

Believing What We Do Not Believe: Acquiescence to Superstitious Beliefs and Other Powerful Intuitions

Jane L. Risen
University of Chicago

Traditionally, research on superstition and magical thinking has focused on people's cognitive shortcomings, but superstitions are not limited to individuals with mental deficits. Even smart, educated, emotionally stable adults have superstitions that are not rational. Dual process models—such as the corrective model advocated by Kahneman and Frederick (2002, 2005), which suggests that System 1 generates intuitive answers that may or may not be corrected by System 2—are useful for illustrating why superstitious thinking is widespread, why particular beliefs arise, and why they are maintained even though they are not true. However, to understand why superstitious beliefs are maintained even when people know they are not true requires that the model be refined. It must allow for the possibility that people can recognize—in the moment—that their belief does not make sense, but act on it nevertheless. People can detect an error, but choose not to correct it, a process I refer to as *acquiescence*. The first part of the article will use a dual process model to understand the psychology underlying magical thinking, highlighting features of System 1 that generate magical intuitions and features of the person or situation that prompt System 2 to correct them. The second part of the article will suggest that we can improve the model by decoupling the detection of errors from their correction and recognizing acquiescence as a possible System 2 response. I suggest that refining the theory will prove useful for understanding phenomena outside of the context of magical thinking.

Keywords: superstition, magical thinking, dual-process model, intuition, acquiescence

A friend was visiting the home of Nobel Prize winner Niels Bohr . . . As they were talking, the friend kept glancing at a horseshoe hanging over the door. Finally, unable to contain his curiosity any longer, he demanded: “Niels, it can’t possibly be that you, a brilliant scientist, believe that foolish horseshoe superstition!?” “Of course not,” replied the scientist. “But I understand it’s lucky whether you believe in it or not.”

—(Kenyon, 1956, p. 13)

No attempt to understand how the mind works would be satisfying without trying to identify the psychological processes that lead even the most intelligent people to hold beliefs that they rationally know cannot be true. Why are people afraid to comment on a streak of success if they reject the notion that the universe punishes such modest acts of hubris? Why do people knock on wood if they cannot cite any conceivable mechanism by which it could change the odds of misfortune?

Traditionally, researchers have treated magical thinking as a cognitive deficit or even a form of psychopathology; certain people simply do not think about things correctly (Eckblad & Chapman, 1983; Frazer, 1922; Levy-Bruhl, 1926; Piaget, 1929; Tylor, 1873). From this perspective, superstitions and magical thinking are limited to specific individuals with specific mental deficiencies. When individuals rack up \$5,000 in phone bills to telephone psychics (Emery, 1995) or pay more for a lucky license plate than for the car itself (Yardley, 2006), it is easy to conclude that there is something fundamentally wrong with them.

But superstitions are not limited to individuals with mental deficits. More than half of surveyed Americans, for example, admit to knocking on wood and almost one quarter avoid walking under ladders (CBS News, 2012). Approximately one-third of surveyed college students regularly engage in exam-related superstitions (Albas & Albas, 1989) and it is exceedingly common for athletes to engage in superstitious rituals (Bleak & Frederick, 1998). Moreover, there is evidence that people maintain supernatural beliefs throughout their lifetime, even for events that are also explained by natural beliefs (Legare, Evans, Rosengren, & Harris, 2012). Thus, it is important to recognize the ordinary psychological tendencies that make these beliefs pervasive among intelligent, emotionally stable adults.

Stated simply, magical thinking is not magical. It is not extraordinary. It is surprisingly ordinary. Because superstitions and magical thinking are not restricted to certain unusual people on the fringes of modern society, the study of these peculiar beliefs ought not be relegated to the fringes of psychology. In this article, I will draw on dual process accounts from social and cognitive psychol-

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Correspondence concerning this article should be addressed to Jane L. Risen, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL 60637. E-mail: jane.risen@chicagobooth.edu

ogy to understand magical thinking and use evidence from magical thinking to inform dual process theories.

Before describing the goals of the article, it is worth pausing to define the scope of inquiry. Superstitions are often defined as irrational or false beliefs (Jahoda, 1969; Vyse, 1997), and are commonly related to the control of good or bad luck (Kramer & Block, 2011). Magical thinking is defined as the belief that certain actions can influence objects or events when there is no empirical causal connection between them (Henslin, 1967; Zusne & Jones, 1989). To distinguish these types of beliefs from other unfounded beliefs, however, it is useful to specify that superstitious and magical beliefs are not just scientifically wrong, but scientifically impossible. In a recent article, Lindeman and Svedholm (2012) reviewed definitions provided by researchers studying superstitious, magical, paranormal, and supernatural beliefs. They offered their own, more narrow definition, suggesting that a belief should be considered superstitious or magical to the extent that it assigns core attributes of one ontological category (e.g., the ability to bring about external events) to another category (e.g., thoughts). Thus, the mistaken belief that a penguin can fly is not a magical belief, but the belief that one's thoughts can fly is. Similarly, it is magical to believe that a symbol, such as the zodiac, can determine personality because it contains a category mistake. Because this definition makes it clear why the beliefs are scientifically impossible, I will use it as a starting point. I will try to note occasions in which examples from the literature would not necessarily fit this more narrow definition. In addition, I will focus primarily on beliefs that include a causal element. Thus, for the purposes of this article, a general belief in the existence of witches or angels would not be included, but the belief that a witch's curse can cause illness would be.¹

This article has two primary goals. In the first part of the article, I will use a dual processing account to understand the psychology underlying superstition and magical thinking. Although dual process models have been developed for topics that span social and cognitive psychology (e.g., Chaiken, Liberman, & Eagly, 1989; Gilbert, Pelham, & Krull, 1988; Epstein, 1994; Evans, 2006; Fiske & Neuberg, 1990; Liberman, 2003; Petty & Cacioppo, 1986; Schneider & Shiffrin, 1977; Smith & DeCoster, 2000; Sloman, 1996; Stanovich, 1999; Wegener & Petty, 1997; Wilson, Lindsey, & Schooler, 2000), my perspective will be primarily informed by research that has emerged in the judgment and decision making literature. In particular, I will focus on the “default-interventionist” or “corrective” model proposed by Kahneman and Frederick (2002, 2005), which suggests that System 1 “quickly proposes intuitive answers to judgment problems as they arise, and System 2 monitors the quality of these proposals, which it may endorse, correct or override (Kahneman and Frederick, 2002, p. 51).”

Applied to the topic of magical thinking, a corrective dual process model posits that System 1 quickly and easily generates magical intuitions, which, once activated, serve as a default for judgment and behavior. System 2 may or may not correct the initial intuition. If System 2 fails to engage, then the magical intuition will guide people's responses (see Figure 1). I suggest that a two-systems perspective can help illustrate why superstitious and magical thinking is widespread, why particular superstitious beliefs arise, and why the beliefs are maintained even though they are not true (see Table 1). To understand why superstitious beliefs

are maintained even when people know they are not true, however, requires that the model be refined.

The second goal of the article, therefore, is to refine and advance current dual process models based on findings from the superstition and magical thinking literature. Kahneman and Frederick (2002, 2005) suggest that System 2 can “endorse, correct, or override” an intuitive answer, with the unstated assumption that if an error is detected, it will be corrected. Many of the demonstrations from magical thinking, however, suggest that System 2 is not necessarily just too “ignorant” or “lazy” to notice an error. Research in superstition and magical thinking shows that people sometimes believe things that they know they shouldn't. In other words, people sometimes recognize—in the moment—that their intuition does not make sense rationally, but follow it nevertheless.² They detect an error, but they choose not to correct it, a phenomenon I will call “acquiescence.” For example, most sports fans rationally know that their behavior in their own living room cannot influence play on the field, but they may still insist on sitting in a particular seat, wearing a certain shirt, or eating a specific snack, and they may feel uneasy when they do not. These fans recognize that their belief is irrational, but choose to acquiesce to a powerful intuition. In the second part of the article, I will suggest that dual process models can be improved by decoupling the processes of error detection and correction and by recognizing acquiescence as a possible System 2 response (see Figure 2). I will suggest that refining the theory will also prove useful for understanding phenomena beyond the context of superstition and magical thinking. Thus, while Part 1 of the article will focus on superstition and magical thinking, Part 2 will move beyond superstition and magical thinking to introduce the concept of acquiescence more broadly.

¹ Lindeman and Svedholm (2012) suggest that there is no reason to distinguish the concepts of superstitious, magical, paranormal, and supernatural beliefs, noting that the differences in how the concepts have been used and studied reflect their etymologies more than theoretical differences. Although I find their plea compelling, the current article will focus primarily on research that has been conducted under the term “superstition” or “magical thinking” for two reasons. First, superstitions and magical thinking focus largely on causal reasoning, whereas paranormal and supernatural beliefs do not. Second, paranormal and supernatural beliefs have mostly been assessed with self-report questionnaires, making it difficult to examine whether people show evidence of beliefs that they explicitly claim not to hold. Although the current theory can be extended to paranormal or supernatural beliefs (e.g., why atheists may sometimes act as if they believe in God), these concepts will not be the focus of the article.

² The claim that people can simultaneously hold contradictory beliefs maps onto the first two criteria offered for identifying self-deception (Gur & Sackeim, 1979). However, unlike self-deception, which requires that the individual be unaware of holding one of the beliefs, I suggest that, when it comes to superstitions, people are often aware of holding both beliefs—they feel that they are “of two minds.” Thus, people can experience a subjective state of conflict between the contradictory beliefs. Note that the experience of conflict may occur if people hold both beliefs at the exact same moment in time, but also if people toggle back and forth between the beliefs very quickly such that both beliefs feel simultaneously present.

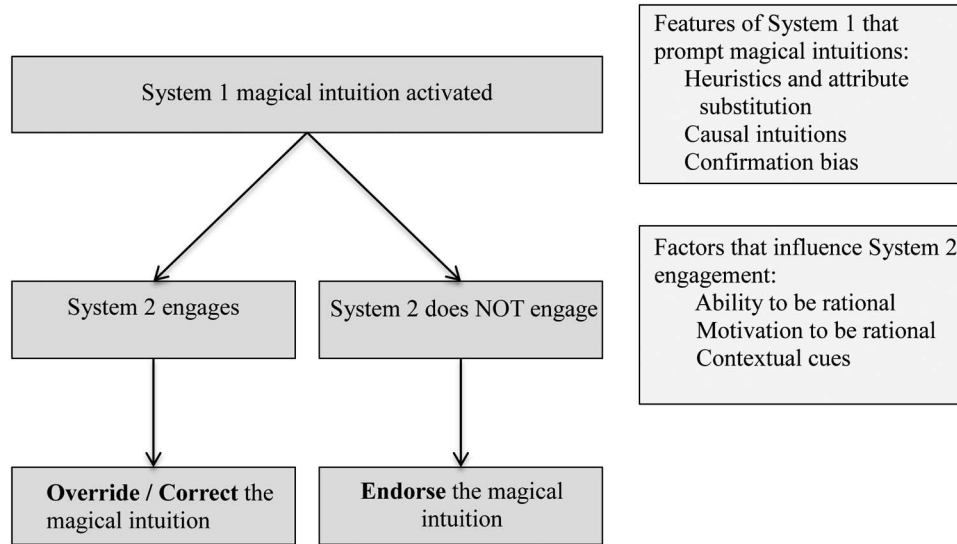


Figure 1. Dual systems account for magical thinking. *Note.* This model takes activation of the magical intuition as a given. Whether or not the intuition is activated in the first place is likely driven by the extent to which people are motivated to manage uncertainty in the moment, whether or not the intuition has been considered before, whether other people are known to believe it, as well as the extent to which the particular intuition easily maps onto features of System 1 processing. Furthermore, the dichotomous representation of System 2 as either engaging or not engaging is a simplification. It is possible for System 2 to engage to a greater or lesser extent. Finally, the features of System 1 that prompt magical intuitions and the factors that influence System 2 engagement are meant to be an illustration rather than a comprehensive list.

Part 1: Magical Thinking From a Two-Systems Perspective

Explanations for Superstitious and Magical Thinking

Traditional accounts. For over a century, research on superstition and magical thinking has focused on people's cognitive shortcomings, whether because of culture, age, anxiety, desire, or stress level (Frazer, 1922; Levy-Bruhl, 1926; Piaget, 1929; Tylor, 1873). People of certain archaic and non-Western modern cultures, for example, were thought to be superstitious because they were too "primitive" to reason properly—they had not yet evolved the technology and urban sophistication necessary for replacing irrational beliefs (Frazer, 1922; Levy-Bruhl, 1926; Tylor, 1873). Children's magical beliefs were also explained by their lack of scientific knowledge and not-yet-developed reasoning skills (Piaget, 1929).

Other early accounts of superstition focused on a motivational component. Malinowski (1948) saw uncertainty and fear as primary motivators, arguing that the primary purpose of superstitious behavior is to reduce the tension associated with uncertainty and fill the void of the unknown. To make his point, Malinowski relied on the now famous example of fisherman in the Trobriand Islands. Fisherman in the inner lagoon who could rely on knowledge and skill did not form superstitious practices, but those who faced the dangers and uncertainty of fishing on the open sea developed superstitions for insuring safety and plentiful fish (Malinowski, 1948).

In contrast to uncertainty, which entails psychological costs, the feeling that one can understand, predict, and control one's environment confers psychological benefits (Thompson, 1981). Because superstitions can offer individuals a sense of understanding even when

there is not sufficient information to develop an accurate causal explanation (Keinan, 1994), superstitions seem to be especially common when people are motivated to understand and control their environment. Reminiscent of the Trobriand Island fisherman, for example, Padgett and Jorgenson (1982) found that superstition was more common in Germany during periods of economic threat and Keinan (1994) demonstrated that Israelis who were living under conditions of high stress (those living in cities that suffered missile attacks during the Gulf War) reported a higher frequency of magical thinking than Israelis who were living in similar cities that had not suffered attacks. Furthermore, experiments that randomly assign participants to feel a lack of control find that they report more superstitious beliefs (Whitson & Galinsky, 2008).

