

The Belief in Magic in the Age of Science

SAGE Open
January-March 2014: 1–17
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DOI: 10.1177/2158244014521433
sgo.sagepub.com



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Abstract

The widely spread view on magical beliefs in modern industrial cultures contends that magical beliefs are a bunch of curious phenomena that persist today as an unnecessary addition to a much more important set of rational beliefs. Contrary to this view, in this article, the view is presented, which suggests that the belief in magic is a fundamental property of the human mind. Individuals can consciously consider themselves to be completely rational people and deny that they believe in magic or God despite harboring a subconscious belief in the supernatural. Research also shows how engagement in magical thinking can enhance cognitive functioning, such as creative thinking, perception and memory. Moreover, this article suggests that certain forms of social compliance and obedience to authority historically evolved from magical practices of mind control and are still powered by the implicit belief in magic. Finally, the article outlines areas of life, such as education, religion, political influence, commerce, military and political terror, and entertainment, in which magical thinking and beliefs of modern people can find practical applications.

Keywords

magical thinking, magical beliefs, cognitive functioning, and social communication

In this article, attempt is made to show that the belief in magic is a fundamental feature of the human mind (the “fundamentality hypothesis”). Even those who explicitly consider themselves to be completely rational individuals implicitly still harbor a belief in magical powers. It is also argued that magical thinking and magical beliefs are different psychological constructs. Whereas magical thinking might have important implications for learning, the belief in magic affects communication in modern societies. Finally, the areas of practice are outlined in which magical thinking and implicit or explicit magical beliefs can be engaged, such as education, political influence, commerce, military and political terror, and entertainment.

The Starting Point: Theoretical Issues and Empirical Evidence of Hidden Magical Beliefs in Modern People

Concepts and Problems

In the modern view, *magical causality* comprises events that violate known physical, biological, and psychological principles and conventions. Affecting or creating physical objects directly through the effort of thought, will, wishes, or words (mind-over-matter magic); affecting people’s lives and health through prayer, magic spells, and rituals, or by promising reinforcement in the afterlife (communicative magic); and harming or helping people by manipulating the objects that those people were in contact with, such as their hair, clothes, or shadow (contagion magic) are just a few kinds of

magical events (Frazer, 1890/1959; Lévy-Brühl, 1923/1966; Nemeroff & Rozin, 2000; Piaget, 1929/1971; Subbotsky, 2010a). The contrast between magical causality and *physical causality* cannot be properly understood without realization that the belief in magical causality goes back for about 30,000 years, to the Upper Paleolithic period, when people populated nature with spiritual agents that could think or wish; that is, they attributed to inanimate things a certain “theory of mind,” a concept that is alien to the objects of science. The assumption that physical objects at the receptive end of a causal event have some kind of consciousness is what distinguishes magical causality from physical causality.¹ By addressing their pleas to the Gods and spirits, people tried to beg favors (good weather, good health, luck in hunting) from natural objects. In return, people were prepared to obey when the Gods and spirits spoke to them, either directly or indirectly through medicine men, kings, or wizards. From this it follows that from the beginning, magical causality had two dimensions: natural (people’s magical communication with nature) and social (people’s magical communication with other people; Boyer, 1994; Boyer & Walker, 2000; Tambiah, 1990).

Whereas *ordinary fantasy* involves mental processing of ordinary characters or events (e.g., a child having

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an imaginary friend or dreaming of going to Disneyland), *magical thinking* comprises mental processing of supernatural characters or actions (e.g., imagining an angel or a troll or watching a movie about an angel or a troll, dreaming of flying on a broomstick or watching a movie about a person flying on a broomstick). Whereas within ordinary fantasy, objects and events exist that comply with the same physical and causal constraints as their real counterparts, within magical thinking, principles of the real physical world can be suspended.² The common feature that unites fictional objects of magical thinking is that they do not have matching prototypes in the real world.³

In addition, magical thinking must be distinguished from *magical beliefs*. Whereas most researchers conflate magical thinking with magical beliefs (Eckblad & Chapman, 1983; Peltzer, 2003; Pronin, Rodriguez, Wegner, & McCarthy, 2006; Simonds, Demetre, & Read, 2009), in this article, magical thinking and magical beliefs will be treated as separate constructs. Magical thinking operates with concepts of impossible objects, without ontological judgment being made about the objects, whereas a magical belief incorporates ontological judgment about the impossible objects of the belief, namely, that these objects exist or (in the case of a disbelief) don't exist in the real world. Consequently, magical thinking unfolds only in one's imagination, perception, or thinking; in contrast, the belief in magic implies that magic might have real world effects. In that regard, every person who watches a movie with magical effects or has a dream where magical things happen is involved in magical thinking without necessarily having explicit magical beliefs. Later in this article, an attempt will be made to show that the distinction between magical thinking and magical beliefs is vital for our understanding of practical implications that our everyday engagement with magical causality involves: Whereas magical thinking can affect learning, the belief in magic has consequences for our social behavior.

Two notions will be challenged in this article: (a) the view that magical thinking and magical beliefs in modern industrial cultures, though extensively present in modern people, are nevertheless, an unnecessary "addition" to the more important rational thinking and rational beliefs, and (b) the implicit view that magical beliefs and magical thinking are side effects of the "cognitive evolution" and, as such, have no significant implications for learning and communication in modern societies.

The "Fundamentality Hypothesis": Magical Beliefs Reconsidered

The traditional view of magical beliefs among people living in modern industrial cultures⁴ emerged in the first half of the 20th century in works on cultural anthropology (Frazer, 1890/1959; Lévy-Brühl, 1923/1966; Mauss, 1903/1972; Taylor, 1929) and developmental psychology (Bühler, 1937; Piaget, 1929/1971). According to this view, still shared by

many contemporary researches, *magical beliefs is an old-fashioned kind of beliefs that existed in past centuries and persist today only in young children and a limited population of superstitious adult individuals.*

In spite of this pessimistic view, in recent decades, magical thinking and beliefs in modern industrial cultures have become a topic of considerable interest among researchers. Paul Rozin and colleagues have argued that in disgust and other domains, people's reactions conform to the main laws of sympathetic magic: contagion ("once in contact, always in contact") and similarity ("the image equals the object"; Nemeroff & Rozin, 2000; Rozin, Haidt, & McCauley, 1993; Rozin, Millman, & Nemeroff, 1986; Rozin & Nemeroff, 1990, 2002; Rozin, Nemeroff, Wane, & Sherrod, 1989; Rozin & Stellar, 2009; Rozin & Wolf, 2008). The effects of Thought Action Fusion (TAF) and the thinking of patients with Obsessive-Compulsive Disorder (OCD) also follow the laws of thought-over-matter magic (Bolton, Dearsley, Madronal-Luque, & Baron Cohen, 2002; Einstein & Menzies, 2004; Morillo, Belloch, & Garcia-Soriano, 2007; Noyes & Hoehn-Saric, 2006; Rachman, 2006; Shafran, Thordarson, & Rachman, 1996; Simonds et al., 2009). In clinical research, schizophrenic patients have been shown to engage in magical thinking to a considerably greater extent than the general population and non-schizophrenic psychiatric patients (George & Neufeld, 1987; Tissot & Burnard, 1980). Considerable effort has been invested in understanding psychological sources of magical practices and superstitions in modern societies (Hutson, 2012; Luhrman, 1989; Tambiah, 1990; Vyse, 1997; Wiseman & Watt, 2004). Thus, superstitious individuals proved to be more prone to attribute inanimate things with mental or biological qualities than non-superstitious individuals (Lindeman & Aarnio, 2007).

