

Explaining Magic: Earliest Christianity as a Test Case

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Introduction

In this article, I will propose a new cognitive explanation of magic and apply it to early Christian evidence from the first and second centuries AD. I will argue that magic emerges and survives due to three factors. (1) Subconscious learning mechanisms create false links between our actions and events in our environment. (2) Miracle stories that are transmitted for a variety of reasons give support to magical belief and performance (and vice versa). (3) A set of explanatory techniques make such false connections plausible. The article elaborates on the results of a former study on magic in the canonical and in apocryphal Acts of the Apostles (Czachesz 2007).

There have been some former attempts in the cognitive science of religion to explain magic. The most comprehensive among them is Jesper Sørensen's recent monograph on magic (2007; cf. Sørensen 2002). Sørensen (2007, 9–30) offers an overview of earlier social-scientific theories of magic and then uses G. Fauconnier and M. Turner's theory of cognitive blending (2002) to examine how people reason about rituals. He distinguishes two types of magic (2007, 95–139). In "transformative magical action," *essential qualities* are transferred from elements belonging to one domain to elements belonging to another domain (e.g. the bread becomes the body of Christ). In "manipulative magical action," magical practices change the state of affairs inside a domain by manipulating elements in another domain (e.g. sunset is delayed by placing a stone on a tree). Here the *relation between elements* is changed, whereas essential qualities remain the same. With the help of blending theory, Sørensen explains how people establish a link between two domains (spaces), relying on either part-whole structures or conventional and perceptual likeness. In his *Magic, Miracles and Religion* (2004, 90–112), Ilkka Pyysiäinen argues that sympathetic magic is based on essentialist thinking: magical effects are mediated by imperceptible essences. Both authors also ask about the relation of magic to religion. Pyysiäinen argues (2004, 96–97) that magic is about effects in known reality, while in religion natural actions effect supernatural reality. According to him, magic and religion support each other: on one hand, magic is easier to falsify (its results are visible), and therefore it needs the support

of religious explanations; on the other hand, magic supports religion by offering individual motivation. For Sørensen (2007, 186–191), magic is embedded in most religious rituals and is one of the major forces that cause religious innovation.

It is not our task to offer here a detailed discussion of these former explanations. We have to note, however, that Frazer's ideas of sympathetic magic (1998 [1922]) have influenced both authors (as Sørensen acknowledges, 2007, 95–96). The use of blending theory certainly enables us to give a formal account of the kind of analogical reasoning that already Tylor and Frazer uncovered in magic as well as to make new predictions, such as about the centrality of elements used in magic and its connection to the efficacy of magic or the role of ritual agents and their ascribed magical agency (Sørensen 2007, 128–133). Yet the question arises whether analogical reasoning provides a sufficient explanation for magic. In many cases analogies (mappings across domains) seem to constitute retrospective interpretations of magic rather than its underlying mechanisms. For example, healing blindness with saliva and mud (Gospel of Mark 8: 23; Gospel of John 9: 6; Tacitus, *Historiae* 4.81) does not obviously involve analogical reasoning. With reference to other sources (Book of Tobit 2: 10; Acts of the Apostles 9: 18), however, we can stipulate that people in antiquity imagined blindness as the formation of “scales” on the surface of the eyes, which one could then attempt to “remove” by the above-mentioned method. As with cognitive blending theory in general, it is often difficult to anchor the “blends” in empirical evidence, and the creativity of the interpreter (rather than formal rules) plays an important role in establishing the “mental spaces” involved in the blend. Moreover, there are a variety of ways to use connections with superhuman agents to bring about changes in both visible and invisible realities through prayers, offerings, and sacrifices. Although analogy may appear in such cases, as well (e.g. as analogy between particular goals and the things being offered or sacrificed), this is not at all necessary.

