


# Everyday Consequences of Analytic Thinking

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## Abstract

We review recent evidence revealing that the mere willingness to engage analytic reasoning as a means to override intuitive gut feelings is a meaningful predictor of key psychological outcomes in diverse areas of everyday life. For example, those with a more analytic thinking style are more skeptical about religious, paranormal, and conspiratorial concepts. In addition, analytic thinking relates to having less traditional moral values, making less emotional or disgust-based moral judgments, and being less cooperative and more rationally self-interested in social dilemmas. Analytic thinkers are even less likely to offload thinking to smartphone technology and may be more creative. Taken together, these results indicate that the propensity to think analytically has major consequences for individual psychology.

## Keywords

analytic thinking, reasoning, cognitive style, religion, morality

Thought constitutes the greatness of man.  
—Blaise Pascal, *Thoughts*

A great many people think they are thinking when  
they are merely rearranging their prejudices.  
—attributed to William James  
(Greene & Haidt, 2002, p. 517)

Is the faculty to reason consequential? This may seem a strange question to ask. Thinking analytically—that is, reasoning about and potentially overriding our intuitions, gut feelings, and instincts—is often considered *the* defining characteristic of the human species and perhaps our only hope for a better, more rational future (see Stanovich, 2004). Reason has long been one of the most cherished human characteristics, including among preeminent philosophers such as Socrates, Descartes, and Pascal.

As is often the case, modern psychological research has emerged as a wet blanket on the bed of idealistic folk psychology. Decades of psychological research have shown humans to be miserly cognitive processors and, as a consequence, irrational decision makers (Evans, 2008; Kahneman, 2011; Stanovich, 2004). Moreover, as exemplified by James's quote above, when people do engage in effortful reasoning, it often comes in the form of justifying or rationalizing prior beliefs, intuitions, or actions (Kunda, 1990). Indeed,

reasoning may have evolved to facilitate interpersonal argumentation and not, as commonly assumed, to determine our beliefs and behaviors (Mercier & Sperber, 2011). Finally, there are many cases in which heuristics (i.e., mental shortcuts) produce better and far more efficient outcomes than analytic thinking (Gigerenzer, 2007).

Research like this has led to an “intuitionist” backlash (e.g., Gigerenzer, 2007; Haidt, 2012) against earlier “reflectionist” perspectives (e.g., Kohlberg, 1969) in psychological science (see Haidt, 2012). According to such a perspective, intuition, not reason, is the key to understanding beliefs and behaviors. Nonetheless, some contemporary psychologists continue to emphasize the importance of reflective reasoning (e.g., Baumeister, Masicampo, & Vohs, 2011; Evans, 2008; Kahneman, 2011; Newell, 2015; Stanovich, 2004).

Recent empirical findings allow us to speak more directly to the debate between intuitionists and reflectionists. Here we will show that analytic thinking is, in fact, highly consequential for human psychology. Individual

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differences in reflectiveness predict a wide range of meaningful beliefs and behaviors; moreover, some experiments have shown that subtle manipulations intended to put participants in a more analytical thinking mode affect particular beliefs and behaviors. We argue on this basis that reflection, however flawed, is an important component of our everyday lives.

## Theoretical Background

Dual-process theories hold that the mind is capable of two fundamentally different types of processes (Evans & Stanovich, 2013): Type 1 processes, which are autonomous and do not require working memory, and Type 2 processes, which are deliberative and require working memory. Type 1 processes are typically considered fast, high capacity, and able to operate in parallel, whereas Type 2 processes are slower, analytical, resource demanding, and able to operate only serially (Evans & Stanovich, 2013). An intuition is the output of a Type 1 process that can be either overridden or rationalized via Type 2 processing. One of the key insights from dual-process theories is that human intelligence is partially discretionary. Given that the application of cognitive abilities (e.g., numeracy, verbal intelligence) often requires the instantiation of Type 2 processing, the mere willingness or propensity to think analytically is a key factor in rational thinking (Stanovich, 2004). Naturally, however, these two factors are positively correlated, which means that it is necessary to measure both cognitive ability and style to make a strong claim about the influence of one or the other on some independent variable. An additional tactic used by those interested in the influence of analytic thinking is to induce an intuitive or analytic thinking mode and see if it has an effect on the variable of interest. Presumably, factors associated with cognitive ability (e.g., numeracy, working memory capacity) cannot be influenced directly by simple manipulations of thinking mode.

