

# Reversing One's Fortune by Pushing Away Bad Luck

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Across cultures, people try to “undo” bad luck with superstitious rituals such as knocking on wood, spitting, or throwing salt. We suggest that these rituals reduce the perceived likelihood of anticipated negative outcomes because they involve avoidant actions that exert force away from one's representation of self, which simulates the experience of pushing away bad luck. Five experiments test this hypothesis by having participants tempt fate and then engage in avoidant actions that are either superstitious (Experiment 1, knocking on wood) or nonsuperstitious (Experiments 2–5, throwing a ball). We find that participants who knock down (away from themselves) or throw a ball think that a jinxed negative outcome is less likely than participants who knock up (toward themselves) or hold a ball. Experiments 3 and 4 provide evidence that after tempting fate, engaging in an avoidant action leads to less clear mental representations for the jinxed event, which, in turn, leads to lower perceived likelihoods. Finally, we demonstrate that engaging in an avoidant action—rather than creating physical distance—is critical for reversing the perceived effect of the jinx. Although superstitions are often culturally defined, the underlying psychological processes that give rise to them may be shared across cultures.

*Keywords:* knock on wood, superstition, embodied cognition, approach and avoidance

Superstitious rituals abound, even among those who claim not to be superstitious. To gain good fortune, for example, people pick up pennies, cross their fingers, and carry lucky charms (Jahoda, 1969; Vyse, 1997; Zusne & Jones, 1989). Superstitious rituals are also enacted to “undo” bad fortune, often after an individual has said or done something that is believed to cause bad luck. In fact, one of the most common superstitions in Western society is for people to knock on wood after having “tempted fate” (Blum, 1976; Fliess, 1944; Keinan, 2002; Risen & Gilovich, 2008). When someone presumptuously comments, “I'm sure we'll have beautiful weather for our outdoor wedding,” he or she will often feel the urge to knock on wood, hoping the action will undo the jinx. In other cultures, people also try to reverse bad fortune, using different superstitious rituals such as spitting or throwing salt.

The urge to undo a jinx or reverse bad fortune arises when people feel that negative outcomes are especially likely to occur after tempting fate (Risen & Gilovich, 2007, 2008; Tykocinski,

2008). Tempting fate behaviors usually involve taking unnecessary risks or expressing hubris or presumptuousness about what will happen in an uncertain future (Risen, 2013). Research suggests that negative outcomes spring to mind following a tempting fate behavior and that this heightened accessibility leads people to believe the bad outcomes are especially likely to occur. For example, people thought Jon was more likely to be rejected from Stanford, his first-choice graduate school, if he tempted fate by wearing a Stanford t-shirt while awaiting the decision than if he stuffed the shirt in his drawer (Risen & Gilovich, 2008). The element of presumptuousness involved in tempting fate behavior closely maps onto the concept of a “jinx.” In this research, we use the term *tempting fate* when referring to the presumptuous behavior and *jinx* when referring to the effect of the behavior (e.g., *jinxed* outcome or effect of the *jinx*). We rely on excessive presumptuousness in the experiments to create a perceived jinx and investigate the psychological processes that are involved in rituals for undoing the jinx. At the close of the current article, we discuss the implications of this research for understanding other types of superstitious rituals, such as gaining good luck (e.g., picking up pennies) or feeling protected from evil that lurks in the environment (e.g., wearing a talisman).

## Rituals for Reversing Bad Fortune

People often engage in superstitious rituals to regain a sense of agency and control (Bleak & Frederick, 1998; Burger & Lynn, 2005; Damisch, Stoberock, & Mussweiler, 2010; Keinan, 1994, 2002; Malinowski, 1948). In times of stress and uncertainty, people may engage in superstitious rituals simply because such rituals provide them with something—*anything*—to do. Although a desire for control can explain people's general motivation to enact superstitious rituals to reverse bad fortune, this account is silent when it comes to the question of why particular rituals are used.

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For instance, after tempting fate, why do people knock on wood, rather than, say, cross their fingers? Theoretically, any action, compared with nonaction, can provide a sense of control. If these rituals are enacted solely to restore a sense of control, then all actions should be equally likely to be adopted as a method for undoing bad luck. Furthermore, if these rituals alleviate people's concerns solely by restoring a sense of control, then all actions should be effective for reversing one's perceived fortune.

In this article, we suggest that not all actions are equally effective. Instead, we suggest that avoidant actions that exert force away from one's representation of self are especially effective for reducing the anticipated negative consequences following a jinx compared with no action or approaching actions. This hypothesis is motivated by several widely used superstitious rituals for reversing one's fortune after people tempt fate, such as knocking on wood, throwing salt, and spitting. In addition, Feng Shui experts recommend that throwing away egg shells or pouring out water is also effective in reversing bad fortune. At first glance, these rituals appear to be random, unrelated, and culturally specific traditions. However, these rituals share a common feature that we believe underlies their cultural "success" over other possible options: they involve motor movements that exert force *away* from the representation of self. After tempting fate, when negative outcomes are especially accessible or "top-of-mind"—as if one just invited bad fortune (Risen & Gilovich, 2008), engaging in an avoidant action may help create the sense that the bad luck is being pushed away. Thus, we expect that if an individual tempts fate about getting into a terrible car accident, knocking down on a table (away from the self) will make him or her less concerned about the likelihood of getting into a car accident than knocking up on the underside of the table (toward the self) or not knocking at all.

To be clear, this is not to suggest that these various superstitious rituals originated because they were seen as a way to push away bad luck. There are different stories surrounding the origin of most superstitious rituals. For example, some people believe that by knocking on wood, people prevent the devil from hearing what they have just said, which stops the negative events that people commented on from occurring. Another popular version is that knocking on wood originated in Ireland as a way to alert leprechauns that one is thanking them for providing good luck. And another version is that it evolved from other rituals involving trees, which were considered sacred. We do not think that these rituals were necessarily introduced because they involved avoidant actions, nor do we believe that the avoidant nature of the act must be part of the ritual's origin story. Rather, we suggest that rituals that involve avoidant movements may be especially effective in reducing people's concerns following a jinx, and therefore stand a better chance of surviving over time.

### Avoidant Actions and Mental Simulation

Our hypothesis was initially inspired by the fact that existing rituals for reversing bad fortune tend to involve avoidant movements. Importantly, this hypothesis also rests on solid theoretical ground, backed by research on the psychology involved in avoidant actions. Numerous studies have shown that people have a natural tendency to approach positive objects and avoid negative objects in their environment (e.g., Cacioppo, Priester, & Bernston, 1993; Chen & Bargh, 1999; Davidson, Ekman, Saron, Senulis, &

Friesen, 1990; Dickinson & Dearing, 1979; Gray, 1994; Lang, Bradley, & Cuthbert, 1990; Strack & Deutsch, 2004). In most cases, avoiding negative stimuli reduces the risk of potential harm. For example, avoiding sick or dangerous people reduces the chance of being infected or injured. The natural tendency to approach the good and avoid the bad is repeated often enough that the actions themselves come to influence judgment and behavior. For instance, people rate neutral objects more positively when they engage in approach actions that pull something toward the self, and more negatively when they engage in avoidant actions that push something away from the self (Cacioppo et al., 1993). In addition, people identify positive stimuli more quickly when engaging in approach actions and identify negative stimuli more quickly when engaging in avoidant actions (Chen & Bargh, 1999).

Our hypothesis focuses on avoidant actions, but it builds on a wider body of embodied cognition research demonstrating that cognition, rather than being centralized and distinct from bodily experience, is largely shaped by sensorimotor processing (Haggard, Rossetti, & Kawato, 2008; Semin & Smith, 2008). This work has highlighted the extent to which bodily experience, the act of mental simulation, the clarity of one's mental representations, and cognition are interrelated. Bodily sensations influence not only people's experience with concrete objects that are present in their environment but also their understanding of abstract concepts that are not present in the environment (Barsalou, 2008; Barsalou, Niedenthal, Barbey, & Ruppert, 2003; Niedenthal, Barsalou, Winkelman, Krauth-Gruber, & Ric, 2005). Experiencing physical warmth, for example, leads to a stronger belief in the abstract concept of global warming by leading people to mentally simulate a world plagued by global warming with more vivid mental imagery (Risen & Critcher, 2011).

It has been demonstrated that people process and represent abstract information, in many cases unintentionally and unconsciously, by mentally simulating motor actions that could be (or have been) used on concrete objects in the actual environment (Beilock & Holt, 2007; Chambers, Tanenhaus, Eberhard, Filip, & Carlson, 2002; Wilson & Knoblich, 2005). For instance, moving one's own facial muscles facilitates people's understanding of emotional language as well as their understanding of other's facial expressions because it leads them to mentally simulate the particular emotion (Niedenthal, 2007). Representational gestures help people mentally represent and simulate the content of the speech they are giving, making the speech easier to deliver (Cartmill, Beilock, & Goldin-Meadow, 2012; McNeill, 1992). And, starting from early age, infants imitate other's behavior to simulate other's feelings, and this process is believed to help them understand their mind and judge their intention (Meltzoff, 2005; Meltzoff & Brooks, 2008).