Taken individually, these lines of research present magical thinking and behavior as a spectrum of specialized phenomena scattered in various domains of the mind and ranging from helpful adaptive strategies (e.g., disgust, fear of contagion, positive superstitions) to the reactions of a troubled mind, as in OCD and schizophrenia. Taken together, however, these studies undermine the traditional view of magical thinking and magical beliefs as a relic of the past centuries. Rather, these studies suggest that the belief in magic is a stable feature of the human mind that is present throughout history, cultures, and the individual's lifespan and exhibits itself in various domains in the forms of superstitions, sympathetic magical thinking, TAF, OCD, and other special phenomena. More direct support for this suggestion comes from recent cognitive studies on religion and human development. Some anthropologists and psychologists argue that religious ideas are based on natural psychological predispositions of the human mind, some of which (such as understanding goal-directedness and making mentalist attributions) may be hardwired by evolution (Atran, 2002; Barrett, 2001; Barrett & Keil, 1996; Bering, 2006a, 2006b; Bloom, 2002; Bloom & Weisberg, 2007; Boyer, 1994, 2001; Boyer & Bergstrom,

2008; Hood, 2009; McKay & Dennett, 2009). However, even if modern people are naturally predisposed to having certain ideas about the supernatural entities, this does not necessarily mean that the people who have these ideas also believe that these supernatural entities really exist or that they will keep these ideas throughout their lives. Indeed, some innate abilities (such as swimming or grasping reflexes, or infants' sensitivity to specific speech sounds not found in their native language) do not survive beyond infancy or early childhood. Even if children's ideas about the supernatural were innate and children believed in supernatural entities, one would expect this belief to disappear by adulthood due to the lack of demand for magical beliefs in science-oriented cultures. This, however, is not the case.

The aforementioned research challenged the traditional view on magical beliefs as a remnant of the past: This research showed that magical beliefs are widely spread in modern societies, may show up even in rational educated adults, and can perform some important functions in the individual's life, such as the "illusion of control" function (Langer, 1975), or the "heuristic" function (Nemeroff & Rozin, 2000; Shweder, 1977). Nevertheless, magical beliefs in modern people are largely still viewed as an unnecessary addition to the much more important rational beliefs. The presence of magical beliefs in rational individuals has been detected by methods that target people's beliefs indirectly, without making the rational people clearly and consciously acknowledge that they, in fact, hold magical beliefs. The positive functions of magical thinking and beliefs are mostly confined to the scope of individual personality. Finally, it remains still unclear how the belief in science and the belief in magic, which are in a logical contradiction with each other, can peacefully coexist in an individual's mind.

The aim of this article is to advance the new view on magical beliefs in modern people still further. The attempt will be made to show that *magical beliefs in modern people is not a bunch of special phenomena that, though widely spread in modern people, are nothing but an unnecessary addition to rational beliefs. Rather, magical beliefs is a fundamental feature of the human mind, which normally creates a necessary (mostly subconscious) background for rational beliefs and, in certain circumstances, comes forward to control and direct people's conscious reasoning and actions without the people being aware of that*⁵ (the "fundamentality hypothesis").⁶ Although people living in modern industrial cultures may consciously consider themselves to be completely rational individuals and deny that they believe in magic or in God, subconsciously they still harbor the belief in supernatural forces and entities, and what is subconscious can become conscious. If the fundamentality hypothesis is true, then it can be expected that (a) under certain conditions, most children and adults who initially deny having magical beliefs will openly and willingly acknowledge that they believe in magic and the number of such individuals will be close to 100%, (b) the roles that magical thinking and magical beliefs

play in the modern life go beyond the role of "a cushion" for resolving individual problems and have important implications for education and social communication. What evidence exists in support of these expectations?

Raising Up From the Depths: Can We Acknowledge That We Believe in Magic?

Jean Piaget (1929/1971) provided multiple examples of young Swiss children's verbal magical reasoning. More recently, Russian children aged 4, 5, and 6 years were told a story of a magic table, which could turn toy animals made of clay into living ones (mind-over-matter magic; Subbotsky, 1985). When asked if such things can happen in real life, almost all children denied this. However, when the children were presented with a real table that could make the toy animals start moving (the effect was achieved by a series of magnets hidden in the toys and the table), around 90% of children behaved as if the magical conversion was indeed taking place, and subsequently acknowledged that magic can be real. Other experiments confirmed the assumption that preschool and elementary school children's verbal disbelief in magic is only superficial: At this age, children are happy to be reassured that magic can actually happen in real life and explicitly acknowledge that they believe in magic and magical entities (Harris, Brown, Marriot, Whittal, & Harmer, 1991; Johnson & Harris, 1994; Rosengren & Hickling, 1994, 2000; Rosengren, Kalish, Hickling, & Gelman, 1994; Subbotsky, 2004; Woolley, 1997; Woolley, Boerger, & Markman, 2004). It is between 6 and 9 years of age that children's verbal magical beliefs, when measured by their reactions toward observable "magical" events, really diminish—a change that can be a result of a mixture of factors, such as growing social competence, intellectual development, and scientific and religious education (Piaget, 1929/1971; Rosengren & Hickling, 1994; Subbotsky, 2004; Woolley, 2000; Woolley, Browne, & Boerger, 2006).

One would assume that modern educated adults are even more skeptical toward magic than 9-year-old children. 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. Surely, an educated adult, who is not religious, cannot consciously believe that our destiny is determined by our genes and environment and also believe that destiny can be influenced by saying a prayer or a magic spell because accepting these two beliefs simultaneously would create a logical contradiction. In addition to creating this logical contradiction inside the mind, the belief in magic also has powerful enemies in social institutions such as science and religion. Science rejects the belief in magic on the grounds that magical laws contradict fundamental physical principles (such as the principle that the object of an observation should be independent from the observer) and everyday experience (Feynman, 1974). Modern monotheistic religions

(Judaism, Christianity, and Islam), which are historically a descendant of magic,⁷ concentrate all spirituality in God and men, while considering objects of nature (physical objects, plants, and animals) as devoid of any spirituality. In contrast, magic views every object as having an internal dimension, a certain “spirit” in it, to which people can direct their pleas or an offer of a “contract” and thus solicit their cooperation. Consequently, modern religion links magical and paranormal phenomena with evil powers such as the devil and the occult (Strandberg & Terry, 2004).⁸

Despite the differences between them, science and religion are united in their negative attitude toward the belief in magic in modern people. On this ground, one can expect that educated adults living in modern industrial societies would explicitly reject magical beliefs. At the same time, if the main hypothesis in this article is correct, the explicit rejection of magical beliefs by adult individuals should be accompanied by behaviors that indicate these individuals’ implicit belief in magic. Moreover, under certain conditions the individuals can explicitly acknowledge the implicit magical beliefs, which normally coexist with the explicit disbelief in magic.

Theoretically, the coexistence assumption can be grounded in the dual-process model of cognition, which is a modern and advanced version of Sigmund Freud’s distinction between primary processes of thinking, motivated by wish fulfillment, and rational and goal-directed secondary processes (Evans & Coventry, 2006). The new version of this classic distinction proposes that the information about the world is processed at two distinct levels: One comprises psychological processes that are nonverbal, rapid, domain specific, and subconscious (System 1 processing), and the other includes processes that are verbal, slow, abstract, and conscious (System 2 processing; Evans, 2003; Evans & Coventry, 2006; Kahneman, 2003; Stanovich & West, 2008). In a more recent interpretation, this distinction defines rapid autonomous processes (Type 1) as yielding default responses unless intervened on by distinctive higher order reasoning processes (Type 2), whereas the Type 2 processing supports hypothetical thinking and load heavily on working memory (Evans & Stanovich, 2013). Extrapolating the dual-process model of cognition on modern people’s attitudes toward magical beliefs, one can predict that whereas at the reflective and conscious level of reasoning (System 2 processing), people deny the existence of magic, the beliefs in magic still work at the subconscious level (System 1 processing). This prediction has been examined in a number of studies.