Consider the bat-and-ball problem from the now-famous Cognitive Reflection Test (CRT; Frederick, 2005; see Table 1). The typical intuition upon first reading the bat-and-ball problem is that the ball costs 10 cents. This intuition is, of course, incorrect. Arriving at the correct answer—5 cents—requires participants to question or reflect on their intuitive response by engaging analytic thinking. It also requires the cognitive ability to perform the necessary computation to obtain the correct response (which, in the case of the bat-and-ball problem, is rather rudimentary).

The fact that the problems in Table 1 have an intuitive (but incorrect) lure means that the willingness to engage analytic (Type 2) thinking is a key determinant of success—a conclusion currently supported by the weight

of empirical evidence (e.g., Campitelli & Gerrans, 2014; Toplak, West, & Stanovich, 2011). Accuracy on the CRT, for example, correlates positively with performance on a variety of decision-making and reasoning tasks (e.g., Frederick, 2005; Toplak et al., 2011). Until recently, however, it was unclear whether the propensity for analytic thinking also relates to cognitive and behavioral measures from other domains of psychology that are typically considered intrinsically important for humans. This question is directly related to the debate over the relative influence of intuition and reflection in cognition.

## Consequences of Analytic Thinking for Belief Systems and Worldviews

Are beliefs and worldviews at least partially determined by reflective reasoning, or do social and cultural factors entirely overwhelm their impact? Recent research has indicated that differences in analytic thinking (both at an individual-difference level and as induced by an experimental manipulation) are consequential for beliefs considered core to the human experience.

### *Religious belief*

Religious belief serves as a good litmus test for whether analytic thinking is consequential. Religious beliefs are often considered to be particularly intuitive, based on arguments that they are a natural by-product of our cognitive structure (see Shenhav, Rand, & Greene, 2012). In theory, the cognitive mechanisms used to question an intuitive (often belief-based) response in a psychology experiment should be similar to the mechanisms used when applying skepticism to one's religious beliefs.

Three independent sets of studies provided strong evidence for a link between analytic thinking and religious disbelief (Gervais & Norenzayan, 2012; Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; Shenhav et al., 2012). All three found a negative correlation between performance on the CRT and various religiosity measures, with correlations ranging from  $-.18$  to  $-.33$ . This association has also been extended to conceptually similar types of problems, including base-rate problems and syllogisms (Table 1). Base-rate problems involve a conflict between intuitive stereotypes and a base-rate probability. Less religious individuals are more likely to respond according to the base rate in lieu of the stereotype (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014a, 2014b; Pennycook et al., 2012). Similarly, syllogisms may elicit belief bias—that is, reasoning based on the believability of an argument's conclusion instead of its logical structure. This tendency is more common among religious believers (Pennycook, Cheyne, Koehler, & Fugelsang, 2013). A number of these studies included

**Table 1.** Example Problems from Measures of Analytic Thinking Style

| Problem name and relevant studies                                       | Example item(s)  | Correct and incorrect/intuitive answers  |
|---|--|--|
| Base-rate neglect (Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012) | “In a study, 1,000 people were tested. Among the participants, there were 5 engineers and 995 lawyers. Jack is a randomly chosen participant of this study. Jack is 36 years old. He is not married and is somewhat introverted. He likes to spend his free time reading science fiction and writing computer programs. What is most likely?—(a) Jack is a lawyer; (b) Jack is an engineer.”   | Correct answer: lawyer (better probability). Intuitive answer: engineer (more stereotypical).  |
| Belief-bias syllogism (Pennycook, Cheyne, Koehler, & Fugelsang, 2013)   | “All mammals can walk. Whales are mammals. Therefore, whales can walk. Is this logically valid?”   | Correct answer: “yes” (logically valid). Intuitive answer: “no” (logically invalid).   |
| Cognitive Reflection Test (Frederick, 2005)                             | <p>“A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?”</p> <p>“If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?”</p> <p>“In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?”</p> | <p>Correct answer: 5 cents.<br/>Intuitive answer: 10 cents</p> <p>Correct answer: 5 minutes.<br/>Intuitive answer: 100 minutes.</p> <p>Correct answer: 47 days.<br/>Intuitive answer: 24 days.</p> |