To be sure, exploration of people's limited cognition as well as the motivation to manage uncertainty contributes to our understanding of superstition. In particular, these accounts help explain why some populations exhibit more magical thinking than others as well as why magical thinking is especially likely to occur when experiencing uncertainty, stress, and anxiety. However, these accounts fail to explain several other aspects of magical thinking. First, why do ordinary people show signs of superstitious and magical thinking in fairly ordinary circumstances? Second, why do people form the particular superstitious beliefs that they do? For example, why are certain numbers considered lucky and others considered unlucky? Why does switching lines in a grocery store seem to guarantee that the new lane will slow down? Finally, why do people develop and maintain superstitious beliefs that so clearly run contrary to reason? Applying a dual systems model to our understanding of superstitious and magical thinking can help answer these questions as well as accommodate

earlier research findings that focus on unusual populations and unusual circumstances.

A dual process account. In recent years, many psychologists have put forward dual process accounts of everyday cognition (e.g., Chaiken et al., 1989; Epstein, 1994; Evans, 2006; Fiske & Neuberg, 1990; Gilbert et al., 1988; Lieberman, 2003; Petty & Cacioppo, 1986; Schneider & Shiffrin, 1977; Sloman, 1996; Smith & DeCoster, 2000; Stanovich, 1999; Wegener & Petty, 1997; Wilson et al., 2000). Although they differ, each of these accounts involves the idea that there is one set of mental processes that operates quickly and effortlessly and another that operates in a deliberate and effortful manner. The quick and effortless set of mental processes is often referred to simply as “System 1” and the slow, deliberate set of processes is known as “System 2” (Stanovich & West, 2002).³

I will focus primarily on dual process models that suggest that System 1 renders quick, intuitive judgments and that System 2 is responsible for overriding System 1 if there is an error detected in the original, automatic assessment (Kahneman, 2011; Kahneman & Frederick, 2002, 2005; Stanovich & West, 2002). This type of model has been described as a “corrective” model (Gilbert, 1999) or a “default interventionist” model (Evans, 2007; Evans & Stanovich, 2013) because the System 1 intuition serves as a default, which may or may not be corrected by System 2 (see also Fiske & Neuberg, 1990; Gilbert et al., 1988; Wegener & Petty, 1997).⁴

According to a corrective dual process model, magical intuitions that are activated will guide judgment and behavior if they fly under the radar of System 2 (see Figure 1). In other words, if a magical intuition comes to mind—for example, “this is my lucky seat for watching football”—and System 2 does not become engaged, then even a fan who is not explicitly superstitious will sit in the lucky seat and feel more optimistic about winning. If System 2 processes are engaged, however—if, say another person is already sitting in the fan’s lucky seat—he may be forced to confront his magical intuition. Furthermore, if he recognizes that it is irrational, he will override the intuition and sit somewhere else.⁵

A dual process account helps explain how magical beliefs can develop for ordinary people in ordinary circumstances while also integrating the insights from previous accounts that focus on special populations and special circumstances. For example, the motivation to manage uncertainty is likely to affect superstitious behavior by influencing whether or not a magical intuition is activated in the first place. Football fans are probably more likely to consider sitting in a lucky seat if they are watching the game live than if they are watching on tape delay because the outcome feels more uncertain in the former case. In addition, a person’s cognitive skills can affect superstitious behavior by influencing whether or not System 2 identifies a magical intuition as an error. Note that the model being put forward focuses on how magical intuitions come to guide judgment and behavior, taking the activation of the magical intuition (e.g., this seat is lucky) as a given (see Figure 1). Whether or not the magical intuition is activated in the first place is likely driven by the extent to which people are motivated to manage uncertainty in the moment, whether or not the intuition has been considered before, whether other people are known to believe it, as well as the extent to which the particular intuition easily maps onto features of System 1 processing. Although these variables will be discussed, a precise account of activation is beyond the scope of the current article. Instead, the article will concentrate on predictions that emerge from a dual process account that relate to

the nature of magical intuitions and their application to judgment and behavior (see Table 1).

A dual systems account of magical thinking requires us to consider the role of each system. Because a corrective model posits that errors are jointly determined by System 1 processing and a lack of System 2 processing, it has been suggested that when people commit errors of intuitive judgment, two questions should be asked. First, what features of System 1 produced the error? And, second, what factors explain why System 2 did not fix the error? (see Kahneman & Frederick, 2002, 2005; Kahneman & Tversky, 1982; Morewedge & Kahneman, 2010). With those two questions in mind, I will outline features of System 1 that play a role in generating magical intuitions, and features of the person or situation that prompt System 2 to correct those intuitions (see Figure 1). I will end the first half of the article by summarizing the extent to which the evidence supports a dual process account as well as by identifying predictions that remain untested.

Features of System 1 That Prompt Magical Intuitions

This section will identify three key features of System 1 that give rise to magical intuitions. Specifically, I will describe how superstitions and magical thinking can emerge from the tendency to (a) rely on heuristics and attribute substitution, (b) impose order and create meaning with causal explanations, and (c) search for evidence that confirms an initial hypothesis.⁶ These processes are common to everyone and occur automatically, which explains why everyone is susceptible to magical thinking.

Heuristics and attribute substitution. People are remarkably adept at providing quick, intuitive answers even for extremely complex problems. One way that people do this is by substituting an easy question for a hard question and answering the easy one instead, often with no awareness that they have answered a different question (Kahneman & Tversky, 1982; Morewedge & Kahneman, 2010; Tversky & Kahneman, 1974, 1983). In other words, instead of engaging System 2 processes to answer a difficult question (e.g., what is the probability that this person is a librarian?), System 1 finds an associated question that is easier to answer (does this person look like a librarian?). Since the introduction of the heuristics and biases research program, researchers have demonstrated that people automatically substitute similarity and availability when making complex judgments. In the next section, I will

³ This is not meant to suggest that there is a singular system underlying each type of process. Nor do I claim that all of the features associated with each system are defining characteristics of the two types of processes (Evans & Stanovich, 2013).

⁴ This type of model differs from “selective” models that rest on the assumption that people *either* rely on quick and effortless mental processes (typically when a judgment is not too important) *or* rely on more deliberate mental processes (typically for consequential judgments) (Chaiken et al., 1989; Petty & Cacioppo, 1986). It also differs from “competitive” and “consolidative” models, which assume that the two processes run in parallel (see Gilbert, 1999 for a description of each).

⁵ In Part 2 of the article, I will refine the model to allow for the possibility that a fan would insist on sitting in his lucky seat even if he recognizes that it is irrational in the moment.

⁶ In his book, *Thinking Fast and Slow*, Kahneman (2011) refers to each of these System 1 features, respectively, with the headings “Substituting questions,” “Seeing causes and intention,” and “A bias to believe and confirm.”

describe magical intuitions that arise from the use of each of these heuristics.

The law of similarity (representativeness). Almost a century before Kahneman and Tversky defined representativeness as a cognitive heuristic, anthropologists studying magic and superstition suggested that people rely on similarity when making causal attributions. Tylor (1873) considered *similarity* the confusion of analogy and causality (“like causes like”) and proposed it as one of the laws of sympathetic magic. Elaborating on Tylor’s work, Frazer (1922) offered several examples of beliefs that involve a similarity match of cause and effect. He described tribes who avoided the flesh of slow animals in fear of becoming slow, people living in Northern India who believed that eating the eyeball of an owl allowed one to see in the dark, and Australians who believed that ingesting kangaroo would lead to an improvement in jumping ability. Similarity based beliefs were also abundant during the European Renaissance and had a powerful influence on early Western medicine. The Doctrine of Signatures was based on the belief that natural substances are marked by signatures, such that one can determine by color, shape, or location how a substance can be used to benefit human life (Nisbett & Ross, 1980). For example, long-living plants were used to lengthen a person’s life and plants with yellow sap were used to cure jaundice. Although these examples are often provided as evidence of superstitious thinking (and almost certainly arise from a confusion of similarity and causality), some do not fit the narrow definition of superstition that requires a category error. Although there is no evidence to suggest that the color of a plant is relevant for its healing power, it is scientifically possible for material attributes to have a material effect.

The similarity heuristic does lead to scientifically impossible beliefs, however, when people react to objects based on symbolic feature matches. The use of voodoo dolls, for example, is based on the belief that causing harm to a doll can cause harm to a person that the doll is meant to represent. An intuitive belief in voodoo is not restricted to traditional cultures. Even college students have been shown to feel responsible for a person’s headache when they have negative thoughts about the person and are led to use a voodoo doll (Pronin, Wegner, Rodriguez, & McCarthy, 2006). Moreover, the tendency to inflict “harm” on a voodoo doll by stabbing it with pins has been found to be a reliable measure of aggressive tendencies toward the person that the doll represents (DeWall et al., 2013). Research has also shown that people are less accurate throwing darts at a picture of someone they like (e.g., a baby) than at someone they do not like (e.g., Hitler), even though the dart cannot cause harm to the actual individual and even when participants are provided financial incentives for accuracy (King, Burton, Hicks, & Drigotas, 2007; Rozin, Millman, & Nemeroff, 1986). Finally, people are reluctant to consume a chocolate they know to be delicious when it is shaped to resemble dog feces (Rozin et al., 1986).

There is also evidence that people behave according to the “resemblance criterion” (Nisbett & Ross, 1980), acting as if a desired random event can be caused by a “matching” action. For example, Henslin (1967) describes how craps shooters roll the dice softly (a small cause) when hoping for a low number (a small effect), and with more vigor (a large cause) when looking for a high one (a large effect).

Finally, research has found that people react to objects based on a name or label assigned to an object, what Piaget (1929) referred to as “nominal realism.” When participants pour sugar into a container and then add the label “Sodium Cyanide, Poison” they become unwilling to use the sugar (Rozin et al., 1986). This type of belief can even manifest itself when something sounds similar to something good or bad. The Chinese consider the number 4 very unlucky and the number 8 very lucky because the former sounds like the word “to die” and the latter like the words for prosperity and luck (Simmons & Schindler, 2003). In fact, research has found that participants from cultures with these lucky and unlucky numbers are more likely to buy an object at a “lucky” price than a neutral price even if it means spending more (e.g., \$888 vs. \$777 Taiwanese dollars) and less likely to buy it at a lower “unlucky” price (e.g., \$444 vs. \$555 Taiwanese dollars; Block & Kramer, 2009). These beliefs have even been said to influence the stock market. One analysis found, for example, that Chinese brokers prefer to postpone trades on the unlucky fourth day of the month, resulting in lower commodities-market returns for U.S. copper, cotton, and soybeans (Chung, Darrat, & Li, 2014).⁷

The psychology underlying these magical intuitions is explained by people substituting a simpler similarity computation for a much more difficult assessment of causality (Kahneman & Tversky, 1973). Thus, people’s magical intuitions are often guided by the belief that “like causes like”: objects or events that are associated with each other based on similarity are often believed to be causally related, even when the causal relationship is scientifically impossible (see also Gilovich & Savitsky, 2002 and Shweder, 1977).

The belief in tempting fate (availability). People believe negative outcomes are especially likely to occur following actions that “tempt fate” (Risen & Gilovich, 2008). For example, people report that a person is more likely to be rejected from his top-choice university if he presumptuously wears a t-shirt from that school while waiting for the decision than if he does not wear the shirt. They claim that they are more likely to be called on at random in class if they are not prepared than if they are. Furthermore, they say that it is more likely to rain if an individual chooses not to bring her umbrella than if she chooses to bring it (Risen & Gilovich, 2008). People also report that negative outcomes are particularly likely when they are not protected by travel, car, or medical insurance (Tykocinski, 2008, 2013, but see van Wolferen et al., 2013) and that they are more likely to contract a disease if they choose not to donate to a charity supporting its cure (Kogut & Ritov, 2011). Finally, when people are led to make a presumptuous statement during a conversation (e.g., “There is no chance that anyone I know would get into a terrible car accident”), they subsequently report that the likelihood of the bad event is higher

⁷ These effects are not limited to certain cultures. In the United States, where the number 13 is considered unlucky, people avoid risky gambles more after thinking about Friday the 13th than after thinking about a neutral day (Kramer & Block, 2008). Another study reported that stock-market returns are lower on Friday the 13th than on other Fridays (Kolb & Rodriguez, 1987). Moreover, some have suggested that the airline industry loses more than 10,000 customers on Friday the 13th and estimate that people’s fear of doing business costs \$800 to \$900 million dollars every unlucky day (Palazzo, 2005).

than if they make a neutral statement (Zhang, Risen, & Hosey, 2014).

Several studies show that tempting fate beliefs can influence behavior, even among educated adults. For example, an experiment examining the reluctance to exchange lottery tickets finds that participants whose lottery tickets have been exchanged buy more insurance to protect against the possibility of losing the upcoming lottery even though the insurance is a bad investment based on the expected value of the lottery (Risen & Gilovich, 2007). In addition, Arad (2014) finds that almost half of participants choose a normatively inferior lottery prize before the lottery (e.g., choosing \$10 instead of \$12 from the set: \$2, \$4, \$6, \$8, \$10, or \$12), presumably because of a concern that choosing the normatively superior option would tempt fate and make it less likely that they would win.

