

The Ghost in the Machine: Why and how the belief in magic survives in the rational mind

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Abstract

Since the time of Galileo (1564 – 1642), Western civilization has increasingly fallen under the spell of science. Despite this fact, anthropological and psychological research has shown that magical beliefs are present in both children and adults in modern industrial cultures. How can a belief in magic coexist with a belief in science in the mind of a rational, educated adult? A possible explanation is that magical beliefs survive in the rational mind by going into the subconscious. The following hypothesis is considered in the series of studies presented in this paper: *In modern industrial cultures, magical beliefs appear in preschool children as a legitimate, conscious form of belief that coexists with children's belief in physical causality and is supported by social environment. In older children and adults, under the pressure of scientific and religious education, magical beliefs descend into the domain of the subconscious.* Experiments examining this hypothesis will be reviewed; theoretical and practical implications of the existence of subconscious magical beliefs in modern rational adults will be analyzed.

Problem

Many beliefs regarding how the world works change with time. Thus, the belief that the Earth is at the center of the universe lasted for millennia but, from the late 16th century onward, this belief was gradually replaced by the belief that the Earth revolves around the Sun and spins on its own axis. In the 18th century, many scientists believed that all flammable materials contain phlogiston, a substance without mass that is liberated by burning, until Lavoisier showed that combustion requires a gas that has weight (oxygen). In the late 19th century, many physicists believed that light waves are propagated in a medium called ether, but a series of complex experiments failed to detect the motion of Earth through the ether, and Einstein's special theory of relativity (1905) was able to explain the propagation of light without referring to an ether.

However, there are ancient beliefs that withstand the challenge of scientific exploration. One of these beliefs is the belief in magic¹. In ancient times, most people consciously believed in magic (Tambiah, 1990), while today things are different. Scientists have persuaded most of us that believing in magic contradicts both everyday experience and the fundamental laws of nature. However, studies have shown that some educated and rational adults in modern industrial cultures exhibit superstitious behaviors (Jahoda, 1969; Luhrman, 1989; Vyse, 1990; Zusne and Jones, 1982). Psychologists and anthropologists have repeatedly claimed that the human mind is a heterogeneous entity that contains different and even incompatible systems of beliefs, such as the belief in both science and magic (Cole & Subbotsky, 1993; Tambiah, 1990; Woolley, 1997). Two questions arise from this fact. The first question is *why are some beliefs that contradict new scientific data given up and why do they subsequently disappear while others persist?* The second question is *how are those beliefs that persist able to coexist with new scientific beliefs in a single mind?*

¹ There are at least four types of causal effects that most theorists usually qualify as truly magical: (1) the direct effect of consciousness over matter, such as affecting or creating physical objects through the effort of thought, will, wish or word (mind-over-matter magic); (2) the sudden acquisition of spontaneity by a nonanimate physical object (animation magic); (3) a violation of the fundamental laws of object permanence, physical space, and time, such as one physical object inexplicably turning into another physical object in an instant (nonpermanence magic); and (4) when certain objects or events affect other objects or events in a nonphysical way, through similarity or contagion (sympathetic magic) (Frazer, 1923; Johnson & Harris, 1994; Nemeroff & Rozin, 2000; Tambiah, 1990; Vyse, 1997). In spite of the differences, all the above effects violate the principle of physical causality.

In regard to the question of “why”, the answer could be that the belief in magic is a different kind of belief than those that are replaced by new scientific discoveries and theories. Whereas the beliefs that were abandoned in the course of scientific progress belong to the class of *wrong alternative theories*, the belief in magic belongs to the class of *conceptual opposites*. Indeed, every scientific theory can be challenged by a number of alternative theories, and only the data from scientific experiments and more profound theoretical understanding of these data can decide which scientific theory remains and which has to go (Kuhn, 1970; Lacatos, 1970). In contrast, the ideas associated with science and the ideas associated with magic are conceptual opposites that condition each other. Whenever we think of physical causality, we inevitably (and usually subconsciously) imagine the possibility of its violation, and this violation by definition, is magical causality. For example, we know that in order to erect a building we need to have three components: the wish to erect a building of a certain kind, the materials (concrete, steel and glass) and human labor. When we imagine that the building is erected with one or more of these components absent (i.e., we wished to erect a building and the building appeared), we understand that physical causality has been violated and that we have witnessed the effect of magical causality. Similarly, the concept of physical time, which is irreversible, has its necessary extension in the concept of magical, reversible time. In a sense, physical science creates magic—even if only to deny that this magic is real. Just as the notion of “upstairs” has its necessary complementation in the notion of “downstairs”, so the notion of physical laws creates the notion of magical laws as its conceptual background. Like many other conceptual opposites, magic not only provides the background for science but also (along with its more advanced “alter-ego”, religion) performs jobs that science cannot. Magic shapes some of the events in our imagination and dreams, creating the phenomenon of *magical thinking* (after all, magical things do happen in dreams and in works of the imagination like “Lord of the Rings”). It also helps us to comprehend the ultimate meaning of life, assists us in fighting with the fear of death, imbues life with the thrill of adventure and unpredictability, provides the divine sanction to moral laws and mediates some human emotional reactions—to mention just a few of its functions

(Nemeroff & Rozin, 2000; Subbotsky, 2010). This difference between alternative theories and conceptual opposites helps explain why the belief in the ether and phlogiston had to disappear in the face of new scientific discoveries, the belief in magic is here to stay regardless of scientific progress.

Answering the question of “why” does not, however, answer the question of how the belief in magic remains alive in the rational mind. In contrast to magical thinking, which is commonly viewed as “the play of the imagination” and thus does not contradict our scientific beliefs, the belief in magic implies that magic might have real world effects. Indeed, a rational person cannot consciously believe that erecting a building requires a wish, materials and human labor and also believe that the building can be erected by the wish alone because accepting these two beliefs simultaneously would create a logical contradiction. In addition to creating this logical contradiction inside our mind, the belief in magic also has powerful enemies in the face of social institutions such as science and religion. Science rejects the belief in magic on the grounds that magical laws contradict both fundamental physical principles (such as the principle that the object of an observation should be independent from the observer) and everyday experience. Religion, being historically a descendant of magic, acknowledges the existence of magic yet links magic with evil powers such as the devil, paganism, and the occult. With such powerful enemies to confront both inside and outside the mind, how is it possible that the belief in magic survives in the minds of rational people today?

Hypothesis and predicted effects

Perhaps the belief in magic survives in the rational minds of people living in modern industrial cultures in the same way that small mammals survived in the era of dinosaurs: by hiding underground, in the depths of the subconscious. The following hypothesis is considered in the series of studies presented in this paper: *In modern industrial cultures, magical beliefs appear in children as a legitimate, conscious form of belief that coexists with a belief in physical causality. Later, under the pressure of science and religion, magical beliefs go into the domain of the subconscious.*

This hypothesis implies that at least the following effects should be observed:

(1) *In modern industrial cultures, preschool children endorse magical beliefs to the same extent that they endorse the belief in physical causality, both in their verbal explanations of unusual physical effects and in their behavioral reactions.*

Rationale: To a significant extent, preschool children are immune to logical contradictions, and their magical beliefs have not yet experienced the pressure of scientific and religious education, the two institutions that confront magical beliefs and exile them into the subconscious.

(2) *In modern industrial cultures, children's involvement in activities with magical content enhances children's cognitive abilities.*

Rationale: In modern industrial cultures, social environment provides children with folk stories, toys, books, movies and interactive games that employ magical effects, thus supporting the children's involvement in activities with magical content. This systematic (and expensive) support can only be justified if child caretakers (parents, teachers, psychologists) intuitively realize that children's involvement in activities with magical content entails benefits for children's cognitive abilities such as imagination and creative thinking.

