87$; $M_{post} = 2.94$, $SD = 1.00$), $F(1,42) = 4.63$, $p = .04$.

Given that those with higher BDI scores may be more likely to be experiencing the vegetative symptoms of depression, which could render the manipulation less

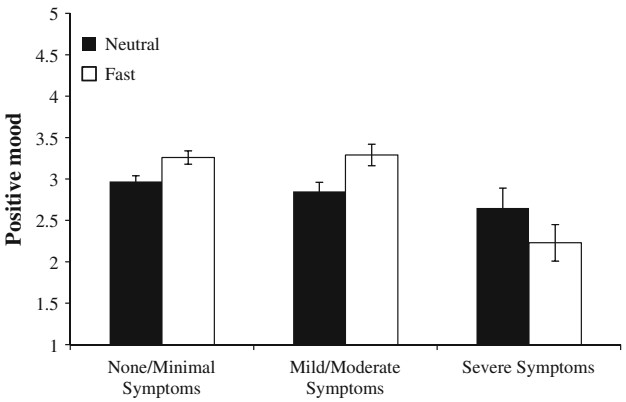

Fig. 1 Effects of thought-speed condition on post-test positive affect (controlling for pre-test positive affect) for participants without depressive symptoms, with mild to moderate depressive symptoms, and with severe depressive symptoms (Experiment 1)

potent, we withheld predictions about that group. We found that the positive affect of participants with severe depressive symptoms did not differ significantly between the fast versus neutral conditions, controlling for pretest positive affect with ANCOVA ($M_{fast} = 2.23$, $SE = .22$; $M_{neutral} = 2.65$, $SE = .24$), $F(1,12) = 1.73$, $p = .21$.

Negative Affect and Depressive Symptoms

Negative affect and depressive symptoms also were assessed with ANCOVAs controlling for pre-test scores. Past research has typically not found effects of thought acceleration on negative affect (e.g., Pronin et al. 2008). No effects were observed among any of the groups: those with mild-to-moderate depressive symptoms ($M_{fast} = 1.76$, $SE = .13$; $M_{neutral} = 1.58$, $SE = .11$), $F(1,32) = 1.04$, $p = .32$; those with minimal or no depressive symptoms ($M_{fast} = 1.30$, $SE = .05$; $M_{neutral} = 1.33$, $SE = .05$), $F(1,75) = .09$, $p = .76$; and those with severe depressive symptoms ($M_{fast} = 3.09$, $SE = .18$; $M_{neutral} = 2.64$, $SE = .20$), $F(1,12) = 2.84$, $p = .12$.

No significant effects on depressive symptomatology were observed for any of the groups: mild-to-moderate ($M_{fast} = 1.88$, $SE = .09$; $M_{neutral} = 1.98$, $SE = .08$), $F(1,32) = .65$, $p = .43$; minimal/non-symptomatic ($M_{fast} = 1.41$, $SE = .05$; $M_{neutral} = 1.49$, $SE = .04$), $F(1,75) = 1.28$, $p = .26$; severe ($M_{fast} = 2.59$, $SE = .20$; $M_{neutral} = 2.63$, $SE = .22$), $F(1,12) = .02$, $p = .89$.

Discussion

Experiment 1 supports the hypothesis that inducing fast thinking boosts positive mood in individuals with mild to moderate depressive symptoms. Those individuals reported more positive affect immediately following the fast thought-speed condition than the neutral thought-speed condition, and they reported more positive mood after the thought-acceleration manipulation than before it. Participants with minimal or no depressive symptoms experienced a similar mood boost, whereas those with more severe symptoms did not. The effect sizes for the relevant ANCOVA analyses indicated that the positive mood of the mild-to-moderate group was at least as responsive as that of their peers with minimal or no depressive symptoms to the thought-speed manipulation. The manipulation did not alter participants' negative affect or CES-D depressive symptoms.