I have made the case that the belief in tempting fate builds on the availability heuristic (Risen & Gilovich, 2008), which is the tendency to infer likelihood or frequency from how easily things come to mind (Tversky & Kahneman, 1973). Although common events tend to come to mind easily, this does not logically imply that events that come to mind easily are common. However, as we see in the case of representativeness, System 1 has trouble with this distinction. Salient, distinctive features and emotionally laden events are easily imagined, which leads people to systematically overestimate the likelihood of those events (Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978; Nisbett & Ross, 1980; Tversky & Kahneman, 1973).

We find that people believe negative outcomes are especially likely following actions that tempt fate because they automatically call the painful possibilities to mind (Risen & Gilovich, 2008). Imagine that you are a student in a large lecture hall and that you have tempted fate by skipping the assigned reading. The professor says that he is going to call on someone at random to answer a question. If you are like most people, you immediately imagine that the professor will call on you. To test whether this outcome is especially likely to come to mind after tempting fate, we ask people either to imagine being unprepared or prepared for class. Next, they indicate as fast as possible whether an ending that is presented is a logical conclusion to the story (e.g., “After several moments of silence, the professor calls on you”) or whether it is a nonsequitur (e.g., “The surprise party goes off without a hitch.”). If a particular ending is already on people’s minds, then they should recognize it more quickly. Indeed, we find that participants recognize the negative ending of being called on by the professor more quickly when they imagine that they are not prepared than when they imagine that they are. We also find that the heightened accessibility of negative endings mediates participants’ inflated likelihood judgments (Risen & Gilovich, 2007, 2008). In other words, because negative outcomes are more accessible when they result from an action that tempts fate, they seem especially likely.

The belief in tempting fate is not the only superstition to develop from a reliance on the availability heuristic. Superstitious beliefs can arise, for example, not only because negative outcomes are especially likely to capture imagination, but also because negative outcomes are more likely to stick in memory (see Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001 for a broader discussion of the negativity bias). Imagine the following: You are standing in the slow checkout line at the grocery store. Your line has barely moved in the last few minutes while

people in the line next to you are whizzing by. You contemplate switching lines. If you worry that the new line will suddenly slow down as soon as you switch, you are not alone. Miller and Taylor (1995) argue that people may refrain from changing lines at the grocery-store checkout counter or switching answers on a multiple-choice test (see Kruger, Wirtz, & Miller, 2005) because of the greater availability of counterfactual thoughts that follow actions compared with inactions. Because people are especially likely to regret actions that turn out badly (more so than inactions that turn out badly), these events become overrepresented in memory, distorting people’s intuitive database. Thus, similar to the belief in tempting fate, people end up believing that bad outcomes are more likely to happen if they take action than if they stick with the status quo because the negative outcome is more likely to jump to mind.

The research described above should make it clear that the law of similarity and the belief in tempting fate are not exclusive to primitive cultures. Rather, these magical intuitions can lead even highly educated individuals to pay more for products with a lucky price and to anticipate bad outcomes after a presumptuous comment has been made. Moreover, these magical intuitions are not random. They arise from the automatic tendency to substitute attributes of similarity and availability when assessing causality. In the next section, I will take a step back to describe how the general tendency to search for causes is also a feature of System 1 processing that gives rise to magical intuitions.

Causal intuitions. It has been suggested that an appealing feature of magic and superstition is its ability to offer an explanation for any and all phenomena (Agassi & Jarvie, 1973). I contend that it is people’s natural tendency to infer causal relationships (Heider, 1944; Michotte, 1963) that makes this so. Research suggests that it is quite easy for people to generate coherent causal theories that link almost any attribute to almost any outcome (Kahneman, 2011; Kunda, 1987). Indeed, there is evidence that causal intuitions can occur with minimal cognitive resources, without awareness or intent, and without any explicit instruction to do so (Hassin, Bargh, & Uleman, 2002; Uleman, 1999), suggesting that they are efficiently generated by System 1 (of course, people can also engage in slow, deliberate causal reasoning).⁸

The natural tendency to infer causality often leads people to generate unnecessary causal explanations for things that are better understood as a result of random variation (see Gilovich, Vallone, & Tversky, 1985). The magical thinking and superstition literature is replete with examples of people perceiving causal relationships that do not actually exist. The Sports Illustrated Jinx, for example, is the culturally shared belief that if an athlete appears on the cover of Sports Illustrated, he or she will then have a terrible season, or worse, suffer a terrible injury. The Sports Illustrated Jinx—along with the broader belief that it is bad luck to call attention to success—arises, at least in part, because of people’s natural tendency to search for causal patterns and their failure to recognize the operation of statistical regression (Gilovich, 1991; Kruger,

⁸ Some dual process models assume that System 1 is purely associative and that System 2 is required for rule-based learning. Recent research suggests, however, that System 1 is capable of learning rules, and in particular is capable of representing causal structure, which I refer to as causal intuitions (see Sloman, 2014 for an overview of causal representation in System 1).

Savitsky, & Gilovich, 1999; Wolff, 2002). A person only calls attention to a streak of success, by definition, when things are going unusually well. Only the best athlete performing at his or her very best is featured on the cover of *Sports Illustrated*. That means that the moment at which one appears on the cover is precisely when circumstances are most likely take a turn for the worse because of regression to the mean. Although noting one's good fortune does not *cause* the decline, their frequent co-occurrence may lead people to infer a causal relationship.

The tendency to see causal patterns that do not exist frequently leads people to erroneously perceive their own behavior as causally relevant, giving rise to the "illusion of control" (Langer, 1975; Rudski, 2004). Indeed, there is evidence of accidental reinforcement leading people—and even pigeons—to behave as if their environment were dependent on their behavior, even when the outcomes are entirely independent (Aeschleman, Rosen, & Williams, 2003; Alloy & Abramson, 1979; Catania & Cutts, 1963; Ono, 1987; Skinner, 1948; Wagner & Morris, 1987). These erroneous beliefs, which build on operant conditioning, are especially likely to form when people are exposed to either a frequent schedule of positive reinforcers (leading to the belief that one's behavior causes positive outcomes) or a lean schedule of negative reinforcers (leading to the belief that one's behavior prevents negative outcomes; Aeschleman et al., 2003; Skinner, 1948).

Because the tendency to jump to conclusions from limited evidence is a central feature of intuitive thinking (Kahneman, 2011), I suggest that accidental reinforcement of just one behavior may also give rise to "one-shot" superstitions (see Risen, Gilovich, & Dunning, 2007 for an example of stereotypes forming in one-shot). In other words, if an especially good or bad outcome happens to follow one notable behavior, people may come to believe that the behavior was causally relevant, even when it is scientifically impossible. For example, a recent Bud Light commercial depicts a football fan returning with a beer to discover that his team had finally scored when he left the room. Immediately, he comes to believe that his absence caused the success and promptly leaves the room; the tagline reads "It's only weird if it doesn't work." When a fan's behavior is rewarded or punished—even just once—they may develop the hypothesis that their behavior is causally related to the outcome. And, once the hypothesis is generated, the confirmation bias can take over.

Confirmation bias. Researchers who study judgment and decision making note that one of the most common and devastating biases that people must manage is the confirmation bias—the tendency to search for and favor evidence that supports current beliefs and ignore or dismiss evidence that does not (Klayman & Ha, 1987; Wason, 1966). Although the confirmation bias can be exacerbated when people deliberately use a positive test strategy, the bias initially emerges because System 1 processing tends to be fast and associative. Indeed, one reason that people fall prey to the confirmation bias is that simply considering a hypothesis automatically makes information that is consistent with that hypothesis accessible (Kahneman, 2011, see also Gilbert, 1991). When considering whether someone is shy, for example, information that is consistent with that possibility is likely to immediately jump to mind. Different information is likely to jump to mind, however, when considering whether that same person is outgoing (see Snyder & Swann, 1978). The Wason (1966) four-card selection task has been used to illustrate how intuitive confirmatory thinking is

and how much more effort is required for disconfirmatory thinking. Although the confirmation bias emerges when people are indifferent to the hypothesis (participants do not have a stake in whether the Wason card rule is true), several lines of research show that the bias becomes much more pronounced when people are motivated to believe the hypothesis under consideration (Dawson, Gilovich, & Regan, 2002; Gilovich, 1991).

The confirmation bias is useful for understanding why superstitious intuitions are maintained even though they are not true. First, when people think about their superstitious intuitions, they are likely to automatically retrieve examples from memory that support them. Second, once a superstitious hypothesis is generated people are likely to repeat the behavior rather than trying new behaviors that could potentially falsify the hypothesis. If you have the theory that your favorite football team runs the ball well when you sit in the middle of the couch (perhaps because they ran it well last week when you sat there), you are unlikely to sit anywhere else. Third, because people tend to interpret ambiguous evidence as confirmatory, then even mixed evidence will be seen as support. If you sit in the middle of the couch and your team has little success running the ball, but ends up winning the game, you might nevertheless count that as a success. Even if the evidence clearly goes against the hypothesis, the motivation to maintain a superstition may lead people to dismiss disconfirmatory evidence ("It doesn't count because our first string running-back was injured") or adjust the hypothesis so that the evidence is uninformative ("I guess they only run well when I sit in the middle seat AND eat potato chips."). Thus, because of the tendency to think of instances that fit our hypothesis, repeat the hypothesized behavior, interpret mixed evidence as support of our hypothesis, and explain away evidence that does not support our hypothesis, superstitious intuitions can feel increasingly correct over time—even if there is no logical way for the behavior to have an effect.

Features of System 2 That Prompt Correction

Thus far, I have reviewed some features of System 1 that play a role in generating magical intuitions. Because these processes are widespread, produce systematic errors in judgment, and occur automatically, it is easy to see why magical thinking is widespread, why particular magical beliefs emerge, and why people have magical intuitions that are not supported by deliberate, rational thinking. In Part 2 of the article, I will suggest that modifying the two-systems perspective can also help us understand why people maintain superstitions that they know are false. However, first, the claim that superstitious thinking is best understood using the lens of two-systems requires evidence suggesting that superstitious beliefs are less pronounced when System 2 is engaged (see Figure 1 and Table 1). In the next section, I will review features of the person and the situation that trigger the engagement of System 2. I will organize these features according to whether they increase an individual's *ability* to be rational, his or her *desire* to be rational, and the contextual cues that make errors more or less *detectable*.

The ability to be rational. Because of its focus on cognitive deficits, the superstition and magical thinking literature has long assumed that people who are smarter and more educated would show fewer of these peculiar beliefs than those who are less intelligent and less educated. There are several empirical studies that suggest a negative correlation between cognitive ability/edu-

cation and superstitious/paranormal beliefs (Aarnio & Lindeman, 2005; Musch & Ehrenberg, 2002; Orenstein, 2002; Otis & Alcock, 1982; Za'Rour, 1972).⁹ Rather than interpret the correlation as support for the traditional notion that only certain people exhibit superstitious thinking, however, I think it ought to be interpreted as support for a two-systems perspective, such that people who are less rational are less likely to engage System 2. In other words, magical intuitions are shared by rational and nonrational people alike, but the intuitions are more likely to be corrected by those who are especially rational.

This interpretation has been supported by studies that test the influence of rational ability on superstitious beliefs using manipulations of cognitive load. To date, there are at least three studies that have done this. First, research suggests that the belief in tempting fate is increased when people are asked to complete a simultaneous task (Risen & Gilovich, 2008). Second, statements that include ontological confusions (i.e., “the moon strives forward” or “trees can sense the wind”) are rated as more literally true when people are forced to respond quickly (Svedholm & Lindeman, 2013). Third, people prefer a sure thing over a risky gamble when primed with Friday the 13th, especially under conditions of high uncertainty, and this effect is more pronounced under cognitive load (Kramer & Block, 2008). These findings support the idea that magical intuitions are generated effortlessly by System 1 and that they can be corrected (at least to an extent) when people have the cognitive resources to do so. Because the same sample of people can show superstitious behavior or not depending on their current cognitive resources, it suggests that superstitions are not limited to certain populations.

The motivation to be rational.

Individual differences. In addition to differing in their ability to be rational, individuals can also differ in their desire or motivation to think rationally (Cacioppo, Petty, & Kao, 1984; Epstein et al., 1996; Stanovich & West, 1997). Several studies have found that people who are motivated to think rationally are less likely to explicitly endorse superstitious beliefs, while those who are motivated to think intuitively are more likely to endorse them (Aarnio & Lindeman, 2007; Epstein et al., 1996; Lindeman & Aarnio, 2006; Pacini & Epstein, 1999; Svedholm & Lindeman, 2013). Recent research has also found that people who are motivated to think intuitively are more likely to be influenced by experimental manipulations designed to encourage magical thinking. For example, people who report a preference for intuitive thinking are more likely to be influenced by a contagious experience (Kramer & Block, 2014) and are less accurate throwing darts at a picture of a baby than a neutral image (King et al., 2007).

Instructions and incentives to be rational. Rather than relying on individual differences in people's propensity to be rational, it is possible to manipulate the motivation by providing instructions or incentives. Instructions to be rational, for example, can lead people to override their intuitive, magical response. In one study, Cornell students imagined trading their lottery ticket and were asked whether they believed this would make their original ticket more likely to win, less likely to win, or would not change the likelihood. When participants were encouraged to respond with their gut feelings, half of them reported that the original ticket would be more likely to win after being exchanged (Risen & Gilovich, 2007). In an unpublished study, we found that when

participants were asked to respond rationally, all of them could correctly indicate that the likelihood would not change.

