

Current Directions in Psychological Science

<http://cdp.sagepub.com/>

When the Mind Races: Effects of Thought Speed on Feeling and Action

Emily Pronin

Current Directions in Psychological Science 2013 22: 283

DOI: 10.1177/0963721413482324

The online version of this article can be found at:

<http://cdp.sagepub.com/content/22/4/283>

Published by:



<http://www.sagepublications.com>

On behalf of:



[Association for Psychological Science](http://www.sagepublications.com)

Additional services and information for *Current Directions in Psychological Science* can be found at:

Email Alerts: <http://cdp.sagepub.com/cgi/alerts>

Subscriptions: <http://cdp.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>


Permissions: <http://www.sagepub.com/journalsPermissions.nav>

>> [Version of Record](#) - Aug 5, 2013

[What is This?](#)

When the Mind Races: Effects of Thought Speed on Feeling and Action

Emily Pronin
Princeton University

Current Directions in Psychological
Science
22(4) 283–288
© The Author(s) 2013
Reprints and permissions:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/0963721413482324
cdps.sagepub.com


Abstract

Thought speed can be altered via controlled exposure to stimuli such as temporally paced text. Experiments show that thinking quickly induces positive mood and that the effect cannot be attributed to alterations of thought content or fluency. The effect is obtained across varied manipulations, including ones that alter the pace of thought involved in reading, problem solving, and visual comprehension. The experience of thinking fast signals a basic imperative for action and triggers a set of responses that mobilize the individual to act. These responses include not only heightened positive affect but also changes in behavior (i.e., increased risk taking), self-perception (i.e., increased self-confidence), and problem solving (i.e., increased creative insight). Implications of these thought-speed effects are discussed with respect to both everyday experiences that induce fast thinking and clinical psychiatric conditions (e.g., depression and mania) that are characterized by thought-speed abnormalities.

Keywords

thought speed, mania, cognitive processing, mood, risk taking

What factors enhance positive psychological outcomes—what makes people feel good, self-confident, or open to taking risks? Some might argue that these outcomes primarily stem from external things, such as wealth or social status. Others might argue that positive outcomes have more to do with one's state of mind—for example, whether one's thoughts are optimistic rather than pessimistic. Undoubtedly, the content of people's thoughts is massively important in guiding human experience.

Another component of thought, however, also shapes human experience and contributes to psychological outcomes. It involves not what people think about, but the speed with which they think it. In this article, I discuss the idea that the pace of thought is a basic driver of psychological outcomes including those involving affect, behavior (e.g., risk taking), and self-perception (e.g., self-esteem).

Thought Speed and Mood

Running, skiing, and driving over the speed limit can be exciting, elating, and energizing. Up-tempo music and fast-paced action movies can have similar effects. Although these experiences are varied, they have in common that each one requires a person's thinking to shift to

a rapid pace so that rapidly changing external stimuli can be processed. However, exposure to fast-paced external stimuli is not required to observe the good feelings associated with speed, provided that the mind itself is thinking at a rapid pace. For example, ingestion of stimulant drugs speeds up the pace of thought and induces euphoria (Asghar, Tanay, Baker, Greenshaw, & Silverstone, 2003; Völlm et al., 2004). The clinical psychiatric condition of mania also is characterized by both racing thoughts and euphoria (e.g., American Psychiatric Association, 2000; Goodwin & Jamison, 1990). In the neurological disease Tourette's syndrome, people experience rapid thinking that manifests itself via rapid outbursts that—despite their often embarrassing content—leave the patient feeling gleeful (Lees, 1985; Sacks, 1989, 1990). In an even more extreme case, Noyes and Kletti (1976, 1977) studied mountain climbers who narrowly escaped death in free-fall accidents. They found that while falling, the climbers experienced a rush of thoughts and a sense of euphoria

Corresponding Author:

Emily Pronin, Department of Psychology, Green Hall, Princeton University, Princeton, NJ 08544
E-mail: epronin@princeton.edu

that might be described as odd (given that the climbers believed that they were about to die).