Those with more severe symptoms of depression did not report thinking faster in response to the fast-speed manipulation. A stronger manipulation may be required to trigger changes in their thought speed. Alternatively, the speed of the fast condition may have been too fast for them, given the lagging cognitive speed that accompanies depressive symptomatology. To examine this possibility, we planned a second experiment in which we could code participants' voice recordings to check whether those participants with more severe depressive symptoms could "keep up" with the fast manipulation (the recordings from Experiment 1 were destroyed and thus unavailable for coding). Another possible explanation for the different results of our samples with severe versus mild-to-moderate depressive symptoms involves the nature of our recruitment procedure. The median participant in our experiment joined the study 15 h after being invited. But, some participants took days. It is possible that for some of those who took longer, their depressive symptoms had remitted, particularly if those symptoms were initially mild. In that case, one might wonder whether the observed effects were driven by individuals with no depressive symptoms who were placed in the mild-to-moderate group. To rule out this possibility, participants in Experiment 2 were assigned to BDI-II groupings based on scores obtained at the start of the experiment.

Experiment 2

Methods

Participants were 196 individuals on MTurk paid for participating. As in Experiment 1, they were invited into the experiment based on a separate BDI-II prescreen. The prescreen was completed by 1,731 individuals, in exchange for monetary compensation. As in Experiment 1, all those who scored $\geq$12 on the BDI-II pre-screen ($N = 756$) received email invitations to participate in the experiment, and a randomly-selected subset ($N = 362$) of those with BDI-II scores <12 were invited to participate, with the exception that any individual (regardless of BDI-II score) who had participated in Experiment 1 was not invited to participate. The Qualifications system from MTurk (see Chandler et al. 2013) was used to identify the MTurk Worker IDs of participants who had been in Experiment 1, and those IDs were blocked from being invited into Experiment 2. Of the 1,118 individuals who were invited to participate, 317 entered the experiment, and 196 successfully completed it (a difference attributable to 11 participants dropping out at the beginning of the study, and 110 dropping out at the point involving download and use of the online voice recorder). Assignment to depressive symptom groupings was based upon BDI-II scores at the start of the actual experiment, and yielded 90 participants with mild-to-moderate depressive symptoms, 75 participants with none or minimal depressive symptoms, and 31

with severe depressive symptoms (using the same BDI-II cut-offs as Experiment 1).

The procedure was the same as Experiment 1. Thought speed and affect were again assessed at baseline and post-manipulation, using the same measures as the prior experiment.[2]

Results

Thought Speed

Participants with mild to moderate depressive symptoms in the fast thought-speed condition reported thinking faster than did their counterparts in the neutral thought-speed condition ($M_{fast} = 5.94$, $SD = 2.16$; $M_{neutral} = 4.81$, $SD = 2.40$), $t(87) = 2.25$, $p = .03$. Participants with minimal or no depressive symptoms also reported thinking faster in the fast condition ($M_{fast} = 6.84$, $SD = 1.68$; $M_{neutral} = 3.88$, $SD = 2.47$), $t(73) = 6.18$, $p < .001$. As in Experiment 1, the manipulation did not alter perceived thought speed among participants with more severe depressive symptoms ($M_{fast} = 6.25$, $SD = 1.86$; $M_{neutral} = 5.55$, $SD = 2.42$), $t(29) = .91$, $p = .37$.

Positive Affect

We next analyzed effects of our thought-speed manipulation on positive mood, using ANCOVAs (as in Experiment 1). Our primary hypothesis was supported. Among participants with mild to moderate depressive symptoms, those in the fast condition reported more positive affect ($M_{fast} = 2.87$, $SE = .10$) than those in the neutral condition ($M_{neutral} = 2.61$, $SE = .08$), $F(1,87) = 3.98$, $p = .049$, $\eta p^2 = .04$ (Fig. 2).

To follow-up, we examined the positive affect of participants with moderate depressive symptoms before versus after the thought-speed manipulation. As predicted, they reported more positive mood after being induced to think fast as compared to before that induction ($M_{pre} = 2.64$, $SD = .63$; $M_{post} = 2.95$, $SD = .81$), $F(1,35) = 7.18$, $p = .01$. By contrast, they showed no pre-to-post change in the neutral condition ($M_{pre} = 2.46$, $SD = .77$; $M_{post} = 2.55$, $SD = .80$), $F(1,53) = 1.35$, $p = .25$.