People can also be motivated to be rational by providing them with social or financial incentives. When people are made to feel accountable for their judgments, for example, they consider options in greater depth and preemptively self-criticize their initial responses (Lerner & Tetlock, 1999). There is also some reason to believe that financial incentives can motivate people to respond accurately (Epley & Gilovich, 2005), but this seems to be limited to cases in which participants are able to recognize an error in System 1 processing and where more deliberate, effortful thinking on the task is useful (Camerer & Hogarth, 1999). Although I am not aware of any magical thinking studies that have directly manipulated social or financial incentives, in one article, participants' judgments either involved money (“how much would you pay?”) or did not (“how unpleasant would it be?”). Participants demonstrated less magical thinking when responding on a financial scale than when they made their judgments on a preference scale (Rozin, Grant, Weinberg, Parker, 2007). For example, when rating how unpleasant it would be to wear a sweater that has previously been worn by a murderer, most participants report it would be unpleasant and only 18% of participants claim to be indifferent. When (different) participants are asked how much they would pay to avoid wearing the sweater, however, 52% report indifference, stating that they would not pay any money to avoid the experience. Even though there were no actual financial incentives at stake, the authors suggest that people show less magical thinking when responding on a financial scale because it makes salient the importance of thinking rationally (Rozin et al., 2007).

Note that providing financial incentives for accuracy is different from simply increasing the stakes of a decision. Indeed, increasing the stakes may make people more determined to follow their intuition (Pacini & Epstein, 1999). Sports fans, for example, may be more likely to follow their superstitious intuitions during the playoffs than during the regular season. Subbotsky (2001) finds that people's superstitious actions are especially likely to diverge from their verbal responses when the stakes are increased. Specifically, people observe a plastic card being placed in a box and an experimenter recites a magic spell. When the box is reopened, the plastic card has been severely scratched. Although only 22% of people report that the magic spell could have caused the damage, 47% refuse to let the experimenter say the same spell while their hand is in the box.

Mood and cognitive difficulty. Feeling happy and experiencing cognitive ease provides people with a signal that everything is going well—and it leads them to rely on their intuition. Feeling sad or experiencing metacognitive difficulty, in contrast, signals that everything is not going well. This can trigger the motivation to be more careful and deliberate (Alter, Oppenheimer, Epley, & Eyre, 2007; Bless, Schwarz, & Wieland, 1996; Isen, Nygren, & Ashby, 1988, but see Meyer et al., 2015 and Thompson et al., 2013). Research suggests that participants who are in a good mood are more likely to demonstrate magical thinking, while those in a negative mood are triggered to slow down and engage in more

⁹ Note, however, that other studies suggest this relationship may not exist or may be better accounted for by other factors (see, e.g., Fluke, Webster, & Saucier, 2014; Stuart-Hamilton, Nayak, & Priest, 2006).

rational, analytical thinking (King et al., 2007). Specifically, participants in a good mood are more likely to show evidence of the belief in similarity (not being able to throw a dart at a picture of a baby) and contagion (distancing themselves from a tainted individual) than those who are put in a bad mood.

Contextual cues to the error. Certain contextual cues, such as the design of a study or features of a task, can help people recognize errors by either changing how they mentally represent the problem or how they direct their attention. Although there have only been a handful of studies that have investigated how contextual cues influence magical intuitions, they support the two-systems perspective.

Within versus between-subjects design. First, one article compares magical beliefs that are reported in a within and between-subjects version of a study (Kogut & Ritov, 2011). In a within-subjects design, participants' attention is drawn to the dimension that researchers are examining, which provides a strong cue for how participants should correct common judgment errors (Kahneman & Frederick, 2002, 2005). In one study of magical beliefs, participants read about a woman who is called by a breast cancer charity to solicit a donation. In the between-subjects design, they either read that she chooses not to donate or to donate. Participants who read that she chooses not to donate provide a higher subjective probability for the chance that she will be diagnosed with breast cancer than those who read that she donates. In a within-subjects design, participants read both versions of the scenario and report subjective likelihood judgments for each. In this case, participants give almost identical ratings for the two scenarios.

Features of the task. Features of the judgment task (Cosmides & Tooby, 1996; Gigerenzer & Hoffrage, 1995; Krosnick, Li, & Lehman, 1990) as well as features of the response scale (Windschitl & Wells, 1996) have also been shown to help people recognize errors and engage System 2. For example, Windschitl and Wells (1996) find that numeric response scales tend to prompt deliberate reasoning, whereas verbal response scales tend to trigger intuitive thinking. Indeed, research has found that the response scale can influence the tendency to report magical intuitions. As described earlier, when participants respond on a financial scale, they are less likely to report magical beliefs of contagion and similarity (Rozin et al., 2007). In addition, research suggests that people are more likely to report magical beliefs of contagion when responding on an affective scale than on a likelihood scale (Nemeroff, 1995; see also Nemeroff, Brinkman, & Woodward, 1994). For example, participants asked to sequentially imagine spending time with several different people who have the flu report that the symptoms will be more severe if they catch the flu from a disliked individual than from a lover or a stranger. In addition, participants draw the germs from disliked individuals as more threatening than those from other people. But, participants report that they are equally likely to catch the flu in each case. Thus, their feelings toward the contagious individuals have a nonnormative influence on their beliefs about severity, but not on their perceived chance of contagion. If participants were asked for a likelihood rating in a between-subjects design, it is possible that the magical belief would emerge for likelihood as well.

In summary, researchers have found evidence suggesting that magical intuitions can be corrected by effortful, deliberate thinking. Specifically, System 2 processing is engaged when people

have the ability and resources to be rational, when they are motivated to be rational, and when they are given cues that trigger them to detect an error in their initial assessment. The fact that the same factors lead people to correct magical intuitions as other intuitive judgment errors suggests that the same dual process model that explains why intuitive judgment errors are widespread can also explain the prevalence of magical thinking. Thus, although the consequences of magical thinking may be notable and extraordinary—namely, believing things that are scientifically impossible—the causes of magical thinking are perfectly ordinary.

Evaluating a Dual Process Account

A dual processing account of superstition and magical thinking generates at least four predictions (see Table 1). First, because System 1 processing is thought to be common to all people, then if magical intuitions result from System 1 processing, they should be widespread. Second, because System 1 processing produces systematic errors, then if magical intuitions result from System 1 processing, they should be especially likely to build on general-purpose heuristics, such as representativeness and availability. Both of these predictions are supported by considerable evidence.

Third, because System 1 processing often occurs either without awareness, effort, or intent, then if magical intuitions result from System 1 processing, they too should operate under some of those same conditions (Bargh, 1994; Moors & De Houwer, 2006). Two articles that manipulate cognitive load suggest that these intuitions can emerge without effort (Risen & Gilovich, 2008; Svedholm & Lindeman, 2013). Future research should continue to test the role of effort as well examine if and when magical intuitions emerge without awareness or intent.

Finally, according to a dual process account, judgment and behavior should be less likely to rely on magical intuitions if System 2 is engaged. As reviewed above, several articles now suggest that magical thinking is reduced when factors that trigger System 2 are present. Note that studies of nonsuperstitious judgment errors find that these different System 2 triggers are likely to interact such that System 2 only becomes engaged when ability, motivation, and cues to the error are simultaneously present (see Stanovich & West, 2008). For example, statistical sophistication reduces the tendency to make a conjunction error on a two-item transparent version of the Linda problem, but not when filler items are included and the error is harder to detect (Tversky & Kahneman, 1983). Similarly, individuals who are naturally motivated to be rational are less susceptible to framing effects in a within-subjects design, but not in a between-subjects design (LeBoeuf & Shafir, 2003). As research on magical thinking progresses, it will be important to test the role of each of these factors independently, as well as their interactions. If people rely on activated magical intuitions unless ability, motivation, and context work together to support System 2 engagement, then that can help explain why superstitious thinking is so widespread.

In the second half of the article, I will suggest that magical intuitions may guide behavior not only when System 2 fails to engage, but also in some cases when it does. Even when the conditions are all perfect for detecting an error—when people have the ability and motivation to be rational and when the context draws attention to the error—the magical intuition may still prevail. This is a problem that

Table 1
Magical Thinking Predictions From a Dual Process Account

Prediction	Explanation	Supportive evidence
Magical intuitions are widespread They occur even among educated adults in modern, Western culture Magical intuitions can be found implicitly even if they are not endorsed explicitly	System 1 processing is common to all people. If magical intuitions result from System 1 processing, then they should be widespread.	Albas & Albas (1989) Arad (2014) Bleak & Frederick (1998) Campbell (1996) CBS News (2012) King et al., 2007 Kogut & Ritov (2011) Kramer & Block (2008, 2014) Pronin et al. (2006) Risen & Gilovich (2007, 2008) Rozin et al. (1986) Subbotsky (2001) Tykocinski (2008, 2013) Zhang et al. (2014)
Magical intuitions that build on System 1 heuristics are particularly likely to develop	System 1 produces systematic errors, often because of a reliance on certain heuristics. If magical intuitions result from System 1 processing, then intuitions that build on those heuristics should develop.	Frazer (1922) Miller & Taylor (1995) Gilovich & Savitsky (2002) Nisbett & Ross (1980) Risen & Gilovich (2008) Rozin et al. (1986) Rozin & Nemeroff (1990, 2002) Shweder (1977) Tylor (1873)
Magical intuitions can occur under certain conditions of automaticity	System 1 operates under certain conditions of automaticity. If magical intuitions result from System 1 processing, then they should be able to develop without awareness, effort, or intent.	Risen & Gilovich (2008) Svedholm & Lindeman (2013)
Judgment and behavior is less likely to rely on magical intuitions if System 2 is engaged (among those who are not explicitly superstitious)	System 2 will correct or override System 1 output if it detects an error. If System 2 corrects a magical intuition, then reliance on the intuition will be reduced.	Aarnio & Lindeman (2005, 2007) Epstein et al. (1996) King et al. (2007) Kogut & Ritov (2011) Kramer & Block (2008) Lindeman & Aarnio (2006) Musch & Ehrenberg (2002) Orenstein (2002) Otis & Alcock (1982) Pacini & Epstein (1999) Risen & Gilovich (2008) Rozin et al. (2007) Svedholm & Lindeman (2013) Za'Rour (1972)

the corrective dual process model struggles to explain in its current form. In the next section, I propose a modification to the current model to explain superstitious acquiescence and to provide insights into similar phenomena in nonmagical situations.

Part 2: Refining a Two-Systems Perspective: The Case for Acquiescence

In Part 1, I presented a dual system account of magical thinking. In that account, System 1 generates magical intuitions and System 2 can sometimes identify these magical intuitions as errors and correct them. In Part 2, I explore what happens when System 2 identifies these magical intuitions as irrational but does not correct them, a process I call acquiescence. Magical thinking offers some unique insights into acquiescence because it is a domain in which even highly rational people will concede that they sometimes act on beliefs that they know are untrue. The process of acquiescence, however, is not restricted to magical thinking. I will argue that understanding how acquiescence unfolds in magical thinking can

help us understand how it is that people knowingly behave irrationally in many other areas of life.

To understand how acquiescence happens, with System 2 detecting a System 1 error, but failing to correct it, we must consider the process by which System 2 monitors the output of System 1. To examine how closely System 2 tends to monitor System 1, Frederick (2005) developed a 3-item Cognitive Reflection Test (CRT). Each question on the test has an intuitive—but incorrect—answer that jumps immediately to mind. For example, one question asks:

A bat and a ball cost \$1.10

The bat costs one dollar more than the ball.

How much does the ball cost?

The answer that tends to spring to mind—10 cents—is incorrect. If the ball cost 10 cents, and the bat a dollar more than the ball, then the total cost would be \$1.20, not \$1.10. When people provide

10 cents as the answer, it indicates that they relied on System 1 and did not invest the effort to check the answer with System 2. Had they checked their answer they would almost certainly have detected their error. If they correctly indicate that the ball costs 5 cents, then they are likely to have engaged System 2.

One of the most remarkable findings from the heuristics and biases literature is how often System 2 fails to override an initial intuition. The questions in the CRT do not require sophisticated knowledge, but more than half of participants at elite universities and more than 80% of students at less selective universities answer the bat and ball problem incorrectly (Frederick, 2005; Kahneman, 2011). This failure has led Kahneman (2011) to describe System 2 as “lazy” and “inattentive.”¹⁰ People know that if you add 10 cents and \$1.10, it cannot total \$1.10, but they do not do the simple calculation.

The presumption Kahneman makes, quite reasonably, is that if System 2 were not lazy or inattentive—if it had noticed the error—it would have corrected it. For example, if someone realized that if the ball cost 10 cents, the total cost would be \$1.20, not \$1.10, then she would revise her answer accordingly. People get the answer wrong because they do not calculate the total cost of the bat and the ball. In other words, they do not notice their mistake.¹¹ An unstated assumption of the Kahneman and Frederick model (Kahneman & Frederick, 2002, 2005) is that when people detect an error, they will correct it. This assumption is reasonable, particularly for these types of cognitive tasks—if people explicitly recognize that they are making an error, they have no reason not to correct it. However, the assumption that people will correct an error once they have identified it may not always hold and this has important implications.

Evidence from the superstition and magical thinking literature suggests that people can know—in the moment—that they are being irrational and still choose to behave that way (Rozin & Nemeroff, 2002). When people refuse to eat sugar that they themselves have labeled “cyanide” they know that they are making an error, but they fail to correct it. Indeed, participants’ verbal reports make it clear to researchers that they “realize that their negative feelings were unfounded, but felt and acknowledged them anyway.” (Rozin & Nemeroff, 2002, p. 205). At times, then, superstitions and other powerful intuitions are so compelling that people cannot seem to shake them, despite knowing that they are incorrect. In these cases, people successfully detect an error of rationality, but choose not to correct it. System 2 acquiesces to a powerful intuition. Thus, in addition to being lazy and inattentive, System 2 is sometimes a bit of a pushover.

In the remainder of the article, I will explain how people can know that their intuitions are wrong, but believe them anyway. I will make the case that the same process that leads people to acquiesce to superstitious intuitions can occur when they make other judgments as well. Therefore, I suggest that refining our dual process model to accommodate acquiescence will be useful for thinking about behavior in both magical and nonmagical contexts.