In one of these studies, British university graduates and undergraduates were instructed about the concept of magic and then subjected to four successive trials in which an apparently magical event happened (did not happen) in the participant’s hands after a magic spell was (was not) cast (Subbotsky, 2004). Although the participants acknowledged that they were struggling to provide a rational explanation for these events, they nevertheless refused to accept a

magical explanation. This result confirms the expectation that at System 2 information processing, educated adults will consistently deny that they believe in magic even when apparently magical events are repeatedly shown to them and they are unable to rationally explain these events.

But if modern adults, who explicitly deny that they believe in magic, subconsciously still hold this belief, could this magical belief, hidden in System 1 information processing, exhibit itself indirectly through participants’ emotionally charged reactions?⁹ To investigate this possibility, American university students were asked to rate their feelings about wearing certain clothes, which had a history of contact with evil or good personalities but were subsequently sterilized. By rating their preferences for the emotional attractiveness or unattractiveness of wearing the clothes that went through the “magical contagion,” participants might acknowledge their hidden beliefs in contagion magic without consciously confronting the view of science.¹⁰ Indeed, in their ratings, the participants indirectly admitted the possibility that having Mother Teresa wear Hitler’s sweater would cancel out his “vibes” or “soul-stuff” and make the sweater more acceptable to wear (Nemeroff & Rozin, 1994). In other studies, a negative relation has been found between individual’s tendency toward analytical thinking and their religious and paranormal beliefs (Aarnio & Lindeman, 2005, 2007; Gervais & Norenzayan, 2012; King, Burton, Hicks, & Drigotas, 2007; Lindeman & Aarnio, 2006). This suggests that prevalence of System 2 rational processing might be a factor, which promotes disbelief in magical, religious, and paranormal phenomena. It remains an open question though, whether this disbelief is achieved through elimination of religious beliefs, or through suppression of these beliefs and ousting them deeper into the subconscious. Empirical confirmation in favor of the suppression hypothesis can be found in the studies that demonstrated coexistence of acquired scientific theories with the earlier intuitive theories, which have been suppressed but not supplanted by scientific theories (Shtulman & Valcarcel, 2012).

The above studies, however, only targeted people’s implicit belief in magic, which can be exhibited indirectly through questionnaires or semi-automatic reactions, such as the feeling of disgust or fear of contagion. Considering this kind of reactions, Gendler (2008) contrasted conscious beliefs and subconscious “aliefs.” In essence, “aliefs” is a more primitive kind of beliefs, which are subconscious and automatically released in appropriate circumstances (such as the fear of walking over an abyss on a safe but transparent bridge). At present, it remains unknown whether people, who harbor implicit magical beliefs, would explicitly acknowledge that they believe in magic. Before such explicit acknowledgment is proven, modern peoples’ reactions, which are often called “sympathetic magic” (such as reactions targeted in studies by Rozin et al.) may only superficially remind sympathetic magic, which is consciously practiced by witches in traditional and modern societies

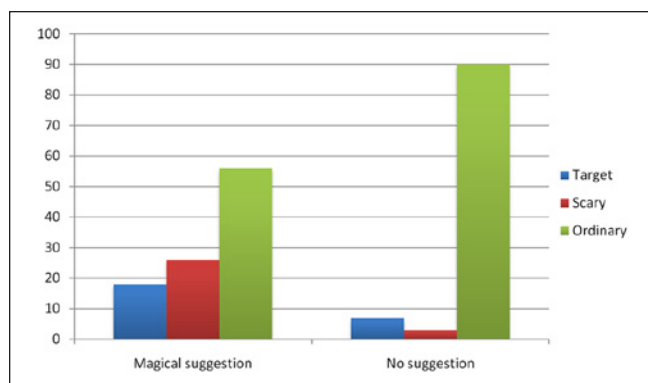


Figure 1. Percentage of dreams as a function of condition (magical suggestion vs. no suggestion) and type of dream (target, scary, and ordinary).

(Frazer, 1890/1959; Lévy-Brühl, 1923/1966; Pyysiäinen, 2004). In reality, these reactions could be “aliefs,” hardwired by evolution or conditioned early in life to protect people from certain dangers, which do not involve any concept of magic at all. But if marking the action of drinking from the glass in which a dead sterilized cockroach had been briefly dipped low on the scale of desirability might not tell us anything about participants’ magical beliefs, then perhaps, putting a mark close to the “strongly agree” end on questions like “Black magic really exists” or “Some people can make me aware of them just by thinking about me”¹¹ might? Unfortunately, positively answering such questions also does not tell us with certainty whether the respondents believe in magic. First, the respondents may not be clear about the distinctions between magical and not magical things on one hand, and between supernatural magic and sleight of hand tricks on the other—the distinctions, which are difficult to make even for scientists. Second, even if the respondents are aware of these distinctions, they might think that questions such as “Some people can make me aware of them just by thinking about me” do not indicate magical beliefs. Finally, getting a high score on a magical beliefs questionnaire does not mean that in their real life the high scorers will follow magical and not physical causality, and the reverse is true as well. Altogether, questionnaires might be the easiest way of collecting empirical data on magical beliefs, yet they are not the most reliable way. This brings us to the conclusion that thus far most researchers have failed to prove the existence of magical beliefs in modern people. Methods that combine instruction, participants’ verbal judgments, and actual behaviors are needed to examine whether modern individuals exhibit magical beliefs.

In a study that aimed at contrasting participants’ explicit and implicit beliefs in magic, British undergraduate and graduate students who were instructed on the concept of magic and proclaimed that they were non-believers in magic were offered a magical spell with the aim to make participants have dreams of their choosing during the next three

nights (Subbotsky, 2007). According to the Threat Simulation theory of dreaming (Revonsuo, 2000), one of the functions of dreaming is simulation of threatening events. In the Judean, Christian, and Islamic traditions, engaging with magic is considered a dangerous enterprise. On this ground, it was hypothesized that if participants had System 1 based implicit magical beliefs, then, after accepting the magical help out of curiosity or other reasons, retrospectively participants would treat their pact with magic as a threat and see bad dreams significantly more frequently than those participants who were not offered the magical help. The results indicated that the total number of dreams recalled in the magical suggestion condition and in the control condition in which no magical help was offered was about the same; however, as predicted, in the magical suggestion condition participants had bad dreams significantly more frequently than in the control condition (Figure 1). This result brings one to the conclusion that even in System 1 subconscious processes such as dreams, the participants experienced a feeling of danger coming from their pact with magic, and this feeling resulted in an increased number of bad dreams.

The aforementioned experiment showed that rational people who deny their belief in magic might still harbor such belief subconsciously. But will educated adults in modern industrial cultures be prepared to explicitly acknowledge that they actually believe in magic, and will the number of such participants be close to 100%—the result that the fundamentality hypothesis predicts?