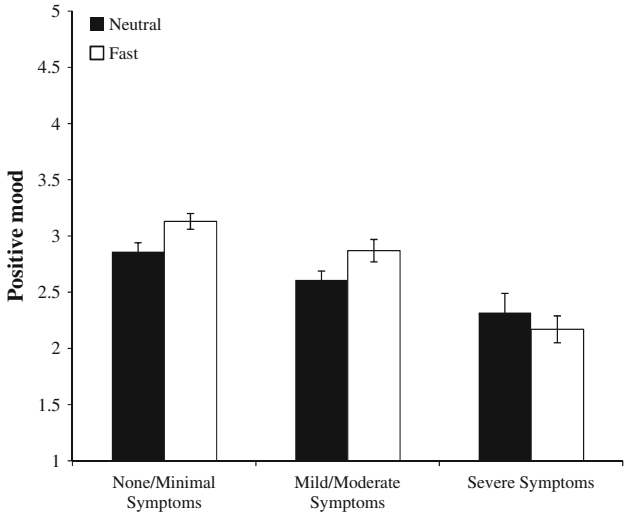

Fig. 2 Effects of thought-speed condition on post-test positive affect (controlling for pre-test positive affect) for participants without depressive symptoms, with mild to moderate depressive symptoms, and with severe depressive symptoms (Experiment 2)

Our manipulation also altered the positive affect of participants with minimal or no depressive symptoms. Those in the fast condition reported greater positive affect than those in the neutral condition ($M_{fast} = 3.13$, $SE = .07$; $M_{neutral} = 2.86$, $SE = .08$), $F(1,75) = 5.87$, $p = .02$, $\eta p^2 = .08$. Follow-up analyses revealed a similar pattern to Experiment 1, but of marginal statistical significance. Those in the fast condition tended towards more positive mood after the manipulation than before it ($M_{pre} = 2.92$, $SD = .91$; $M_{post} = 3.03$, $SD = .95$), $F(1,42) = 2.95$, $p = .09$. And, those in the neutral condition tended towards *less* positive mood after the manipulation than before it ($M_{pre} = 3.17$, $SD = .90$; $M_{post} = 3.00$, $SD = 1.02$), $F(1,31) = 3.33$, $p = .08$.

As in Experiment 1, participants with severe depressive symptoms did not report more positive mood in response to the fast versus neutral manipulation ($M_{fast} = 2.17$, $SE = .12$; $M_{neutral} = 2.32$, $SE = .17$), $F(1,28) = .51$, $p = .48$, $\eta p^2 = .02$.

Negative Affect

Participants with mild to moderate depressive symptoms showed no difference in negative affect between the two conditions ($M_{fast} = 1.80$, $SE = .08$; $M_{neutral} = 1.72$, $SE = .07$), $F(1,87) = .58$, $p = .45$. Among participants with minimal or no depressive symptoms, those in the fast condition reported more negative affect ($M_{fast} = 1.46$, $SE = .05$; $M_{neutral} = 1.28$, $SE = .06$), $F(1,72) = 5.06$, $p = .03$. Among participants with severe depressive symptoms, there was no difference ($M_{fast} = 2.31$, $SE = .13$; $M_{neutral} = 2.47$, $SE = .18$), $F(1,28) = .53$, $p = .47$.

[2] We also measured self-esteem on the Beck Self Esteem scale which is geared towards assessing self-esteem in depressive populations (Beck et al. 2001), and depressive symptomatology on the 2-item Physician Health Questionnaire depression screener (Kroenke et al. 2003). Neither measure yielded significant results and we refrain from further discussion in the interest of brevity (except to note that the means for both depressive symptoms groups were in the direction of greater self-esteem, and less depression, in the fast condition compared to the neutral condition, and there were no signs of differences in the groups with minimal or no depressive symptoms).

Reading Success

We next examined whether the severe-symptoms participants' unresponsiveness to the speed manipulation reflected it possibly being too fast for them. Participants' voice recordings were coded (by a research assistant blinded to BDI-II scores) for how successfully the participant completed the paced-reading task ($N = 64$ recordings were available; the remaining were destroyed prematurely by the voice-recorder program). The codings indicated that the vast majority of participants (94 %) were either completely or almost completely successful in their narration (4 or 5, on a 5-point scale), indicating that participants with severe depressive symptoms had not struggled excessively with the pace of the reading task (of the 4 participants who were less successful, 1 had severe depressive symptoms).