Superstitious Contradiction

When explaining his decision to forward a chain letter, Gene Forman of *The Philadelphia Inquirer* said, “You understand that I am not doing this because I’m superstitious, I just want to avoid

bad luck” (Vyse, 1997, p. 105). By forwarding the chain letter, Gene Forman acted as though he believed he could ward off bad luck even though he claimed not to hold the superstitious belief.

This contradiction is not unique to Gene Forman—it has been identified as a general phenomenon (Campbell, 1996; Shafir & Tversky, 1992; Vyse, 1997). Past accounts have taken people’s claims about their beliefs at face value—if a person claims not to hold a superstitious belief, it is assumed that she does not hold the belief. These accounts, as I will explain, are insufficient. I will argue instead that people who act superstitiously really do hold the superstitious belief, at least to some degree, despite explicitly rejecting it.

Quasi-magical thinking and half-beliefs. Shafir and Tversky (1992) coined the term quasi-magical thinking to describe cases in which people act as if they hold a superstitious belief, even though they do not really believe it. Campbell (1996) used the term half-belief to describe a similar contradiction in modern superstition: “This then is perhaps the most puzzling feature of modern superstition: it involves individuals engaging in practices which they don’t believe” (p. 157). Campbell (1996) reports, for example, that although more than half of responders to a 1984 Gallup poll in London admitted to avoiding walking under ladders and to knocking on/touching wood, only 26% said that they believed in any superstitions. Similarly, in an online Mechanical Turk survey that I recently conducted of 500 United States residents, 46% of participants reported engaging in superstitious behaviors despite claiming not to believe that the behaviors affect their luck (48% reported that they do not engage in any superstitious behavior, and 6% reported believing that superstitious behavior does affect their luck) (Risen, 2015).

Because the concepts of quasi-magical thinking and half-belief assume that people do not hold the superstitious belief, there is a gap between belief and action that needs to be explained. Why would someone act superstitiously if she does not believe the superstition? I believe that the answers that have been offered are not completely satisfying.

Hedging one’s bets. One argument that has been made to bridge the gap between belief and action is that superstitious actions are rational strategies for hedging one’s bets (Vyse, 1997). If the cost of action is cheap and the reward one seeks is great, then it may make sense to perform superstitious acts even if one does not believe that the action will have its intended outcome. For example, when deciding whether to forward or break a chain letter, a person should weigh the cost of e-mailing the letter to several friends against the cost of being struck by lightning or being left by one’s wife and kids (the unfortunate fates of those who recently broke the chain, according to the letter). Following this logic, regardless of whether the person believes the letter, it may be rational to hedge against even the

¹⁰ Kahneman (2011) describes the two systems as characters with personality traits because it makes it easier to understand. Of course, he does not actually believe there is a lazy homunculus inside people’s heads. I do not believe that either.

¹¹ Recent research by De Neys and his colleagues (2013, 2014; De Neys, Rossi, & Houde, 2013) suggest that although these mistakes are not detected explicitly, there is reason to believe they may be detected implicitly (but see Pennycook, Fugelsang, & Koehler, 2012). For example, even biased reasoners are less confident in their answers when the heuristic answer conflicts with logical principles than when there is no conflict.

remote possibility of its being true. After all, if an individual chooses to send the letter, and the superstition is true, then he has protected himself against great calamity; if it is not true, the cost is negligible. However, if he does not send the letter and the superstition is true, then the cost is great.

Although this logic seems reasonable on the surface, I contend that it is a justification for superstitious behavior rather than a logical explanation for it. A cost-benefit analysis is only appropriate if one already has some level of belief in the superstition (or if one accepts the possibility that other people's superstitious beliefs may be true).¹² Even if the cost of an action is low, a person can only conclude that it makes sense to engage in the action if he acknowledges some possibility that the superstition is true. If a person avoids walking under a ladder to prevent bad luck, but does not avoid an action that is similarly easy (e.g., stepping over a pile of sticks), then that suggests he believes there is some possibility—however remote—that avoiding the ladder could provide a benefit that avoiding the sticks could not.¹³ Thus, rather than interpreting the desire to hedge one's bets as an explanation for why people who are not superstitious behave as if they are, I contend that it provides evidence that people who claim not to be superstitious actually believe the superstition to some extent.

Ritual instrumentalism and the utility of action. Another argument that has been made to explain why people behave superstitiously even when they do not believe in the superstition is that it helps reaffirm their commitment to human agency (Campbell, 1996). Even if nonaction is more “rational” in any given situation, action may be preferable because it fits with a fundamental value that it is better to take control over one's life than to be resigned to what happens. Thus, people may engage in actions because it feels good to take action “while at the same time refusing to commit themselves to the belief that such acts will achieve the desired result” (Campbell, 1996, p. 161). In a sense, Campbell is suggesting that engaging in superstitious rituals may provide a form of utility even when it is not accompanied by a superstitious belief.

There can certainly be value in taking action. For example, engaging in symbolic rituals can reduce anxiety and grief (Brooks et al., 2015; Norton & Gino, 2014; Zhang et al., 2014). Moreover, by reducing anxiety in high-anxiety performance situations (e.g., singing in public or taking a math test), symbolic rituals can actually improve performance (Brooks et al., 2015). Thus, even actions that appear irrational on the surface may sometimes turn out to be sensible because they can indirectly affect outcomes by affecting the actor (see also Damisch, Stoberock, & Mussweiler, 2010, but see Calin-Jageman & Caldwell, 2014).

Despite the value that acting can provide, ritual instrumentalism cannot fully explain the contradiction in modern superstition. For example, to explain superstitious “nonactions” one needs to posit a different form of utility. When people refuse to use sugar from a container labeled poison, touch an object that has been in contact with a disliked other, or allow a disliked other to buy an object of theirs (Kramer & Block, 2011; Rozin et al., 1986; Rozin & Nemeroff, 1990), they are not being guided by a goal of instrumentalism. Instead, they seem to be protecting themselves from the emotional disutility (e.g., anxiety) that each action would generate. And, although it is easy to understand why people would not act *if* acting would produce disutility, this account cannot explain why people would experience disutility in the first place.

More broadly, an account that focuses on the utility of action (or nonaction) cannot explain the superstitious feelings and expectations that seem to underlie behavior. For example, although ritual instrumentalism may help explain why people knock on wood after tempting fate, it cannot explain why knocking on wood affects their subsequent beliefs (Zhang et al., 2014). Similarly, ritual instrumentalism may help explain why people do good deeds—donating time and money, for example—when they focus on outcomes they want that are beyond their control (Converse, Risen, & Carter, 2012), but it cannot explain why people expect this “karmic investment” to pay off (Converse et al., 2012).

Superstitious acquiescence. Unlike Campbell (1996) and Shafir and Tversky (1992), I suggest that people who act superstitiously do not simply act *as if* they believe, but that they actually hold the belief or intuition to some degree. I am reluctant to use the terms *quasi-belief* and *half-belief* because they have been defined as cases in which people act superstitiously without holding the belief. My argument does suggest, however, that magical intuitions are a form of *partial belief*—a belief that is supported by System 1, but not necessarily endorsed by System 2.¹⁴ Thus, educated adults from cultures that value rationality may be reluctant to explicitly endorse such superstitious beliefs (especially inside a psychology lab or on a survey). Nevertheless, studies that use response times or other implicit measures will often uncover evidence of superstitious intuitions that converge with people's superstitious behavior (e.g., Risen & Gilovich, 2008).

My argument differs from past accounts, in part, because the intuitions from System 1 are included as part of what it means to believe. However, the difference in perspective is not just semantic—it leads to a fundamentally different question. If my account

¹² This analysis bears a striking resemblance to Pascal's justification for believing in God. In Pascal's wager, he seeks to justify Christian faith by considering the consequences of believing or not believing in God based on whether God does or does not exist. Many objections have been leveled against Pascal's wager. One important objection—and the one that is particularly relevant to the “superstition wager” described in the text—is that the same analysis can be made for belief in Mohamed, Kali, or Buddha. Taken further, the same analysis can be made for why, on balance, it is better to worship my couch, desk, and the coffee cup that I just threw away than to not worship each of them. Although the cost-benefit analysis leads to the same conclusion in all of these cases, people do not worship every object in sight “just in case.” This highlights that Pascal's wager is only appropriate for justifying a belief in a Christian God if one already has some level of belief in a Christian God. Or, at a minimum, one must recognize that other people share a belief in a Christian God and be open to the possibility that those people are correct.

¹³ I have focused on the personal benefit of getting good luck, which is the way the superstition cost-benefit analysis is usually discussed (Vyse, 1997). It is also possible, however, that people hedge with social costs and benefits in mind. In other words, people may avoid walking under a ladder and not avoid stepping over sticks because other people will be happy or think well of them for the former action, but not the latter. In addition, although certain superstitions may be entertained because features of the superstition are intuitively compelling, even arbitrary superstitions may be entertained if they gain acceptance in a social group (Risen & Gilovich, 2008). Both of these issues suggest that superstitions may be a useful context for exploring how an individual's beliefs and behaviors come to be shaped by the beliefs of those around her.

¹⁴ The philosopher Tamar Gendler (2008) introduced the term “alief” to describe automatic belief-like attitudes, which often conflict with people's explicit beliefs. This roughly corresponds to the partial belief described here. Thus, one could say that someone who uses a lucky charm has an alief that it is lucky even if she does not believe it is.

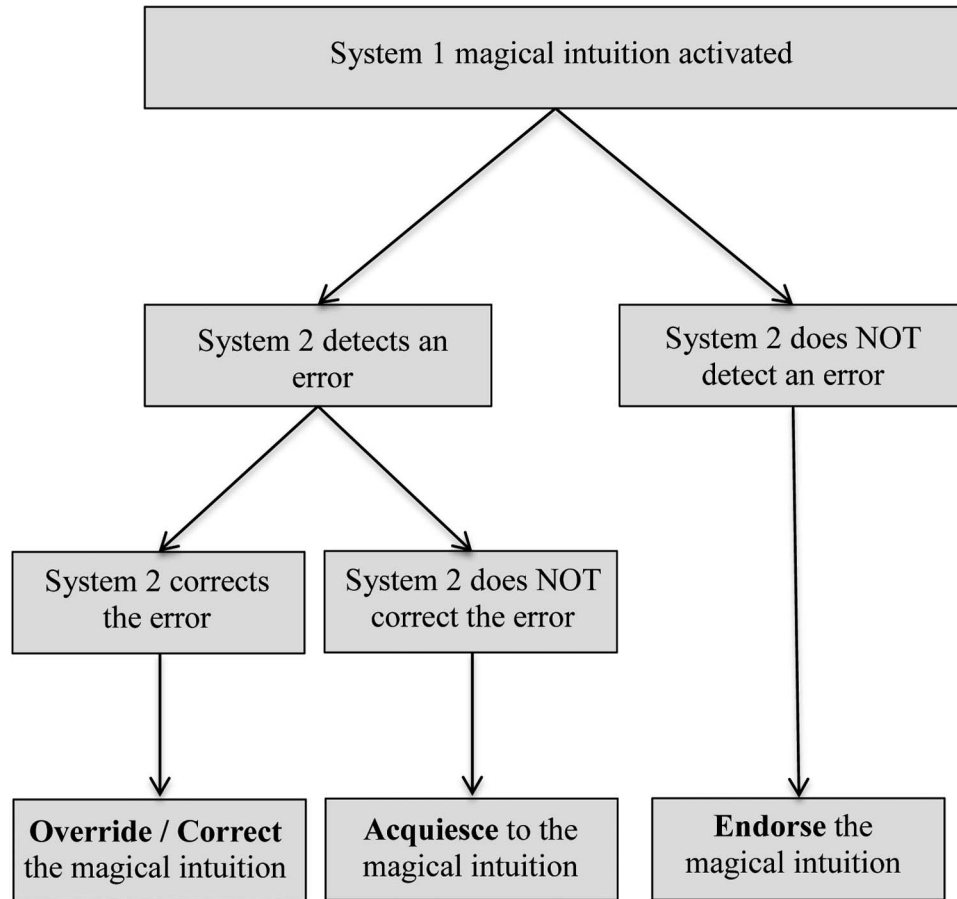


Figure 2. Dual systems account that decouples detection and correction. *Note.* Correction is conditional on detection. If an error is not detected, then the magical intuition will be endorsed. If the error is detected and corrected, then the magical intuition will be overridden, at least to some extent. If the error is detected, but not corrected, then acquiescence will occur. This experience of acquiescence—believing something that we know is false—emerges from a model that decouples detection and correction.

is correct—if superstitious actions often reflect underlying superstitious beliefs or intuitions—then the goal is not to explain the gap between belief and action, but rather to explain how people can simultaneously know that something is irrational and believe that it is true. After all, many people who hold superstitious intuitions and engage in actions that reflect those intuitions are aware that their thoughts and behaviors are irrational. Despite the awareness, they are often unable to rid themselves of such beliefs and behaviors (Keinan, 1994; Rozin & Nemeroff, 2002). For example, I assume that almost all readers rationally know that no harm can come from reading the following sentence out loud: “No one I know will ever get cancer” but I suspect that many readers are reluctant to do so. Thus, people can be aware that they are not being rational, but acquiesce to a powerful intuition nevertheless. Indeed, for people who claim not to be superstitious the most commonly cited reason for engaging in superstitious actions is “Although I know rationally that the superstition can’t affect my luck, I can’t help but feel that it could help” (Risen, 2015). I contend that we gain insight into cases in which people believe superstitions that they know are false if we modify Kahneman and

Frederick’s (2002, 2005) model to decouple the processes of detection and correction such that even when System 2 detects an error it does not necessarily correct it (see Figure 2).