Note: Each problem cues an intuitive (but incorrect) response that requires analytic thinking to override. This is not an exhaustive list.

controls for cognitive ability and various demographic factors (e.g., age, sex, education, conservatism). Furthermore, manipulations designed to promote analytic thinking have been shown to (at least temporarily) decrease religious belief (Gervais & Norenzayan, 2012; Shenhav et al., 2012). This supports the idea that the mere motivation to apply analytic thinking has an effect on religiosity (i.e., over and above the ability to think analytically; see Table 2).

### ***Epistemically suspect beliefs***

Pennycook et al. (2012; Pennycook et al., 2014a) theorized that the supernatural nature of religious beliefs explains their disruption by analytic thinking. As would be expected on this account, skepticism toward a wide range of paranormal beliefs (e.g., ghosts, astrology, extra-sensory perception) is associated with a more analytic thinking disposition after controlling for cognitive ability (Pennycook et al., 2012). This finding is consistent with evidence from self-report measures of thinking disposition (e.g., Svedholm & Lindeman, 2013). Moreover, less analytic individuals who suffer from sleep paralysis (which often invokes complex hallucinations) are more likely to form supernatural explanations for their experience, such as demonic possession or alien abduction (Cheyne & Pennycook, 2013). By contrast, experimental

evidence indicates that more analytic individuals are less likely to attribute supernatural causation to uncanny experiences (Bouvet & Bonnefon, 2015).

Supernatural beliefs may be labelled *epistemically suspect* because they conflict with common materialistic conceptions of the world (Lobato, Mendoza, Sims, & Chin, 2014). Conspiracy theories are another form of epistemically suspect or counterfactual belief. Although conspiracies sometimes do occur (e.g., Watergate), conspiracy theories are typically used to explain some important event by invoking an unlikely and often nefarious plot by multiple individuals (Swami, Voracek, Stieger, Tran, & Furnham, 2014). Recently, Swami et al. (2014) found a negative correlation between conspiracist ideation and self-report measures of analytic thinking disposition and, across three experiments, found that manipulations designed to promote analytic thinking decreased conspiracist ideation.

Many pseudoscientific beliefs are also epistemically suspect (Lobato et al., 2014) and could therefore potentially relate to analytic thinking. Belief in alternative medicine (e.g., homeopathy), a sort of pseudoscience, is positively correlated with self-reported intuitive thinking (Lindeman, 2011) and negatively correlated with CRT performance (Browne, Thomson, Rockloff, & Pennycook, 2015). There is also evidence that CRT performance predicts science understanding for areas that