Following from this research, we expect that engaging in an avoidant action should facilitate mental simulation of the thoughts, feelings, and sensations that typically follow an avoidant action. Because avoidant actions are strongly associated with avoiding or getting rid of negative objects, engaging in an avoidant action may lead people to simulate the experience and sensations of having avoided bad fortune, making negative possibilities less salient and vivid in one's mind. Thus, when a negative event is currently on one's mind, as it is following a jinx (Risen & Gilovich, 2008), engaging in an avoidant action may reduce people's concern about this event because it feels that the bad event has been pushed away.

Neutral actions and approaching actions, in contrast, do not simulate the experience of pushing away anticipated bad outcomes, and thus are not expected to be effective in reversing one's perceived fortune following a jinx.

Our theory suggests that even nonsuperstitious avoidant actions will be effective in reducing the perceived likelihood of negative events. If rituals for reversing fortune work because the avoidant movement helps simulate the thoughts and feelings that typically follow an avoidant action, then other actions that involve avoidant body movements should also reduce anticipated bad fortune, even if the action is not culturally engrained as a method for undoing bad luck. Take, for example, the action of throwing a ball. We predict that this nonsuperstitious avoidant action can also help an individual who tempts fate about a car accident simulate the experience of having avoided harm and danger, thereby reducing his or her judgment of the likelihood of a future car accident.

### Mental Image Clarity

People form mental images and rely on them to make evaluations and predictions. We expect that the clarity of one's mental image might play an important role in explaining the effect of an avoidant action on the perceived likelihood of a jinxed outcome, for two major reasons.

First, there is a well-established finding that mentally interacting with object images plays an important role in motor cognition (Decety, 1996; Jeannerod & Frak, 1999). When planning and producing motor movements, for example, people form and manipulate mental images of their possible actions as well as imagine the consequences of their actions. Recent research has shown that a bodily experience can affect the clarity with which relevant mental images are represented. Risen and Critcher (2011) found that people's current visceral state influences the vividness of their mental representation. When participants were asked to adjust the clarity of landscape images to match what they had seen before, those in a hot room adjusted the hot images to be clearer than those in a neutral room did. If performing an avoidant action after tempting fate simulates the experience of having avoided negative outcomes, then this process should influence people's mental representations for the jinxed event, leading them to represent the event in a less vivid and clear fashion.

Second, mental image clarity is often used as a cue for judging likelihood. Whether an event is perceived to be likely or not is largely driven by emotional feelings one experiences at the time of judgment (Loewenstein, Weber, Hsee, & Welch, 2001). One of the most important determinants of emotional reactions to future outcomes is the vividness with which those outcomes are described or represented mentally (Damasio, 1994; Elster & Loewenstein, 1992; Rottenstreich & Hsee, 2001). For example, Rottenstreich and Hsee (2001) suggested that "the fear engendered by the possibility of a terrible car accident is due, at least in part, to the vividness of the image associated with the possibility" (p. 186). Along these lines, research has found that people believe they are more likely to contract a disease if they imagine having a disease than if they read about the disease, but this only occurs if the symptoms are easy to imagine (Sherman, Cialdini, Schwartzman, & Reynolds, 1985). In addition, people believe more in global warming if they are exposed to vivid images of hot landscapes than

if they are exposed to blurry versions of the same images (Risen & Critcher, 2011).

Combing the two streams of research, we predict that avoidant actions influence the perceived likelihood of the bad outcome following a jinx by influencing the clarity with which people mentally represent the jinxed event. Specifically, we suggest that avoidant actions will decrease the mental image clarity of the jinxed event, but approaching or neutral actions will not, and that the clarity with which people imagine jinxed events will influence their perceived likelihood judgments.

### Action and Distance

On the surface, certain superstitious rituals for reversing fortune may appear inconsistent with our hypothesis. In particular, throwing salt backwards over one's shoulder requires arm flexion, which usually is involved in approaching actions rather than avoidant actions. We want to highlight that whether an action is avoidant or approaching is not determined by motor action per se (i.e., arm extension/pushing or arm flexion/pulling), but by the meaning of the action (i.e., pushing toward or pulling away from one's representation of self; Eder & Rothermund, 2008; Markman & Brendl, 2005). Markman and Brendl (2005) found that participants were faster to move positive than negative words toward their name on the computer screen, regardless of whether moving the words toward their name required pushing or pulling the joystick. Actions that are represented as "away from the self" are avoidant, regardless of the specific muscles involved, suggesting that whether an action is considered an avoidant one depends on how people interpret the movements. Therefore, although throwing salt backwards over one's shoulder may utilize similar muscles as knocking up on the underside of the table, the former will likely be interpreted as an avoidant movement because people throw away from the self, and the latter will likely be interpreted as an approach movement because people knock toward the self.

An alternative account to our predictions speaks to the final physical distance that is created between the self and the object with which one interacts, which is how avoidant actions have been defined in some articles (Seibt, Neumann, Nussinson, & Strack, 2008). This account suggests that it might be the physical distance, rather than the avoidant action, that lowers people's concern about the negative outcomes. Applying the distance argument to our paradigm, one could suggest that creating physical distance between the self and the object may make people feel that they are distant from the bad luck, which, in turn, makes them less pessimistic. Recent research suggests, however, that the effect of final distance on target evaluations may be more context-dependent than what some past research has assumed. Target evaluations seem to be influenced by mental representation more directly, which in some paradigms is consistent with the final physical distance between the self and the object, but in other paradigms is not. For example, mentally simulating the experience of approaching or avoiding an object influences people's attitude toward the object just as physically performing the approaching or avoiding action does (Labroo & Nielsen, 2010). Researchers who study motor imagery, the mental rehearsal of movements without any overt change of physical distance, also found that imagined actions generate similar motor representations as executed actions (Frak, Paulignan, & Jeannerod, 2001; Jeannerod, 2001). Because the



results in the above two examples do not depend on physical distance being created, it seems that distance may also not be necessary for an avoidant action to affect likelihood judgments.

Our contention, then, is that what makes an avoidant action effective in reducing negative concerns is not the increased physical distance between the self and the concrete object in the environment, but the mental process of simulating the feelings and experiences of avoiding bad luck. Unlike research that examines how people avoid negative objects, the objects that people interact with in these superstitious rituals are not actually negative, and bad fortune is not mentally attached to the object. As a result, creating physical distance should not be necessary; instead, what should matter is whether people are led to simulate the experience of pushing something away from their representation of self. Accordingly, we suggest that pretending to throw something may reverse perceived bad fortune as effectively as actually throwing something because avoidant actions simulate an avoidant experience, even if there is no physical distance created when one pretends to throw.

### Overview

Previous findings show that negative outcomes seem especially likely after people tempt fate (Risen & Gilovich, 2008). We suggest that the effect of the jinx will be reduced if people engage in avoidant actions that exert force away from their representation of self. Critically, we predict that even nonsuperstitious avoidant actions will be effective for reversing the effect of a jinx. Past research has relied on hypothetical scenarios or experimenter's behavior to tempt fate. In our experiments, we implement tempting fate through participants' own behavior. Participants are led to tempt fate by giving a presumptuous answer during a conversation with the experimenter. Participants then engage in either an avoidant or control action. In Experiment 1, we test our hypothesis using a superstitious action (knocking on wood) without explicitly mentioning the name of the ritual, and Experiments 2a and 2b generalize the finding to a nonsuperstitious action (throwing a ball). In Experiments 3 and 4, we test the prediction that performing an avoidant action after tempting fate leads to less clear mental representations of the jinxed event, which leads to lower perceived likelihood judgments for the event. Finally, in Experiment 5, we distinguish between engaging in an avoidant motor action and creating physical distance between one's representation of self and an object one exerts force on to test which one is essential for undoing the effect of the jinx. Collectively, these experiments move beyond the issue of gaining a sense of agency or control and identify a distinct psychological mechanism for how superstitious rituals affect perception and behavior.

### Experiment 1: Knocking on Wood

In Experiment 1, we examine whether knocking on wood can lower the perceived likelihood of bad events occurring. We predict that after tempting fate, knocking down on the table (and away from the self) will lower the perceived likelihood of a jinxed negative outcome, but knocking up on the underside of a table (and toward the self) or not knocking will not.

### Method

The experiment was conducted during the University of Chicago's winter quarter from January to March. Because the study materials focused on getting into a car accident during the winter, we stopped data collection at the end of the quarter, when the lab was closed for spring break. We were able to run 190 undergraduates (91 women,  $M_{\text{age}} = 19.9$  years) during that time. Participants completed the experiment in exchange for \$2.<sup>1</sup> Participants were randomly assigned to one of six conditions in a 2 (tempting fate: yes vs. no)  $\times$  3 (knocking: down vs. up vs. none) between-participants design.