Experimental evidence

Recent experiments have gone beyond these observations to identify a causal path from thought speed to mood. In an initial study, Pronin and Wegner (2006) induced participants to think quickly or slowly by having them read text presented on a computer monitor at approximately double or half their normal reading speed, respectively. The text was taken from the Velten (1968) mood-induction procedure, which involves reading a series of statements that become either increasingly elating or increasingly depressing. The result was that participants showed independent effects of thought speed and thought content on mood: Elating content induced more positive mood than depressing content, and reading quickly induced more positive mood than reading slowly (Fig. 1). It is noteworthy that the effect of the thought-speed manipulation was at least as strong as the effect of the thought-content manipulation. In addition, subsequent analyses of mood changes from baseline revealed that participants experienced a significant increase in positive affect after the fast-speed induction, and a significant decrease after the slow-speed induction (Pronin & Jacobs, 2008).

Varied experiments involving thought speed reveal that its effects do not depend on any particular manipulation. Reading is not required. For example, participants who are verbally induced to generate solutions to a problem at a rapid pace (a manipulation based on the tenets of brainstorming) experience increased positive mood relative to those induced to generate solutions more slowly (Pronin, Jacobs, & Wegner, 2008). Indeed, the pleasure that typically accompanies the experience of a

brainstorming session is mediated by the speed of idea generation in that session (Nijstad & Stroebe, 2006). This suggests that people like brainstorming because of the rush of mind it induces rather than because of its effects on esprit de corps or idea quality (indeed, ideas generated in brainstorming often are worse than those generated in other ways; Diehl & Stroebe, 1987). Thought-speed effects also are not reliant on any particular thought content. Effects have been demonstrated with content that is sad, elating, humorous, neutral, self-relevant, complex, and dull. For example, although the joy of thinking through a challenging problem is well-documented (e.g., Nakamura & Csikszentmihalyi, 2002), research on thought speed has found that positive mood is also induced by such unchallenging but fast thinking as generating a handful of words that start with a particular letter or that rhyme with a particular word. People rate such thinking as dull, but nonetheless respond with positive mood, and that mood is mediated by their self-reported fast thinking (Pronin et al., 2008). Finally, speed manipulations need not involve linguistic stimuli. For example, watching a muted television clip in fast-forward has been found to elicit more positive affect than watching a similar clip at its normal pace (Pronin et al., 2008).

Cognitive processing speed

In the past couple of decades, rapid cognitive processing has been the subject of much research. Rapid cognitive processing involves “low-level” fast thinking, and its effects have generally been studied in terms of consequences for the stimulus being processed (e.g., liking of the stimulus). Some studies suggest mood effects, although the evidence is correlational. When perceptual stimuli are presented at rates that necessitate fast processing, people not only like those stimuli (such as human

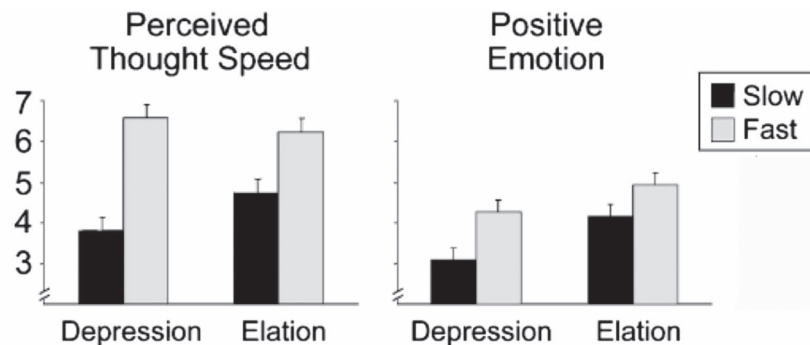


Fig. 1. Mean ratings (on a nine-point scale) as a function of experimental condition (depressed vs. elated statements, slow vs. fast thinking), and perceived thought speed. Error bars indicate +1 SE. From “Manic thinking: Independent effects of thought speed and thought content on mood,” by E. Pronin & D. M. Wegner, 2006, *Psychological Science*, 17, p. 810. Copyright 2006 by the authors. Reprinted with permission.