Corrective dual process models like Kahneman and Frederick’s suggest that System 1 produces automatic intuitions that serve as a default when people make judgments. System 2 can then endorse this initial assessment or correct it. Although never explicitly specified in this way, Kahneman and Frederick’s model can explain two different forms of endorsement. First, if System 2 generates the same answer as System 1 (i.e., if both processes lead to the same judgment), then one could say that System 2 “actively” or “intentionally” endorses the System 1 judgment. People who explicitly claim to be superstitious would actively endorse their superstitious intuitions. Second, if System 2 fails to detect an error, then one could say that System 2 has “passively” or “unintentionally” endorsed System 1’s assessment. This seems to fit the cases in which System 2 is described as inattentive or lazy: People may endorse a System 1 judgment, but if they had the proper motivation, resources, and context cues for noticing the error, they would correct it. Note that for both active and passive endorsement, there

is an immediate leap from detection to correction. If System 2 endorses a magical intuition it is either because it is thought to be right or because it failed to notice that it is wrong. If people detect an error, the assumption is that they will correct it.

I suggest that acquiescence is a third form of “endorsement”—one that cannot be explained by a model that confounds detection and correction and assumes that they always work in tandem. When people refuse to use sugar that they have personally just labeled as poison (Rozin et al., 1986), I contend that System 2 has detected an error but has not corrected it—it has acquiesced to a powerful intuition, but one it knows is irrational. A modified dual process account that decouples detection and correction can help explain why superstitious beliefs are maintained even when people *know* they are not true. System 1 produces a magical intuition. System 2 recognizes the error, but acquiesces to the initial intuition. And, when this happens, people may find themselves simultaneously believing and not believing—System 2 knows that the intuition is an error, but lets it stand.¹⁵

The suggestion that we ought to decouple detection and correction was inspired by the findings from research on superstition and magical thinking, but it applies more broadly. In the next section I will describe three cases outside of magical thinking in which people follow their intuition even if they know in the moment that it is not the normatively appropriate course of action. After highlighting examples of acquiescence outside of magical thinking, I will return to the theory, exploring the theoretical and empirical implications of decoupling detection and correction in a dual process model.

Acquiescence Outside of Magical Thinking

Ratio bias paradigm. Perhaps the most compelling case of acquiescence outside the realm of magical thinking is the ratio bias paradigm developed by Epstein and colleagues (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992; Pacini & Epstein, 1999). Participants are given the opportunity to win a prize by selecting a red marble from a bowl containing both red and white ones. Before drawing, participants are asked to choose whether they would like to draw from a small or large bowl. The small bowl has 10 marbles with only one red winner (10% chance to win). The large bowl has 100 marbles and fewer than 10 of them are red, making the likelihood of winning when drawing from the large bowl less than with the small bowl. Remarkably, people often choose the nonoptimal large bowl, even when the percentages are clearly labeled and even when participants report that the small bowl has better odds. For example, in studies that include four or five different trials of this type, more than 80% of participants choose nonoptimally at least once (Denes-Raj & Epstein, 1994; Pacini & Epstein, 1999). Although it is not a rational choice, many people—in particular those who are more intuitive and less rational (according to the Rational-Experiential Inventory)—seem compelled to choose the large bowl with the greater number of winners (Pacini & Epstein, 1999). Simply put, it feels easier to draw a winner when there are more winners to draw and some people, particularly those who are intuitive, find that feeling difficult to shake.

Betting on the favorite. Betting on sports is far more common than betting on bowls of marbles. Research suggests that when people bet on the outcome of sporting events, their

intuition drives them to bet on the favorite rather than the underdog. In most cases, instead of simply deciding who will win, bettors have to make a more difficult decision. Namely, they have to bet whether or not the favorite will win by a certain number of points (the “spread”). Furthermore, that number of points is carefully selected for each game so that the chance of the favorite beating the spread is roughly 50%. Even though favorites beat the spread 50% of the time, people tend to bet on them to do so more than two-thirds of the time (Levitt, 2004; Simmons & Nelson, 2006). Simmons and Nelson (2006) suggest that when deciding to bet, people first think about who is likely to win. The quicker and easier that question is to answer, the more confident people feel in their intuition, and the more likely they are to rely on that intuition when making the more difficult decision to bet against the spread.

The tendency to bet the favorite against the spread emerges even when people estimate their own spread (Simmons & Nelson, 2006) and even when betting the favorite is costly (Simmons et al., 2011). That is, when the spread has been artificially increased so that the favorite will win less than 50% of the time, people continue to bet on them (Simmons et al., 2011). Remarkably, and most relevant to the case of acquiescence, people continue to bet the favorite even when they are explicitly warned that the spread has been artificially increased. The authors explain,

... the temptation to rely on one’s intuitions is so strong as to lead people to rely on what they intuitively feel to be true (the favorite will prevail against the spread) rather than what they generally know to be true (the favorite will usually lose against the spread) (Simmons et al., 2011, p. 13).

Thus, even though people know that the favorite is less than 50% likely to cover the spread when it has been artificially increased, they acquiesce to a powerful intuition and bet on the favorite.

Sudden death aversion. Imagine that it is nearing the end of a basketball game and your team is down by two points. You can set up a 3-point shot that, if successful will give your team the win but, if unsuccessful, will result in a loss. Alternatively, you can set up a 2-point shot designed to force overtime and then try to win it in the extra period. What would you do?

With Thomas Gilovich and Richard Thaler, I have found that people often choose an option that is statistically less likely to produce a win if it means they are less likely to lose immediately, a phenomenon we refer to as “sudden death aversion.” (Risen, Gilovich, & Thaler, 2015). In the basketball scenario described above, for example, we tell participants that all the relevant statistics point to a 33% chance of successfully hitting the 3-point shot, a 50% chance of hitting the 2-point shot, and a 50% chance of winning in overtime (they are playing an evenly matched rival). Although the chance of winning the game by setting up the 3 is higher (33%) than by setting up the 2 (25% chance to hit the 2 and win in overtime), an overwhelming majority of people (80%) choose to set up the 2 (Risen et al., 2015).

¹⁵ Although Kahneman and Frederick’s (2002, 2005) corrective model does not consider the possibility that people can follow their intuition if they recognize that it is wrong, competitive dual process models like those offered by Epstein (1990, 1994) and Sloman (1996, 2002, 2014) have recognized this possibility. At the end of the article, I will discuss the similarities and differences of those models to the one I am proposing.

Several psychological factors likely play a role in why the “fast” option feels intuitively more risky, even though it provides better overall better odds. Furthermore, relevant to the case of acquiescence, we believe that some of these factors are compelling enough to lead people to go with their intuition even when they are fully aware that it conflicts with what is rational. In one version of the basketball scenario, we not only provide the relevant statistics, but we calculate the conjunctive probability for participants and summarize it by explicitly comparing the odds of the two options. “Statistically speaking, going for 3 gives you better odds of winning the game.” Even when participants are explicitly told that the chance of winning is higher if they set up the 3-point shot, slightly more than half of participants (54%) choose to set up the 2. I suggest that these participants are following an intuition that they know—in the moment—is not rational.

Just as I believe that superstitious intuitions underlie most superstitious acts, I believe that compelling intuitions underlie many of these other acts of acquiescence as well. When people choose the large bowl in the ratio bias paradigm, I contend that their intuition tells them that they are more likely to draw a winner, even if they know that is not true. Similarly, when people bet on the favorite against an artificially increased spread or set up a 2-point shot at the end of the basketball game, I contend that their intuition tells them that they are more likely to win their bet or the game. Thus, although acquiescence may occur because the psychological utility for following an intuition is especially powerful, it can also occur because our intuitive beliefs are especially powerful. Instead of suggesting that people prefer the 2-point shot because it feels bad to do something that they believe is risky, researchers should also ask why people believe an option is risky when they know that it has better odds. Although it is certainly useful to think about different forms of utility that may accrue from selecting an intuitive option, it is also important to think about the underlying intuition itself: What is the value or function of the belief? What processes give rise to it? What determines its strength?

In summary, even outside of the realm of superstition and magical thinking, there is evidence that people acquiesce to beliefs that they recognize are not rational or sensible, even when there are financial consequences. I suggest that these effects are not well explained by current dual process models that treat detection and correction as a unified process. In the next section, I will highlight some of the theoretical and empirical implications of a model that decouples the two processes.

Decoupling Detection and Correction

Most simply, decoupling detection and correction recognizes the possibility that people can detect an error, but choose not to correct it. People can acquiesce to a System 1 intuition while simultaneously being aware that the intuition is not rational. The model I am advocating assumes that correction is conditional on detection. Thus, people can (a) detect and correct, (b) neither detect nor correct, or (c) detect without correcting (i.e., acquiescence; see Figure 2). I do not believe that people can correct an error without having detected it (though it is an open question as to how implicit or explicit the detection may be). Thus, if there is evidence of correction, I will assume that some form of detection has taken place.

The most important prediction of the model I am offering is that people can acquiesce—they can follow their intuition even when they have identified it as irrational. Indeed, the model was developed specifically to accommodate instances of superstitious acquiescence. Several other predictions also emerge from the model, however—beyond this basic prediction (see Table 2). In the remainder of the article, I discuss these predictions as well as how the proposed model can encourage and guide empirical research (see Table 2).

Measuring detection and correction separately. First, because detection and correction are assumed to be separate processes, I predict that they can be measured separately. Thus, researchers can examine whether an error is primarily the result of a failure to detect or a failure to correct as well as whether an intervention primarily influences the detection or correction process. For an intervention to be effective, it should target the appropriate process, which it cannot do unless we acknowledge both processes.

In the first half of the article, I reviewed factors that trigger System 2 based on whether they influence the ability to be rational, the motivation to be rational, and the contextual cues that make errors more or less detectable. These factors have been shown to influence the extent to which people can override their intuition and respond rationally. However, because detection and correction have been treated as a unified process, researchers have not explored whether these interventions improve judgment by helping people detect their errors or by helping them to correct them. For an intervention to be effective, it should focus on the relevant process, which is why it is important to examine whether variables that have been linked to the engagement of System 2 operate primarily by influencing the detection or the correction process (and under what circumstances).

In the case of the third category—contextual cues that make errors more or less detectable, even the label itself makes it clear that these factors primarily operate by influencing the detection process. A transparent or within-subjects version of a task, for example, allows people to more easily identify the dimension that the researcher is examining. This transparency gives people the chance to recognize a mistake that might go unnoticed if they were only exposed to one form of the question (Kahneman & Frederick, 2002, 2005). If people make an error even when they recognize their mistake, then we can assume that the error is because of a failure to correct.

The motivation and the ability to be rational could affect people’s tendency both to detect and correct errors. When people are motivated to be rational and careful—whether because of instructions, incentives, mood, or natural predispositions—they may be more likely to notice a System 1 error. And, conditional on noticing an error, the motivation may also make people more likely to fix it. In contrast, when people do not have the motivation to be rational, they may be less likely both to detect and correct a mistake. Similarly, when people’s ability to be rational is compromised—for example, when experiencing cognitive load—they may be less likely to detect an error, and, even if they are able to detect the error, they may have fewer cognitive resources available to correct it.

Although the motivation and ability to be rational may operate on both processes, if researchers want to help people be more rational, it is critical to examine whether certain variables influence one process more than the other. Experiments can be designed to help researchers infer which process is being affected. To

Table 2
Research Implications of an Account That Decouples Detection and Correction

Topic	Questions	Predictions	Methods
Measuring detection and correction separately	Are some judgment errors due to a failure to correct (e.g., acquiescence) rather than a failure to detect?	People will sometimes make errors even when they explicitly recognize the error.	Measure error rates for tasks in which the errors are completely transparent (e.g., the odds of different options are explicitly noted).
	Do some factors influence detection more than correction? Do some influence correction more than detection?	Some interventions will improve rationality by helping people detect errors and others will do so by helping people correct them.	Compare the effects of a System 2 trigger (e.g., accountability, incentives, mood, cognitive load) on error rates when an error is either easy or hard to detect. Within a single study, separately measure process DVs that map onto detection (e.g., immediate reaction time; ACC activation) and correction (e.g., time spent re-thinking; DLPFC activation).
Identifying factors that influence acquiescence	Why do people acquiesce to their System 1 assessment when they know it isn't rational?	People will acquiesce more if the intuition provides a compelling default.	Compare acquiescence when a good or bad outcome springs to mind easily or does not. Compare acquiescence when knowledge of what is true is presented before or after the intuition forms.
		People will acquiesce more if the costs of ignoring rationality are low relative to the costs of ignoring intuition	Compare acquiescence for decisions in which the increase in expected value for being rational is small or large and those in which personal feelings are weak or powerful.
		People will acquiesce more if they can rationalize or justify their intuition by thinking that the particular situation is special	Compare acquiescence for a single decision or a policy decision. Compare acquiescence for an elaborated or impoverished decision. Compare acquiescence for a decision made for oneself or for others
Examining the experience of acquiescence	Is experiencing a conflict between System 1 and System 2 aversive?	People will experience discomfort when they fail to act on powerful intuitions.	Compare psychological discomfort/arousal when participants are assigned to act rationally when it conflicts or does not conflict with a powerful intuition.
		People will experience discomfort when they act on intuitions that they explicitly reject	Compare psychological discomfort/arousal for following intuitions when the error is explicitly noted or not.
	Do people use preventative strategies to avoid experiencing conflict in the first place?	People will avoid information that encourages a rational decision to make it easier to make an intuitive decision. People will avoid information that encourages an intuitive decision to make it easier to make a rational decision.	Measure people's interest in costless, decision-relevant information.

examine this, one could compare the effect of motivation or ability when an error is easy or hard to detect. If social accountability reduces errors when the error is explicitly noted to participants, for example, we can assume it influences correction. If a sad mood improves performance to a greater extent when errors are hard to detect than easy to detect, then that would suggest it is influencing detection.¹⁶

Of course, because the measurement of detection and correction typically relies on the same observable behavior—whether people respond with a normatively correct answer or an incorrect intuition—the paradigm I suggested above can only indirectly measure the extent to which people detect and correct errors. More direct measurement would require that researchers develop different tools for measuring each of the processes.