To examine this question, British graduates and undergraduates, all informed disbelievers in magic, 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, 2005). In one scenario (good spell), the spell aimed at making the participants rich and happy, and in another scenario (bad spell), it aimed at making the participants servants to evil forces. The participants were asked whether they would accept or decline the spell. There were also two conditions. In the “personal involvement” condition the spells were aimed at participants’ own future lives, and in the “no personal involvement” condition, the spells were aimed at the life of an imaginary character - a scientist and non-believer in magic. The expectation was that if participants’ claim that they don’t believe in magic is true, they should treat both spells as irrelevant to their (or the character’s) future lives and react similarly to both spells in both conditions. If, however, their claim of not believing in magic is false, they should react to the good and the bad spell differently in the personal involvement condition. The results (Figure 2) indicated that in the “no personal involvement” condition, participants indeed reacted to both spells in a similar way: around half of participants said that the scientist should decline the good spell, and approximately the same number said that the scientist should decline the bad spell. However, in the “personal involvement” condition, in which participants’ own lives were at stake, the participants treated

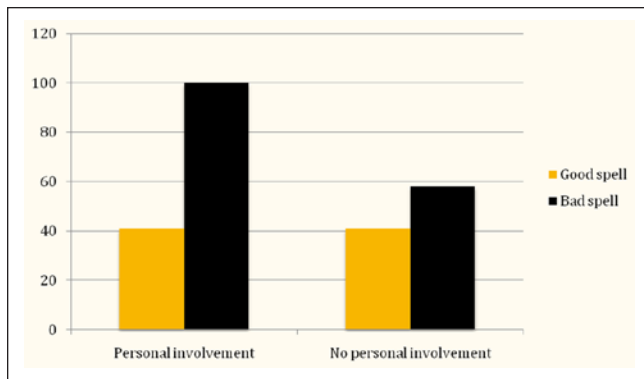


Figure 2. Percent of participants that refused to accept the magic spell, as a function of condition (personal involvement vs. no personal involvement) and type of magic spell (good vs. bad).

the good and bad spell differently: whereas the good spell was again declined by about 50% of participants, all participants declined the bad spell.¹² Contrary to their self-proclaimed disbelief in magic, in their justifications of why they had rejected the bad spell, the participants admitted that the bad spell might actually affect their future lives in a magical way. This result was replicated in other studies (Subbotsky, 2007, 2010b).

To summarize, the above experiments provide support for the first expectation that follows from the “fundamentality hypothesis,” specifically, that under certain conditions, children and adults who initially deny having magical beliefs will openly and willingly acknowledge that they believe in magic, and the number of such participants will be close to 100%. In other words, the experiments showed that rational adults in industrial societies consciously deny that they hold magical beliefs while allowing their magical thinking to thrive in the domains of play and the imagination.¹³ Subconsciously, the adults still harbor the belief in magic, and are prepared to consciously acknowledge such belief when denying this belief threatens the participants’ *personally significant objects*, such as their future lives.

Thus far, this article addressed the first prediction, which followed from the fundamentality hypothesis: that under certain conditions, the great majority of rational adults would willingly acknowledge that they believe in magic. In the next sections, the second prediction of the fundamentality hypothesis will be analyzed, according to which the list of roles that magical thinking and magical beliefs play in the modern life goes beyond those confined to the scope of individual personality and extends into the domains of education and social communication.

Magical Thinking and Learning

Background

The idea to explore the relationships between magical thinking and learning has its root in the previous research, which

investigated the role of fantasy in learning. By definition, fantasy is a psychological process that is closely related to magical thinking though not identical to it. It is therefore justified to begin this section by considering the relationship between fantasy and learning. The existing evidence regarding the effect of fantasy on learning and other cognitive processes is mixed. On one hand, some evidence suggests that framing cognitive tasks within a fantasy context facilitates thinking. Thus, Dias and Harris (1988, 1990) reported that embedding a logical task within the make-believe imaginary context improved 4- and 6-year-old children’s ability to make correct logical inferences from counterfactual premises, as compared with the tasks presented within a normal matter-of-fact context. Facilitative effect of fantasy contexts on children’s performance on cognitive tasks has been shown in other research as well (Hawkins, Pea, Glick, & Scribner, 1984; Leevers & Harris, 1999; Lillard, 1996; Lillard & Sobel, 1999; Principe & Smith, 2008; Richards & Sanderson, 1999; Sobel & Lillard, 2001). On the other hand, some evidence shows that fantasy context can be less favorable for cognitive functioning than real life context. For example, using the analogical problem-solving paradigm, Richert, Shawber, Hoffman, and Taylor (2009) reported that 3½- to 6-year-old children were less likely to transfer solutions from the stories about fantasy characters to real life tasks than from the stories about real people to real life tasks. Similarly, Richert and Smith (2011) found that 3½ to 5½-year-old children were less likely to transfer problem solutions from stories about fantasy characters compared with stories about real people. Obviously, putting cognitive tasks within fantasy contexts is not the same as making children think magically. For example, in the aforementioned studies by Richert et al., some story characters were fantastic (a monster, a giant robot in space), but they did not exhibit any magical properties or produce magical actions. Also, transferring solutions from realistic stories to real life tasks is easier than transferring solutions from fantastic stories to real life tasks, simply because realistic stories have more features in common with real life tasks than fantastic stories have. Finally, even if children’s analogical reasoning from fantasy contexts into real life problems was less effective than that from realistic contexts, fantasy contexts still allowed a significant proportion of children to reason analogically. Nevertheless, the reviewed experiments suggest that benefits of children’s engagement in magical thinking are more likely to show up in the domain of creative thinking, perception, and memory, rather than in the domain of common problem solving.

Can Watching Magical Films Affect Cognitive Functioning?

To test this expectation, British children aged 4 and 6 years from the area of Greater London were divided into experimental and control conditions (Subbotsky, Hysted, & Jones, 2010). In both conditions, children were shown clips from

the film *Harry Potter and the Philosopher's Stone*. In the experimental condition, the clip was full of magical effects, whereas in the control condition, the clip showed the same characters but no magical effects. Both clips were matched according to other dimensions, such as pace, action, and emotional content. Before and after exposure to the clips, the children were tested on identical sets of creativity tasks (such as those included in Torrance's "Creativity in Action and Movement" test). Creativity is typically defined as the ability to generate "novel behavior that meets a standard of quality and/or utility" (Eisenberger, Haskins, & Gambleton, 1999, p. 308). This ability is akin to *divergent thinking*, the ability to solve problems that do not have only one correct answer but allow for a variety of alternative solutions. As the key feature of magical thinking is processing the information about characters and events that are alternative to characters and events of the real world, magical thinking could also be viewed as a simplistic type of divergent thinking. Whereas creativity in realistic thinking provides multiple realistic solutions to realistic problems (i.e., one can move from one place to another by using a car, a train, or a plane), magical thinking provides multiple unrealistic (supernatural) solutions to realistic problems (i.e., one can move from one place to another by using a broomstick, a magic carpet, or on a dragon). The common feature (divergent thinking) makes it possible to expect that engaging children in one of these activities—magical thinking—might enhance the other activity—creativity of realistic thinking, through practice or (and) associative learning. The results indicated that after, but not before, exposure to the film clips, children in the experimental condition scored significantly higher than controls on the majority of tasks, thus supporting the expectation that engagement in magical thinking enhances the creativity of realistic thinking. These results were replicated with 6- and 8-year-old children from Shropshire county in England.