(3) *In modern industrial cultures, magical explanations disappear from the verbal accounts of school children about the causes of physical effects; however, these explanations can be easily reactivated if unexplained causal effects that assert magic are shown to them.*

Rationale: At the beginning of children's scientific and religious education, the banishing of magical beliefs into the subconscious is not yet complete, and these beliefs fluctuate between the domains of the conscious and subconscious.

(4) *When asked to explain unusual causal effects that assert magic, educated adults living in modern industrial cultures will deny magical explanations of such effects, even if these effects are repeatedly shown to them.*

Rationale: In their explicit judgments, most rational adults in Western societies want to be in accord with science and religion.

(5) *When confronted with magical intervention in their lives, either in the form of witnessing “magical” phenomena or in the form of a sorcerer trying to exert influence with the help of magic, educated adults living in modern industrial cultures will resist such interventions. They will either interpret “magical” phenomena as ordinary phenomena (cognitive defense) or deny that magical influence had any effect on their lives (emotional defense).*

Rationale: Modern science rejects magic as a false alternative to physical causality, and modern religion associates magic with evil forces (the devil, evil spirits, the occult). These associations create a fear of magic in adults and trigger psychological defenses against magical intervention.

(6) *When psychological defenses against magical influence are relaxed or lifted (for example, in cases when denying the possibility of magic involves a high cost or when exploring magical effects does not clash with the participants’ belief in science), educated adults in modern industrial cultures will retreat to magical behavior and explicitly acknowledge that they believe in magic.*

Rationale: In adults, the belief in magic does not disappear but is subconscious. In psychoanalysis (Freud, 1935), when defenses are overcome, subconscious thoughts and beliefs ascend to the surface of consciousness.

(7) *In contrast to educated adults in modern industrial cultures, uneducated adults in developing cultures will endorse magical beliefs both in their verbal explanations of “magical” effects and in their non-verbal behavior.*

Rationale: In developing cultures, magical beliefs are not suppressed by science and religion and remain in the domain of consciousness.

The rest of the paper reviews empirical verification of the aforementioned effects and considers theoretical and practical implications of the existence of subconscious magical beliefs in educated adults in modern industrial cultures.

Empirical evidence: Summary

Effect 1. In modern industrial cultures, children believe in magic.

Jean Piaget (1971) provided multiple examples of Swiss children's verbal accounts of their magical beliefs (e.g., one boy believed that by saying their names he could make gorgeous birds and butterflies in his father's illustrated manual "come to life and fly out of the book, leaving holes behind them") (p.135).

More recently, Russian children aged 4, 5 and 6 years were asked if pictures of objects (such as a picture of a golden ring) can be turned into real objects in a wooden box by saying a magic spell. As Figure 1 shows, only a few 4-year-olds said yes. However, when the children were left alone with the pictures, only a few behaved in a rational manner (played with the pictures or examined the box). The majority applied the magic spell in the hope of converting the pictures into objects and were quite disappointed when this did not happen. Even though most children initially denied that magic was possible, their verbal skepticism towards magic was short lived. After they were told a story in which magical events had happened, up to 75 % of 4- and 5-year-olds and 38% of 6 year olds changed their minds and said that magic could actually be real (Subbotsky, 1985).

Fig. 1 about here

Harris, Brown, Marriot, Whittal, and Harmer (1991) asked English children aged 4 and 6 years to pretend that there was a creature (a rabbit or a monster) in an empty box. When left alone, some children behaved as if the creature was really present in the box. Similar effects of preschool children's behavior toward magic were reported in studies with American children (Johnson & Harris, 1994; Woolley, Boerger & Markman, 2004).

Effect 2. In modern industrial cultures, children's involvement in activities with magical content enhances their cognitive abilities.

Principe & Smith (2008) reported that the belief of 5- and 6-year-old American children in a fantastic entity—the Tooth Fairy—facilitated the children's false memories, allegedly through

stimulating the children's creative imagination². Assuming that children's exposure to magical effects stimulates their creative imagination, through priming or (and) association, we hypothesized that watching a movie with magical content should enhance the children's ability to solve creative cognitive tasks.

In Experiment 1, English children aged 4 and 6 years from the area of Greater London were divided into experimental and control conditions. In both conditions, children were shown fragments from the Harry Potter movie. In the experimental condition, the movie was full of magical effects, whereas, in the control condition, the movie showed the same characters but no magical effects. Both movies were matched according to other dimensions, such as pace, action and emotional content. The children were then tested on identical sets of creativity tests (such as Torrance's "Creativity in action and movement" test). The results (Fig. 2) indicated that children in the experimental conditions scored significantly higher than controls on the majority of subsequent creativity tests. In Experiment 2, these results were replicated with 6- and 8-year-old children coming from Shropshire County in England (Subbotsky, Hysted & Jones, 2008; Subbotsky, 2010).

Fig. 2 about here

In another study conducted in our lab, exposing 6- and 9-year-old English children to a movie with magical effects enhanced the children's ability to discriminate fantastical visual displays from realistic ones (Slater, 2010).

Effect 3. In modern industrial cultures, magical explanations disappear from school children's verbal accounts, yet they can be easily reactivated.

Rosengren & Hickling (1994) confronted 4- and 5-year-old American children with commonplace and impossible transformations after the children were asked to judge the possibility of these transformations. Although, in the beginning, most children denied the reality of impossible

² The children who strongly believed in the Tooth Fairy frequently claimed that they had heard or seen the Tooth Fairy.

transformations, many 4-year-olds changed their minds after seeing the “impossible” events and acknowledged these events to be “really magical,” whereas 5-year-olds insisted that they were tricks.

In order to ascertain that children understand what “real magic” is before they are asked to make judgments about it, English children aged 5, 6 and 9 years were first tested on their understanding of the difference between real magical events and magic tricks (Subbotsky, 2004). Only 45% of 5 year olds were able to understand this difference but, in 6 and 9 year olds, this number increased to 60 and 90%, respectively. Those children who could understand the difference between real magical events and tricks were asked whether they believed that magic exists in the real world. As Figure 3 shows, the number of believers in magic is substantial among 5 year olds, but significantly drops in 6 and 9 year olds.

Fig. 3 about here

Those who claimed that they did not believe in magic were presented with a causal effect that looked like an instance of real magic. A brand-new postage stamp became burned in an empty box after the experimenter cast a magic spell on the box ordering the stamp to be burned. The children were then asked if they now believed that real magic exists. As predicted, all 5 year olds and a large number of 6 and 9 year olds returned to magical beliefs as soon as they were shown an effect that looked “really magical” (Fig. 4).

Fig. 4 about here

Effect 4. In modern industrial cultures, adults deny magical explanations of apparently “magical” events even when repeatedly confronted with such events.

British university graduates and undergraduates, who exhibited an understanding of the concept of “real magic” and acknowledged that they were non-believers in magic, were subjected to three trials in which a postage stamp appeared or disappeared in an apparently empty box after the experimenter cast a magic spell on the box and one trial in which the box stayed empty after the magic spell was not cast (Subbotsky, 2004). Altogether, each participant witnessed four subsequent events in which a change (no change) in the empty box was observed as a possible result of casting (not casting) the magic spell. The participants held the box in their hands and were encouraged to inspect the box as thoroughly as they could. After they failed to find anything unusual about the box’s construction, the participants acknowledged that they were struggling to provide a rational explanation for these events. Nevertheless, when asked to assess the probability of a magical explanation for these events on a scale between 0 to 100%, the participants estimated this probability to be extremely low (see Fig. 5). This result confirms the expectation that educated adults will consistently deny magical explanations of apparently “magical” events—even when such events are repeatedly shown to them and they are unable to rationally explain these events.

Fig. 5 about here

Effect 5.1. When confronted with apparently “magical” events, educated adults in modern industrial cultures will distort their memories to make it easy to interpret these events as ordinary events (cognitive defense).