**Table 2.** Empirical Studies Demonstrating the Everyday Consequences of Analytic Thinking

| Topic   | Study   | Individual-differences measure(s)                                  | Control for cognitive ability | Experimental manipulation |
|---|---|--|-------------------------------|---------------------------|
| Religious belief  | Shenhav, Rand, and Greene (2012)                        | CRT  | X                             | X                         |
|   | Pennycook, Cheyne, Seli, Koehler, and Fugelsang (2012)  | CRT, base-rate problems  | X                             |                           |
|   | Gervais and Norenzayan (2012)                           | CRT  |                               | X                         |
|   | Pennycook, Cheyne, Koehler, and Fugelsang (2013)        | Syllogisms   | X                             |                           |
|   | Pennycook, Cheyne, Barr, Koehler, and Fugelsang (2014a) | CRT, base-rate problems, thinking-disposition questionnaire        | X                             |                           |
|   | Pennycook, Cheyne, Barr, Koehler, and Fugelsang (2014b) | CRT, base-rate problems  | X                             |                           |
| Paranormal belief   | Pennycook et al. (2012)                                 | CRT, base-rate problems  | X                             |                           |
|   | Svedholm and Lindeman (2013)                            | Thinking-disposition questionnaire                                 |                               |                           |
|   | Cheyne and Pennycook (2013)                             | CRT, base-rate problems  | X                             |                           |
|   | Bouvet and Bonnefon (2015)                              | None   |                               | X                         |
| Conspiracist ideation   | Swami, Voracek, Stieger, Tran, and Furnham (2014)       | Thinking-disposition questionnaire                                 |                               | X                         |
| Science-related beliefs (e.g., alternative medicine, evolution) | Lindeman (2011)   | Thinking-disposition questionnaire                                 |                               |                           |
|   | Browne, Thomson, Rockloff, and Pennycook (2015)         | CRT  |                               |                           |
|   | Shtulman and McCallum (2014)                            | CRT  |                               |                           |
|   | Gervais (2015)  | CRT  |                               |                           |
| Moral judgment  | Paxton, Unger, and Greene (2012)                        | CRT  |                               | X                         |
|   | Pennycook, Cheyne, Barr, Koehler, and Fugelsang (2014b) | CRT, base-rate problems  | X                             |                           |
|   | Royzman, Landy, and Goodwin (2014)                      | CRT  |                               |                           |
| Moral values  | Pennycook, Cheyne, Barr, Koehler, and Fugelsang (2014b) | CRT, base-rate problems  | X                             |                           |
|   | Garvey and Ford (2014)                                  | Thinking-disposition questionnaire                                 |                               |                           |
| Prosociality  | Rand, Greene, and Nowak (2012)                          | None   |                               | X                         |
|   | Rand et al. (2014)                                      | None   |                               | X                         |
|   | Corgnet, Espín, and Hernán-González (2015)              | CRT  | X                             |                           |
| Creativity  | Barr, Pennycook, Stolz, and Fugelsang (2015b)           | CRT, base rate problems, thinking disposition questionnaire        | X                             |                           |
| Smartphone use  | Barr, Pennycook, Stolz, and Fugelsang (2015a)           | CRT, base rate problems, heuristics and biases battery, syllogisms |                               |                           |

Note: This is not an exhaustive list. “Heuristics and biases battery” refers to a set of decision-making problems derived from the heuristics and biases tradition (see Kahneman, 2011). It measures susceptibility to common judgmental errors such as the gambler’s fallacy, the sunk-cost fallacy, and the conjunction fallacy. For more information, see Toplak, West, and Stanovich (2011). Barr, Pennycook, Stolz, and Fugelsang (2015a) included measures of cognitive ability but did not test for statistical independence. A re-analysis of their data (for details, see the Supplemental Material, available online) indicates that cognitive style is, in fact, a significant predictor of smartphone use once cognitive ability is taken into account. CRT = Cognitive Reflection Test.

require conceptual change (e.g., astronomy, evolution, thermodynamics; Shtulman & McCallum, 2014). Moreover, belief in divine creation in lieu of biological evolution is associated with lower levels of analytic thinking, even after religious belief and various demographic factors have been taken into account (Gervais, 2015). In contrast, analytic thinking polarizes preexisting opinions about anthropogenic global warming (Kahan et al., 2012), perhaps because it is a very politically charged issue that is highly susceptible to motivated reasoning (i.e., “identity-protective cognition”; Kahan, 2013). Although this early research has suggested that individual differences in analytic thinking style may be consequential for science-related beliefs, these associations have not been shown to be independent of cognitive ability (see Table 2). More systematic investigations of the potentially complex association between analytic thinking and science-related beliefs are necessary.