An experimenter who was blind to the hypothesis administered the experiment in individual sessions. Participants began by having a scripted conversation with the experimenter. They were told that we were interested in their conversational style and that they should select answers that sound like them. The same cover story about the conversation applied to all experiments in this article. Participants were given a paper with three possible answers for each question that they would be asked. All three responses to a given question contained qualitatively equivalent information and differed only in the phrasing. Participants were asked to select the response that they felt most accurately represented how they would phrase the response. They were asked to look at the experimenter as they gave each answer to make it feel like a real conversation.

To acclimate participants to the procedure, the experimenter began with small talk, asking about weekend plans and favorite late-night snacks. He then changed the topic to car accidents. He said,

A friend of mine recently got into a car accident . . . it got me thinking about how dangerous it can be on the road, especially when the snow starts to fall. Do you think that there is a possibility that you or someone close to you will get into a horrible car accident this winter?

Participants in the control condition selected a response from one of three neutral options: "I can't believe it's going to start snowing soon," "Winter is really here, isn't it?" and "I'm not sure I'm ready for snow." Participants in the tempting fate condition selected a response from one of three options designed to express presumptuousness: "No way. Nobody I know would get into a bad car accident. It's just not possible," "I'm certain that everyone I know will be 100% safe all season long," and "C'mon. Everyone I know was safe in the past, and there's absolutely no way that anyone would get into a terrible accident this winter."

A pretest that was conducted among 50 undergraduate students from the same university showed that the conversation was effective in triggering a sense of tempting fate. Participants first eval-

<sup>1</sup> This experiment and Experiment 4 were conducted at the University of Chicago Decision Research Lab, which uses a walk-in system. Students can participate in as many or as few studies as they are eligible, and, for each study, they are paid at a rate of \$10–\$12 per hour. For our 10-min experiment, participants were paid \$2. The order of experiments is not fixed, and it depends on which lab room has space when a participant arrives, so whether participants completed other studies before or after ours is not predetermined. Records from the lab suggest that, on average, students participate in two to three studies when they come to the lab. Experiments 2a and 3 were conducted in Singapore. Experiments 2b and 5 were conducted at the Museum of Science and Industry in Chicago. These four experiments were not part of a larger data collection.

uated how uncomfortable they would be answering each of the responses to the question of getting into a car accident on a 1 (*completely comfortable*) to 7 (*not comfortable at all*) scale. They reported that they were much more uncomfortable in saying the three presumptuous answers ( $M = 5.33$ ,  $SD = 1.37$ ) than in saying the three neutral answers ( $M = 3.35$ ,  $SD = 1.72$ ),  $F(1, 49) = 46.11$ ,  $p < .0001$ ,  $\eta_p^2 = .45$ . Pairwise comparison shows that every presumptuous answer was rated as more uncomfortable than every neutral answer,  $F_s(1, 49) > 16.88$ ,  $ps < .001$ . Participants also evaluated whether they thought each of the six answers would tempt fate or jinx a person if he or she said it out loud. For the three presumptuous answers, 84% of participants indicated at least one of the three answers would tempt fate, whereas for the three neutral answers, only 6% of participants indicated at least one of the three answers would tempt fate,  $\chi^2(1, N = 50) = 60.84$ ,  $p < .0001$ .

After the conversation, the experimenter told participants that they should clear their thoughts before continuing to the next part of the experiment. To help, he would slowly count to five. In the knocking-down condition, participants were instructed to knock down on the (wooden) table with each number. In the knocking-up condition, participants were told to knock up on the underside of the table. In the no-knocking condition, the experimenter counted to five with no instructions to participants to knock. The experimenter never referred to *knocking on wood* while instructing participants. Participants then rated how likely they believed it was that they or someone close to them would get into a horrible car accident during the winter on a 1 (*very unlikely*) to 9 (*very likely*) scale. At the end, we implemented a funneled debriefing, asking participants about their general thoughts about the study as well as their thoughts about each part of the study (e.g., the counting, the conversation, and their particular answers in the conversation).

## Results and Discussion

We predicted that participants who tempted fate would believe a car accident was more likely compared with participants who did not tempt fate but that knocking down would reduce the effect of the jinx.

A 2 (tempting fate: yes vs. no)  $\times$  3 (knocking: down vs. up vs. none) analysis of variance (ANOVA) revealed a significant main effect for tempting fate,  $F(1, 184) = 11.74$ ,  $p < .001$ ,  $\eta_p^2 = .06$ , with those who tempted fate being more concerned about car accidents ( $M = 3.36$ ,  $SD = 1.61$ ) than those who did not tempt fate ( $M = 2.62$ ,  $SD = 1.34$ ). To test whether knocking down would reduce the perceived effect of the jinx, we conducted a planned contrast, with weights reflecting the original hypothesis (Control-Down, -1; Control-None, -1; Control-Up, -1; Tempt-Down, -1; Tempt-None, 2; Tempt-Up, 2). As shown in Figure 1, the planned contrast revealed that participants who tempted fate but did not knock or knocked on the underside of the table were significantly more concerned about car accidents than those who did not tempt fate as well as those who tempted fate but knocked down on the table,  $F(1, 184) = 15.30$ ,  $p < .001$ ,  $\eta_p^2 = .08$ . The residual variance was nonsignificant ( $F < 1$ ), which means the unexplained variance did not vary by condition, suggesting that our contrast model captured the major sources of variation in the data.

Next, we separately examined the effect of tempting fate in each of the three knocking conditions. As predicted, there was an effect of tempting fate in the no-knocking and knocking-up conditions.

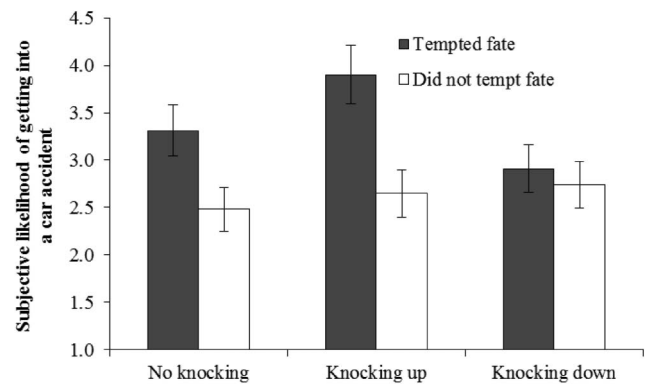


Figure 1. Subjective likelihood of getting into a car accident as a function of whether people tempted fate and how they knocked on wood in Experiment 1. Error bars represent standard error.

Participants who tempted fate in these conditions were more pessimistic (no-knocking:  $M = 3.31$ ,  $SD = 1.53$ ; knocking-up:  $M = 3.84$ ,  $SD = 1.74$ ) than participants who did not tempt fate (no-knocking:  $M = 2.48$ ,  $SD = 1.32$ ; knocking-up:  $M = 2.65$ ,  $SD = 1.40$ ),  $F(1, 184) = 5.43$ ,  $p = .02$ ,  $\eta_p^2 = .08$ ; and,  $F(1, 184) = 9.00$ ,  $p < .01$ ,  $\eta_p^2 = .13$ , respectively. The perceived effect of the jinx was eliminated, however, when participants knocked down on the table. Participants who knocked down after tempting fate made judgments ( $M = 2.91$ ,  $SD = 1.44$ ) similar to those who did not tempt fate ( $M = 2.74$ ,  $SD = 1.31$ ),  $F(1, 184) = 0.20$ ,  $ns$ ,  $\eta_p^2 = .00$ .

We believe that participants' answers reflect their true likelihood beliefs. It is possible, however, that participants in the tempting fate condition reported that a car accident was more likely—not because they really believed it was more likely, but because they wanted to avoid showing presumptuousness another time after tempting fate. It is important to note, however, that both interpretations of the likelihood judgment reflect a concern about the jinxed event. Thus, for either interpretation, the results still suggest that knocking down reduced the concern that was created among those in the tempting fate condition.

No participant spontaneously associated the knocking action with “knocking on wood” when asked about each aspect of the study. Only after being told about the design of the experiment, one participant in the Control-Down condition suggested that knocking might get rid of the negative feeling for people who had been led to tempt fate. It seems that even though we used a very well-known superstitious action, participants were not explicitly aware that they were behaving according to the superstition, suggesting that the effect did not depend on people being aware that they were performing a superstitious ritual.

These results suggest that, to some extent, the superstition works. The objective likelihood of the negative outcome did not change, of course. Nonetheless, knocking down effectively reduced the subjective likelihood of the negative outcome. Knocking up on the table, however, did not reduce the perceived effect of the jinx, which, if anything, was exacerbated compared with the no-knocking condition. Although the “knocking on wood” superstition does not specify how people should knock, these results suggest that they should knock away from themselves, because we found that avoidant actions, rather than approaching actions, are especially effective for reversing the effect of a jinx.