Discussion

Experiment 2 again found a positive-mood boost among individuals with mild to moderate depressive symptoms who were led to think fast. Participants with mild to moderate depressive symptoms experienced more positive mood in the fast condition than in the neutral condition, and they felt more positive mood after the fast manipulation than before it. Individuals lacking depressive symptoms were similarly (but somewhat less strongly) responsive to the thought-speed manipulation, whereas those with severe depressive symptoms appeared unaffected by it.

This experiment also addressed two ideas concerning why participants with more severe depressive symptoms may have differed in their results. One idea concerned whether participants with minimal or no depressive symptoms may have been assigned to the depressive symptoms groups if some of those with milder symptoms had remitted in their symptoms since taking the BDI-II prescreen. In order to address this concern, participants in Experiment 2 completed the BDI-II immediately prior to the experiment and were assigned to condition based on current BDI-II levels. The other concern was that our participants with more severe symptoms may have failed to reap the positive benefits of the fast-speed manipulation because they were unable to "keep up" with it. Coding of participants' voice recordings while engaged with the thought-speed manipulation failed to support this possibility.

General Discussion

The present experiments demonstrate a mood-boosting effect immediately after accelerating the thought pace of individuals with mild to moderate depressive symptoms. This boost was at least as strong as that observed in individuals lacking depressive symptoms, and it was not observed among those with more severe symptoms. These positive mood effects were obtained using a simple, brief, and well-tested manipulation involving reading streaming text at a controlled pace. The entire speed induction took less than 3 min. While these studies are consistent with the existing literature showing that thought acceleration boosts positive mood, they are the first to demonstrate this effect among people who reported mild to moderate symptoms of depression. The benefits for positive mood found in these experiments highlight the need for future studies to test thought speed as a method for improving the mood of individuals with mild to moderate symptoms of depression. If accelerated thought pace could alleviate mood-related depressive symptoms, this could have implications for treatment and for the consideration of thought speed (in addition to thought content) as a dimension worth investigating within the cognitive model of depression.

The firsthand experience of having an energetic pace of thought may counter at least some depressive symptoms, particularly those involving mood and energy level. Positive effects of thought-speed manipulations have been observed on individuals' mood and energy level in nonclinical populations, and parallels have been drawn to the positive effects of physical exercise (see Pronin and Jacobs 2008). It is possible that, as with exercise, fast thinking induces physiological changes in arousal that could enhance feelings of energy and positive mood. It is also possible that participants in the fast-thinking condition felt good as a result of their success at the rapid reading task (which was more challenging than reading in the neutral-speed condition). Pronin et al. (2008) found that task success was not correlated with the positive mood effects of thought speed in an undergraduate sample, but it is possible that for individuals experiencing the low positive mood and decreased motivation that can go along with depressive symptoms, having successfully participated in a challenging task could be a mood booster. Another possibility is that the fast speed induction in our experiments distracted participants from potentially ruminative thinking, by presenting them with a rapid flow of varying ideas. Rumination is a cognitive style characterized by self-focused brooding and reflection on one's own thoughts and emotions, and it can perpetuate dysphoric or depressed mood (Nolen-Hoeksema and Morrow 1993). Distraction can ameliorate sad mood and break the cycle of ruminative thinking (see Nolen-Hoeksema et al. 2008, for review). One possible strike against the distraction hypothesis is that Pronin and Wegner (2006) found positive mood effects of fast thinking even when that fast thinking was manipulated via a rapid stream of depressing thought content. Future studies are needed to examine these different mechanisms

and to establish whether the observed effects primarily involve distraction or thought speed per se.

For participants with severe depressive symptoms, our manipulation of thought speed was ineffective. People experiencing such symptomatology may have decreased motivation and interest, which may have manifested as less engagement with the questionnaires and manipulations in the experiments. The specific characteristics of this subset of individuals may explain why they would not respond favorably to thought-speed manipulation. Nonetheless, it may be worthwhile in future research to explore alternative manipulations of thought pace (i.e., apart from paced reading) that may have more positive effects in this group.