British undergraduate and graduate students were shown a magical effect: an object that the participants had put in an empty box disappeared without a trace (Subbotsky, 1996). Shortly before the participants were asked to place the object into the box, they were given a distracter task: bringing the experimenter a toy car from the other corner of the room. The aim of this manipulation was to find out if participants would remember the order of the events incorrectly by placing the

distracter event between the hiding of the object in the box and then the participant finding that the box is empty. By changing the order of the events in their memory, participants would make it easy to interpret the “magical” effect as an ordinary effect (for example, while the participant looked away in order to bring the toy, the experimenter removed the object from the box). The results showed that, when the object “magically” disappeared, 75% of participants did indeed recollect the order of the events incorrectly, whereas, in the control condition in which the object stayed in the box, only 15% of participants made the memory error, a result that can be explained by the natural limitations of working memory. This finding was replicated in Germany, confirming the prediction that the rational mind will protect its commitment to natural explanations of apparently magical events by adjusting the accompanying events to the possibility of such explanations.

Interestingly, the cognitive defense against magic was not found in Russian preschool children. Only 20% of Russian 5 year olds made the memory error in each of the two conditions, whereas many 8 and 10 year olds, like the British and German adults, recollected the order of events incorrectly (Fig. 6) (Subbotsky, Chesnokova & Greenfield, 2002). This result is again in favor of the hypothesis that, in preschool and elementary school children, magical beliefs peacefully coexist with their belief in physical causality at the level of consciousness. In older children who are under the pressure of scientific and religious education, magical beliefs start to descend into the subconscious, and the cognitive defense against magical explanations increases in strength.

Fig. 6 about here

Effect 5.2. When confronted with magical intervention in their conscious or subconscious lives, educated adults in modern industrial cultures will deny that magical influence had any positive effect on their lives (emotional defense).

British undergraduate and graduate students were offered a magic spell with the aim of improving their *general satisfaction with their lives* (GSL) (Subbotsky, 2009a). About 30% of the participants declined the offer (“help declined” condition), and the rest accepted it (“magical suggestion” condition). In the control “no suggestion” condition, no offer of magical help was made. In all of the conditions, the participants were twice asked to assess their level of GSL on a 1 to 10 point scale: once during the experiment (but prior to the offer of magical help) and two weeks after. As expected, in the “no suggestion” condition, the participants’ level of GSL did not change; however, in the “magical suggestion” condition, it significantly dropped (Fig. 7). In the “help declined” condition, the level of GSL significantly increased, which is also in concordance with the “emotional defense” hypothesis. In this condition, the participants felt relief from escaping the danger of being involved with magical forces, which increased their level of GSL.

Fig. 7 about here

In another experiment in this study, magical help was given in order to make participants see their chosen dreams during the next three nights. Independent scorers who were naïve to the purpose of the experiment assessed the participants’ dreams as being target dreams (those that participants chose to see), scary dreams (dreams that contained a threat to the participants’ lives) or ordinary dreams (non-threatening, non-target dreams). The results indicated that, in the “magical suggestion” condition, participants indeed saw target dreams more frequently than in the control “no suggestion” condition in which no magical help was offered, but the difference was not significant (Fig. 8). However, the number of scary dreams in the “magical suggestion” condition significantly exceeded that in the control condition. This result suggests that, even in subconscious processes such as dreams, the participants experienced the feeling of danger coming from the magical help, and this feeling resulted in scary dreams that devalued the magical help.

Fig. 8 about here

Effect 6. When defenses are lifted, educated adults in modern industrial cultures revert to magical behavior and explicitly acknowledge their magical beliefs.

One way of lifting the defenses is to make the denial of magical explanations costly. In order to examine this effect, British university graduates and undergraduates were shown an apparently “magical” effect—a square, plastic card became badly damaged in an empty box after a magic spell was cast on the box (Subbotsky, 2001). The participants were then tested in (a) the low-risk condition, where their driver’s licenses were at risk of destruction by a magic spell or (b) the high-risk condition, where the participants’ own hands were the objects at risk of being damaged as a result of the magic spell. The results showed that, in the low-risk condition, only 12% of participants prohibited the magical spell; however, in the high-risk condition, 50% of participants asked the experimenter not to repeat his spell and justified their decision by admitting that the magic spell might indeed damage their hands.

In another study, British graduates and undergraduates were told an imaginary scenario in which a witch approached them on an empty street and offered to put a magic spell on their future lives (Subbotsky, 2007). In one condition (good spell), the spell aimed at making the participants’ rich and happy and, in another condition (bad spell), it aimed at making the participants servants to evil forces (the devil). The participants were asked whether they would accept or decline the spell. In the previous experiments, it was established that, in a sample of British adults who claim that they don’t believe in magic, about 50% accepted the good spell and the other 50% declined the offer (Subbotsky, 2005). Both categories of participants produced a similar justification for their decision to accept or decline the good spell: they don’t believe that the spell is going to work, so they take the spell (in order to please the witch) or don’t take the spell (in order to avoid encouraging false expectations on the part of the witch). If the participants’ claimed disbelief in

magic is true, then the same distribution of the “accept” and “decline” answers should be expected in regard to the bad spell on the same grounds. If this claim is false, then the number of participants who decline the bad spell should be significantly higher than 50% because the aforementioned motives are compounded by the worry that the spell might actually work.

The results (Fig. 9) indicated that, in the personal involvement condition (when participants’ own future lives were at stake), only 40% of participants declined the good spell but all of them declined the bad spell. In their justifications, the participants admitted that the bad spell might actually affect their future lives in a magical way. In the no personal involvement condition (in which the offer of the spell was made to an imaginary character), around 50% of participants advised the character to decline each of the spells. In other words, when participants’ own lives were at stake they behaved as if they believed in magic and openly acknowledged this belief, but when the bad spell threatened someone else’s life, the participants’ behavior was consistent with their declaration that they did not believe in magic.

Fig. 9 about here

Finally, another way of overcoming defenses is by making magical beliefs an object of exploration. Exploring phenomena that people think they do not believe in does not overtly challenge their dominant beliefs in science but instead allows them to play with the “forbidden reality”. If magical beliefs are present, consciously or subconsciously, then, all other conditions being equal, a novel and unusual event will elicit stronger curiosity and exploratory behavior if its suggested explanation involves an element of magic (the magical over counterintuitive physical effect—the M/CP). This result is expected because, in addition to their reaction to the novelty of the display, the participants’ curiosity also gets additional energy from their hidden magical beliefs in the magical explanation condition.

Children taken from schools in Thessaloniki and Stavros, Greece, and British graduate and undergraduate students were shown an unusual phenomenon (the spontaneous disintegration of a physical object in an apparently empty box) framed in the context of either a magical (the magical event) or a scientific (the counterintuitive physical event) explanation. Both children and adults showed the M/CP effect (Fig. 10 and 11). They were more likely to run the risk of losing their valuable objects in order to explore the impossible, magical event than the same event framed in a scientific context. In addition, quite inconsistently with their earlier declarations that they did not believe in magic, most adults explicitly acknowledged that the magical effect they were so eager to explore might actually be real (Subbotsky, 2009b).

Fig. 10 about here

Fig. 11 about here

Effect 7. In contrast to educated adults living in industrial cultures, uneducated adults living in developing cultures will endorse magical beliefs both in their verbal explanations of apparently magical events and in their non-verbal behavior.

Experiments in which British adult participants were tested in (a) the low-risk condition, where their important documents were at risk of destruction by a magic spell, or (b) the high-risk condition, where the participants' own hands were at risk of being damaged as a result of the magic spell, were repeated with uneducated adult inhabitants of a rural area in central Mexico (Subbotsky & Quinteros, 2002). As predicted, in both conditions, the majority of Mexican participants exhibited the belief in magic both in their verbal explanations of "magical" effects and in their behavioral reactions (Fig. 12 and 13). In the low-risk condition (Fig. 12), Mexicans proved to be stronger believers in magic than Britons both in their verbal judgments and practical actions.