Moreover, these results suggest that the evolution of rituals for reversing bad fortune in different cultures may not be an unpredictable process of random selection. Rather, such rituals may have been selectively narrowed down over time to avoidant actions that can lead people to simulate the experience of having pushed away bad events. The fact that most people knock away from themselves when they knock on wood lends support to the claim that avoidant rituals are widely used as rituals to reverse bad fortune. Of course, this also means that participants in the knocking-down condition engaged in the more typical action for trying to undo bad luck. Even though people did not recognize that they were engaging in a superstitious ritual, perhaps the typicality of knocking down explains some of its success. To rule out this alternative, in Experiments 2–5, we use actions that are not part of a superstitious belief system. If the avoidant nature of a ritual is the key for its effectiveness in reducing negative concerns, other avoidant movements, even those that are not ingrained as superstitious rituals, should also reduce concerns about a bad outcome after people tempt fate. In Experiment 2, we test this prediction.

### Experiment 2: Throwing a Ball

In Experiment 2, we examine whether a nonculturally ingrained avoidant action can lower the perceived likelihood of bad events after tempting fate. Participants in Singapore (Experiment 2a) and the United States (Experiment 2b) were asked to either hold a ball in their hand or toss it away. We predicted that jinxed outcomes would seem more likely after tempting fate but that tossing a ball would reduce the perceived effect of the jinx, whereas holding a ball would not.

### Method

**Experiment 2a.** One hundred seven undergraduate students (59 women,  $M_{\text{age}} = 20.8$  years) from National University of Singapore participated for course credit. Participants were randomly assigned to one of four conditions in a 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) between-participants design. We selected the sample size to roughly match the sample size per condition from Experiment 1.

As in Experiment 1, participants had a scripted conversation with an experimenter. After small talk, she initiated a topic about H1N1: “I just read the news that H1N1 is spreading very fast recently. Are you concerned about the flu?” Participants in the tempting fate condition were made to reply with a presumptuous answer (“No, I am not worried. I haven’t had a cold in years. I am sure I will be fine”). Participants in the control condition were made to reply with a neutral answer (“Yeah, I also heard that if you got H1N1, the school will ask you to stay home”).

After the conversation, participants were shown a tennis ball on the desk next to them. In the holding-the-ball condition, participants were instructed to grab the ball, return to their seat, and hold the ball in their nondominant hand until the end of the experiment. Participants in the tossing-the-ball condition were instructed to grab the ball, toss it to the opposite corner of the experiment room, and return to their seat. Participants then reported how likely they thought it was that they would get sick in the next few days on a 1 (*very unlikely*) to 9 (*very likely*) scale.

**Experiment 2b.** One hundred visitors to the Museum of Science and Industry in Chicago (42 women,  $M_{\text{age}} = 36.6$  years)

completed the experiment in exchange for a small reward. Participants were randomly assigned to one of the same four conditions as in Experiment 2a. Again, we selected the sample size to roughly match the sample size per condition from Experiment 1.

Participants had a scripted conversation with an experimenter. After small talk, the experimenter said, “A friend of mine recently got mugged here in Chicago, not too far from the museum . . . Do you think that there is a possibility that you or someone close to you will get mugged this year?” Participants selected from either three presumptuous responses or three neutral responses. The presumptuous responses were similar to Experiment 1, except that “getting into car accidents” was replaced with “getting mugged.” To make sure that the previous results were not due to the somewhat non-sequitur nature of the neutral responses, we used a different set of neutral responses in this study. Participants chose from, “Interesting question. I don’t know,” “Hmm . . . that’s interesting. I’m not sure what I think,” and “That’s an interesting question. I’d have to think about that.”

As in Study 1, a pretest conducted among 46 museum visitors showed that the conversation was effective in triggering a sense of tempting fate. Participants first evaluated how uncomfortable they would be answering each of the responses to the question of getting mugged on a 1 (*completely comfortable*) to 7 (*not comfortable at all*) scale. They reported that they were much more uncomfortable in saying the three presumptuous answers ( $M = 6.00$ ,  $SD = 1.21$ ) than in saying the three neutral answers ( $M = 2.60$ ,  $SD = 1.29$ ),  $F(1, 45) = 150.35$ ,  $p < .0001$ ,  $\eta_p^2 = .77$ . Pairwise comparison shows that every presumptuous answer was rated as more uncomfortable than every neutral answer,  $F_s(1, 45) > 47.4$ ,  $p_s < .001$ . Participants also evaluated whether they thought each of the six answers would tempt fate or jinx a person if he or she said it out loud. For the three presumptuous answers, 70% of participants indicated at least one of the three answers would tempt fate. No participant (0%) indicated that any of the neutral answers would tempt fate,  $\chi^2(1, N = 46) = 48.53$ ,  $p < .0001$ .

After the conversation, participants were instructed to either hold a ball or throw it to the opposite corner of the room. Participants then rated how likely they believed it was that they or someone close to them would get mugged this year on a 1 (*very unlikely*) to 9 (*very likely*) scale. To determine whether the perceived effect of the jinx would generalize to irrelevant negative outcomes, participants also judged the likelihood of getting into a car accident and the likelihood of becoming seriously ill. If the tempting fate behavior caused people to believe that the irrelevant negative outcomes were especially likely, we could then test whether the avoidant action would reduce concerns for those outcomes.

### Results and Discussion

**Experiment 2a.** We predicted that tossing the ball would reduce the perceived effect of the jinx. A 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) ANOVA returned the predicted interaction,  $F(1, 103) = 4.30$ ,  $p = .04$ ,  $\eta_p^2 = .04$ . A planned contrast revealed that participants who tempted fate and held the ball believed they were more likely to get sick than those in the other three conditions (Tempt-Hold, 3; Control-Hold, -1; Tempt-Toss, -1; Control-Toss, -1),  $F(1, 103) = 6.95$ ,  $p = .01$ ,  $\eta_p^2 = .06$ . The residual variance was nonsignificant ( $F < 1$ ). As can be seen in the top panel of Figure 2, when holding the ball, participants

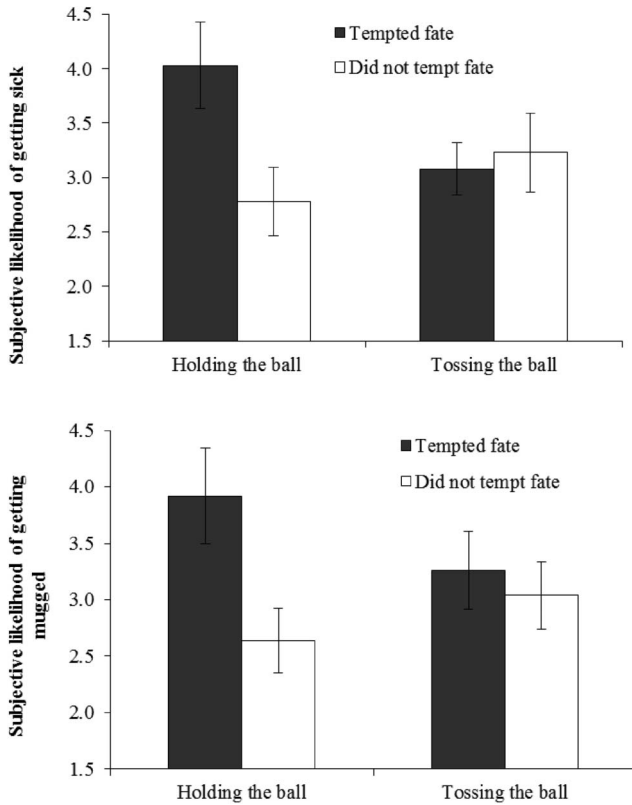


Figure 2. Subjective likelihood of getting sick (top panel) and getting mugged (bottom panel) as a function of whether people tempted fate and whether they held or tossed the ball in Experiment 2. Error bars represent standard error.

who tempted fate thought the likelihood of getting sick was higher ( $M = 4.03$ ,  $SD = 2.14$ ) than those who did not tempt fate ( $M = 2.78$ ,  $SD = 1.63$ ),  $F(1, 103) = 3.99$ ,  $p = .04$ ,  $\eta_p^2 = .04$ , suggesting that the tempting fate manipulation was effective. However, when participants tossed the ball away, there was no longer an effect of the jinx ( $M_{\text{tempt}} = 3.08$ ,  $SD = 1.19$ ;  $M_{\text{control}} = 3.23$ ,  $SD = 1.84$ ),  $F(1, 103) = 0.89$ ,  $ns$ ,  $\eta_p^2 = .01$ , suggesting that tossing the ball effectively reduced the negative expectation that was generated by tempting fate.

**Experiment 2b.** A 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) ANOVA returned an interaction that trended in the predicted direction,  $F(1, 96) = 2.38$ ,  $p = .12$ ,  $\eta_p^2 = .02$ . Importantly, the planned contrast indicated that participants who tempted fate and held the ball believed they were more likely to get mugged than those in the other three conditions (Tempt-Hold, 3; Control-Hold, -1; Tempt-Toss, -1; Control-Toss, -1),  $F(1, 96) = 5.62$ ,  $p = .02$ ,  $\eta_p^2 = .06$ . The residual variance was nonsignificant ( $F < 1$ ). As shown in the bottom panel of Figure 2, when holding the ball, participants who tempted fate believed that getting mugged was significantly more likely ( $M = 3.92$ ,  $SD = 2.11$ ) than those who did not tempt fate ( $M = 2.64$ ,  $SD = 1.44$ ),  $F(1, 96) = 6.94$ ,  $p = .01$ ,  $\eta_p^2 = .07$ . However, the perceived effect of the jinx was eliminated when participants tossed the ball ( $M_{\text{tempt}} = 3.26$ ,  $SD = 1.74$ ;  $M_{\text{control}} = 3.04$ ,  $SD = 1.49$ ),  $F(1, 96) = 0.21$ ,  $ns$ ,  $\eta_p^2 = .00$ .