In another study, the effect of watching a magical movie on children's ability to discriminate fantastic from realistic visual displays was investigated (Subbotsky & Slater, 2011). Distinguishing fantasy from reality is important because it mediates the effect of mass media on children and adults' subsequent behavior. It has been shown that children who believed a violent film clip was a documentary later reacted more aggressively compared with children who believed the film was fantasy (Atkin, 1983). When children have an increased ability to distinguish between fiction and reality, exposure to TV violence may have less of an effect (Bushman & Huesmann, 2001; Comstock & Scharrer, 2006). Boyer and Walker (2000) argued that counterintuitive magical effects that violate known physical laws are "attention grabbing" and should, therefore, be better recalled and recognized than "ordinary" (i.e., expected) physical events that do not violate the laws of physics. Thus, here it was hypothesized that watching a film with magical content would have such a priming effect, focusing the children's attention on the distinction between possible and impossible characters and

events and subsequently enhancing their ability to discriminate fantastic from ordinary visual displays through priming and association. To examine this, before and after watching the film 6- and 9-year-old British children were presented with a choice task requiring them to discriminate between ordinary and fantastic visual displays on a computer screen. The results supported the hypothesis: After, but not before exposure to the films, the children who watched the film with magical effects obtained significantly higher scores on correct identifications than children who watched the film without magical effects.

Finally, an attempt was made to investigate whether the facilitating effect of a magical context on learning in children can also work for adolescents and adults. For the latter categories of participants, magical contexts are usually used in commercial TV advertisements. Accordingly, the aim of the study was to examine whether framing advertised products in the context of magical effects (i.e., talking animals, inanimate objects that turn into humans, objects that appear out of thin air or instantly turn into other objects) could facilitate the viewers' memory for these products. Indeed, memory experts have long advocated that bizarre imagery facilitates learning through reduced interference ("bizarreness effect"; Germak, 1975; Lorayne, 1957; Wollen, Weber, & Lowry, 1972). Magical events are implausible and can therefore be described as bizarre. Studies have shown that placing commercial products within films can elicit successful recognition and recall of the advertised products through cues and association (Babin & Garder, 1996; Gupta & Lord, 1998). Based on these findings, one can assume that marketing companies that place their products in the context of visual magical images do this because they believe that the use of these images is effective, though they may not know why exactly this technique works. If the bizarreness effect applies to magical images, then this belief might indeed have a psychological basis. To investigate this possibility, British adolescents and adults viewed two films containing television advertisements and were asked to recall and recognize the films' advertised products. Film 1 included magical images and effects, but Film 2 did not. The films were matched according to other dimensions, such as pace, action, and emotional content. After watching the films, participants completed a recognition test. It was predicted that participants would recognize a significantly larger number of advertised products from the magical film than the non-magical one. The results supported the prediction (Subbotsky & Matthews, 2011).

Altogether, the aforementioned studies confirmed the assumption that *magical thinking* is relevant for learning and education: In some conditions, viewing magical effects appears to enhance creative thinking, helps memorize certain aspects of the display, and helps differentiate between fantasy and reality. But can *magical beliefs* as well be relevant for processes other than those confined to the individual personality?

In answering this question, this article will focus on just one form of magical beliefs: the belief that some people have special powers and are able to influence our life, health, and destiny in a magical way (communicative magic). The hypothesis, which is proposed, is that *in the course of history, this form of magical beliefs, in order to adapt to the modern world where science and rational thinking hold sway, evolved into a special form of social compliance.*

Magical Beliefs and Communication: The Belief-in-Magic-Based Social Compliance (BMSC)

Communicative Magic: From the Past to the Present

The psychological structure of the modern belief in some people's special abilities cannot be properly understood unless we have a brief look at historical roots of this belief. In traditional societies, people believe that some individuals have special powers; these individuals can speak with the Gods and spirits or even become spirits when they die (Frazer, 1890/1959; Lévy-Brühl, 1923/1966; 1926/1985).

As the belief in magical forces in traditional societies is so strong, people view the orders coming from their leaders as imperatives that are sanctioned by spirits, and the issues of resisting these orders or critically analyzing if these orders are true or false rarely arise. In modern industrial cultures, with the demise of conscious magical beliefs, people can critically analyze the messages that come from persons of power. Yet, in some conditions, even if the people's conscious analysis finds these messages untrue and/or harmful, subconscious magical belief hidden in System 1 can still make the people view these messages as imperatives and trigger the reaction of obedience. In other words, whereas in traditional societies people's compliance with their spiritual leaders' orders comes naturally, in modern industrial societies this compliance involves a contradiction between people's conscious beliefs (that their leaders are ordinary people and may be wrong) and their implicit beliefs (that these leaders have supernatural abilities and, therefore, must be right).

Experiments reviewed in the "Raising up From the Depths: Can We Acknowledge That We Believe in Magic?" section of this article have demonstrated that the hidden belief in that some persons (such as a witch or an experimenter) possess magical powers can indeed take control over participants' behavior. This happens in the conditions when participants' defenses against admitting this belief are weakened, for instance, by heightening the risk of denying such belief for participants' personally significant objects. In real life, unrealistic, misleading, and sometimes immoral promises and demands may have a similar effect, if those promises and demands are issued by an authoritative source and target people's personally significant objects. In other words,

it is suggested in this article that *System 1 implicit magical belief in that some people may possess magical powers can take control over our behavior in a special form of social compliance.* Further in this article, this form of social compliance will be referred to as *the BMSC*. Three questions arise in regard to this new concept: (a) What is the definitive feature of BMSC? (b) How can one distinguish BMSC from other forms of social compliance, which are not based on magical beliefs? (c) What evidence exists in support of BMSC hypothesis?

BMSC: The Definitive Feature

By definition, BMSC is observed when System 1 hidden magical beliefs override System 2 critical thinking and fuel the reaction of compliance in modern adults (Subbotsky, 2007). It is well known that reasoning, perception, and other cognitive functions can be affected by emotional attitudes (Forgas, 2002; Gasper, 2004). However, the characteristic feature of BMSC that distinguishes it from other "emotionally driven" responses is that while affecting participants' actions, subconscious magical beliefs do not affect participants' critical reasoning capacities. As a result, an individual who exhibits BMSC must display a word/action dissociation of the following type: (a) Individuals are conscious that the suggested idea is wrong and/or has no personal benefit to them, but (b) they act as if they believed that the suggested idea is true.¹⁴

The aforementioned dissociation is a special case of the pattern when someone engages in a behavior that appears to be different from what they verbally endorse. Typically, the word/action dissociation involves intentional or unintentional cheating. For instance, in the moral domain, people preach morality but pursue their selfish interests (Batson & Thompson, 2001); similarly, in the social domain, individuals' verbal attitudes conform to social expectations whereas the individuals' actions conform to their economic interests (Wicker, 1969). The belief-in-magic-based word/action dissociation follows the opposite pattern: Individuals consciously acknowledge that the idea that some people can trespass the laws of nature and affect natural processes or people's lives via a magic spell is wrong and/or that obeying these people's demands would be acting against the individuals' personal interests, yet the individuals act as if the aforementioned idea were true and obey the demands. For instance, in the experiments described in the "Raising up From the Depths: Can We Acknowledge That We Believe in Magic?" section, participants initially denied that they believed in magic and that, therefore, the experimenter's or the witch's magic spell could affect their future lives, yet they prohibited the experimenter or the witch from proceeding with their magic spells. On this ground, the belief-in-magic-based type of word/action dissociation will be referred to in this article as the "inverted word/action dissociation."

Clearly, if it were proven that in certain circumstances, people living in modern industrial cultures exhibit inverted word/action dissociation, this would add strength to the assumption that these people hold subconscious magical beliefs; without such beliefs, it would be difficult to explain why rational people would voluntarily accept and obey messages that they consciously reject as false and/or as having no benefit. The inverted word/action dissociation is the definitive feature of BMSC.