However, in the high-risk condition (Fig. 13), the difference only persisted in the verbal judgments trial. In the action trial, the difference narrowed to an insignificant level due to the increase in the number of Britons displaying magical beliefs.

Fig. 12 about here

Fig. 13 about here

Theoretical implications

The traditional view on magical beliefs in people living in modern industrial cultures emerged in the 1st half of the 20th century in works on cultural anthropology (Frazer, 1923; Lévy-Brühl, 1966; Taylor, 1958) and developmental psychology (Büler, 1930; Piaget, 1971). According to this view, *magical beliefs are the old-fashioned mode of thinking that existed in past centuries and still exists in young children and a limited population of superstitious adult individuals today* (Vyse, 1990).

The results summarized above suggest a new view on magical beliefs in modern industrial cultures. This view proposes that *modern educated adults cannot be divided into those who believe in magic (i.e., superstitious individuals) and those who do not. Rather, everyone is a believer in magic, and individual differences exist only in how deep in the subconscious magical beliefs are buried and how strong the psychological defenses are. Consciously, an individual can consider himself or herself to be a completely rational person and deny that he or she is a believer in magic; subconsciously, the person can still hold the belief in magical causality.*

One theoretical implication of the new view is reassessing the mechanisms and origins of psychological phenomena when the individual's critical ability is suspended, phenomena known as suggestibility, conformity and obedience to persuasion. In modern psychology, these phenomena

are not associated with magic even though their mechanisms are not fully understood (Asch, 1951; Milgram, 1992; Sherif, 1966). Recent research, however, shows that the psychological underpinning of these phenomena, the reaction of participation³, is the same as the one that underlies magical beliefs (Subbotsky, 2007). On this basis, one can assume that these phenomena originally emerged as various forms of an individual's sensitivity to social control based on the individual's beliefs in gods and spirits, sensitivity that was important for linking people into complex communities and societies. People believed that the pharaohs, kings, priests and other persons of power had a special link with gods and thus possessed the "divine right" to be obeyed. In the course of history, these social phenomena have changed their appearances. In a world where science reigns, they disguised themselves through dropping their "old skin" (the belief in the magical powers of gods and spirits) and taking on a "new skin" (the belief in the powers of society, evolution, and natural selection). On the seat of power, presidents, medical doctors and psychology experimenters replaced kings and priests. However, to a large extent, our impulse to go along with suggestions, to conform and to obey is still powered by the subconscious belief that the commands come from entities with supernatural abilities. Stripped of its original sacred context and renamed suggestibility, compliance, and obedience, modern peoples' vulnerability toward communicative magic survives in societies that otherwise strictly adhere to science and rational logic (for more on this, see Subbotsky, 2010, Ch. 9).

Another theoretical implication is the understanding that the motivation for a variety of activities may come from subconscious magical beliefs. These include people's attraction toward entertainment products that involve magical effects, the persistence of superstitious behaviors, the exploration of magical effects in the form of "psi-effects", and interest in the occult and paranormal

³ The way participation works is as follows: if the idea is suggested to an individual, it is adopted on a subconscious level and acted upon at that level even though the individual's rational judgment may indicate that the idea is untrue or contrary to his or her personal interest. For example, suggesting that an individual becomes ill after a magic curse is cast on him or her (the idea) can indeed have the effect of influencing the person's mental/physical state. The important characteristic of the reaction of participation is that a recipient unconsciously adopts the agent's message while consciously disagrees with the message and rejects it. In other words, the participation-based behavior is observed when two criteria are met: (1) individuals willingly act or feel in accord with the suggested idea and (2) they are aware that the idea is wrong and/or is of no personal benefit to them.

phenomena. Even the attraction of some modern scientists who consider themselves to be non-believers in God or magic toward studying magic and religion can be, at least partially, fueled by subconscious magical beliefs. On the extreme end, some prominent advocates of the scientific purity of our view of the universe might find it quite surprising to discover that their zeal in persecuting magic and religion can be fed by their hidden magical beliefs.

Practical implications

According to psychoanalysis, both conscious and subconscious thoughts and beliefs have energy, and this energy can be accessed and released (Freud, 1935). If the energy of conscious or subconscious magical beliefs is accessed, it can be used to enhance the effectiveness of various practices including cognitive functioning, problem solving, commercial advertising, political control, military and political terror, entertainment, etc.

(1) Using the energy of magical thinking for enhancing cognitive functioning in children.

In regards to problem solving, as Effect 2 has demonstrated, exposing children to a movie with magical content enhanced their ability to solve creative cognitive tasks (Subbotsky, Hystead & Jones, 2009). In regards to perception, exposing children to a magical movie improved their ability to discriminate fantastical visual displays from realistic ones (Slater, 2010)

(2) Using the energy of magical beliefs for the purposes of commercial advertising.

In the study conducted in our lab, adolescents and adults were exposed to a series of TV commercials that either employed or did not employ magical effects. The commercials were matched according to such measures as pace, action, and emotional content. The participants' memories of these advertisements were assessed immediately after the exposure and two weeks later. Although the immediate reproduction did not show any differences between the memories of magical and non-magical advertisements, adults remembered magical advertisements to a significantly better extent than non-magical advertisements in the delayed reproduction and they were remembered magical advertisements to the same extent as they remembered these advertisements immediately after the exposure (Matthews, 2010).

(3) Using the energy of magical beliefs for the purposes of political influence.

Early forms of political control relied on magical beliefs (Frazer, 1923; Jaynes, 1976; Levy-Bruhl, 1985). For instance, in Egypt, the power of the pharaoh took its legitimacy from the mass belief in the pharaoh's divine origins. Today, political power in modern industrial societies is based on rationally controlled electoral processes and not on magical beliefs. Nevertheless, psychological mechanisms that make many people collaborate with political power today retain some features of worshiping the gods (Malinowski, 1935; Tambiah, 1990). In the current democratic electoral process, "elections are won and lost not primarily on 'the issues' but on the values and emotions of the electorate, including the 'gut feelings'" (Westen, 2007, p. 423). Subconscious magical beliefs may well be among these "gut feelings." A political candidate who is able to access the people's hidden belief in his or her supernatural powers has a greater chance of winning the electorate than those candidates who exclusively rely on the rational argument.

(4) Using the energy of magical beliefs for the purposes of military and political terror.

The damage that kamikaze ("divine wind") pilots inflicted on the American fleet in the Battle of Okinawa (April 1945), which strongly impacted the U. S. decision to use the atomic bomb in order to end the war, showed the power of magical beliefs because the kamikaze were volunteers who sacrificed their lives for their divine values and hoped for a reward in the afterlife. Anthropological research on suicidal terrorism today suggests "sacred values" are at the core of this kind of terrorism and that these values supersede economic and other material considerations (Atran, Axelrod, & Davis, 2007). Religious values are particularly important in this context. It has been found that most Palestinian suicide bombers do not differ from the average member of their community in terms of education, well-being, or mental health, yet "all were deeply religious, believing their actions sanctioned by the divinely revealed religion of Islam" (Atran, 2003, p. 1537). It would be wrong to reduce the phenomenon of suicidal terrorism to religious belief alone, yet the belief in a magical unity with God's will and the belief in great rewards waiting in the afterlife undoubtedly make the decision to commit a suicidal act of terror more psychologically acceptable.

(5) Using the energy of magical beliefs for the purposes of entertainment.

As Effect 6 showed, both children and adults in modern industrial cultures were more likely to run the risk of losing their valuable objects in order to explore the impossible, magical event over the equally surprising and counterintuitive physical event. This finding can explain the phenomenal financial success of such magical masterpieces of the entertainment industry as Rowling's "Harry Potter", Tolkien's "Lord of the Rings" and Cameron's "Avatar". In the modern industrial world both children and rational adults are tempted by the enchantment of magic, and this temptation is powered by their subconscious magical beliefs.