Further analysis showed that tempting fate only increased pessimism for the event that was jinxed, though we should note that the perceived likelihood judgments about getting into a car accident and becoming ill were collected after the measure of perceived likelihood of getting mugged. Participants who tempted fate about being mugged thought a car accident was equally likely when they tempted fate ( $M = 4.49$ ,  $SD = 2.14$ ) and when they did not ( $M = 5.12$ ,  $SD = 2.04$ ),  $F(1, 96) = 2.23$ ,  $p = .14$ ,  $\eta_p^2 = .02$ . They even reported that they were less likely to become ill ( $M = 4.21$ ,  $SD = 2.08$ ) than those who did not tempt fate ( $M = 5.30$ ,  $SD = 2.04$ ),  $F(1, 96) = 6.93$ ,  $p = .01$ ,  $\eta_p^2 = .07$ . Because participants who tempted fate about being mugged did not believe they were especially likely to become ill or get into a car accident, we could not determine whether an avoidant action would reduce their concern for these outcomes. A 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) ANOVA for judgments for the non-relevant negative outcomes returned no main effect of holding or tossing the ball and no interaction ( $F < 1$ ) for both car accident and illness measures.

These results provide supportive evidence that avoidant actions, even those that are not culturally ingrained, reduce the negative expectations generated by tempting fate. When holding the ball in hand, tempting fate made people more concerned about the possibility of getting sick (Experiment 2a) and getting mugged (Experiment 2b). Importantly, the effect of tempting fate disappeared when people tossed the ball away. Throwing a ball is not associated with any superstitious belief, but nonetheless reduced the subjective likelihood of jinxed outcomes in Experiment 2, just as knocking down on wood did in Experiment 1, suggesting that for the effects to emerge, it is not necessary for people to engage in actions that belong to a superstitious belief system or explicitly believe in the superstition.

### Experiment 3: Mental Image Clarity

Experiments 1 and 2 demonstrated that engaging in an avoidant action, such as knocking down and throwing a ball, can reduce the heightened concern that otherwise follows a tempting fate behavior. Thus, even if the negative event jumps to mind after people tempt fate (Risen & Gilovich, 2007, 2008), engaging in an avoidant action transforms how people think about the jinxed event such that it no longer seems especially likely.

The clarity of mental imagery underlies people's likelihood judgments (Loewenstein et al., 2001). Car accidents are judged to be more likely when people have a clear and vivid mental image of car crashes. Contracting a disease seems more likely when people can easily imagine experiencing the symptoms (Sherman et al., 1985). If performing avoidant actions lowers people's concerns about jinxed negative outcomes because it leads them to simulate the experience of having pushed away the negative event, then we should observe an effect of avoidant actions on people's mental representations of the negative events. We expect that after tempting fate, avoidant actions will lead people to have a less vivid mental image of the negative event, and consequently feel less concerned about the negative event. In other words, we suggest that the effect of an avoidant action on perceived likelihood judgments following a jinx may be mediated, at least in part, by the clarity with which people mentally represent the negative event.



Experiment 3 was designed to test this mediated moderation by measuring the mental image clarity for the jinxed event.

## Method

One hundred fifty participants (100 women,  $M_{\text{age}} = 21.4$  years) from National University of Singapore completed the experiment in exchange for 3 Singapore dollars. We increased our sample by roughly 50% compared with Experiments 1 and 2 because a larger sample might be necessary for testing mediation. Participants were randomly assigned to one of four conditions in a 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) between-participants design.

As in Experiments 1 and 2, participants were told that we were interested in their conversation style, and their task was to choose the answer that sounded the most like them during a question-and-answer conversation. After familiarizing participants with the procedure using the same small-talk questions from previous experiments, they were asked a question about getting sick:

Last week I was seriously sick. I got the flu, and then fever and diarrhea, and I could not come to school. It took me the entire week to recover. A few of my friends were also sick. It seems this is the flu season, isn't it?"

Participants in the control condition provided a sensible answer that included some concern for the experimenter ("Maybe. Are you okay now?"). Participants in the tempting fate condition replied with the same answer, but had a presumptuous comment included at the end ("Maybe. Are you okay now? It occurred to me that I haven't been sick for a long time. I will not get sick during this season").

Instead of having participants answer each question out loud to the experimenter, participants in this experiment chose their answer by writing it down. To make the jinx feel real, we told participants that their answers would be used anonymously in a follow-up experiment for others to evaluate their conversation style. We conducted a pretest among 38 undergraduate students from the same university. We found that the written format was effective in triggering a sense of tempting fate and increasing the perceived likelihood of getting sick. After the tempting fate manipulation, participants in the pretest reported how likely they thought it was that they would get sick in the next 3 months on a 1 (*very unlikely*) to 9 (*very likely*) scale, and how strongly they felt that they would stay healthy in the next 3 months (1 = *not strongly at all*, 9 = *very strongly*). Participants then evaluated how uncomfortable they felt when writing down their answers on a 1 (*not uncomfortable at all*) to 9 (*very uncomfortable*) scale. Because we measured the perceived likelihood construct twice, we reverse coded the healthy judgment score and submitted it together with the sick judgment score to a 2 (tempting fate: yes vs. no)  $\times$  2 (variable: reverse-coded healthy score vs. sick likelihood score) mixed model analysis with the two judgment scores as within-participant variables.<sup>2</sup> The analysis returned a significant effect of tempting fate,  $F(1, 36) = 15.51, p = .0004, \eta_p^2 = .30$ , reflecting the fact that participants in the tempting fate condition felt that they were more likely to become ill ( $M = 4.61, SD = 1.70$ ) than did those in the control condition ( $M = 2.87, SD = 1.82$ ). In addition, participants in the tempting fate condition felt significantly more uncomfortable with their answers ( $M = 5.00, SD = 2.29$ ) than did

those in the control condition ( $M = 3.42, SD = 2.12$ ),  $F(1, 36) = 4.88, p = .03, \eta_p^2 = .12$ .

After the written conversation, participants either held or tossed a tennis ball, following a procedure identical to that of Experiment 2. Participants then reported how likely they thought it was that they would get sick in the next 3 months on a 1 (*very unlikely*) to 9 (*very likely*) scale, and how strongly they felt that they would stay healthy in the next 3 months (1 = *not strongly at all*, 9 = *very strongly*). Then they reported the extent to which the mental picture of getting sick felt vivid in their mind and the extent to which the mental picture of getting sick felt salient in their mind on a 1 (*not vivid/salient at all*) to 9 (*very vivid/salient*) scale.

## Results and Discussion

**Likelihood judgment.** First, we replicated the findings of Experiments 1 and 2 in terms of likelihood judgment (see the top panel of Figure 3). To examine the extent to which people felt that they would become ill, we reverse coded the healthy judgment score and submitted it together with the sick judgment score to a 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing)  $\times$  2 (variable: reverse-coded healthy score vs. sick likelihood score) mixed model analysis with the two judgment scores as within-participant variables. The analysis returned a significant interaction between tempting fate and ball,  $F(1, 146) = 3.90, p = .05, \eta_p^2 = .03$ . The model averaged the reverse-coded healthy score and the sick judgment score to create an index of the perceived likelihood of becoming ill, which is what was used for analyzing the conditional effects. When holding the ball, participants in the tempting fate condition reported their perceived likelihood of becoming ill trending higher ( $M = 4.52, SD = 1.96$ ) than those in the control condition ( $M = 4.00, SD = 1.92$ ),  $F(1, 146) = 2.39, p = .12, \eta_p^2 = .02$ . However, tossing the ball effectively reduced the effect of jinx: For those who tossed the ball away, the perceived likelihood of becoming ill was not higher among those in the tempting fate condition ( $M = 4.03, SD = 1.89$ ) than those in the control condition ( $M = 4.46, SD = 2.09$ ),  $F(1, 146) = 1.56, ns, \eta_p^2 = .01$ .

**Mental image clarity.** We next examined whether our manipulation influenced the mental image clarity of becoming ill. As shown in the bottom panel of Figure 3, a 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing)  $\times$  2 (variable: vivid vs. salient) mixed model analysis with the vividness rating and the salience rating as within-participant variables returned a significant interaction between tempting fate and ball,  $F(1, 146) = 5.72, p = .02, \eta_p^2 = .04$ . The model averaged the salience and vividness scores to create an index of the clarity of participants' mental image for becoming ill, which is what was used for analyzing the conditional effects. When holding the ball, participants who tempted fate reported having a clearer mental image of getting sick ( $M = 4.45, SD = 2.16$ ) than did those who did not tempt fate ( $M = 3.45, SD = 2.12$ ),  $F(1, 146) = 8.06, p = .005, \eta_p^2 = .05$ . This difference was eliminated, however, among those who tossed the ball away ( $M_{\text{tempt fate}} = 3.79, SD = 2.03$  vs.  $M_{\text{control}} = 4.00, SD = 1.83$ ),  $F(1, 146) = 0.33, ns, \eta_p^2 = .00$ .