faces) more but also a “warm glow” of positive affect results (e.g., Winkielman, Schwarz, Fazendeiro, & Reber, 2003). In addition, as people’s processing speed increases during the course of working on a task, their positive mood increases (Robinson, Meier, Tamir, Wilkowski, & Ode, 2009). Stanley and Isaacowitz (2011) found that the faster people’s processing speed, the more positive their emotional trajectories while watching emotional stimuli.

Because much of the work on processing speed has focused on fluency (or ease of processing) as an explanation for its effects (e.g., Whittlesea, Jacoby, & Girard, 1990; Winkielman et al., 2003), it is important to note that thought-speed effects cannot be explained in terms of fluency. Although the two are often confounded—stimuli that are more easily processed are thereby processed more quickly—cases of unconfounding reveal that fast thinking induces positive mood even when that thinking is more difficult than slow thinking. For example, fast reading is more difficult (and subjectively feels more difficult) than slow reading, but it induces more positive mood. Moreover, when stimuli are made fluent through repeated exposures, liking for them increases only to the extent that the repeated presentations are fast (often in the millisecond range—so fast that perception of them is subliminal). When repeated exposures are slow, liking does not ensue—boredom does (e.g., Bornstein, 1989; Zajonc, 2001)—which suggests the possibility that rapid thinking may play a key role in eliciting fluency effects.

The Basis of the Effect: Preparing for Urgent Action

Why does fast thinking induce positive mood? I suggest that the answer involves the conditions that naturally elicit rapid thinking. Thoughts are fastest when the mind must process rapidly changing stimuli or when it must rapidly generate novel cognitions. These mental requirements resemble the ones present in an emergency. Thus, the occurrence of fast thinking may signal to mind and body the need to mobilize for urgent action. In theory, such mobilization should involve a state of excitement and other action-oriented positive emotions. It also should involve increased energy, self-confidence, willingness to take risks, and capacity for solving novel problems. These responses should be triggered by circumstances that are far more tame than a true emergency so long as they are sufficient to make the mind race (for example, seeing rapidly presented text scrolling forward on the television news). The notion is related to that of a “fight-or-flight” response, which can be induced by a basic survival threat (e.g., a bear about to attack) or by a more mundane stimulus that produces the same fear state (e.g., a horror movie). Indeed, fast thinking resembles fear in its capacity to induce a set of complex responses that are rooted in a

biological imperative but that can be triggered by a broad set of social stimuli. The idea that this mobilization response would arise from fast thinking is supported by a rudimentary neuroscientific analysis. In particular, situations involving rapid thinking are characterized by the mind’s exposure to a plethora of novel stimuli to process; novel stimuli elicit firing of dopamine neurons and an increase in dopamine levels (Rebec, Christensen, Guerra, & Bardo, 1997); and, finally, increased dopamine activity induces psychological responses including a reward feeling, approach focus, increased behavioral activity, and—interestingly—an accelerated internal clock (Buhusi & Meck, 2005; Kandel, Schwartz, & Jessell, 2000). This theoretical approach also speaks to the time course of thought-speed effects. By inducing an emergency-like response, it is likely that fast thinking will produce effects that are more short-lived than sustained. However, the existing literature has not examined the time course of speed effects or whether repeated exposure to circumstances that accelerate thought speed induces a more sustained response pattern.

The Psychological Profile of Thought Speed

Risk taking

Thinking fast induces risk taking. When people are faced with limited time to make a decision, they tend to choose the riskier course of action (Cella, Dymond, Cooper, & Turnbull, 2007; DeDonno & Demaree, 2008). This phenomenon could reflect time pressure inducing faster thinking (Ariely & Zakay, 2001). Chandler and Pronin (2012) directly examined the possibility that thinking fast induces taking risks. Participants read trivia statements at an experimentally controlled pace. They then completed a behavioral risk-taking measure that involved inflating virtual balloons on their computer screen (Lejuez et al., 2002). With each pump of air, 5¢ went in a bank. Participants could stop pumping at any time and keep the money they earned, but if they pumped too many times, the balloon burst and they lost all the money. Participants who were induced to think quickly rather than slowly pumped up the balloons more (and burst them more), indicating that they were taking more risks (Fig. 2).