BMSC and Other Forms of Social Compliance

BMSC should be distinguished from *compliance based on indirect persuasion* and from *compliance based on rational analysis*.¹⁵ For example, in their “elaboration likelihood model,” Petty and Cacioppo (1986) distinguished between the two “routes” to persuasion. Central route processes involve conscious scrutiny of a persuasive communication to determine the merits of its arguments. So, if favorable thoughts are a result of the elaboration process, the message will most likely be accepted (i.e., an attitude congruent with the message’s position will emerge), and if considering the merits of presented arguments ended up in unfavorable thoughts, the message will most likely be rejected. In contrast, the peripheral route to persuasion relies on subconscious mechanisms: The persuasion effect is achieved indirectly, when the listener or viewer relies on cues other than the strength of the rational argument, like the perceived credibility of the source, the attractiveness of the source, or the catchy slogan that contains the message.

What distinguishes BMSC from social compliance based on indirect persuasion is the inverted word/action dissociation: Subjects who exhibit BMSC process the persuasive message consciously (i.e., through the central route of elaboration), with the presented arguments producing unfavorable thoughts in the subjects, and yet the subjects voluntarily act against their own interests, as if they were persuaded by the arguments.

The inverted word/action dissociation also distinguishes BMSC from compliance based on rational analysis. The latter conforms to the central route to persuasion of the “elaboration likelihood model” and does not involve the dissociation between words and action: The individuals either accept the message, both in judgment and in action (i.e., they agree that the message is true and/or beneficial for them and follow the message), or reject the message (they think that the message is wrong, of no benefit, or even harmful for them and do not follow the message). In other words, unlike BMSC, the rationality-based compliance results in word/action harmony.¹⁶

BMSC—Empirical Evidence

Experiments reviewed in the “Raising up From the Depths: Can We Acknowledge That We Believe in Magic?” section have shown that when magical causality was embedded

within the context of magical mythology (e.g., witches, wizards, magic spells, and magic wands), then both children and adults produced behavioral patterns based on the inverted word/action dissociation. Specifically, the participants acknowledged that the suggested idea about the connection between the magic spell and the real life effects was wrong, yet they acted as if they believed that the magic spell could indeed cause these effects. This result supports the hypothesis that in the laboratory condition where magical causality is embedded in the magical context, modern adults exhibit BMSC. The question is that unlike in laboratory experiments, in real life, suggestions that appeal to people’s hidden magical beliefs usually operate through communication, which is free from magical mythology. In politics or commerce, messages that suggest magical causal effects are usually framed in the everyday matter-of-fact context, and not in the context of witchcraft and sorcery. For instance, a political candidate may promise that he or she will overcome a paramount state budget deficit without raising taxes or applying austerity measures, or a commercial clip may suggest that buying this brand of car or wearing this brand of clothing will make one rich. Clearly, these promises appeal to the people’s belief in the magical powers, rather than in common logic and physical causality. Anthropological observations also suggest that some persuasion techniques used in clinical medicine and politics today evolved from magical practices (Castiglioni, 1946; Coriat, 1923; Malinowski, 1935; Tambiah, 1990). One empirically verifiable prediction that can be made on the basis of BMSC hypothesis is, therefore, an expectation that *magical causality embedded within the magic-free context should produce the same results as magical causality framed within a magic-loaded context—the inverted word/action dissociation*.

To examine this expectation, participants’ images of their future lives were targeted by magical causality framed either within a magic-loaded or a magic-free context condition (Subbotsky, 2007). The magic-loaded context condition of this experiment was identical to the one in the study reported earlier (i.e., the witch suggesting to put a good or bad spell on participants’ future lives; Subbotsky, 2005) and replicated its results. In contrast, in the magic-free context condition, magical causality was embedded within a context that was deprived of any association with magical mythology—It was suggested to participants that if the experimenter increased or decreased the number of ones in the row of ones shown on a computer screen (i.e., changed 111 into 111111), then the number of difficult life problems that the participants would have to go through in their future life would grow or diminish proportionally.¹⁷

Understandably, to the question of whether changing the number of ones on a computer screen would affect their future lives, 95% of participants answered “no.” This result confirms that participants were aware that the suggested causation was false, that is, there was not a causal connection between changing the number of ones on a computer screen

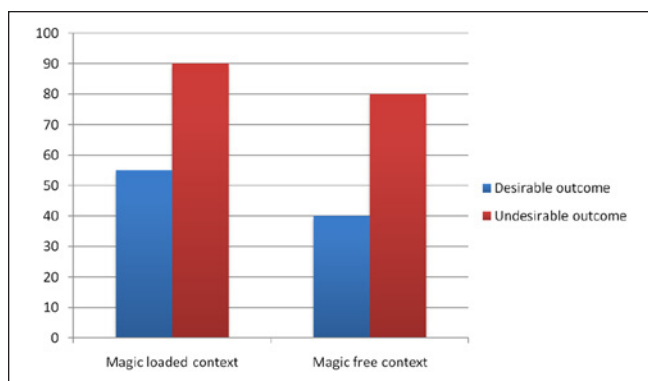


Figure 3. Percent of participants who said “no” to the suggested offer, as a function of type of suggestion (magic-loaded context vs. magic-free context) and type of outcome (desirable vs. undesirable).

and their future lives. Yet, in their practical actions, participants demonstrated the same pattern of behavior as the one they showed in the magic-loaded context condition: In the desirable outcome trial (i.e., decreasing the number of ones on the screen), the number of participants who prohibited the change from being made was at chance level (40%), whereas in the undesirable outcome trial (i.e., increasing the number of ones), the number of participants prohibiting the change was at a level significantly above chance (80%) and significantly higher than the number of participants who prohibited the spell in the desirable outcome trial (Figure 3). This pattern of behavior meets the criterion of inverted word/action dissociation: Consciously, participants knew that the message “changing the number of ones on the screen will change your future life” was false, yet they acted as if they believed that this message was true and that the experimenter indeed possessed the magical power of affecting their future lives by his manipulations with the numbers on the computer screen. The results supported the prediction that with regard to affecting another person’s imaginary reality through suggestive communication, magical causality framed within a real life context works in the same way as magical causality framed within a magical context.

The second prediction, which follows from the BMSC hypothesis, is that in modern societies, rules must exist that require compliance and that historically were introduced as divine (i.e., given by God). Do we have such rules? Yes, we do. In the Judeo-Christian cultural tradition, Moses accepted the code of our modern moral rules directly from God, yet today many of us view these rules (the *Ten Commandments*) not as divinely given, but as a set of useful conventions worked out by our societies. Some people today voluntarily obey moral rules in the absence of surveillance, although obeying these rules involves sacrificing their personal interests (Batson & Thompson, 2001). This suggests that subconsciously, people might still believe that the *Ten Commandments* are God’s imperatives, even though

consciously they may consider themselves not to believe in God. Ever since the Kantian claim of the existence of the “categorical imperative,” there has been an ongoing debate over why some people are able to act for the sake of “goodness itself.” The popular answer to this difficult question by reference to evolutionary benefits of unselfish behavior (Dawkins, 1976; Stenger, 2007) has a plausible alternative in the hypothesis that subconsciously, some people, including atheists, still believe that following “goodness itself” pleases God.¹⁸