A handful of recent articles have included measures that go beyond whether the final answer is right or wrong. These articles typically focus on the “monitoring” question that dual process theories must answer. Namely, how does an individual determine that System 2 thinking is necessary without having to engage

¹⁶ In theory, a variable could even operate on the two processes in opposite directions. For example, consider the effect of being surrounded by other people. Social facilitation research finds that being in the presence of others increases arousal and therefore increases people's dominant, automatic response (Zajonc, 1965). Thus, people may be less likely to detect an error in the presence of others. However, if the error is easy to detect or explicitly noted to people, then social accountability may help them correct the error (Lerner & Tetlock, 1999).

System 2 thinking to do so? Although there is no consensus on how exactly this happens, there is a general movement toward recognizing that the decision to engage System 2 cannot itself require System 2, particularly among those who advocate a corrective model (Alter et al., 2007; De Neys, 2014; Evans & Stanovich, 2013; Simmons & Nelson, 2006; Thompson, 2009; Thompson, Prowse Turner, & Pennycook, 2011).

Some authors have answered the monitoring question by advocating that the metacognitive feeling attached to the System 1 intuition is used to determine whether System 2 is necessary. That is, when people experience a feeling of confidence or rightness (Simmons & Nelson, 2006; Thompson, 2009; Thompson et al., 2011) when generating an intuition, it signals that System 2 is not necessary. A lack of confidence, in contrast, signals that System 2 processes are needed. De Neys (2012, 2014) has answered the monitoring question by suggesting that, in addition to intuitive heuristics being automatically evoked, intuitive logical principles are also automatically triggered. When these two System 1 intuitions conflict, System 2 is engaged.

Thompson and colleagues (2011) tested the metacognitive account by having participants provide two answers to a series of reasoning questions (the first answer that came to mind and a final answer). They measured participants' confidence in their initial response, whether the answer changed from Time 1 to Time 2, and the amount of time participants spent rethinking the question. As predicted, when participants felt more confident in their initial answer, they spent less time rethinking it and were less likely to change their answer. Note that although the theory suggests that the feeling of rightness is used as a way to monitor or "detect" whether System 2 needs to be engaged, the variables being measured (switching an answer and spending time thinking) seem to map onto correction processes better.

In a separate program of research, De Neys and colleagues have compared response times, confidence, skin conductance, and activated brain regions when people face problems in which there is a conflict between a heuristic and normative response (e.g., the bat and the ball problem from the CRT) and when they face problems that do not include such a conflict (e.g., "A magazine and a banana together cost \$2.90. The magazine costs \$2. How much does the banana cost?"). Even people who give the wrong answer when there is a conflict (e.g., the ball costs 10 cents) respond differently to the two types of problems, suggesting that they may implicitly detect the conflict or error, even if they do not explicitly recognize it or correct it (for a summary see De Neys, 2014).

To my knowledge, judgment and decision making researchers have not introduced process measures designed to separately measure detection and correction in a single study. However, the dependent variables that have been used across different programs of research provide a rich set of options to choose among. For example, to measure whether errors are detected, researchers could compare response times (RTs) when generating an initial answer for problems in which there is a conflict between a heuristic and normative response and those in which there is no such conflict. Additionally, in the same study, researchers could measure correction by comparing the time people spend rethinking their initial answers to these different types of problems.

Brain imaging may also be useful in teasing apart these two processes. There is evidence that the anterior cingulate cortex (ACC) is associated with the experience of cognitive conflict

(Botvinick, Braver, Barch, Carter, & Cohen, 2001) and that regions in the dorsolateral prefrontal cortex (DLPFC) are involved in abstract reasoning processes and cognitive control (Miller & Cohen, 2001). Thus, activation in the ACC may map especially well onto detecting an error and activation in the DLPFC may map especially well onto correcting it. Although both of these regions are likely to be active when people face conflict (Cunningham et al., 2004; Greene, Nystrom, Engell, Darley, & Cohen, 2004), as neuroscience and brain imaging progresses (especially in conjunction with more precise timing measures), we may be able to observe meaningful differences. Future research may not only be able to distinguish between System 1 "reflexive" and System 2 "reflective" neurological processes (Lieberman, 2003, 2007), but also between different elements of System 2. Evidence of increased ACC activation without increased DLPFC activation could be interpreted as a neural signature of acquiescence.

Identifying factors that influence acquiescence. Conditional on recognizing that something is not normative or rational, what would lead people to acquiesce to their System 1 assessment and what would lead them to correct the error? Broadly speaking, I predict that acquiescence is more likely to occur if (a) an intuition provides a compelling default, (b) the costs of ignoring rationality are low relative to the costs of ignoring intuition, and (c) if people have the opportunity to rationalize their intuition—that is, if they can find reasons to put aside their knowledge of what is true in general to follow their intuition in a particular situation. In the next section, I will discuss variables that may influence each of these categories. Building on the discussion from above, because some variables may also influence the tendency to detect an error, it is important to isolate the correction process when testing whether these variables influence acquiescence. That is, to test specifically for acquiescence, studies must draw explicit attention to the error for everyone—so that it is always detected—and then test whether these factors lead people to acquiesce to their intuition or correct it.

Intuition provides a compelling default. I predict that factors that contribute to the strength of an intuition are likely to play a role in whether people will make the rational choice or acquiesce to their intuition. The ease with which a good or bad outcome springs to mind (Risen & Gilovich, 2007, 2008) and the clarity with which one imagines an outcome (Risen & Critcher, 2011; Zhang et al., 2014), for example, may influence the tendency to acquiesce. If it is especially easy to imagine missing the 3-point shot or to visualize an overtime win, people may decide to set up the 2-point shot, despite knowing the odds are worse.

The order in which information is provided may also influence the tendency to acquiesce by affecting the extent to which an intuition serves as a default. According to a corrective dual process model, intuition serves as a default because it occurs automatically—before System 2 has a chance to detect whether there is an error. Thus, even in cases in which the error is explicitly noted to people, it is generally assumed that they have generated their intuition first. It may be possible, however, to "preempt" people's intuition with knowledge, such that the intuition does not become the default. I predict that if knowledge of what is true is activated before people form an intuition, then people will be less likely to acquiesce. For example, if people know that the 3-point shot is normatively superior before they are presented with the details of the situation that lead them to develop the intuition that going for

3 is risky (e.g., time is running out and missing the 3 would mean immediate defeat), then they should be more likely to make the normatively correct decision and go for 3-points.

Costs of ignoring rationality or intuition. Factors that influence the costs and benefits of acquiescence (vs. correction) will also certainly play a role in predicting behavior. As the expected value of following rationality grows, for example, people should be less likely to acquiesce. This is supported by people's decisions in the ratio bias paradigm. People are more likely to acquiesce when the probability of winning in the large bowl is only slightly worse than the probability in the small bowl (e.g., 9% vs. 10%). As the odds in the large bowl drop, people are less likely to acquiesce (Denes-Raj & Epstein, 1994).

Conversely, as the cost of ignoring intuition grows, people should be more likely to acquiesce. For example, to the extent that an intuitive response taps into personal, powerful feelings (e.g., anxiety or disgust), people should be more inclined to follow their intuition even if they know it is irrational. Supporting this, even people who report that a magic spell cannot cause damage are less willing to allow an experimenter to say a magic spell if their hand is at risk than if some other, less valuable object is at risk (Subbotsky, 2001).

In addition, I suggest that it will seem costly to ignore one's intuition for decisions that "ought" to be made intuitively and costly to ignore rationality for decisions that "ought" to be made rationally. Research suggests that when features of a choice resemble features of System 2 processing (objectively evaluable, sequential, complex, and precise), people think the choice should be made rationally. When features resemble System 1 processing, in contrast, they think the choice should be made based on their intuition (Inbar, Cone, & Gilovich, 2010). For example, people prefer a rational process for decisions with outcomes that are considered objectively evaluable (e.g., choosing a medical treatment), but not for decisions without objectively evaluable outcomes (e.g., choosing a spouse). This suggests that for people who see basketball coaching as an art, it may be harder to ignore their intuition and for people who see coaching as a science it may be harder to ignore the odds, leading to more acquiescence in the former group than the latter.

Applying general knowledge to the specific situation. One participant explained his decision to set up the 2-point shot by saying, "It comes down to intuition I suppose. Statistically it might not be wise but I guess I would have a feeling it could work so I'd give it a shot" (Walco & Risen, 2015). This case illustrates that an individual can be aware that the odds favor the 3-point shot, but also believe that the 2-point shot is the better option for winning the game.

Acquiescence occurs when people put aside what they know to be generally true to follow their intuition. I predict that to the extent that people can think of a particular decision as different or special (even in an arbitrary way), it may be easier to ignore what one knows is broadly true and choose based on what one feels is true in this particular situation. This suggests that it may be harder to acquiesce, for example, when setting up a rule or a policy to use for many similar decisions than when making a decision for one situation. If this is true, coaches should be more likely to acquiesce to their intuition and go for 2 when deciding about a single basketball game than if they are deciding the coaching policy for the entire season.

In addition, this suggests that the more information that differentiates a particular decision from others, the more people should be willing to acquiesce. Information that differentiates a particular decision from others may lead to acquiescence even if the information is not relevant to the decision. Thus, an elaborated option with concrete but irrelevant details may make it easier to acquiesce because people have more opportunities to put aside their knowledge and rationalize their intuition. People may be more likely to go for 2, for example, if they consider that this is the first time (or last time) these two particular teams will play this season. If people are looking for anything to "hang their hat on," then just about anything might do. Finally, because people tend to think of themselves as different and special (Chambers & Windschitl, 2004; Weinstein, 1980), acquiescence may be more likely to occur when people are making decisions for themselves than for others.

If these predictions are supported, then it suggests that people will make more normative choices when they are encouraged to think about their decisions as a policy, when they have fewer specific details and justifications available, and when they are thinking about the decisions that someone else should make. These conditions map onto the point of view that tends to emerge when outsiders, rather than insiders, are asked to evaluate different courses of action (Kahneman & Lovallo, 1993; Kahneman & Tversky, 1979). However, it may not be that outsiders are more accurate than insiders because it is easier to detect errors from an outsider's perspective, but rather, because it is easier for insiders to acquiesce to their intuition. Thus, even if insiders are provided with all the information that an outsider has and are equally likely to detect an error, they may still be prone to acquiescence because they may be more likely to justify leaving the error uncorrected and convincing themselves that, in this particular case, it's not actually an error.

Examining the experience of acquiescence. Acknowledging acquiescence as a possible System 2 response will hopefully also encourage researchers to study the subjective experience of acquiescence, as well as its consequences. Acquiescence refers to cases in which people believe things and act in ways that they know—in the moment—are not rational. There is a rich tradition in social psychology suggesting that experiencing conflict between thoughts and behaviors is associated with psychological discomfort (Cooper, 2007; Festinger, 1957). I predict that experiencing conflict between System 1 and System 2 can create such discomfort. That is, people may experience something akin to dissonance either from acting on intuitions that they do not explicitly endorse or from failing to act on these intuitions.

It also may be useful to examine whether similar strategies are implemented to manage these experiences, and whether they are successful. For example, after walking around a ladder rather than under it, an individual may be motivated to reduce a feeling of conflict by explicitly expressing a belief that walking under a ladder can cause bad luck. Of course, this is only a viable option for reducing discomfort if an individual is willing to admit to some degree of belief. If not, then people may need to find other ways to reduce the discomfort, for example, by rationalizing the behavior ("I don't want to risk having the ladder fall on me"). If, instead, an individual chooses to walk under the ladder, then he may rely on other strategies for quieting a nagging magical intuition. Because intuitions generated by System 1 often do not disappear even when System 2 corrects them, I suspect that in many cases it may

be more aversive for people to act against their intuitions than to act against their knowledge. Thus, it may be more aversive to walk under a ladder than to walk around it. This may help explain why, even in cultures that value rationality, there is so much advice to “trust your gut” or “follow your heart.” Whereas dissonance research has focused on thoughts and behaviors that conflict with people’s attitudes, future research can examine the consequences that emerge when behavior conflicts either with people’s knowledge about the world or their intuitions.

If conflicts between System 1 and System 2 are aversive, then instead of managing discomfort after it has been experienced, people may also try to avoid the experience of conflict. In recent research, we examine whether people strategically avoid information that would encourage a rational decision to allow themselves to make an intuitive one (Woolley & Risen, 2015). For example, might someone avoid learning the number of calories that are in a dessert because she knows she would feel compelled to pass on the dessert if the number were too high? Our results suggest that people do. Specifically, participants imagine being tempted to order dessert even though they are concerned with healthy eating. We find that the majority of people want to avoid information about the calorie content of the cake. However, when the calorie information is provided, it influences their subsequent decision to order the cake—even for those who did not want the information. In another set of studies, participants decide whether to learn how much money they could win by accepting an intuitively unappealing bet (winning money if their kid’s soccer team loses, if a hurricane hits a third-world country, or if a sympathetic student performs poorly in class). Although intuitively unappealing, the bets are financially rational because they only have financial upside. We find that people avoid learning the payout information so that it is easier to make the intuitive decision to refuse the bet. Thus, people avoid information to protect an intuitive preference, even though they use the information when it is provided. Of course, it is also possible that people strategically avoid information so that it is easier to make a rational decision. Indeed, research suggests that people sometimes use precommitment strategies to avoid temptation and make it easier to be rational (see Schwartz et al., 2014).