In a second experiment, thought speed was manipulated via three versions of a video that varied in pace. The videos shared the same neutral content (e.g., scenes of waterfalls, urban landscapes) but differed in average shot length. The result was that as the pace of the film increased, the participants reported greater intentions to engage in risky behaviors such as unprotected sex and illegal drug use. Given that average shot length in

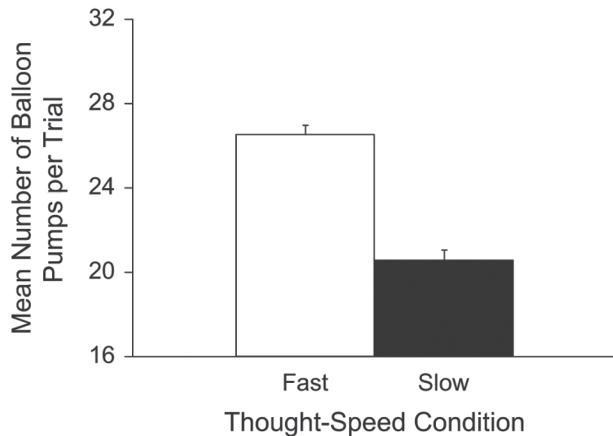


Fig. 2. Mean number of balloon pumps as a function of experimental condition (fast vs. slow thinking). The average balloon was pre-programmed to burst at 32 pumps. Error bars indicate +1 *SE*. From “Fast thought speed induces risk taking,” by J. J. Chandler & E. Pronin, 2012, *Psychological Science*, 23, p. 372. Copyright 2012 by the authors. Reprinted with permission.

commercial films has been decreasing over time (Bordwell, 2002; Cutting, DeLong, & Brunick, 2011), those who lament the “racy” content of modern movies (“too much sex, drugs, and violence”) may now have another type of raciness to fear.

Self-Esteem

Rapid thinking boosts self-esteem and its clinical variant, grandiosity (Pronin et al., 2008; Pronin & Wegner, 2006). In one experiment, participants were induced to experience a rush of ideas for how to solve a problem—a rush induced by their being permitted to steal the ideas of others whom they had overheard. Afterward, the participants reported not only faster thinking and more positive mood than those in a control condition but also greater self-esteem—an ironic finding given that they had stolen their ideas, whereas those in the control condition had generated their own (Pronin et al., 2008). In a variant of this experiment, participants read solutions to this same problem that were presented on a computer monitor; those induced to read rapidly rather than slowly reported higher self-esteem (Pronin et al., 2008). This heightened response is useful for urgent action, when there is no time for second-guessing or lack of self-assurance.

Energy

The positive mood effects of thought speed resemble an elated and excited style of positive mood, a mild version of euphoria rather than a more serene sort of contentment (Pronin & Jacobs, 2008). Consistent with

that response, manipulations of thought speed enhance feelings of energy. People consistently report feeling more energetic (Pronin et al., 2008; Pronin & Wegner, 2006), and those induced to think quickly literally speak at a more energetic pace (one that is more rapid and difficult to interrupt; Pronin et al., 2008). In addition, drugs that elevate thought speed produce enhanced feelings of energy (e.g., Lieberman, 2000), although such a link is correlational. Future research is needed to examine whether fast thought speed elevates biophysical signs of arousal or energy (e.g., increased catecholamines indicative of an adrenaline rush, elevated heart rate, or increased metabolic work).