<sup>2</sup> The mixed model treats judgments as a repeated variable without assuming compound symmetry, which is required by a repeated measure ANOVA.



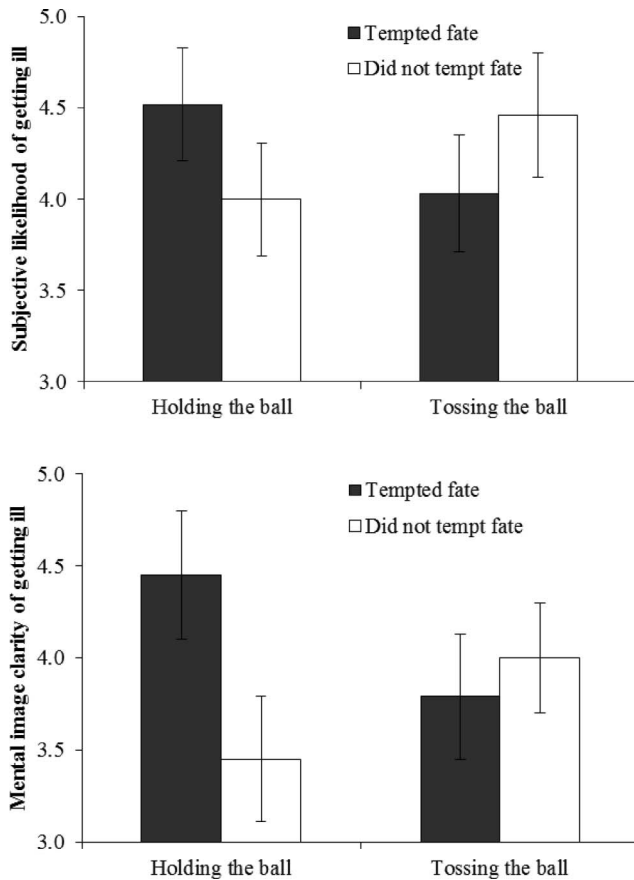


Figure 3. Subjective likelihood (top panel) and mental image clarity (bottom panel) of becoming ill as a function of whether people tempted fate and whether they held or tossed the ball in Experiment 3. Error bars represent standard error.

We next examined whether the perceived mental image clarity mediated the effect of motor action and tempting fate on perceived likelihood judgment. A bootstrap analysis following procedure by Preacher, Rucker, and Hayes (2007) revealed that the 95% bias-corrected confidence interval for the indirect effect of the interaction between tempting fate and the ball manipulation excluded zero ( $-0.90, -0.02$ ), suggesting a mediated moderation: The effect of tempting fate on perceived likelihood judgment was moderated by the ball manipulation, and this moderation effect operated by influencing the mental image clarity of becoming ill.

We also tested whether perceived likelihood judgments mediated the effect on mental image clarity, but did not find support for this. The 95% confidence interval for the indirect effect of the interaction between tempting fate and the ball manipulation included zero ( $-0.83, 0.05$ ), suggesting that it was the mental image clarity that caused the changes in perceived likelihood judgment, not vice versa.

#### Experiment 4: Picture Transparency

Replicating previous experiments, in Experiment 3 we found that engaging in an avoidant action lowered the perceived likelihood of a jinxed outcome. Moreover, the results were consistent

with our suggestion that the effect is due, at least in part, to a reduction in how clearly the jinxed outcome was mentally represented. We found that clarity judgments mediated perceived likelihood judgments, but not the reverse. Of course, the clarity measures were self-report judgments that might not be easy to assess for a layperson, and they were collected after people reported their perceptions of likelihood. Experiment 4 was designed to conceptually replicate the effect of an avoidance action on mental image clarity using a measure that taps more directly onto perception. As in Experiment 3, we predict that engaging in an avoidant action after tempting fate will lead people to mentally represent the jinxed event as less vivid and clear. After manipulating whether people tempt fate and whether they engage in an avoidant action, we measured the clarity of participant's mental images of the jinxed event using the transparency slider task (TST), developed by Risen and Critcher (2011).

#### Method

One hundred sixty students (86 women,  $M_{\text{age}} = 20.0$  years) from the University of Chicago participated in exchange for \$2. Like Experiment 3, we increased our sample by roughly 50% compared with Experiments 1 and 2 because a larger sample might be necessary for the TST task. All participants started the experiment by evaluating 17 images. The three critical images were of car crashes. Six negatively valenced filler images included pictures of house fires and muggers with guns. Eight neutral filler images included pictures of dining rooms and classrooms. The 17 images were displayed on the computer screen for 5 s each in a random order. With Microsoft Office's editing features, the car crash images were degraded to 50% transparency, and the filler images were degraded between 30% and 70%. To assure that participants were attending to the images, we asked them to judge whether each image, after it was shown, was real or computer generated on a 1 (*definitely fake*) to 5 (*definitely real*) scale.

Participants then worked on an ostensibly irrelevant task. They were randomly assigned to one of four conditions in a 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) between-participants design. Participants were led to either tempt fate about car accidents or not by having a conversation with the experimenter, following a procedure identical to that of Experiment 1. Afterwards, they either held or tossed a tennis ball, following a procedure identical to that of Experiments 2 and 3.

Last, to measure the clarity of participants' mental representation for the jinxed event, all participants completed the TST (Risen & Critcher, 2011). Participants were told that the transparency of the images that they had evaluated at the start of the study varied, and their task was to adjust the transparency of each image to the level at which they were originally presented. Each image was re-presented on the screen individually. The images started invisible at 100% transparency. Participants adjusted the transparency level using a slider to make the images appear. They stopped when the transparency level matched their mental image, and the program recorded the clarity level as the key dependent variable, with higher numbers indicating higher clarity. Participants in the holding-ball condition held the ball in their nondominant hand until they finished the TST. We predicted that for participants who tempted fate, throwing the ball would make the mental representation of a car crash less clear than holding the ball, but for those

who did not tempt fate, throwing or holding the ball would not affect the mental representation of car crashes.

## Results and Discussion

First, we submitted the data to a 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) mixed model on ratings of the authenticity of the car crash pictures, treating participant and the three car images as random variables,<sup>3</sup>  $F(1, 156) = 1.46, ns$ . In general, the images were perceived as real ( $M = 4.01, SD = 0.85$ ).

We next submitted the data to a 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) mixed model on image clarity, treating participant and the three car images as random variables. The analysis yielded a significant interaction between tempting fate and ball,  $F(1, 156) = 4.91, p = .03, \eta_p^2 = .03$ . As expected, the ball manipulation showed no effect on the clarity of car crash mental images among those who did not tempt fate ( $M_{\text{toss}} = 68.66, SD = 14.25$  vs.  $M_{\text{hold}} = 65.38, SD = 15.06$ ),  $F(1, 156) = 0.81, ns, \eta_p^2 = .005$ . In contrast, among those who had tempted fate about car accidents, tossing the ball away effectively made the mental images of car crashes less clear ( $M = 61.07, SD = 17.80$ ) than holding the ball in hand ( $M = 69.20, SD = 17.79$ ),  $F(1, 156) = 4.98, p = .03, \eta_p^2 = .03$ . Controlling for the judged image authenticity did not change the pattern of results,  $F(1, 155) = 4.39, p = .04, \eta_p^2 = .03$ , for the interaction,  $F(1, 155) = 4.67, p = .03, \eta_p^2 = .03$ , for the effect of tossing on clarity among those who tempted fate, and  $F(1, 155) = 0.66, ns, \eta_p^2 = .00$ , among those who did not tempt fate.

We also examined the clarity results for the nonrelevant negative images (fire and gun) in a 2 (tempting fate: yes vs. no)  $\times$  2 (ball: holding vs. tossing) mixed model analysis, treating participant and the images as random variables. There were no significant effects; however, the results trended in the same direction as was seen for the car accident images. The interaction was marginal for the fire images,  $F(1, 156) = 3.12, p = .08$ , and trending for the gun images,  $F(1, 156) = 2.39, p = .12$ . For participants who tempted fate, perceived clarity of the fire images was nonsignificantly reduced after people threw the ball ( $M_{\text{toss}} = 63.86, SD = 14.98$  vs.  $M_{\text{hold}} = 58.59, SD = 16.52$ ),  $F(1, 156) = 2.44, p = .12$ , and perceived clarity of the gun images was marginally reduced after people threw the ball ( $M_{\text{toss}} = 71.89, SD = 16.45$  vs.  $M_{\text{hold}} = 65.32, SD = 16.94$ ),  $F(1, 156) = 3.28, p = .07$ . There were no differences for participants who did not tempt fate ( $F_s < 1, ns$ ). It is possible that tempting fate and throwing the ball had a direct influence on participants' representations of these nonrelevant negative events. It is also possible that participants used their feelings about car accident images to infer the clarity of other images. Because the results did not reach significance, we do not discuss it further.