The explanation put forward in this article proceeds from more elementary, subconscious, pre-cognitive forms of learning. Whereas in Sørensen's theory of magic theories of ritual and magical agency need to be established before one can start to explain magic, in my explanation these levels will be added to an underlying, elementary pattern of magical behavior. In this context we have to mention Stuart A. Vyse's work on magic (1997), which uses F.B. Skinner's work on superstitious conditioning in animals and related human experiments. Whereas Vyse has identified, in my view, the proper starting point for an explanation of magic, the book actually does not move beyond “superstition” and fails to explain how magic differs from it. In this article I will use Skinner's insights as well as subsequent experimental work on his concept of superstitious conditioning, and show how this line of research can be combined with other evidence to provide a new explanation of magic.

Magic and Religion

Whether “magic” and “religion” need to be handled as two different entities is an important question and the way we answer this question has far-reaching implications for explaining magic. If there is no difference between the two, then “magic” and “religion” are merely two labels that refer to the same cultural phenomenon and putting forward an explanation of magic is not different from explaining religion in its totality.

The much-debated dichotomy of “religion” and “magic” has been first proposed by representatives of the intellectualist school of religion studies, Edward B. Tylor (1871) and James G. Frazer (1911). Although the views of Tylor and Frazer were different in many re-

spects, both of them associated “magic” with an earlier, primitive stage of human thought, and religion with a later, more developed stage. Once established by these scholars, the dichotomy of religion and magic has underlain the work of generations of theorists in religious studies, such as W. Wundt, G. van der Leeuw, É. Durkheim, M. Mauss, M. Weber, and W.J. Goode – although the exact meaning of the terms has changed from time to time (Versnel 1991; Braarvig 1999; Stevens 1996; Pyysiäinen 2004, 90–112; Middleton 2005). In subsequent theorizing about religion, however, the distinction between magic and religion has become a suspicious principle. For example, Claude Lévi-Strauss (1966, 220–228) argued that it serves to mark off (assumedly inferior) outsiders from ones’ own (assumedly superior) culture. The Zande people (living in south-Western Sudan and accurately studied by E. E. Evans-Pritchard) claim, for example, that surrounding people are more involved in magic than themselves, even as Westerners similarly call other cultures superstitious. The condemnation of the distinction made between religion and magic has become especially widespread under the influence of postmodernism. According to this view, “magic” is an ethnocentric and pejorative term, a Western projection about non-Westerners, an invention of the Victorian middle-class for the purpose of self-definition against colonial subjects and domestic peasants, and a tool that serves for social discrimination (Kuklick 1991; Smith 1995; Kapferer 1997; Braarvig 1999, 21–27; Fowler 2005).

More recently, however, scholars have warned that the colonial and ethnocentric misuse of the term “magic” does not necessarily mean it is altogether useless as a category for the study of culture (Thomassen 1997; Braarvig 1999; Bremmer 2008, 347–352; Pyysiäinen, 2004, 96). Thus, the distinction between religion and magic might serve to express the different attitudes, goals, and social positions of their performers (Braarvig 1999, 51–53), the direction of supernatural causation, or the motivational and contextual sides of “magico-religious” practice (Pyysiäinen, 2004, 96–112). A look at the origins of the word in classical Greek culture might also help us to judge more adequately about the analytical potential of the term “magic.” As Jan Bremmer argues (2008, 235–247), in the fifth and fourth centuries BC the term *magos* (magician) was a term of abuse in Greek tragedy, rhetoric, and earlier philosophy, whereas it was neutral or positive with the historians and Aristotelian philosophy. According to Herodotus, the Persian Magi were specialists in interpreting dreams (Herodotus 1.107–108, 120, 128; 7.19) and celestial events (7.37), they offered libations (7.43), and performed sacrifices (7.113–114, 191). As Bremmer remarks (2008, 235–247), the classical Greek association of magic with the Persians, among whom Magos was a frequent proper name, also provides interesting insights about the role of magic in the creation of “the other.” Whereas the Persians were representing “the other” in Athenian rhetoric, on account of their despotism, slavishness, luxury and cruelty, which were the exact opposite of Greek virtues, at the same time the Greeks were highly impressed by them and imitated them in many spheres of life. To these observations we can add a piece of evidence from the New Testament that reveals positive attitude toward Magi. In the infancy narrative of the Gospel of Matthew, we read about three Magi (*magoi*) who came from the East to Jerusalem to find and adore (*proskynein*) the newborn king of the Jews (Gospel of Matthew 2: 1–2). When they saw that the star they were following had stopped over the place where Jesus was born, they “rejoiced with very great joy” (verse 10, *echarêsan charan megalên sfodra*). As Ulrich Luz rightly observed (1992, 118), this scene suggested for contemporary readers a positive image of the Magi and their astrological wisdom. In the eyes of Matthew and his readers, the Magi did not need to convert from any godless practice but from the very beginning they were doing the right thing.