Creativity

When thoughts race, the onslaught of ideas can make one feel creatively inspired. Drawing on historical evidence, scholars have suggested a link between creativity and mania, possibly stemming from the rush of ideas that people experience during mania (Andreasen, 1987; Goodwin & Jamison, 1990; compare Weisberg, 1994). Positive mood has been associated with creativity and “loose thinking,” suggesting links between thought speed, mood, and creativity (Isen, Daubman, & Nowicki, 1987).

In a number of experiments, we have found that people report feeling more creative after being induced to think quickly (Pronin et al., 2008; Pronin & Wegner, 2006). Kaite Yang and I have recently begun to examine whether those feelings reflect a tendency for fast thinking to promote actual creativity. Across multiple experiments, we have found that participants who are induced to read neutral statements at a fast pace (compared with a normal pace) perform significantly better on tasks measuring insight creativity, including verbal insight problems and remote-associates problems (e.g., problem: *cracker; fly; fighter*; solution: *fire*). For example, in one experiment, those in the normal-speed condition solved an average of 6.60 of 10 remote-associates problems, whereas those in the fast speed condition solved an average of 7.55 problems, $t(87) = 2.18$, $p = .03$ (Yang & Pronin, 2013). This finding suggests that fast thinking fosters the sorts of “aha moments” associated with creative insight. It is noteworthy that this is the sort of creativity that is most useful in emergency situations.

Mania, Depression, and Anxiety

The psychiatric condition of mania is associated with all of the responses that are triggered by experimentally induced fast thinking, including inflated self-esteem, positive emotion, and elevated risk taking (American Psychiatric Association, 2000; Goodwin & Jamison, 1990). It may not be coincidental that the manic state looks like

one of preparation for urgent action. Mania proneness and a number of the responses associated with mania are thought to involve increased output of the behavioral activation system (Johnson, Edge, Holmes, & Carver, 2012). Although highly speculative, the idea that rapid thinking may even play a role in mania onset is worthy of investigation, because rapid thinking is a common prodrome (precursor) to manic episodes (Keitner et al., 1996; Lam and Wong, 2005).

Depression is associated with low levels of positive mood, energy, and self-esteem, and also with slow thinking (e.g., American Psychiatric Association, 2000). In general, slow thinking may signal that little action is required and that low levels of excitement, energy, and self-esteem are fine. That experience could produce calm serenity or contentment. But when external circumstances produce significant demands, the constellation of responses associated with slow thinking may hamper action and escalate the trademark depressive symptoms of helplessness and dysphoria. Anxiety also involves changes in thought speed. Here, thinking is fast—theoretically signaling an urgent situation—but thoughts are repetitive. In a situation that feels like an emergency, thoughts that stagnate are likely to be a source of anxiety, thus feeding into a loop that may make the anxious experience difficult to overcome. Research on repetitive thinking suggests that the experience of such thought stagnation saps positive emotion (Mason & Bar, 2012), particularly when those thoughts are not positive (Feldman, Joormann, & Johnson, 2008), and may contribute to anxiety (Segerstrom, Tsao, Alden, & Craske, 2000). An important direction for future research concerns possible interaction effects between thought speed and other aspects of thought process, such as repetition.

Implications and Applications

Accelerations in the pace of thought elevate mood, self-confidence, energy, risk-taking, and creativity. The implications of this knowledge are broad. From a clinical perspective, it may be possible to treat depression by accelerating the pace of thought or to alleviate manic symptoms by decelerating that pace. From the perspective of everyday life in the modern world, we should be mindful that our daily activities expose us to a barrage of thought-speed manipulations. The seemingly increasing rapidity of everyday life, whether that involves the faster pace of communication via social media, the shorter shot length in films, or the greater swiftness of financial transactions, is the subject of much theory and speculation. People worry that it may make us distracted and our children hyperactive. Although it may be required in emergencies, fast thinking may lead to a host of biases that compromise rational judgment (Kahneman, 2011). A

culture of slow, quiet contemplation has much to recommend it—but one that seeks to balance that slowness with speed is probably even better.