Experiment 4 conceptually replicated the results of Experiment 3. Whether measured by a self-report judgment (Experiment 3) or the TST (Experiment 4), we found that engaging in an avoidant action reduced the clarity of people's mental representation for a jinxed event compared with a control action. The results of Experiments 3 and 4 extend those of Experiments 1 and 2 by highlighting the role of mental simulation in the process of reversing one's fortune. We find that avoidant actions reduce the clarity of people's mental representations of the jinxed event, which appears to lower the perceived likelihood of the event.

## Experiment 5: Action Versus Distance

We have suggested that tossing a ball makes people feel less pessimistic about the jinxed outcome because the action leads people to simulate the experience of having pushed away the negative event. It is possible, however, that the effects are not due to the avoidant action per se, but to the physical distance that is created between participants and the ball. By creating distance from the ball, participants may feel that they are distant from the bad luck, which, in turn, makes them less pessimistic. It is therefore important to disentangle the physical distance from the action itself and examine which factor drives our findings. Experiment 1 provides preliminary evidence supporting the critical role of avoidant motor action rather than the role of physical distance created by the action—after all, knocking down on the table did not actually move the table away from participants. Experiment 5 was designed to provide a direct test by dissociating the avoidant action of tossing from the physical distance created between the self and the ball. Would an avoidant action undo the perceived effect of a jinx even if it did not create distance, as we suggest, or is distance necessary?

## Method

One hundred four visitors (55 women,  $M_{\text{age}} = 35.4$  years) to the Museum of Science and Industry in Chicago completed the experiment in exchange for a small prize. We selected the sample size to roughly match the sample size per condition from Experiments 1 and 2. Participants were randomly assigned to one of four conditions in a 2 (avoidant action: yes vs. no)  $\times$  2 (distance created: yes vs. no) between-participants design.

Participants first engaged in a conversation about getting mugged identical to Experiment 2b, except that all participants tempted fate during the conversation. After the conversation, the experimenter pointed out a ball on a nearby table and asked participants to get up, pick up the ball, and perform one of the following four actions. In the avoidant action conditions, participants either threw the ball to the opposite corner of the room, creating physical distance between the self and the ball, or pretended to throw the ball (i.e., completed the action of throwing without actually releasing the ball), creating no distance between the self and the ball. In the no-avoidant action conditions, participants either carried the ball to the opposite corner of the room and left it there, creating physical distance between the self and the ball without involving an avoidant action, or held the ball in their nondominant hand, creating no distance. Participants then reported how likely they believed it was that they or someone close to them would get mugged this year on a 1 (*very unlikely*) to 9 (*very likely*) scale.

## Results and Discussion

We predicted that engaging in an avoidant action would help reverse the effect of the perceived jinx and that creating physical distance would not be necessary. If bodily movements facilitate

<sup>3</sup> Participants and images are treated as random variables because both were sampled from a broader population of possible participants and possible images (see Judd, Westfall, & Kenny, 2012).

mental simulation of avoiding negative events, pretending to throw a ball (engaging in an avoidant movement without creating physical distance) would be just as effective for reducing negative concern as actually throwing the ball away.

A 2 (avoidant action: yes vs. no)  $\times$  2 (distance created: yes vs. no) ANOVA on the perceived likelihood of getting mugged only returned a main effect for action,  $F(1, 100) = 6.37, p = .01, \eta_p^2 = .06$ . As can be seen in Figure 4, participants who performed an avoidant action (throw the ball and pretend to throw) reported a lower likelihood of getting mugged ( $M = 2.94, SD = 1.63$ ) than those who did not (hold the ball and carry the ball) ( $M = 3.75, SD = 1.63$ ). The analysis did not yield a significant main effect for distance,  $F(1, 100) = 0.71, p = .40, \eta_p^2 = .00$ , or an interaction,  $F(1, 100) = 0.92, p = .34, \eta_p^2 = .00$ .

We replicated the results from Experiment 2b, finding that the action of throwing the ball away lowered the perceived likelihood of getting mugged ( $M = 2.96, SD = 1.51$ ) compared with holding the ball ( $M = 4.04, SD = 1.84$ ),  $F(1, 100) = 5.31, p = .03, \eta_p^2 = .10$ . More importantly, pretending to throw was as effective as actually throwing the ball away, lowering the perceived likelihood ( $M = 2.92, SD = 1.77$ ) compared with holding the ball ( $M = 4.04, SD = 1.84$ ),  $F(1, 100) = 4.97, p = .03, \eta_p^2 = .09$ , suggesting that avoidant actions, even without creating distance, appear sufficient for reversing one's perceived fortune. In contrast, creating distance without engaging in an avoidant action was not sufficient for undoing the jinx: The carry-the-ball condition ( $M = 3.46, SD = 1.36$ ) was not significantly lower than the hold-the-ball condition ( $M = 4.04, SD = 1.84$ ),  $F(1, 100) = 1.64, p = .21, \eta_p^2 = .02$ , despite creating distance between the self and the ball.

Experiment 5 not only replicated the basic finding from Experiments 1–3 but also demonstrated that pretending to throw a ball without creating physical distance was as effective as actually throwing a ball, whereas carrying the ball to a distant place without involving an avoidant action did not lower people's concern for the jinxed event. These results suggest that performing an avoidant action works for reversing one's perceived fortune because the action leads people to simulate an avoidant experience, rather than because the action creates physical distance between the object and

the representation of self. These results are consistent with how people actually enact superstitious rituals, often "pretending" to throw salt or spit, for example, instead of actually doing so.

It is worth mentioning that our instructions did not explicitly suggest that the jinx or bad luck was attached to the ball. Research that has documented the importance of physical distance creation has used a paradigm in which the evaluative target is the object with which people interact (Seibt et al., 2008). Participants in our experiment, however, interacted with a neutral ball but evaluated the likelihood of getting mugged. Distance creation could potentially affect likelihood judgment if the tempting fate behavior were psychologically tied to the ball, such that the ball itself came to represent bad luck. For instance, if people wrote down their jinxed response on a piece of paper, then carrying the paper to the other side of the room might lower the perceived likelihood of the negative event because it feels like the bad luck has been carried to a distant place. Psychologically, this may operate similarly to writing down negative emotions on a piece of paper and sealing it in an envelope (Li, Wei, & Soman, 2010). This may involve a psychological process very different from the process involved in the superstitious rituals used for reversing fortune following a jinx, because the rituals for reversing fortune generally do not require that people attach the jinx to the object with which they interact. In our experiment, without explicitly suggesting a connection between the ball and the bad luck, creating physical distance between the ball and the self was not sufficient to reverse one's perceived fortune.

## General Discussion

Superstitious rituals are widely used when people face the possibility of negative events. Psychological research on superstition has mostly focused on how performing a superstitious ritual can help people gain a sense of agency or control. That research has helped us understand why people engage in superstitious rituals in the first place. However, we still know very little about how particular superstitious rituals are selected and favored over other possible rituals. The current research marks the first step to address this question by exploring whether a common psychological mechanism underlies different superstitious rituals used for reversing one's perceived fortune following a jinx. We suggest that avoidant actions reduce the heightened concern engendered by a tempting fate behavior and tested this hypothesis across six experiments. As predicted, we found that the perceived effect of a jinx was reduced for participants who knocked down on wood but not for those who knocked up, for participants who tossed a ball but not for those who held the ball in hand, and for participants who engaged in the tossing movement without releasing the ball but not for those who carried the ball to a distant place.

These results suggest that, to a certain extent, the superstitious rituals that people use to reverse their fortune are effective. These rituals do not change the objective likelihood of negative outcomes but nonetheless reduce the perceived likelihood of negative outcomes following a jinx. Although superstitions are often considered irrational and even foolish, this work joins prior research (Damisch et al., 2010) in demonstrating how superstitions can potentially be useful. This research also adds to the growing body of work examining the psychological processes underlying the use and effectiveness of rituals (Norton & Gino, 2013; Vohs, Wang, Gino, & Norton, in press).

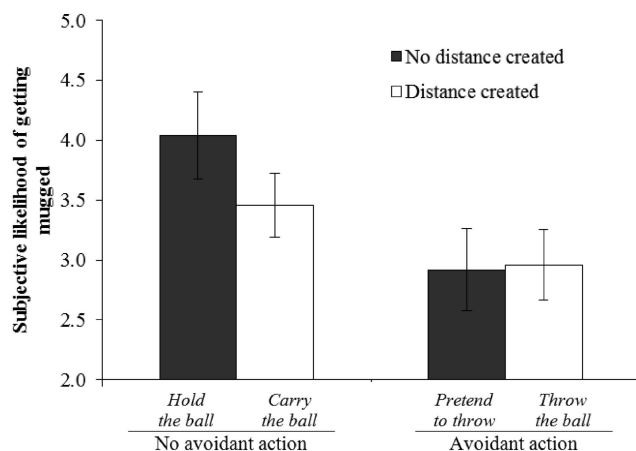


Figure 4. Subjective likelihood of getting mugged as a function of whether people engaged in an avoidant action and whether they created distance from the ball in Experiment 5. Error bars represent standard error.