In the canonical and apocryphal Acts of the Apostles, “magicians” are employed as stock adversaries of the apostles. Two magicians are featured in the canonical Book of Acts: Simon and Bariesus (or Elymas). In Acts 8: 9, Simon is introduced as a practitioner of magic (*mageuôn*) in the city of Samaria (rebuilt as *Sebastê* under Herod the Great). Not only is he advertising himself as “something great” but also the people give him the title “the power of god that is called great” (v. 10: *hê dynamis tou theou hê kaloumenê megalê*). The text explains that people were attracted to Simon because he “amazed them with his magic (v. 11: *hai magieai*.)” When he sees “the great signs and miracles” (v. 13: *sêmeia kai dynameis*) performed by Philip, Simon is taken by the same kind of amazement (*ekstasis*) as were his followers before; he believes and receives the baptism. There are four important conclusions regarding magic that we can draw from this passage. First, Simon is not condemned for his practice. Whereas this silence cannot be interpreted as a positive attitude, the neutral presentation of Simon’s art in this episode is certainly different from the reaction given on his activity in the *Acts of Peter* 9, where he is called “most wicked” (*improvissimus*) and a “troubler” (*sollicitator*) and “deceiver” (*seductor*) of “simple souls” (Czachesz 1998 and 2007b, 85–123). We can add that the conflict in the subsequent episode (Book of Acts 8: 17–24) is not about Simon’s magic as rather his offering money so that he can give people the Holy Spirit by the laying on of hands. Second, the parallels between Simon’s and Philip’s impact on the people (especially the latter’s impact on Simon himself) suggests a great deal of phenomenological similarity between the appearances of the two wonderworkers. There is no effort in the text to deny such a parallel, but in fact it is strengthened by the repetitive structure of the narrative. Third, Philip wins the people of the city for himself because he outperforms Simon. This is a case of “magical competition” of the sort that is first attested in biblical literature in 1 Kings 18 (Elijah and the Baal priests) and will take place in the *Acts of Peter* between Peter and Simon. Fourth, despite the phenomenological similarity, the terminology is clearly creating an image of Simon as “the other” his deeds are “magic” (*magai*), whereas Philip performs “sings and miracles” (*sêmeia kai dynameis*).

A more militant attitude toward magical practice in Acts starts with Paul’s missionary journeys. When Paul, Barnabas, and John Mark arrive at Paphus on Cyprus, they are confronted with the Jewish magician Bar-Jesus or Elymas (Book of Acts 13: 6–12). This time the conflict is narrated in very much the same way as the competition of Peter and Simon in the *Acts of Peter*. The proconsul is interested in Paul’s message, but Elymas tries to turn him away. Paul responds to the challenge, calls him “full of deceit (*dolos*) and villainy (*rhadiourgia*),” “son of devil,” “enemy of all righteousness,” and finally strikes him with temporary blindness. When he sees the outcome of the competition, the proconsul becomes a believer. Three observations have to be made in connection with this episode. First, although he subsequently qualifies the activity of Bar-Jesus as *dolos* and *rhadiourgia*, the reason of Paul’s demonstration of power is not Bar-Jesus’ practice as rather his attempt to turn away the proconsul from the missionaries. Second, Paul’s move of calling temporary blindness on Bar-Jesus is an act of magic itself, by which he outperforms the magician and convinces the proconsul. Third, the apostle is reported to have acted “filled with the Holy Spirit.” In this context the Holy Spirit appears as a so-called *parhedros* (lit. one that sits nearby), a figure of a supernatural assistant who collaborates with the magician (see below). This attitude to magic is different from the coercive approach when the magician tries to persuade the divinity to assist him in reaching his own ends. The magician often calls the supernatural assistant “lord” or “ruler” and himself “servant.”