Recommended Reading

- Kahneman, D. (2011). (See References). A book for lay audiences concerning the importance for judgment of fast versus slow cognitive processing.
- Pronin, E., & Jacobs, E. (2008). (See References). A comprehensive review and theoretical framework concerning thought speed and its psychological effects.
- Pronin, E., & Wegner, D. M. (2006). (See References). Initial experiment testing effect of speed on mood, with description of reading-based speed induction.

Declaration of Conflicting Interests

The author declared no conflicts of interest with respect to the authorship or the publication of this article.

References

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.
- Andreasen, N. C. (1987). Creativity and mental illness: Prevalence rates in writers and their first-degree relatives. *American Journal of Psychiatry*, *144*, 1288–1292.
- Ariely, D., & Zakay, D. (2001). A timely account of the role of duration in decision making. *Acta Psychologica*, *108*, 187–207.
- Asghar, S. J., Tanay, V. A. M. I., Baker, G. B., Greenshaw, A., & Silverstone, P. H. (2003). Relationship of plasma amphetamine levels to physiological, subjective, cognitive, and biochemical measures in healthy volunteers. *Human Psychopharmacology*, *18*, 291–299.
- Bordwell, D. (2002). Intensified continuity. *Film Quarterly*, *55*, 16–28.
- Bornstein, R. F. (1989). Exposure and affect: Overview and metaanalysis of research, 1968–1987. *Psychological Bulletin*, *106*, 265–289.
- Buhusi, C. V., & Meck, W. H. (2005). What makes us tick? Functional and neural mechanisms of interval timing. *Nature Reviews Neuroscience*, *6*, 755–765.
- Cella, M., Dymond, S., Cooper, A., & Turnbull, O. (2007). Effects of decision-phase time constraints on emotion-based learning in the Iowa Gambling Task. *Brain and Cognition*, *64*, 164–169.
- Chandler, J. J., & Pronin, E. (2012). Fast thought speed induces risk taking. *Psychological Science*, *23*, 370–374.
- Cutting, J. E., DeLong, J. E., & Brunick, K. L. (2011). Visual activity in Hollywood film: 1935 to 2005 and beyond. *Psychology of Aesthetics, Creativity, and the Arts*, *5*, 115–125.
- DeDonno, M. A., & Demaree, H. A. (2008). Perceived time pressure and the Iowa Gambling Task. *Judgment and Decision Making*, *3*, 636–640.
- Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Toward the solution of a riddle. *Journal of Personality and Social Psychology*, *53*, 497–509.