Conclusion

Out of the ruins of the old view of magical beliefs, there emerges a new discipline: the cognitive-developmental science of magical thinking and magical beliefs in modern humans. This discipline may potentially link together phenomena that thus far have been studied separately from one another: superstitions and beliefs in the paranormal, religious beliefs, indirect suggestion and persuasion effects, "brainwashing" and "zombie" effects, sympathetic magic in the area of disgust and fear of contagion, the appeal of psychedelic drugs, and other effects that employ the energy of the magical mind.

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Figure 1. Percent of children who showed their belief in magic in their verbal judgements (verbal) and actual behaviour (actual)

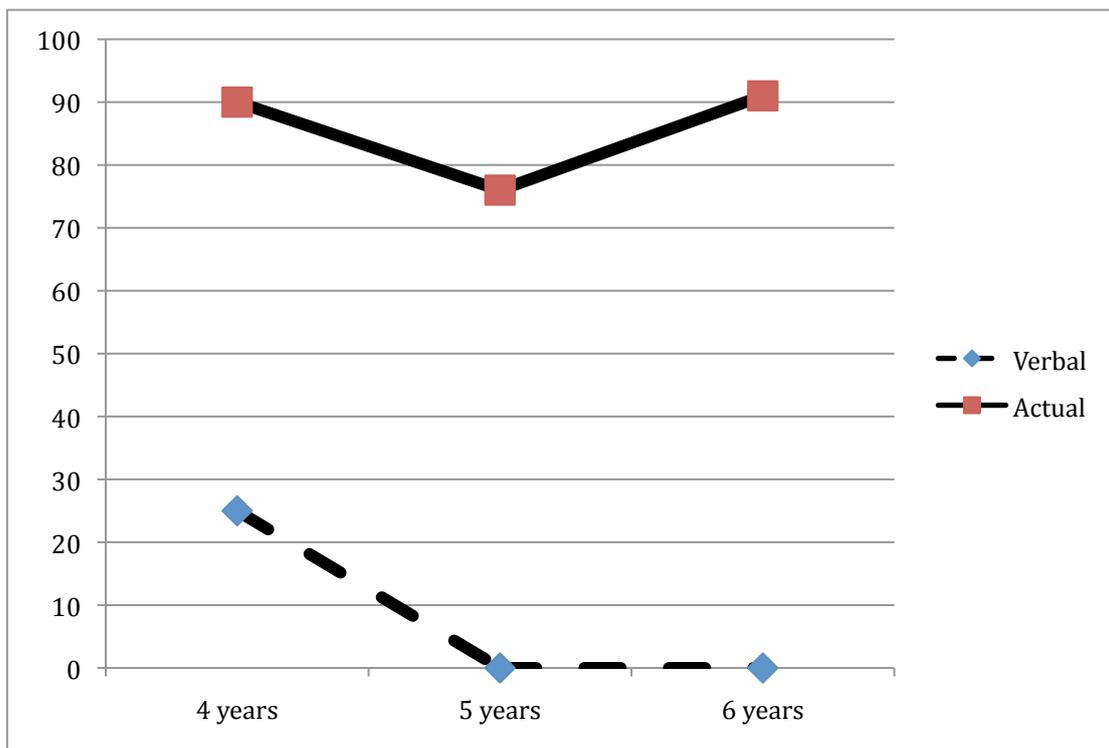


Figure 2. Means of summarized TCAM scores (fluency, originality and imagination) as a function of Condition (magical versus non-magical), and Age (4 versus 6)

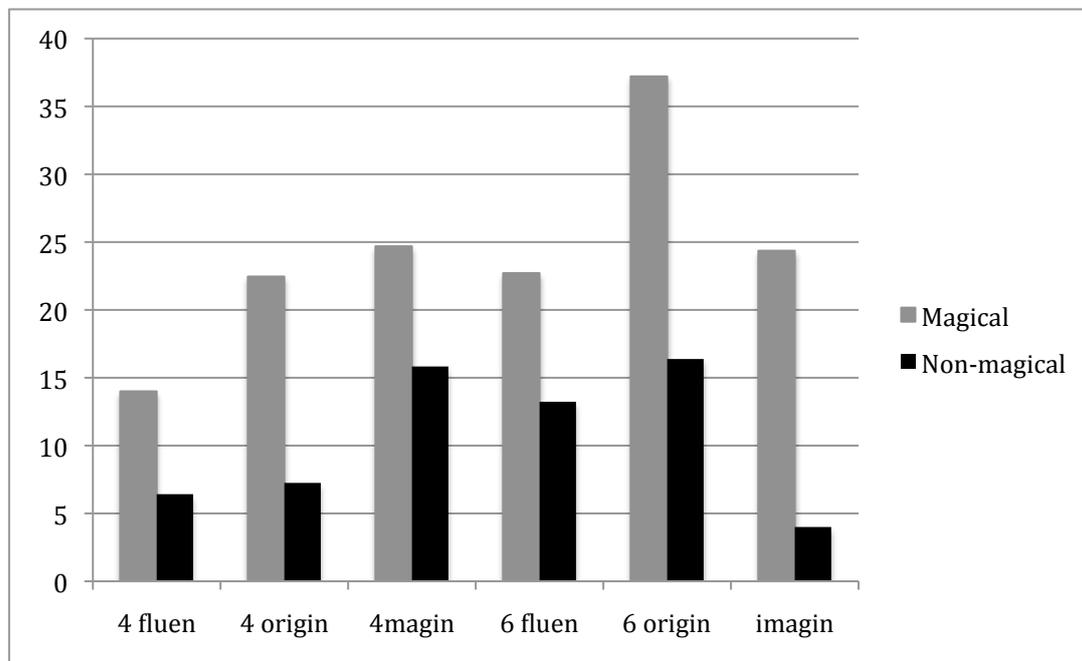


Figure 3. Percent of children who understood the difference between true magic and tricks and answered that true magic can or cannot happen in real life

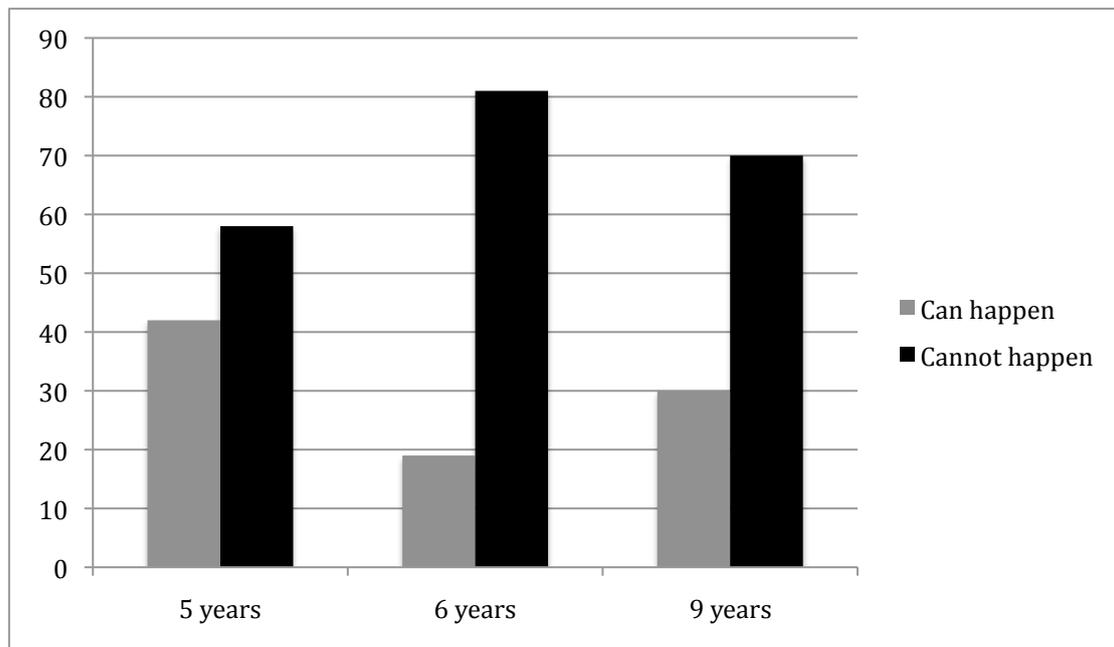


Figure 4. Percent of non-believers in magic who changed or did not change their disbelief in magic for belief