Another spectacular confrontation with magic occurs in Book of Acts 19: 11–20. While

Paul was in Ephesus, God did extraordinary miracles through him: “when the handkerchiefs and aprons that had touched his skin were brought to the sick, their diseases left them and the evil spirits came out of them.” However, when the seven sons of the Jewish high-priest Sceva tried to exorcise a man invoking the name of Jesus, the demons turned against them, so that they must flee out of the house naked and wounded. People all over Ephesus heard about this, Jesus’ name was praised, and many of them who practiced superstition (*perierga praxantoi*) collected their books and burnt them publicly. Similarly as in the other two conflicts with magicians in the Book of Acts, *magic* is confronted with *magic*. In terms of the above-mentioned ancient theory, we can conclude that the coercive approach of the priest’s sons failed when they tried to invoke Paul’s *parhedros*. After comparing the healings and exorcisms caused by “Paul’s laundry” in this episode with the powers communicated by Peter’s shadow (Book of Acts 5: 15) and the hem of Jesus’ garment (Gospel of Luke 8: 44), Klauck (2000, 98) admits that “these phenomena are externally very similar,” but suggests that there was a difference in the “system of convictions involved.” It would be illusory, however, to hypothesize that Paul and his followers had a radically different world-view from that of their adversaries. References to the assumed “allergy” of Jews against all sorts of magic on account of the Old Testament (e.g. Luz 1992, 118) are equally anachronistic and misleading (cf. Jeffers 1996). The very fact that Paul’s adversaries in these episodes are themselves Jews excludes such an interpretation. In spite of Biblical prohibitions, magic was not only tolerated but actively practiced in the Qumran community (García Martínez 2002, 33). It was not only Christians who used the label “magician” for their adversaries. Their enemies, both Jews and pagans, have condemned Jesus as a magician (Origen, *Against Celsus* 1. 28, 38, 47; *Tractate Sanhedrin* [Babylonian Talmud] 107b; Arnobius, *Adversus nationes* 1.43; cf. Kollmann 1996). Rather than choosing from religion and magic, the question was which approach to magic and which particular *parhedros* people in a particular culture or group thought to be more powerful than others.

For the same reasons, the accounts of magic in the Book of Acts cannot be interpreted as pejorative descriptions of other peoples’ practices, which we have earlier seen in contemporary Western and African contexts. Attributing to this writing a distinction between religion and magic is even further from the truth. The practices of John, Paul, Peter, and Philip are phenomenologically not different from the practices of their adversaries. Even early Christian writings admit that the apostles were identified in their cultural milieu as magicians (*Acts of Paul* 15; *Acts of Andrew*, Epitomy 12 and 18; *Acts of Thomas* 20). The key to the interpretation of magic in the Book of Acts seems to be the theory of coercion and *parhedros*: magical practices that are performed in other ways than using the assistance of the Holy Spirit as *parhedros* must be condemned. If we accept this solution, it is not a sheer coincidence any longer that the Book of Acts, the New Testament writing that pays the most attention to the Holy Spirit, also contains the most references to the Christian and non-Christian use of magic.