The BMSC hypothesis also predicts that there should be a positive correlation between BMSC and magical beliefs: The more prone individuals are to exhibit BMSC, the more likely they are to endorse magical beliefs. Indeed, if BMSC takes its energy from the subconscious belief in the authoritative figures’ magical powers, then in individuals whose magical beliefs are “closer to the surface” and whose defenses against acknowledging these beliefs are weak, this energy source is easier to access than in individuals whose belief in magic is buried deep in the subconscious and is sealed by strong defenses. The first class of individuals is therefore more likely to both exhibit BMSC and acknowledge that they believe in magical phenomena than the second. Substantial evidence in favor of this prediction comes from research on interrogative suggestibility. Interrogative suggestibility is defined as “the extent to which, within a closed social interaction, people come to accept messages communicated during formal questioning, as a result of which their subsequent behavioral response is affected” (Gudjonsson, 1987, p. 352). Gudjonsson Suggestibility Scale (GSS; Gudjonsson, 1984) is designed to measure participants’ tendency to change their answers and memories in response to interpersonal pressure. In this procedure, participants’ original responses are considered as “verbal,” whereas the participants’ subsequent responses to the same questions obtained as a result of social pressure (“shift”) are interpreted as “behavioral.” In this regard, interrogative suggestibility involves the inverted word/action dissociation and is a version of BMSC. Accordingly, in a correlational study, Haraldsson (1985) reported that suggestibility measured by GSS positively and significantly correlated with participants’ beliefs in witchcraft, spiritualism, and precognition measured by Tobacyk and Milford’s (1980) Paranormal Belief Scale. Similarly, Hergovich (2003) reported that individuals who scored higher on GSS also exhibited a greater belief in common superstitions that imply mind-over-matter magic than individuals who scored lower on GSS. In a special study, which targeted the relationships between magical beliefs and suggestibility (Petsa, 2012), participants’ suggestibility measured by GSS positively and significantly correlated with the participants’ belief in magic measured by Subbotsky’s Magical Belief Scale (see Subbotsky, 2009, Experiment 2), and Eckblad and Chapman’s (1983) Magical Ideation Scale.

Finally, the BMSC hypothesis can help explain some established effects of social compliance, which involve the

inverted word/action dissociation and whose mechanisms are not completely understood. One such effect has been reported in Milgram's famous study on "obedience to authority." In one condition of this experiment, 62% of participants who were asked to give electric shocks of increasing intensity to an anonymous "learner," followed the experimenter's suggestion to continue up to the highest level of 450 V (Milgram, 1992). It was obvious that from a certain moment of Milgram's experiment, the participants' behavior was not a consensual cooperation with the experimenter, and there was no clear reason for the participants to remain obedient. To put it in Milgram's own words, "something akin to fields or force, diminishing in effectiveness with increasing psychological distance from their source, have a controlling effect on the subject's performance" (Milgram, 1992, p. 147). The psychological nature of motivation behind these "fields or force" remains, however, unclear.

It is to be noted that the inverted word/action dissociation showed up in Milgram's experiment. According to Milgram himself, many participants displayed tension and the dissociation between words and action: They disapproved of the experimenter's demand, argued with the experimenter, and yet kept obeying. The participants acted in accordance with the order that the experimenter's message contained (to keep increasing the shock's intensity) even though they viewed this message as wrong and harmful to both the "learners" well-being and their own morality. The BMSC hypothesis suggests that *in the obedience to authority phenomenon the individual's compliance with social influence is powered by Level 1 implicit magical beliefs*. But what does the obedience effect have to do with magical beliefs? The answer rests in the historic origins of this kind of "rules" in our social minds. Indeed, suppose that in early humans such mechanisms as obedience to authority were absent. We need to bear in mind that early human groups had no police or other external social incentives to maintain surveillance and punish for disobedience. One possible way to compel people to follow demands of authority was to claim that such demands had divine origin. For example, a person could be made believe that if he or she disobeyed, this would enrage ancestral spirits, who would then exact punishment.¹⁹ Through time, the rule's magical masters were abandoned and the law enforcement agencies took their place. Yet, implicitly, even if the punishment for disobedience is not a threat, people today might still follow the demand of authority because they feel that this demand is backed by spiritual entities whose orders cannot be questioned.

In other words, the "obedience to authority" mechanism could have originally been shaped as obedience to divine powers—the Gods and spirits. In the course of history, the role of the power that expects obedience shifted from Gods to secular members of society (e.g., a doctor, a psychology experimenter, a political leader) whose orders can be questioned. Yet, despite criticism, the hidden belief that the people in power have a pact with God might still cause

obedience. As Cialdini (2007) puts it, in the Old Testament, we read,

. . . what might be the closest biblical representation of the Milgram experiment—the respectful account of Abraham's willingness to plunge a dagger through the heart of his young son, because God, without any explanation, ordered it. We learn in this story that the correctness of an action was not adjudged by such considerations as apparent senselessness, harmfulness, injustice or usual moral standards, but by the mere command of a higher authority. Abraham's tormented ordeal was a test of obedience, and he—like Milgram's subjects, who perhaps learned an early lesson from him—passed." (pp. 217-218)

To summarize, the BMSC hypothesis suggests that stripped of its original sacred context and renamed as compliance and obedience, modern people's vulnerability toward communicative magic survives in societies that otherwise strictly adhere to science and rational logic. This hypothesis also suggests that it is possible to use modern people's hidden magical beliefs for mind control, with the purpose of extracting psychological, political, or financial benefits. Viewed in this light, the practices that use BMSC for social control over the minds are literally the magic of today.

Magical Beliefs in the Modern World

Implications for Practice

Religion was and still is the most powerful domain in which magical thinking and the belief in mind-over-matter causality finds its applications (i.e., a petitionary prayer, see Barrett, 2001) in the modern industrial world. A proper analysis of these applications goes beyond this article's objectives. With all the glory of modern religion, with its fundamental impact on history, art, and culture of the Western world, we should not overlook the fact that modern religion has a common historical root with magical beliefs.²⁰ As many people in the modern industrial world consciously believe in God, religious control over the minds does not necessarily have to be accompanied by the inverted word/action dissociation. There are, however, other domains in which magical thinking and implicit beliefs in magical causality are used.

As argued above, one way of using magical thinking is for enhancing cognitive functioning, such as problem solving, perception, and memory. Teachers sometimes use conjuring magic in the classroom to enhance interest and increase engagement in the material (Frasier, 1993). The research reviewed in the "Magical Thinking and Learning" section of this article suggests that engaging children, adolescents, and adults in processing magical content may entail benefits for learning and used in education and commercial advertising.

The area where hidden magical beliefs can be involved is purposeful or coincidental influence on people's minds and behavior. As argued in the previous section, to a considerable extent, our impulse to go along with suggestions by our

leaders, to conform and to obey might still be powered by the subconscious belief in that the commands come from entities blessed by “higher powers.” For example, many people in Nazi Germany collaborated with Hitler’s regime willingly, even in circumstances under which there was no prospect of retaliation for disobedience (Fromm, 1941, 1961). Many victims of Stalin’s repressions, wrongly accused of crimes they had not committed, died with words of blessing to Stalin. Cases of mass suicides of cult members as a result of their leaders’ orders are cited in general psychology texts (Barker, 2002; Westen, 2002). The unwillingness of aircraft crewmembers to challenge the captain’s obvious errors has been named as a cause of plane crashes (Kanki & Foushee, 1990). Understanding this might have substantial consequences. It is one thing to believe that you comply with political or economic requests on your own decision and quite another to know that you do this due to your hidden belief in magical powers. Acknowledgment of this might liberate people from BMSC dependence and make them more cautious and conscious in their decision making.