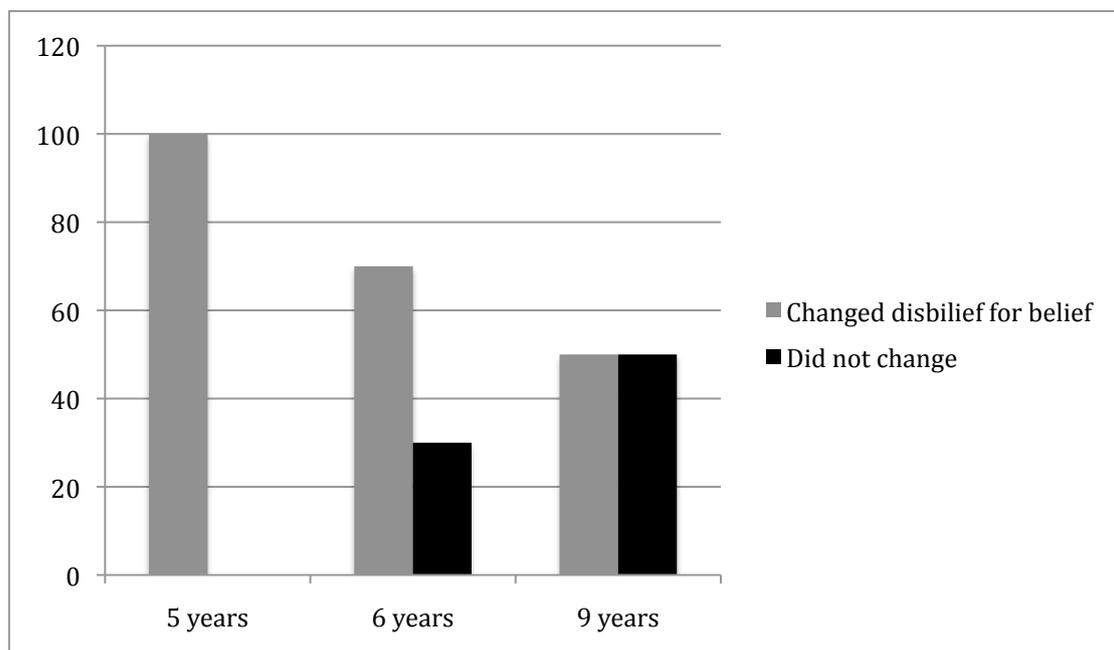


Figure 5. Percent estimates of the probability that the unusual transformation was caused by the magic spell

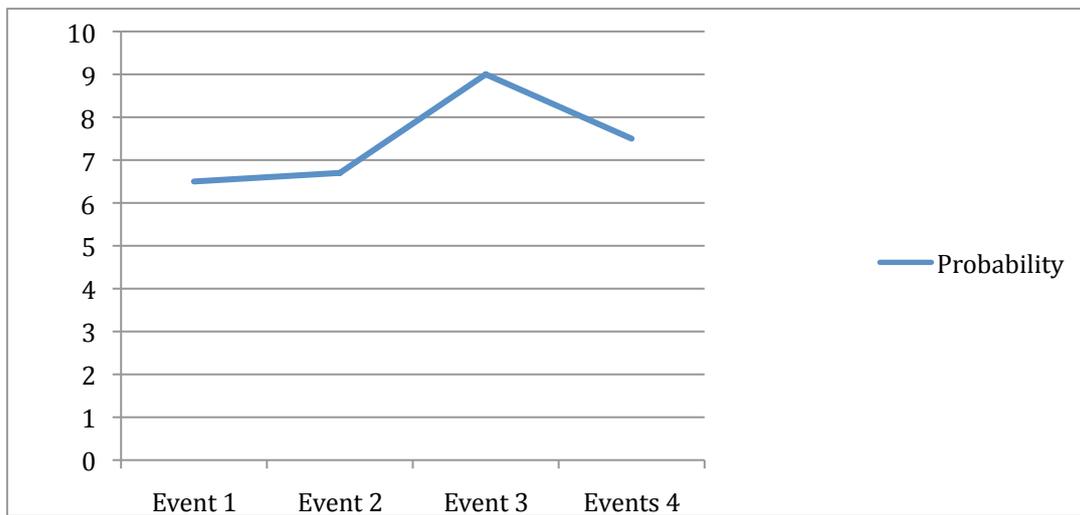


Figure 6. Percent of participants who recollected the wrong order of events, as a function of age and condition

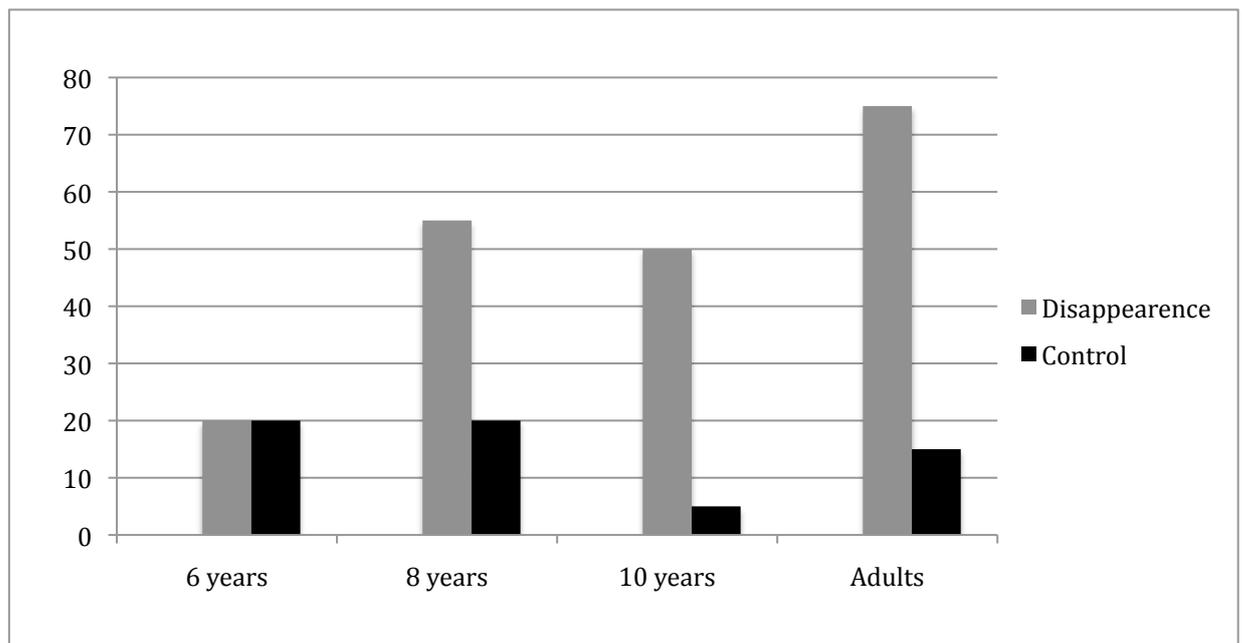


Figure 7. Mean scores that assessed participants' general satisfaction with their lives, as a function of condition (help-declined, magical-suggestion and no-suggestion) and time (in the experiment and two weeks after)