In conclusion, a dichotomy of magic and religion is not supported by the evidence from religious antiquity and earliest Christianity. In antiquity it was possible to use the term “magic” to describe one’s own practices, the activities of other people in one’s culture, or the practices of other cultures; but the use of “magic” in opposition with “religion” can be excluded. Such a use was also impossible, because hardly any shared concept of “religion” existed. To take just a few obvious examples, most religions of Greco-Roman Antiquity were first of all cults, which could be described in terms of their rites and institutions. The interpretation of mythology, together with the discussion of the great issues of life, lay

outside the realm of religion. Judaism was a complex national, cultural and ethnic phenomenon, and had the tendency to involve the entirety of life, rather than being limited to certain cultic events. Christianity attempted to coordinate mythology, rituals, social life, philosophical thought, and ethics. More than other religions of the period, it was divided from the beginning by fierce philosophical debates. In conclusion, there existed a more or less clear, shared concept of magic, without an equally clear and shared concept of religion. The first steps toward establishing the dichotomy of religion (that is, Christianity) and magic was taken by Augustinus, but this is beyond the scope of this essay (cf. Graf 2002). At the same time, identifying magic with religion would be an equally big mistake: the variety of forms of religion that we have just illustrated cannot be subsumed under the category of magic.

Defining Magic

In the foregoing section we have seen that neither a sheer dichotomy of “magic” and “religion,” nor a complete identification of them describe their relation adequately. When people in antiquity used the term “magic” to mark boundaries between cultural practices, this was not necessarily because they saw the practices of “magicians” essentially different from their own practices (or practices ascribed to their own religious heroes). In this context, we could say that “magic” denotes the manipulation of visible reality with the help of superhuman agents. This can occur either within or outside of an institutional, religious setting. This preliminary (and narrow) definition raises the following two questions: (1) Does magic always make use of superhuman agents? (2) Is the manipulation of *invisible* realities to be excluded from magic?

According to Sørensen (2007, 164), a number of psychological factors facilitate and strengthen the representation of “certain event-states as the result of ‘magical’ actions by super-human agents.” Sørensen, who applies Lawson and McCauley’s ritual form hypothesis to magical rituals, suggests that “the performance of magical rituals has as a prerequisite ... the ascription of magical agency to some element found in the ritual” (2007, 97). Whereas we will also use agency as an explanatory factor of the success of magic, the involvement of superhuman agency in every form of magic is far from obvious. For example, the use of spells to stop bleeding is attested since Homer (*Odyssey* xix. 457–458) and many of such spells contain no reference to supernatural agents (Graf 2005, 291–292). We can only speculate whether the spells were pronounced in the framework of rituals in a way that presupposed the involvement of supernatural agency. I suggest that including supernatural agency in a definition of magic is not the best strategy for two reasons. First, as our examples show, magic can be performed without reference to superhuman agents. Healing can be attributed to natural and/or human causes. This may involve some sort of agency, but it makes no sense to extend “magical agency” to just any kind of human or natural agent. Second, in ancient culture (as in any pre-scientific worldview) we have to presuppose the involvement of supernatural agents such as demons or ancestors in all domains of life. In this sense any action taken by ancient people was connected with supernatural agency. Although we can stamp this as a “magical worldview,” but this is hardly helpful in explaining magic as a particular domain and in extending such a theory to contemporary magic.

The other question is if the manipulation of invisible reality—or supernatural reality, as Pyysiäinen (2004, 96–97) calls it—needs to be excluded from the definition of magic. It does not seem to have any advantage from the explanatory point of view to put sacrifice

that secures the support of the gods, for example, into a different category (religion) than the healing of a patient by exorcism (magic). On one hand, most contact with the gods, even if it manipulates the supernatural world in the first instance, does intend to influence the state of affairs in visible reality, as well. Manipulations that purportedly influence visible reality, on the other hand, often attempt in fact to bring about changes in supernatural reality, such as expelling a demon from a patient. Is baptism first of all about invisible, supernatural qualities, such as washing away sin—as Pyysiäinen (2004, 97) argues? Maybe it is in elite theological discourse (where most probably integration into the Church as *communio sanctorum* is the major concern), but certainly not in the heads of the parents and the congregation, where baptism is more about fulfilling social expectations and securing the future of the child by integrating her into the religious and larger community, as well as gaining God's protection and support for her. I do not want to deny that there may exist purely supernatural concerns behind ritual acts. Such rituals do not qualify as magic in my categorization.