Military and political terror is another domain in which magical beliefs have been widely exploited. The damage that kamikaze (“divine wind”) pilots inflicted on the American fleet in the Battle of Okinawa (April 1945), which greatly affected the U.S. decision to use the atomic bomb to end the war, showed the power of magical beliefs, as the kamikaze were volunteers who sacrificed their lives for their divine values and who hoped for a reward in the afterlife (Ivanov, 2003). Anthropological research on suicidal terrorism today suggests that “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 members of their communities 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. For example, it has been shown that coping with the threat of death requires self-regulation, and the effort of self-regulation consumes a limited energy resource that is measurable in terms of blood glucose level in the brain (Benton, Parker, & Donohoe, 1996; Fairclough & Houston, 2004; Gailliot et al., 2007). In a series of experiments, after writing about death versus a control topic, participants’ performance worsened on several measures of self-regulation that were irrelevant to death, such as the Stroop task, logical reasoning, and solving anagrams and word puzzles (Gailliot, Baumeister, & Schmeichel, 2006). One can assume on that ground that magical beliefs, such as the belief in God and the afterlife,

can diminish the effort of self-regulation necessary to overcome the fear of death and thus conserve the limited energy resources required for committing an act of heroism during a war or an act of suicidal terror.

Conclusion

Research reviewed in this article suggest that magical thinking and the belief in magic are not just a group of special phenomena that, though widely spread in modern industrial cultures, do not go beyond an unnecessary addition to rational thinking and rational beliefs. Like magical thinking, the belief in magic is a fundamental feature of the human mind, which is present throughout history, cultures, and the lifespan, and may have important implications for education and communication in the modern world. Unlike magical thinking, which remains a conscious practice throughout the lifespan, the belief in magic in adult educated individuals becomes mostly subconscious. This view links together phenomena that thus far have been studied separately from one another: magical beliefs in ancient and medieval cultures and modern developing and developed cultures, magical thinking in mentally disturbed patients, children’s magic, superstitions in adults, religious beliefs, indirect suggestion and persuasion effects in politics and commerce, military and political terror, and the use of magical effects in the entertainment industry. This new view can also explain and help develop modern-day social and educational practices that use the energy of magical thinking and magical beliefs.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research and/or authorship of this article.

Notes

1. For early modern humans, there was no division between people who have minds and natural things that do not: For them [modern hunter-gatherers] there are not two worlds of persons (society) and things (nature), but just one world—one environment—saturated with personal powers and embracing both human beings, the animals and plants on which they depend, and the landscape in which they live and move. (Ingold, 1992, p. 42)
2. Experiments have shown that 4- and 6-year-olds can distinguish between imagined ordinary objects (an imagined cup) and fantastic objects (a witch flying in the sky; Harris, Brown, Marriott, Whittal, & Harmer, 1991), and adults treat fantastic objects (a flying dog) as free from physical constraints, such as permanence and physical causality (Subbotsky, 2005).
3. As far as magical thinking is engaged with fictional characters and events, it partially overlaps with hypothetical thinking.

According to hypothetical thinking theory (Evans, 2007), hypothetical thinking involves the imagination of possibilities and exploration of their consequences by means of mental simulation. At the same time, whereas hypothetical thinking is an integrated construct for a wide range of thinking processes, which include hypothesis testing, reasoning, judgment, and decision making, magical thinking is focused on operating with fictional characters and events that have no prototypes in the real world.

4. There is no doubt that magical beliefs are still widespread in modern developing cultures, such as most traditional cultures of Asia, Africa, Central and South America, and the Pacific (Malinowski, 1935; Tambiah, 1990).
5. The process known as rationalization (see Evans & Coventry, 2006; Freud, 1935).
6. Theoretical grounding for the fundamentality hypothesis has been discussed in another article, see Subbotsky (2011).
7. Anthropological research has shown that the two concepts we think of as religion and magic were originally the same (Frazer, 1890/1959; Lévy-Brühl, 1923/1966; Malinowski, 1935; Pyysiäinen, 2004; Tambiah, 1990). In early religions, people worshipped ancestral spirits and animal spirits as their Gods. As Steven Mithen (2005) writes, "The anthropomorphic images in the cave paintings and the burial of people with grave goods, suggest that these Upper Paleolithic people were the first to have beliefs in supernatural beings and possibly an afterlife. We are indeed seeing here the first appearance of religious ideologies" (p. 198). Some forms of tribal religions today, and even major religions like Hinduism, retain similar features. However, as monotheistic religions (such as Judaism or Christianity) emerged, religion gradually separated itself from everyday magic and became an established and legitimized institution that is inherently hostile toward everyday magic.
8. Thus, a negative correlation between religious and paranormal beliefs was found in religious individuals, against a positive one in non-religious individuals (Aarnio & Lindeman, 2007).
9. Indeed, in personality research, using indirect "projective" techniques is an effective way of cheating people's psychological defenses and revealing hidden emotions and internal conflicts (Sundberg, 1977).
10. Gendler (2008) gave an interesting theoretical perspective on behavioral reactions of this kind, by contrasting conscious beliefs and subconscious "aliefs."
11. Questions from the two most popular scales of identifying people's belief in magic: Tobacyk and Milford's (1980) paranormal beliefs scale and Eckblad and Chapman's (1983) magical ideation scale.
12. If participants don't believe in magic, they might accept the bad spell to show that they are non-believers and therefore have no fear of the bad spell.
13. One could suggest on this ground that the division between magical thinking and magical beliefs is a historical development. In early human groups, no such division existed. Thus, anthropologists and historians of art argue that Paleolithic cave paintings and figurines that combine human and animal features were not just pieces of art (i.e., magical thinking), but also the embodiment of the ancestral spirits (i.e., magical beliefs; Mithen, 2005). In the course of history, magical beliefs descended into the subconscious, leaving what we now call

magical thinking "upstairs." In this sense, magical thinking is an "ontologically neutral" form of magical beliefs. We pretend that magic exists in the artificial world of the imagination while consciously claiming that magic does not exist in the real world.

14. Belief-in-Magic-Based Social Compliance (BMSC) should not be confused with heuristic biases, which are based on the fact that people rely their decision making on appearances of things and not on rational weighting of chances (Stanovich & West, 2008).
15. Compliance based on hypnotic suggestion is deliberately left aside, as under hypnosis, a person's critical thinking is, to a significant extent, deactivated and the person acts on verbal instructions of a hypnotist without full awareness of the consequences of these actions (Wagstaff, 1996).
16. This does not include "pseudo-rational" forms of manipulation, in which a skillful debater can befuddle and manipulate people with rational arguments by "bending" the truth or simply preying on people's trust and lack of sufficient information.
17. This type of magical causality was classified as framed within a magic-free context because in this condition, unlike the magic-loaded context condition, the suggestion did not explicitly refer to supernatural entities, rituals, and accessories. Indeed, changing simple numbers on computer screens is something that most participants routinely do (or see being done) on a daily basis, and there are no superstitions in Western societies that link working with a computer with participants' future lives.
18. It is even possible that these two explanations are not alternatives but refer to factors that complement each other: At the evolutionary level of humankind, the "Selfish Gene" might exhibit itself in people through their belief in magical entities and, ultimately, God.
19. Anthropological studies describe a wide range of such "the belief in magic based" rules in traditional societies, which regulate everyday life of an individual virtually "from birth till death" (see Frazer, 1890/1959; Lévy-Brühl, 1923/1966).
20. For the analyses of historical links between magic and religion, see Atran (2002), Boyer (1994, 2001), Pyysiäinen (2004), and Tambiah (1990).

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