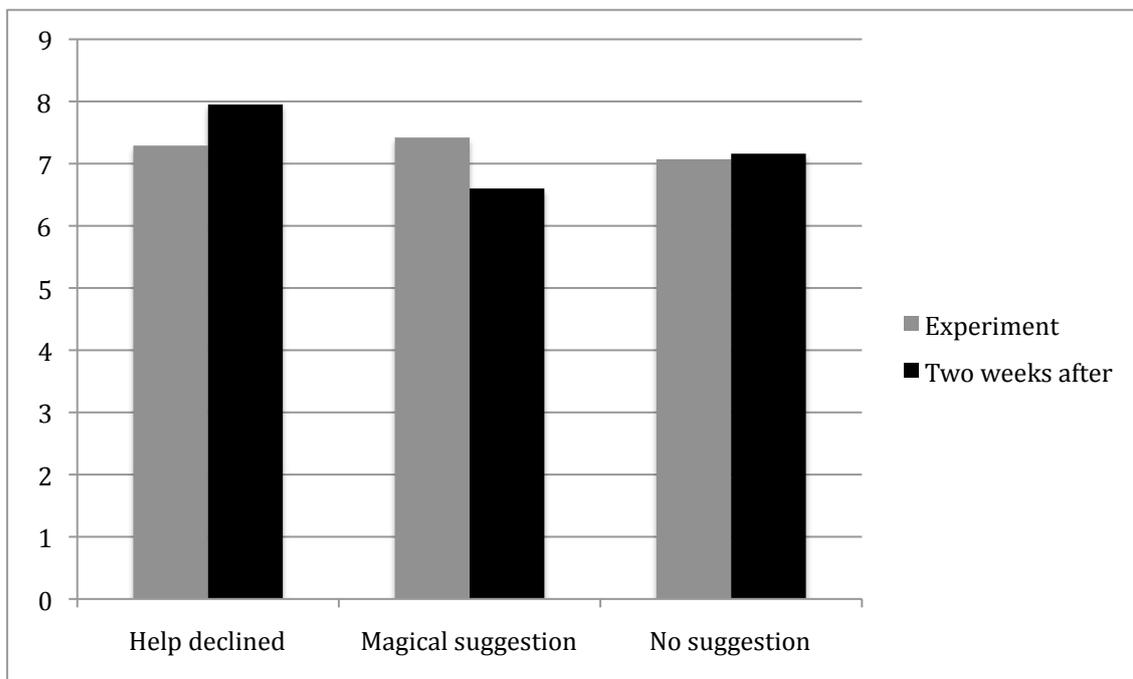


Figure 8. Percentage of dreams as a function of condition (magical suggestion versus no-suggestion) and the dream type (target, scary and ordinary)

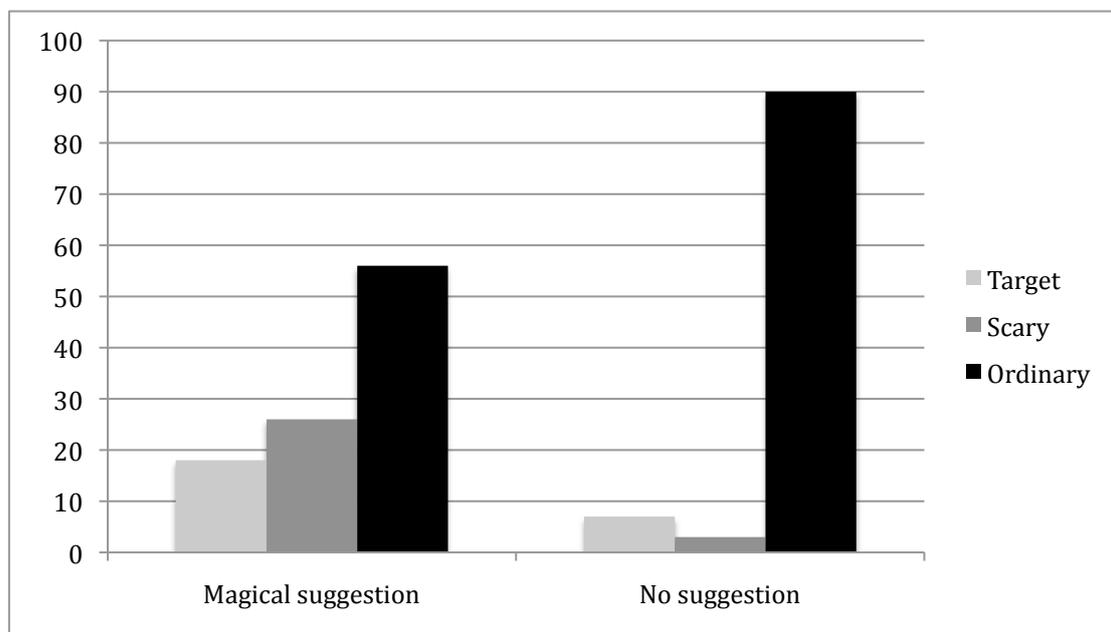


Figure 9. Percent of participants that refused to accept the magic spell, as a function of condition (personal involvement versus no personal involvement) and the kind of the magic spell (good versus bad)

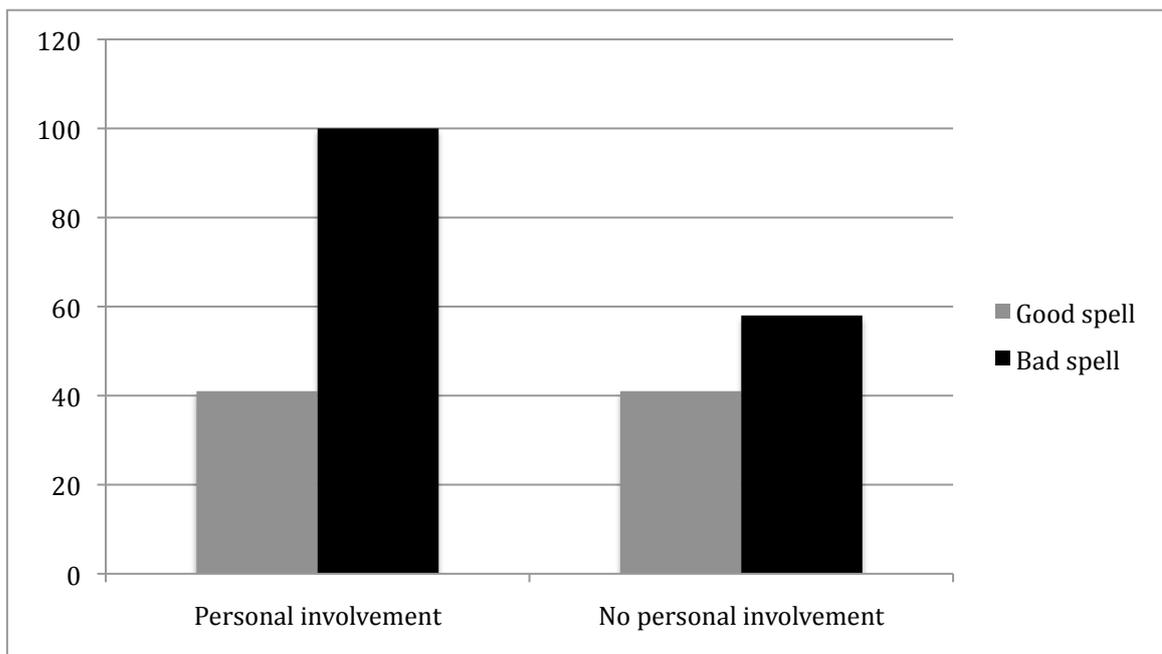


Figure 10. Percent of children who were willing to put their valuable objects under risk in order to explore the novel and unusual effect, as a function of the effect (magical versus counterintuitive physical) and age