I suggest that we call “magic” the illusory manipulation of visible or invisible realities: magic assumedly changes the state of affairs in visible or invisible reality, whereas in actuality it does not. This is in a sense a strongly *etic* approach, inasmuch as a particular behavior qualifies as magic not because of what its performer believes about it, but rather on account of what the modern investigator believes about it from the point of view of modern science. It also abandons criteria related to the form of magic: a spell, the manipulation of objects, a prayer, an offering, or a sacrifice can be equally proper means of magic.

This (broad) definition has various advantages over the previous (narrow) one (see above). First, we do not have to decide what is visible and invisible—or in Pyysiäinen's (2004, 96–97) terminology, “known” and “supernatural”—reality. Deciding that question would imply very complex discussions about what counts as “visible” or “not supernatural.” Second, we do not have to know beforehand the explanations people give to their actions, such as the involvement of supernatural or magical agency. Third, the definition gives up even mild forms of cultural relativism: magic is not defined from the point of view of different cultures but solely from the point of view of empirical truth as established by modern science (and a modern scientific worldview). The choice of such an approach is not meant as a value judgment about other cultural perspectives. It is a move that follows logically from the decision of the cognitive science of religion to anchor the study of religion in scientific methods and principles rather than in interpretative ones—or at least to shift the emphasis in that direction.

Since our understanding of magic does not include a reference to the underlying beliefs and the procedures employed, instances of contemporary alternative medicine may also fall under the rubric of magic, even though they might operate with pills or complicated technology. Our definition excludes, on the other hand, cases where procedures *do work*, even if they are based on wrong theories (in terms of modern science) about the reality to be changed and the mechanisms underlying the procedure. If the patient is actually cured due to a placebo effect, we talk about a case of folk- or alternative medicine rather than magic. In such cases there are underlying causal mechanisms that science can potentially discover and explain. Medical anthropology makes an important difference between healing and cure. The latter means the removal of a disease or injury in the modern sense, whereas healing means the restoration of the well-being of the patient, particularly in social and psychological terms. John Pilch (2000) has argued that many early Christian miracle stories (e.g. about Jesus) may refer to actual *healings* in the latter sense, which is also the

goal of much folk medicine. It is not the task of this article to explore such alternatives, but the way magic is combined with other medical procedures in ancient sources suggests it was (at least many times) intended to actually cure the patient (e.g. Plato, *Republic* 426b and *Charmides* 155e–156e; Pliny, *Natural History* 24–32; Pseudo-Hippocrates, *On Regimen in Health* 4; Furley 1993; Leven 2004; van der Eijk 2004).

Another group of manipulations is clearly directed at realities that by their nature exclude the possibility of any empirical control. Even in such cases, as I have mentioned above in connection with baptism, explicit, theologically correct accounts of the manipulations might differ from people's implicit or private interpretations and expectations. However, in cases where procedures secure one's favorable lot in life after death or people receive invisible cosmic energies, or are released from Purgatory, science has no means to check their efficiency. Although such beliefs might be labeled as "magical" from the perspective of a scientific *worldview*, they are religious actions without a magical component in terms of our definition.

Magical Behavior is Rooted in Superstitious Conditioning

In the 1940s, Harvard psychologist Burrhus Frederic Skinner, known as the father of "behaviorism", placed a hungry pigeon in a cage equipped with an automatic feeder (Skinner 1948; Morse and Skinner 1957; cf. Vyse 1997, 59–97; Wulff 1997, 129–39). A clock was set to give the bird access to the food for five seconds in regular intervals. Instead of just waiting passively for the next appearance of the food, most of the birds started to perform various kinds of repetitive behaviors: one was turning counter-clockwise two or three times between two feedings, another was thrusting its head into one of the upper corners, a third was moving its head as if tossing an invisible bar, two displayed a pendulum motion of the head and body, yet another bird made pecking and brushing movements toward the floor. Skinner called this behavior "superstitious conditioning." He suggested that "superstitious conditioning" developed because the birds happened to execute some movement just as the food appeared, and as a result they repeated it. If the subsequent presentation of food occurred before a not too long interval, the response was strengthened further. Skinner observed that fifteen seconds was a particularly favorable interval of feeding for the development of the response. Skinner suggested that the behavior he observed with pigeons is analogous to the mechanism of some human superstitions, such as rituals performed to change one's luck with cards or movements of the arm after a bowler released the ball.