- Feldman, G. C., Joormann, J., & Johnson, S. L. (2008). Responses to positive affect: A self-report measure of rumination and dampening. *Cognitive Therapy and Research, 32*, 507–525.
- Goodwin, F. K., & Jamison, K. R. (1990). *Manic-depressive illness*. New York, NY: Oxford University Press.
- Isen, A. M., Daubman, K. A., & Nowicki, G. P. (1987). Positive affect facilitates creative problem solving. *Journal of Personality and Social Psychology, 52*, 1122–1131.
- Johnson, S. L., Edge, M. D., Holmes, M. K., & Carver, C. S. (2012). The Behavioral Activation System and mania. *Annual Review of Clinical Psychology, 8*, 243–267.
- Kahneman, D. (2011). *Thinking, fast and slow*. New York, NY: Farrar, Straus and Giroux.
- Kandel, E. R., Schwartz, J. H., & Jessell, T. M. (2000). *Principles of neural science* (4th ed.). New York, NY: McGraw-Hill.
- Keitner, G. I., Solomon, D. A., Ryan, C. E., Miller, I. W., Mallinger, A., & Kupfer, D. J. (1996). Prodromal and residual symptoms in bipolar I disorder. *Comprehensive Psychiatry, 37*, 362–367.
- Lam, D., & Wong, G. (2005). Prodromes, coping strategies, and psychological interventions in bipolar disorder. *Clinical Psychology Review, 25*, 1028–1042.
- Lees, A. J. (1985). *Tics and related disorders*. New York, NY: Churchill Livingstone.
- Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., . . . Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: The Balloon Analogue Risk Task (BART). *Journal of Experimental Psychology: Applied, 8*, 75–84.
- Lieberman, H. R. (2000). The effects of ginseng, ephedrine, and caffeine on cognitive performance, mood, and energy. *Nutrition Reviews, 59*, 91–102.
- Mason, M. F., & Bar, M. (2012). The effect of mental progression on mood. *Journal of Experimental Psychology: General, 141*, 217–221.
- Nakamura, J., & Csikszentmihalyi, M. (2002). The concept of flow. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 89–105). New York, NY: Oxford University Press.
- Nijstad, B. A., & Stroebe, W. (2006). How the group affects the mind: A cognitive model of idea generation in groups. *Personality and Social Psychology Review, 10*, 186–213.
- Noyes, R., & Kletti, R. (1976). Depersonalization in the face of life-threatening danger: A description. *Psychiatry, 39*, 19–27.
- Noyes, R., & Kletti, R. (1977). Depersonalization in response to life threatening danger. *Comprehensive Psychology, 18*, 375–384.
- Pronin, E., & Jacobs, E. (2008). Thought speed, mood, and the experience of mental motion. *Perspectives on Psychological Science, 3*, 461–485.
- Pronin, E., Jacobs, E., & Wegner, D. M. (2008). Psychological effects of thought acceleration. *Emotion, 8*, 597–612.
- Pronin, E., & Wegner, D. M. (2006). Manic thinking: Independent effects of thought speed and thought content on mood. *Psychological Science, 17*, 807–813.
- Rebec, G. V., Christensen, J. R., Guerra, C., & Bardo, M. T. (1997). Regional and temporal differences in real-time dopamine efflux in the nucleus accumbens during free-choice novelty. *Brain Research, 776*, 61–67.
- Robinson, M. D., Meier, B. P., Tamir, M., Wilkowski, B. M., & Ode, S. (2009). Behavioral facilitation: A cognitive model of individual differences in approach motivation. *Emotion, 9*, 70–82.
- Sacks, O. W. (1989). Neuropsychiatry and Tourette's. In J. Mueller (Ed.), *Neurology and psychiatry: A meeting of minds* (pp. 156–174). New York, NY: Karger.
- Sacks, O. W. (1990). *The man who mistook his wife for a bat*. New York, NY: Summit Books.
- Segerstrom, S. C., Tsao, J. C. I., Alden, L. E., & Craske, M. G. (2000). Worry and rumination: Repetitive thought as a concomitant and predictor of negative mood. *Cognitive Therapy and Research, 24*, 671–688.
- Stanley, J. T., & Isaacowitz, D. M. (2011). Age-related differences in profiles of mood-change trajectories. *Developmental Psychology, 47*, 318–330.
- Velten, E. C., Jr. (1968). A laboratory task for induction of mood states. *Behaviour Research and Therapy, 6*, 473–482.
- Völlm, B. A., de Araujo, I. E., Cowen, P. J., Rolls, E. T., Kringelbach, M. L., Smith, K. A., . . . Matthews, P. M. (2004). Methamphetamine activates reward circuitry in drug naïve human subjects. *Neuropsychopharmacology, 29*, 1715–1722.
- Weisberg, R. W. (1994). Genius and madness? A quasi-experimental test of the hypothesis that manic-depression increases creativity. *Psychological Science, 5*, 361–367.
- Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29*, 716–732.
- Winkielman, P., Schwarz, N., Fazendeiro, T., & Reber, R. (2003). The hedonic marking of processing fluency: Implications for evaluative judgment. In J. Musch & K. C. Klauer (Eds.), *The psychology of evaluation. Affective processes in cognition and emotion* (pp. 189–217). Mahwah, NJ: Erlbaum.
- Yang, K., & Pronin, E. (2013). *The causal impact of thought speed on subsequent creativity*. Manuscript in preparation.
- Zajonc, R. B. (2001). Mere exposure: A gateway to the subliminal. *Current Directions in Psychological Science, 10*, 224–228.