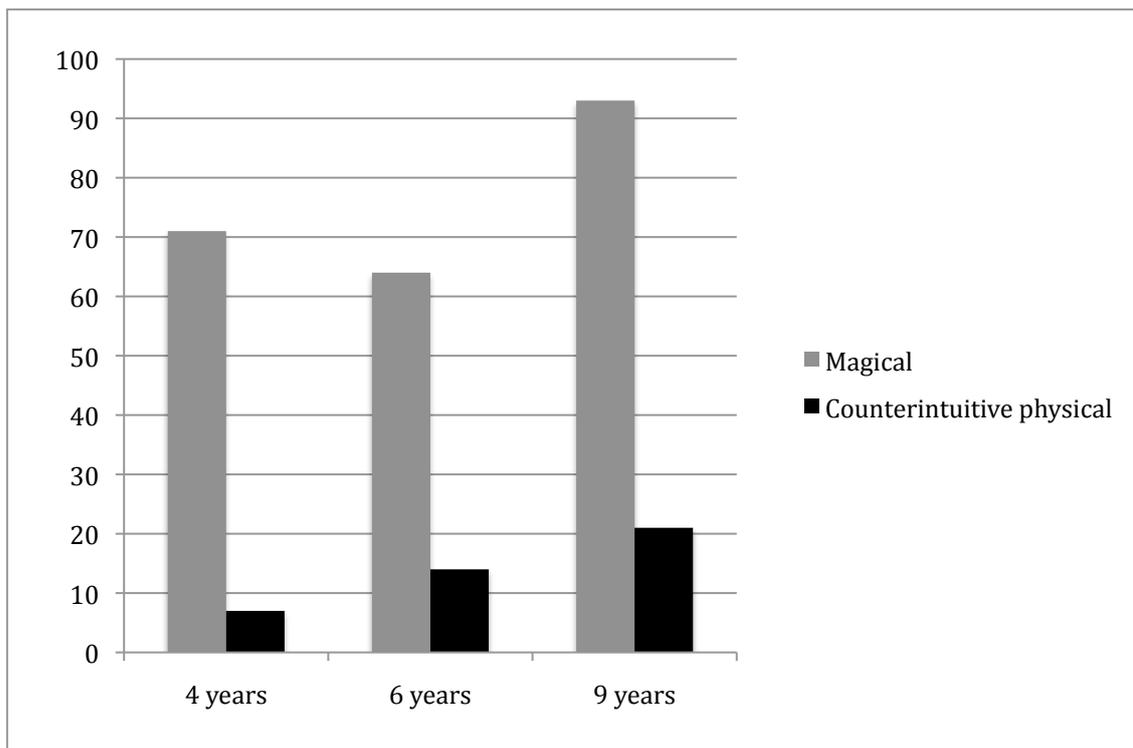


Figure 11. Percent of adults who were willing to put their valuable objects under risk in order to explore the novel and unusual effect, as a function of the effect (magical versus counterintuitive physical) and the object's value (driver's license versus passport)

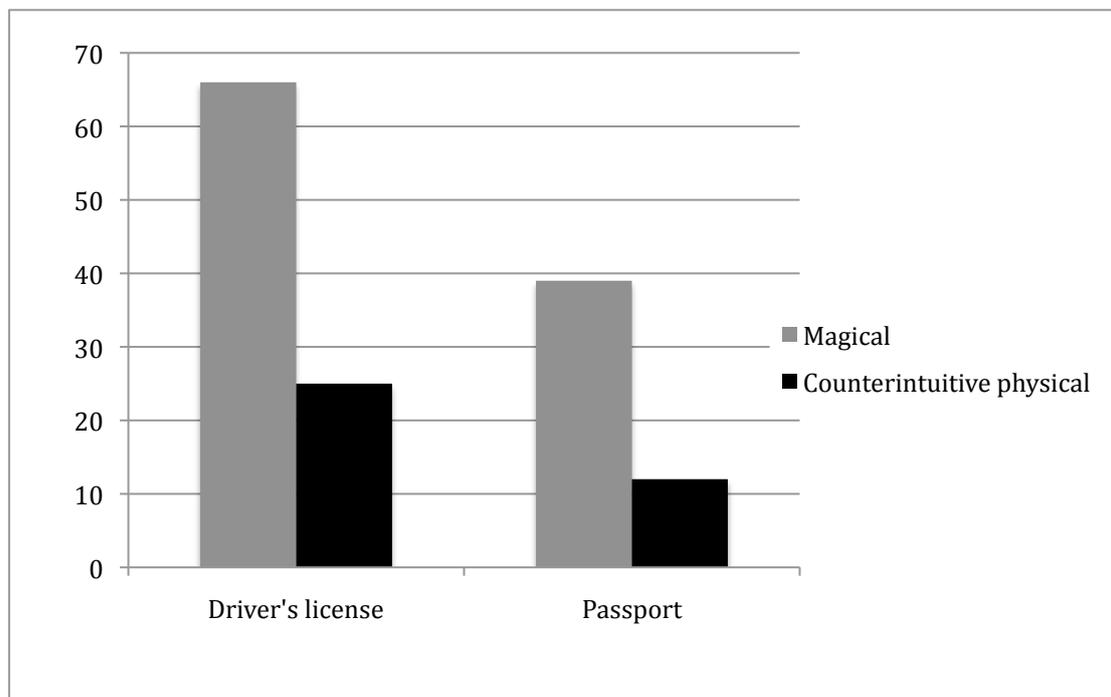


Figure 12. Percent of participants who revealed their belief in the effect of the magic spell under the low risk condition, as a function of the type of acknowledgement (verbal versus through action) and culture (British versus Mexican)

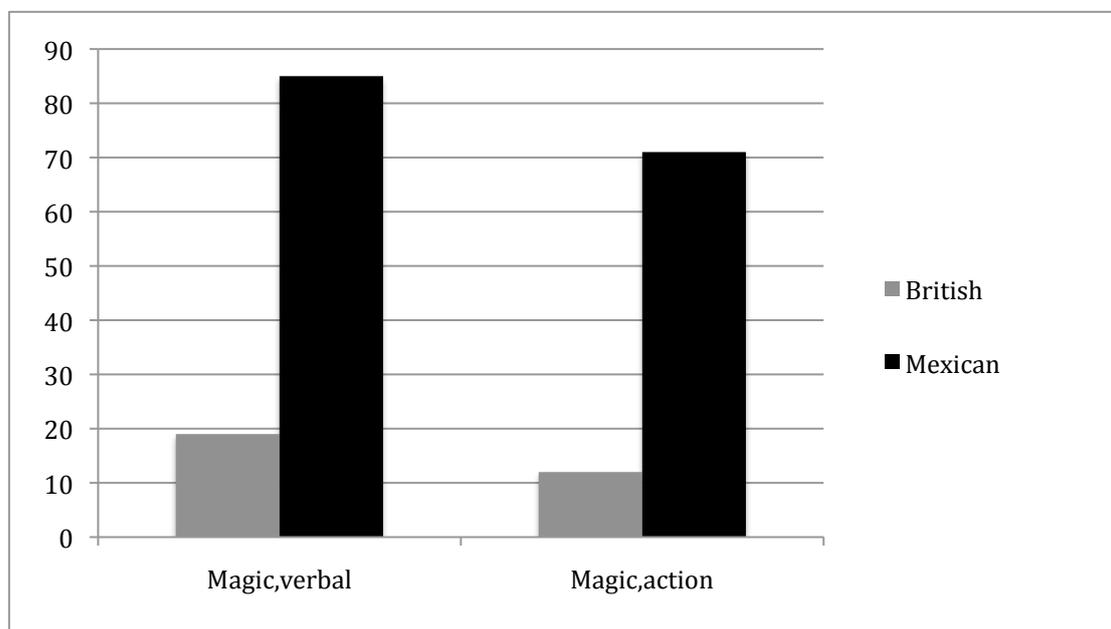


Figure 13. Percent of participants who revealed their belief in the effect of the magic spell under the high risk condition, as a function of the type of acknowledgement (verbal versus through action) and culture (British versus Mexican)