### Consequences of Analytic Thinking for Morality and Prosociality

The debate between intuitionism and reflectionism is particularly stark in the field of morality (see Pennycook et al., 2014b). Whereas early researchers such as Kohlberg (1969) emphasized the role of advanced reasoning in the development of moral judgment, more recent work has instead emphasized the role of emotion and intuition (e.g., Haidt, 2012). Nonetheless, there is recent evidence that analytic thinking plays a key role in moral judgment, even after cognitive ability is taken into account (e.g., Paxton, Unger, & Greene, 2012; Pennycook et al., 2014b; Royzman, Landy, & Goodwin, 2014). Consider the following scenario:

A man goes to the supermarket once a week and buys a chicken. But before cooking the chicken, he has sexual intercourse with it. He then cooks it and eats it. Is this morally wrong? (Haidt, 2012, pp. 3–4)

The immediate sense of disgust elicited by this scenario leads to an intuitive attribution of moral wrongness despite the fact that nothing is hurt in the scenario (Haidt, 2012); among analytic individuals, this intuition may be reflected on and rejected based on the lack of negative consequences in the scenario (Pennycook et al., 2014b).

#### Moral values

A perhaps more direct investigation of the role of analytic thinking in everyday morality pertains to beliefs about morality or moral values. In an influential set of studies, Graham and colleagues (e.g., Graham et al., 2011)

isolated a set of “moral foundations” that can be broken up into two categories: *individualizing* moral values, which are primarily concerned with care/harm and fairness/reciprocity, and traditional, *binding* moral values, which concern in-group identification/loyalty, authority/respect, and purity/sanctity. There are meaningful individual differences in subscription to these values. For example, conservatives score higher on binding and lower on individualizing moral values compared to liberals.

Moral-foundations theorists typically focus on the cultural factors that cause variation in moral values (e.g., Graham et al., 2011). Recent evidence, however, has also indicated an association between analytic thinking and moral values. Pennycook et al. (2014b) reported a negative correlation between performance on measures of analytic thinking disposition (namely, CRT and base-rate problems) and binding moral values. This association was independent of political ideology, religiosity, other demographic measures, and cognitive ability (albeit marginally in the latter case). Garvey and Ford (2014) reported a similar finding using self-report measures of thinking disposition. However, in contrast to Pennycook et al. (2014b), Garvey and Ford also reported a positive correlation between analytic thinking style and individualizing moral values. These results suggest that analytic thinking not only plays a role in moral judgment but also influences people’s fundamental moral values. This research highlights the dual roles of cognition and culture in the formulation of moral values.

#### Prosociality

Recent research in the field of prosociality has also indicated a major role for analytic thinking. Specifically, selfishness in economic games is decreased by manipulations that limit analytic thinking (e.g., time pressure/delay; Rand, Greene, & Nowak, 2012; Rand et al., 2014), suggesting that humans are intuitively cooperative but can override these intuitions for selfish reasons via analytic processing. This *social-heuristics hypothesis* has been used to explain the general negative effect of analytic thinking on cooperation. According to this hypothesis, people learn cooperation strategies through social interaction, with the most successful strategies becoming intuitive through positive reinforcement (Rand et al., 2014). Analytic thinking is then necessary to adapt and modify these heuristics in atypical social situations. Because cooperation is typically beneficial in everyday life, intuitive thinkers fail to recognize when selfishness pays.

Investigations of analytic thinking and prosociality at the trait level have further qualified this basic account. Corgnet, Espín, and Hernán-González (2015) found that analytic thinking disposition (i.e., CRT performance after



controlling for cognitive ability) can support cooperative strategies in economic games if it increases another person's payoff at a low cost to the individual (i.e., resulting in the use of a strategy that is "mildly altruistic" but neither fully egalitarian nor spiteful). Analytic individuals are not merely greedy; rather, they are able to evaluate more complex trade-offs between self-interest and altruistic concerns than are intuitive individuals.