Applying acquiescence to other domains. A model that allows for acquiescence can also be useful for understanding behavior in other domains in which people experience conflict. For example, some of the intuitive responses discussed above—not wanting to bet on people dying or wanting to indulge in a delicious dessert—suggest that acquiescence may also be relevant for thinking about moral intuitions and self-control temptations. Indeed many researchers who study moral reasoning and self-control rely on dual process models (Greene, 2007, 2013; Hofmann, Friese, & Strack, 2009; Metcalfe & Mischel, 1999; Strack & Deutsch, 2004).

The domains of self-control and moral reasoning are prone to intuitive-deliberative conflicts, but unlike magical thinking, it is usually impossible to definitively declare one response irrational. It is easy to make the case that superstitious beliefs are not rational (after all, they are scientifically impossible by definition). Furthermore, it is easy to make the case that other examples of acquiescence—for example, choosing the large urn in the ratio bias paradigm or betting on the favorite when the spread is known to be artificially increased—violate basic principles of rationality. The same cannot be said for these other domains. It may not necessarily

be irrational to violate one’s long-term goals, and utilitarianism is only one normative standard by which moral reasoning can be judged. Acquiescence is brought into sharpest relief when people follow intuitions that they acknowledge are irrational. However, we may be able to export the lessons we learn from cases in which people are clearly acquiescing to an irrational belief to study cases in which acquiescence may be more difficult to detect.

First, it is worth noting that acquiescence—although not explicitly labeled as such—is an underlying assumption in self-control research and has also been explored in moral reasoning. Haidt’s (2001) Social Intuitionist Model of moral reasoning, for example, which emphasizes the role of intuition and deemphasizes the role of deliberate reasoning, could be considered a model of moral acquiescence. Moral dumbfounding studies (Haidt, Bjorklund, & Murphy, 2000), show that people stick to their moral intuitions (e.g., It is never permissible for a brother and sister to have sex) even when they know that there is no “rational” problem with the behavior (e.g., they use birth control, will not be emotionally hurt, etc.), suggesting that people may sometimes recognize that their moral intuition is not sensible, but follow it anyway (see also Kahneman & Sunstein, 2005). In addition, self-control researchers readily acknowledge that people can knowingly violate their long-term goals. Although some self-control failures occur because people do not recognize that they are facing a conflict, many occur even when people do recognize it.

Although acquiescence is recognized in these domains, I suggest that self-regulation and moral reasoning scholars may benefit from explicitly considering what it means to acquiesce when facing a self-control or moral dilemma. For example, it may be productive to consider how moral acquiescence differs from cases in which people follow their moral intuition without recognizing that it is irrational. Does their confidence in the judgment vary? Do they punish wrong-doers differently? Do they avoid information that would complicate their intuitive moral judgment? It may also be useful for researchers in these domains to consider factors that influence acquiescence. For example, self-control researchers may benefit from examining variables that influence the extent to which people have an opportunity for rationalization. As discussed above, it may be easier to acquiesce when making a single decision than a set of decisions and when a situation seems unique—even if its uniqueness is arbitrary. Thus, the opportunity for rationalization may help explain cases in which people acquiesce to their hedonic impulses, such as when they break a diet by claiming that today is different and special. If we can learn to identify the markers of acquiescence in domains such as superstition, then those insights may help us recognize acquiescence in self-control conflicts. For example, it may help us to distinguish cases in which people have genuine reasons for setting aside a long-term goal (e.g., it is my anniversary) and cases when they generate rationalizations just so that they can acquiesce to a powerful temptation (e.g., I was extra healthy yesterday).

Decoupling detection and correction may open up avenues of inquiry in several other domains in which people are known to make errors—even beyond those of self-control and moral reasoning for which dual process models are often applied. For example, although the overoptimism that emerges in the planning fallacy may occur most commonly because people fail to consider their own past behavior or base-rates when predicting the future (Buehler, Griffin, & Ross, 1994), people may sometimes show the

fallacy even when they have all the right information and know they are being unrealistic (see Kahneman, 2011 p. 245, for a wonderful example as Kahneman and his team plan to write a textbook). I suggest that different interventions may be needed to help people recognize that they are being unrealistic and to convince them not to acquiesce to an optimistic intuition that they recognize is unrealistic. In addition, consider cases in which certain populations have a negative distorted sense of reality, such as those who suffer from paranoia, Obsessive-Compulsive Disorder, or have specific phobias. Many people who suffer from these conditions may fail to recognize that their beliefs are not grounded in reality and may, therefore, benefit from treatments that help them recognize their error. Other people, however, may experience the paranoia and fear while simultaneously recognizing that they are being irrational (Evans, 2014; Goldin et al., 2013). In this case, treatments that focus on the correction process will be more useful. These examples illustrate that even if the majority of people's mistakes occur because they fail to notice errors, another portion may occur even when people do notice them. Thus, acquiescence does not describe all—or even most—of the mistakes that people make in any given domain, but it does help explain a portion of errors across a wide variety of domains.

Comparing acquiescence to other models. I have argued throughout the article that, despite its strengths, the corrective dual process model offered by Kahneman and Frederick (2002, 2005) cannot accommodate situations in which people follow an intuition that they recognize in the moment is irrational. I suggest that by refining the model to decouple the processes of detection and correction it can help explain how people can hold superstitions that they know are false and how they can follow other powerful intuitions known to be irrational. I believe that a corrective model that allows for acquiescence has more explanatory power than a basic corrective model and opens new avenues of inquiry.

Note that although Kahneman and Frederick's (2002, 2005) corrective model does not consider the possibility that people can follow their intuition if they recognize that it is wrong, some other approaches to dual systems have recognized this general possibility and it is worth pointing out the similarities and differences of those models to the one I am proposing. Thus, in the final section, I will highlight some of the ways in which a corrective model that allows for acquiescence is similar and different from competitive dual process models, such as Epstein's (1990, 1994) and Sloman's (1996, 2002, 2014) models, and from the quad model (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Sherman, 2006).

Competitive dual process models. Epstein's Cognitive-Experiential Self-Theory (CEST: 1990, 1994; Epstein et al., 1996) has been extremely influential, especially for social and personality psychologists interested in superstition and magical thinking. CEST suggests that people process information through two parallel systems, one that is experiential (mapping onto System 1) and one that is rational (mapping onto System 2). The Rational-Experiential inventory was developed to measure individual differences in the tendency to engage in intuitive and rational thinking and, as predicted, being more intuitive and less rational is correlated with people being more superstitious and more influenced by magical thinking manipulations (Aarnio & Lindeman, 2007; Epstein et al., 1996; King et al., 2007; Kramer & Block,

2014; Lindeman & Aarnio, 2006; Pacini & Epstein, 1999; Svedholm & Lindeman, 2013).

Sloman's (1996, 2002) original two-system model of reasoning describes the two processes as "associative" and "rule-based." His updated model (2014), however, introduces the terms "intuition" and "deliberation" to reflect research suggesting that System 1 can also involve abstract rule-like relations, including representations of causal structure. Indeed, if I were to provide descriptive labels for the two Systems, intuitive and deliberative would be among the best word choices to capture the critical distinction between the processes. In addition, it was Sloman (1996, 2002) who suggested that dual process accounts are supported by evidence of "Criterion S," referring to the idea that people can simultaneously believe two contradictory responses. Criterion S is the closest articulation in the literature of my claim that people can believe things that they know in the moment are false.

Despite the similarities with each of these models, there are several differences from the one I am proposing that are worth noting. First, my account fits the "corrective" (Gilbert, 1999) or "default-interventionist" (Evans, 2007) category of dual process model, previously advanced by judgment and decision making authors such as Kahneman and Frederick (2002, 2005); Evans (2006, 2007, 2008), and Stanovich (1999), as well as by many other social psychologists (see, e.g., Fiske & Neuberg, 1990; Gilbert et al., 1988; Wegener & Petty, 1997; Wilson et al., 2000). Like those authors, I suggest that System 1 automatically offers judgments that serve as a default, which may or may not be corrected by System 2. In contrast, both Epstein's and Sloman's models are competitive dual process models, which suggest that the two processes occur in parallel. Whereas a corrective model suggests that System 1 is activated automatically and that System 2 may or may not become activated, a competitive model suggests that people approach judgments by simultaneously engaging both systems of thought. Because System 2 processing is effortful and requires cognitive resources, the corrective model is especially compelling for those who believe that people often behave as "cognitive misers," carefully conserving mental resources when possible. In addition, whereas a corrective model suggests that judgment and behavior can blend the two processes—with System 2 adjusting from the initial anchor offered by System 1, a competitive model suggests that one of the two processes will control output (Gilbert, 1999). These different assumptions lead to different predictions. For example, as discussed above, a corrective model that allows for acquiescence predicts that people should be more likely to correct their intuition and follow the output of System 2 if the process of generating an intuitive default is preempted by general knowledge. In contrast, because a competitive process model does not assume an intuitive default, it would not make such a prediction. In addition, for decisions that are not dichotomous, the model I am proposing predicts that behavior will sometimes combine System 1 and System 2 responses. If only one process controls output in a competitive model (Gilbert, 1999), then it would not make such a prediction.

Moreover, the model of acquiescence that I am proposing highlights different factors that help determine which system of thought will play a dominant role in people's final response. With its emphasis on personality, Epstein's model focuses on how individual differences can help predict which system of thought will end up controlling behavior. My account acknowledges indi-

vidual differences, but does not emphasize those over situational factors that influence System 2 engagement. Furthermore, while I agree that highly intuitive people are likely to follow their intuition, because acquiescence requires that people detect the error in the first place, acquiescence may be especially likely to occur among people high in both rationality (that helps them detect errors) and intuition (that leads them to acquiesce).

Sloman suggests that when people have access to both systems, System 2 will dominate (Sloman, 1996). His updated version (Sloman, 2014) relaxes this assumption to some extent, but continues to advocate that System 2 will dominate “when the deliberative response is compelling and the conflicting intuitive one can be ignored with little personal cost” (Sloman, 2014, p. 74). Although I accept Sloman’s claim about System 2, I make the same prediction for System 1 as well. That is, System 1 will dominate when the intuitive response is compelling and the conflicting deliberative one “can be ignored with little personal cost.” Thus, although we agree that the strength of the competing responses and the costs associated with each will surely play a role in people’s decisions, my account does not assume that System 2 is necessarily privileged.

Furthermore, the predictions I make about when people will apply what they know to be true in general to a specific situation do not emerge from their accounts. I predict that variables that make a decision seem different and special will allow people to follow their intuition even if they recognize that it is an error. I do not believe a competitive model would make those same predictions.

Finally, and most critically, although they allow for the possibility that people can simultaneously believe two different things, Sloman and Epstein do not distinguish between error detection and correction. When people follow a magical intuition, for example, it could either be because they did not manage to generate a nonmagical response or because they preferred their magical response over the deliberative one. Thus, I suggest that competitive dual process models would also be improved by decoupling the deliberative process into its constituent parts.

Quad model. On the surface, the model that I am proposing is quite different from the Quad model. The quad model separates automatic and controlled processing each into two components, thereby giving rise to four different processes thought to contribute to judgment and behavior (Conrey et al., 2005; Sherman, 2006). In addition, it is a formal mathematical model and has primarily been used to examine performance on implicit measures of evaluation (e.g., the IAT).

Despite many differences, it has one critical similarity with the model I am proposing. Namely, it explicitly decouples different aspects of controlled processing. The authors note that some dual process models focus on aspects of control that relate to stimulus detection processes—for example, when people try to form an accurate representation of reality such as discriminating strong and weak persuasive arguments. Other models focus on aspects of control that relate to self-regulatory processes—for example, when people try to inhibit certain associations such as overcoming stereotypes. The quad model is designed to include both: “A police officer’s decision about whether or not to shoot a Black man who may or may not have a gun depends both on his ability to discriminate whether or not the man has a gun and, if he has no gun, his ability to overcome an automatic bias to associate Blacks

with guns and to shoot” (Conrey et al., 2005, p. 470). They label these processes as *discriminability* (the ability to determine a correct response) and *overcoming bias* (the success at overcoming automatically activated associations), which roughly map onto detection and correction. Moreover, they find that certain factors can differentially influence each process. For example, when people are expecting to be accountable for their judgments in a weapons identification task—compared with when their judgments are private—they are worse at detecting the difference between tools and weapons, but they are more successful at overcoming their automatic associations of Blacks and guns (Conrey et al., 2005 reanalysis of Lambert et al., 2003). Because the quad model can only be implemented for tasks that include repeated dichotomous choices, it is hard to apply it to many of the situations discussed in the current article. Nevertheless, I believe that the model and the findings that it has generated help support the case for decoupling the processes of detection and correction in a corrective dual process model.

Conclusion

Even smart, educated, emotionally stable adults believe superstitions that they recognize are not rational. Dual process models, such as the corrective model advocated by Kahneman and Frederick (2002, 2005), are useful for illustrating why superstitious thinking is widespread, why particular superstitious beliefs arise, and why superstitious beliefs are maintained even though they are not true. To understand why superstitious beliefs are maintained even when people *know* they are not true, however, requires that dual process models be modified to decouple the processes of error detection and correction. That is, they must allow for the possibility that people can recognize—in the moment—that their belief does not make sense, but follow it nevertheless. This notion, which I have labeled acquiescence, is not only useful for understanding how people can believe superstitions that they know are false, but also for understanding when and why people will follow other powerful intuitions that run contrary to reason. I hope that the arguments laid out in the article are compelling enough—both intuitively and deliberately—to persuade researchers that examining the causes and consequences of acquiescence is important for understanding behavior across a variety of judgment and decision making contexts.

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