We have provided evidence that these rituals work because of their avoidant nature. The reduction of perceived likelihood of negative outcomes was seen not only after people engaged in culturally defined superstitious actions, like knocking on wood (Experiment 1), but also after people engaged in avoidant actions that are not embedded within a superstitious belief system, like throwing a ball (Experiments 2–5). Note that even in Experiment 1, only one of the participants reported an association between the knocking action and the knocking on wood ritual, suggesting that knocking down can work even when people are not aware that they are engaging in a superstitious act. We have suggested that avoidant actions reduce people's concern after tempting fate because engaging in the action facilitates mental simulation of having avoided harm. The results of Experiments 3, 4, and 5 are consistent with this proposition. Experiment 3 showed that clarity judgments mediated the effect of an avoidant action on likelihood judgments. Experiment 4 demonstrated that, for those who tempted fate, engaging in an avoidant action reduced the perceptual clarity of people's mental representation for a jinxed event. Experiment 5 revealed that simulating an avoidant action by pretending to throw a ball was as effective for undoing a jinx as actually throwing a ball. Although the effect sizes are consistently small, we find reliable effects throughout the five experiments.

The fact that people formed less clear mental representations for the jinxed event suggests that the avoidant action did not lead people to simulate the negative event itself, but to simulate the thoughts and feelings that follow an avoidant action. The results also suggest that the avoidant action did not encourage people to consciously try to ignore or inhibit negative thoughts. If, instead of having participants engage in an avoidant action, we encouraged them to deliberately "not think about a car accident," we suspect that the effect of the jinx would not be eliminated and would even likely be exacerbated due to ironic processes (Wegner, Schneider, Carter, & White, 1987). Thus, the reduced clarity and lower likelihood that we find in the current studies suggest that avoidant actions simulate the experience of avoidance without engaging conscious thought suppression.

Experiment 5 also provides evidence that it is the avoidant nature of the actions used in the current set of studies, rather than their other characteristics that contributes to our findings. Although one may claim that throwing a ball is more distracting or more empowering than holding a ball, these alternatives do not explain our findings in a parsimonious way. First, it is difficult to argue that knocking down on the surface of the table is more engaging or distracting than knocking up on the underside of a table, or that tossing a ball away is more engaging or distracting than carrying a ball to the other side of the room. Nevertheless, we found that knocking down and throwing effectively reduced the effect of the jinx but that knocking up and carrying a ball did not. Second, it is difficult to argue that pretending to throw a ball is as empowering as actually throwing it, yet we find that both are effective in reducing people's heightened concern about a jinxed event. Taken together, we believe that it is the avoidant nature of the actions, rather than these actions being more distracting or empowering, that make them particularly effective.

The current research advances the superstition literature methodologically and theoretically. First, whereas past tempting fate research has relied on participants reading hypothetical scenarios or having their fate tempted by the behavior of a confederate or the

experimenter (Risen & Gilovich, 2007, 2008; Tykocinski, 2008), the current work developed a new method to make participants tempt fate through their own behavior. Participants who chose from presumptuous answers rather than from neutral answers thought that the relevant negative outcomes were more likely. We believe that the experience of actually committing a tempting fate behavior may be more emotionally arousing and may provide researchers with the opportunity to study judgments and behaviors that were not possible to study previously.

Second, our findings have implications for understanding the development and evolution of superstitious rituals over time. The superstition literature has traditionally focused on the role of superstitious behavior in helping people manage broad motivations, such as the motivation to understand or cope with one's environment (Case, Fitness, Cairns, & Stevenson, 2004; Keinan, 1994, 2002). The current work advances our knowledge by shedding light on why people engage in particular behaviors for managing particular superstitious goals. Although the broad desire for control explains why people use rituals for reversing their fortune in the first place, our findings push one step further and explain why particular actions are selected as rituals for reversing fortune following a jinx. Our results suggest that avoidant actions are selected because they are particularly effective in reducing people's concerns about a jinxed event. Our research demonstrates that knocking down on wood is uniquely effective for undoing a jinx, compared with knocking up. Following this logic, other culturally ingrained rituals for reversing fortune, such as spitting and throwing salt, may also be effective due to their avoidant nature. In the long history of rituals being developed, selected, and eliminated by cultures, an avoidant action like throwing a ball may be more likely to gain acceptance than holding or catching a ball because engaging in the throwing action is especially effective for reducing the perceived effect of a jinx. Future research should examine whether individual and cultural differences moderate the effect of an avoidant action on beliefs and whether they influence the extent to which these avoidant rituals are adopted. For example, does the belief in tempting fate influence how it is "undone"? Does having a prevention mindset or being immersed in a prevention-oriented culture encourage the use of such rituals such that they end up being more prevalent in cultures that are prevention oriented than promotion oriented?

Our findings also contribute to the literature on the link between motor actions and subsequent judgment and cognition. Note that avoidant motor actions do not seem to reduce the perceived likelihood of all negative outcomes at all times. In our experiments, when participants did not tempt fate, there was no effect of engaging in an avoidant action. Avoidant actions only reduced the perceived likelihood of a negative outcome that had just been brought to mind by a tempting fate behavior. Thus, it seems that avoidant actions only influence thoughts that are currently salient in people's minds.

The current research also makes a distinction between avoidant actions that focus on concrete negative objects and those that focus on abstract concepts. Past research on approach and avoidant actions has used negative objects as the stimuli and revealed that the physical distance between the representation of self and the actual object is the key that influences people's approach and avoidance tendency (Seibt et al., 2008). Unlike concrete negative objects, however, luck, as an abstract concept, does not have to

(and probably cannot) be literally “pushed away.” Our data suggest that in order to reduce perceived bad luck, creating physical distance between the self and an object is not the key. Even if the ball remains in one’s hand, having engaged in the avoidant action appears sufficient for “pushing away” the bad luck. In contrast, even if distance is created, doing so without engaging in an avoidant motor action does not make the jinxed event seem less likely. The simulated experience of having pushed away the negative event, which is activated by avoidant actions, seems to be the critical psychological process that produces the feeling that bad luck is far away from the representation of self. It seems that for abstract concepts or feelings that are not tied to a specific object, avoidant actions play a bigger role than the actual distance created between the self and the object.

This research has focused on avoidant actions in the context of undoing jinxes. Future research could also examine how other behaviors may be particularly useful for managing other specific superstitious goals. Following the logic that bodily movements simulate the experience of interacting with abstract concepts such as luck, it may also be the case that approach actions are particularly effective for creating a sense of good luck. Picking up pennies and four-leaf clovers are common rituals for trying to acquire good luck. Future research could test whether these rituals lead people to feel that good events are more likely as well as whether approach actions that are not part of a superstitious belief system (e.g., catching a ball or picking up neutral objects) would have similar effects. Our theory also suggests that “shielding actions” may be particularly effective for feeling protected from evil spirits in the environment. Do people feel that various bad outcomes are less likely to occur when wearing a talisman? Would nonsuperstitious shielding actions, like standing behind an object or putting one’s hands in front of one’s face, also make people feel protected from potential evil?

This is not to suggest that our theory applies to every superstition. Many rituals do not simulate the experience of interacting with luck. For example, in China, people avoid using scissors, using foul language, or sweeping the house on the New Year. In Japan, people avoid cutting their toenails at night. In Western cultures, people wish actors good luck by saying “break a leg,” avoid their bride on their wedding day, and walk around ladders rather than under them. Nevertheless, we think that extending our predictions to other areas of superstition could potentially provide a coherent understanding of how different rituals are used for different superstitious purposes as well as the psychological mechanisms that play a role in the process.

Our findings may even generalize beyond superstition and luck and add to a broader theoretical framework about the role of bodily action in shaping affective judgment. We have argued that avoidant actions are effective in reversing one’s perceived bad fortune following a tempting fate behavior because such actions lead people to simulate the experience of pushing away bad luck. Similarly, one can imagine that avoidant actions can lead people to simulate the experience of pushing away other types of negative feelings activated by events that are not related to superstition or luck. For example, an avoidant action may lead people to feel less guilty after a moral transgression or less regretful after a bad decision. It is possible that avoidant actions can undo the salient negative consequences of previous actions in non-superstitious domains as well.

## Conclusion

Superstitious rituals, such as knocking on wood, throwing salt, and spitting, are commonly used to reverse bad fortune. Such rituals seem to be effective in reducing the heightened concern that typically follows a tempting fate behavior. Moreover, our results suggest that the effectiveness is due, at least in part, to the avoidant nature of the act and its impact on mental simulation. After a jinx, avoidant actions—even those that are not part of a superstitious belief system—effectively undo the effect of the jinx. Although superstitions are often culturally defined, the underlying psychological processes that give rise to them may be shared across cultures.

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