## Future Directions

If analytic thinking is consequential enough to influence belief systems and morality, it stands to reason that its influence must extend to additional psychological domains that would benefit from similar investigations. For example, in creativity research, there are reflectionists who argue that executive functioning is crucial to generating creative outputs (e.g., Beaty, Silvia, Nusbaum, Jauk, & Benedek, 2014) and intuitionists who argue that increased executive functioning and attentional control may actually be detrimental to the creative process (e.g., Wiley & Jarosz, 2012). In support of the reflectionist perspective, Barr, Pennycook, Stolz, and Fugelsang (2015b) found a strong positive correlation between analytic thinking style and creativity on tasks that require the connection of semantically distant relations.<sup>1</sup> Moreover, this association was independent of cognitive ability, suggesting that the mere willingness to engage analytic thinking supports at least some forms of creative thought. More analytic individuals may be more willing to put the effort into making more distant connections between concepts.

An understudied area in psychology involves the intersection between cognition and technology. Consider smartphone technology, which permits immediate access to the Internet at all times. If, as argued, analytic thinking is consequential to our everyday lives, then the mere willingness to think analytically may affect the way people interact with smartphone technology. Barr, Pennycook, Stolz, and Fugelsang (2015a) investigated this hypothesis and found that, across three studies, those who relied more heavily on smartphones as information sources performed worse on analytic-thinking tasks. There was no such association with the time spent using smartphones for social media or entertainment purposes. This preliminary research suggests that smartphones may serve as a "second brain" to which those inclined to avoid analytic thought offload their thinking.

## Conclusions

The mere willingness to think analytically predicts a wide range of beliefs and worldviews, has a bearing on our moral judgments and values, and may also be associated

with creativity and technology use. These results are difficult to reconcile with a strict intuitionist perspective. Rather, the ability to reflect on and override intuitions appears to influence everyday thinking and beliefs about the world.

Although dual-process theory has been applied in many areas throughout psychology (see Evans, 2008), investigations of the real-world consequences of analytic thought are still in their infancy. The breadth of the reviewed work is curtailed by a lack of depth in many cases. Many studies have not included controls for cognitive ability (see Table 2), and the cognitive-ability measures used have varied from study to study. Moreover, one of the long-term consequences of thinking analytically is that it allows cognitive processes that were once deliberative and effortful to become automatic and intuitive (Stanovich, West, & Toplak, & 2011). Thus, it is truly the interaction between intuition and reflection that characterizes the human mind. Finally, analytic cognitive style is typically considered a "top-down" initiator of reflective thought, but more analytic individuals are also better able to detect conflicts during reasoning—a presumably "bottom-up" process (Pennycook, Fugelsang, & Koehler, 2015). This indicates that individual differences in bottom-up causes of analytic thinking (e.g., conflict-detection efficiency) may work in concert with top-down individual differences in cognitive style as initiators of reflective thought. Future research is necessary to both identify the determinants of analytic thinking and investigate additional domains in which analytic thinking may be consequential for our everyday lives.

## Recommended Reading

- Barr, N., Pennycook, G., Stolz, J. A., & Fugelsang, J. A. (2015a). (See References). Novel research on analytic thinking and technology use.
- Frederick, S. (2005). (See References). Introduction and initial uses of the Cognitive Reflection Test.
- Pennycook, G. (2014). Evidence that analytic cognitive style influences religious belief: Comment on Razmyar and Reeve (2014). *Intelligence*, *43*, 21–26. A review of studies that linked analytic thinking with religious disbelief.
- Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2014b). (See References). An overview and investigation of intuitionist and reflectionist accounts of morality.
- Rand, D. G., Peysakhovich, A., Kraft-Todd, G. T., Newman, G. E., Wurzbacher, O., Nowak, M. A., & Green, J. D. (2014). (See References). An overview of the social-heuristics hypothesis.

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## Supplemental Material

Additional supporting information may be found at <http://pss.sagepub.com/content/by/supplemental-data>

## Note

1. For example, consider the difference between the following analogies: (a) lamb chop is to lamb as pork chop is to pig, and (b) lamb chop is to lamb as chapter is to book. The latter, but not the former, is a “cross-domain” analogy that requires the connection of semantically distant relations to verify as an appropriate analogy.