Future Directions

These experiments found that rapid thinking boosted positive mood in participants with mild to moderate depressive symptoms based on the Beck Depression Inventory. BDI-II scores can predict individuals' clinical depression status, but we cannot know who in our sample would meet the diagnostic criteria for current major depressive disorder. Future research should be conducted in a clinical setting using clinical interviews and a more exhaustive battery of diagnostic tests in order to directly assess the relevance of these findings to individuals who are currently depressed. Such research could speak more directly to the question of whether fast thinking inductions might be a useful component of treatment for participants who are clinically diagnosed with depression.

In the present studies, the thought speed manipulations were the same across all participants. That is, the neutral thought-speed video presented sentences at a predetermined pace for all participants in the neutral condition, as did the fast video for participants in the fast condition. Therefore these inductions do not account for variations in participants' baseline reading speed. While we are confident that the fast video did evoke a rapid pace of thinking based on pretested speed ratings and ratings of perceived thought speed in both studies, personalized speed induction could be employed in future studies in order to provide a more "tailored" approach.

Future research should examine the long-term effects of inducing fast thinking. While the present experiments examined acute effects of a brief manipulation, a viable treatment option for depression would need to carry long-term affective and behavioral effects. It is unlikely that one single incidence of exposure to a fast-speed induction lasting less than 3 min would carry effects over days or weeks, but repeated exposure to speed inductions could potentially boost mood over a longer period of time.

More prolonged and more tailored regimens for inducing thought acceleration may yield more powerful effects. Although the effects of our manipulations were statistically significant for participants with mild to moderate depressive symptoms, they were not large. This might be expected given the nature of our experiments. Our manipulation was brief, untailored, and administered over the Internet. Participants all complied with the reading manipulation instructions, but their environment while participating in the experiment was less controlled than in a standard therapeutic setting. Participants also were required to be English speakers, and to have the technological savvy necessary for participating in an online experiment, both characteristics that limit the generalizability of our findings.

The present findings focus on the benefits of a thought acceleration manipulation for positive mood. We also examined effects on depressive symptomatology and self-esteem, but found no significant results. Past research with nonclinical samples has shown a variety of responses to thought acceleration, apart from positive mood (see Pronin 2013). The problems associated with depression go beyond the absence of positive mood and pleasurable feelings, and as such future experiments should explore other potential benefits of manipulations that accelerate thought pace. Perhaps not coincidentally, the varied responses that have been shown to issue from thought acceleration manipulations (e.g., heightened self-esteem, energy, positive mood, risk-taking) are generally lacking among individuals experiencing depression (and excessively present during mania).

Implications for Treatment

The present experiments suggest the need for future experiments with depressed participants that could test the utility of incorporating thought-speed manipulations into cognitive therapy for depression. That therapy has targeted the content of depressed people's cognitions. This research suggests the need for studies to examine whether it might benefit from also targeting the pace of their cognitions.

Real-world efforts to improve individuals' mood via thought-speed manipulations could build on experimental methods with a number of possible improvements. These might include the use of repeated thought-speed inductions rather than single-shot interventions. Also, the effects of a thought acceleration manipulation that moves seamlessly from neutral to very fast could provide an "easing-in" quality to any therapeutic use of fast thinking manipulations. An iterative thought-induction process could also benefit severely depressed participants who may require a lower speed induction rate to achieve the same levels of perceived thought speed as less depressed individuals. In another potential clinical direction, thought-speed inductions could aim to improve mood not only with their speed

but also with the content that is used in the induction, for example by having participants read increasingly positive self-statements (e.g., Velten 1968).

If shown to be effective, inducing rapid thinking could be a low-cost, low-effort, and low-risk treatment approach that could be easily combined with other existing forms of cognitive therapy. Not only would this expand the accessibility and range of the arsenal of treatments available to individuals with depression, it would contribute to the growing knowledge of how depressive cognitions are experienced, formed, and altered.

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