## References

- Barr, N., Pennycook, G., Stolz, J. A., & Fugelsang, J. A. (2015a). The brain in your pocket: Evidence that smartphones are used to supplant thinking. *Computers in Human Behavior*, *48*, 473–480.
- Barr, N., Pennycook, G., Stolz, J. A., & Fugelsang, J. A. (2015b). Reasoned connections: A dual-process perspective on creative thought. *Thinking & Reasoning*, *21*, 61–75.
- Baumeister, R. F., Masicampo, E. J., & Vohs, K. D. (2011). Do conscious thoughts cause behavior? *Annual Review of Psychology*, *62*, 331–361.
- Beaty, R. E., Silvia, P. J., Nusbaum, E. C., Jauk, E., & Benedek, M. (2014). The roles of associative and executive processes in creative cognition. *Memory & Cognition*, *42*, 1186–1197.
- Bouvet, R., & Bonnefon, J.-F. (2015). Non-reflective thinkers are predisposed to attribute supernatural causation to uncanny experiences. *Personality and Social Psychology Bulletin*, *41*, 955–961.
- Browne, M., Thomson, P., Rockloff, M., & Pennycook, G. (2015). Going against the herd: Understanding the psychosocial factors underlying the ‘vaccination confidence gap.’ *PLoS One*, *10*(9), e0132562. Retrieved from <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0132562>
- Campitelli, G., & Gerrans, P. (2014). Does the Cognitive Reflection Test measure cognitive reflection? A mathematical modeling approach. *Memory & Cognition*, *42*, 434–447.
- Cheyne, J. A., & Pennycook, G. (2013). Sleep paralysis post-episode distress: Modeling potential effects of episode characteristics, general psychological distress, beliefs, and cognitive style. *Clinical Psychological Science*, *1*, 135–148.
- Corgnet, B., Espín, A. M., & Hernán-González, R. (2015). The cognitive basis of social behavior: Cognitive reflection overrides antisocial but not always prosocial motives. *ESI Chapman Working Papers*, *1*, 1–47.
- Evans, J. St. B. T. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annual Review of Psychology*, *59*, 255–278.
- Evans, J. St. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives in Psychological Science*, *8*, 223–241.
- Frederick, S. (2005). Cognitive reflection and decision making. *The Journal of Economic Perspectives*, *19*, 25–42.
- Garvey, K., & Ford, T. G. (2014). Rationality, political orientation, and the individualizing and binding moral foundations. *Letters on Evolutionary Behavioral Science*, *5*, 9–12.
- Gervais, W. M. (2015). Override the controversy: Analytic thinking predicts endorsement of evolution. *Cognition*, *142*, 312–321.
- Gervais, W. M., & Norenzayan, A. (2012). Analytic thinking promotes religious disbelief. *Science*, *336*, 493–496.
- Gigerenzer, G. (2007). *Gut feelings*. London, England: Penguin.
- Graham, J., Nosek, B. A., Haidt, J., Iyer, R., Koleva, S., & Ditto, P. H. (2011). Mapping the moral domain. *Journal of Personality and Social Psychology*, *2*, 366–385.
- Greene, J., & Haidt, J. (2002). How (and where) does moral judgment work? *Trends in Cognitive Sciences*, *6*, 517–523.
- Haidt, J. (2012). *The righteous mind: Why good people are divided by politics and religion*. New York, NY: Pantheon.
- Kahan, D. M. (2013). Ideology, motivated reasoning, and cognitive reflection. *Judgment and Decision Making*, *8*, 407–424.
- Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Larrimore Ouellette, L., Braman, D., & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature Climate Change*, *2*, 732–735.
- Kahneman, D. (2011). *Thinking, fast and slow*. New York, NY: Farrar, Strauss, Giroux.
- Kohlberg, L. (1969). Stage and sequence: The cognitive-developmental approach to socialization. In D. A. Goslin (Ed.), *Handbook of socialization theory and research* (pp. 347–480). Chicago, IL: Rand McNally.
- Kunda, Z. (1990). The case for motivated reasoning. *Psychology Bulletin*, *108*, 480–498.
- Lindeman, M. (2011). Biases in intuitive reasoning and belief in complementary and alternative medicine. *Psychology & Health*, *26*, 371–382.
- Lobato, E., Mendoza, J., Sims, V., & Chin, M. (2014). Examining the relationship between conspiracy theories, paranormal beliefs, and pseudoscience acceptance among a university population. *Applied Cognitive Psychology*, *28*, 617–625.
- Mercier, H., & Sperber, D. (2011). Why do humans reason? Arguments for an argumentative theory. *Behavioral & Brain Sciences*, *34*, 57–111.
- Newell, B. R. (2015). “Wait! Just let me *not* think about that for a minute”: What role do implicit processes play in higher-level cognition? *Current Directions in Psychological Science*, *24*, 65–70.
- Paxton, J. M., Unger, L., & Greene, J. D. (2012). Reflection and reasoning in moral judgement. *Cognitive Science*, *36*, 163–177.
- Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2014a). Cognitive style and religiosity: The role of conflict detection. *Memory & Cognition*, *42*, 1–10.
- Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2014b). The role of analytic thinking in moral judgements and values. *Thinking & Reasoning*, *20*, 188–214.

- Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. (2013). Belief bias during reasoning among religious believers and skeptics. *Psychonomic Bulletin & Review*, *20*, 806–811.
- Pennycook, G., Cheyne, J. A., Seli, P., Koehler, D. J., & Fugelsang, J. A. (2012). Analytic cognitive style predicts religious and paranormal belief. *Cognition*, *123*, 335–346.
- Pennycook, G., Fugelsang, J. A., & Koehler, D. J. (2015). What makes us think? A three-stage dual-process model of analytic engagement. *Cognitive Psychology*, *80*, 34–72.
- Rand, D. G., Greene, J. D., & Nowak, M. A. (2012). Spontaneous giving and calculated greed. *Nature*, *489*, 427–430.
- Rand, D. G., Peysakhovich, A., Kraft-Todd, G. T., Newman, G. E., Wurzbacher, O., Nowak, M. A., & Green, J. D. (2014). Social heuristics shape intuitive cooperation. *Nature Communications*, *5*, Article 3677. Retrieved from <http://www.nature.com/ncomms/2014/140422/ncomms4677/full/ncomms4677.html>
- Royzman, E. B., Landy, J. F., & Goodwin, G. P. (2014). Are good reasoners more incest-friendly? Trait cognitive reflection predicts selective moralization in a sample of American adults. *Judgment and Decision Making*, *9*, 176–190.
- Shenhav, A., Rand, D. G., & Greene, J. D. (2012). Divine intuition: Cognitive style influences belief in god. *Journal of Experimental Psychology: General*, *141*, 423–428.
- Shtulman, A., & McCallum, K. (2014). Cognitive reflection predicts science understanding. In P. Bello, M. Guarini, M. McShane, & B. Scassellati (Eds.) *Proceedings of the 36th Annual Conference of the Cognitive Science Society* (pp. 2937–2942). Austin, TX: Cognitive Science Society.
- Stanovich, K. E. (2004). *The robot's rebellion: Finding meaning in the age of Darwin*. Chicago, IL: The University of Chicago Press.
- Stanovich, K. E., West, R. F., & Toplak, M. (2011). The complexity of developmental predictions from dual process models. *Developmental Review*, *31*, 103–118.
- Svedholm, A. M., & Lindeman, M. (2013). The separate roles of the reflective mind and involuntary inhibitory control in gatekeeping paranormal beliefs and the underlying intuitive confusions. *British Journal of Psychology*, *3*, 303–319.
- Swami, V., Voracek, M., Stieger, S., Tran, U. S., & Furnham, A. (2014). Analytic thinking reduces belief in conspiracy theories. *Cognition*, *133*, 572–585.
- Toplak, M. V., West, R. F., & Stanovich, K. E. (2011). The Cognitive Reflection Test as a predictor of performance on heuristics-and-biases tasks. *Memory & Cognition*, *39*, 1275–1289.
- Wiley, J., & Jarosz, A. (2012). Working memory capacity, attentional focus, and problem solving. *Current Directions in Psychological Science*, *21*, 258–262.