Skinner's suggestions about human analogies inspired further experimentation. In the late 1980s, Gregory A. Wagner and Edward K. Morris (1987) designed a mechanical clown, Bobo, that dispensed a marble from its mouth at regular intervals. They promised preschool children they would receive a toy (that they actually received anyway) if they collect enough marbles in an eight-minute session. The session was repeated once a day for six days. Children developed responses similar to those of Skinner's pigeons: they grimaced before Bobo, touched its face, wriggled, smiled at him, or kissed his nose. Koichi Ono (1987) experimented with twenty Japanese university students. The students were asked to take a seat in a booth that was equipped with a counter, a signal lamp (with three colors), and three levers. They were not required to do anything specific but were told they may earn scores on the counter if they do something. Scores appeared on the counter either at regular or random intervals, but without any consistence with the light signals and anything students did. Three of the twenty students developed "superstitious behavior: " one

student pulled a lever several times and then held it, consistently repeating this pattern for 30 minutes; another student developed a different pattern of pulling the levers; the third student performed a complex sequence of movements that gradually changed during the session.” The most spectacular was the behavior of a female student.

About 5 min into the session, a point delivery occurred after she had stopped pulling the lever temporarily and had put her right hand on the lever frame. This behavior was followed by a point delivery, after which she climbed on the table and put her right hand to the counter. Just as she did so, another point was delivered. Thereafter she began to touch many things in turn, such as the signal light, the screen, a nail on the screen, and the wall. About 10 min later, a point was delivered just as she jumped to the floor, and touching was replaced by jumping. After five jumps, a point was delivered when she jumped and touched the ceiling with her slipper in her hand. Jumping to touch the ceiling continued repeatedly and was followed by points until she stopped about 25 min into the session, perhaps because of fatigue (Ono 1987, 265).

The behavioral patterns observed in these experiments are acquired by the elementary learning mechanism of “operant conditioning,” a phenomenon exhaustively studied by Skinner. In operant conditioning, the animal learns about the relationship of a stimulus and the animal’s own behavior (Skinner 1938, 19–21; Schwartz *et al.* 2002, 131–245). For example, Skinner placed a hungry rat in a small box containing a lever. When the rat pressed the lever, a food pellet appeared. The rat slowly learned that food could be obtained by pressing the lever, and pressed it more and more often. In terms of the law of reinforcement, the probability of the rat’s response (pulling the lever) increases if it is followed by a positive reinforcer (presentation of food). The previously mentioned experiments differed from this basic setting inasmuch as the subjects’ action did not influence the presentation of the reinforcer. It is interesting to examine which reinforcement schedules result in the strongest conditioning (Ferster and Skinner 1957; Schwartz *et al.* 2002, 217–224). One might expect that this to be continuous or monotonous, invariable reinforcement. In fact, the opposite is true: continuous reinforcement leads to the lowest rate of responding, whereas the “variable ratio schedule” leads to the fastest rates of responding. Variable ratio means that every *n*th (e.g. fifth or tenth) response is rewarded on the average, but the gap between two rewards can be very short or very large. In real life, the latter type of rewarding schedule is found in fishing and gambling, for example, which might be an important factor in people getting so easily addicted to these activities (cf. Eysenck 2004, 267).

The spontaneous development of ritualized behavior as a response to positive reinforcement that is independent of the response suggests that operant conditioning is the source of magical behavior. Notice that the emergence of “magical” activities in the experiments did not rely either on an explanatory mechanism—be it implicit (such as analogical reasoning or agency) or explicit (such as ghost beliefs or theological doctrines)—or on long-term memory and cultural transmission (such as counterintuitive ideas and miracle stories). Whereas it is difficult to compare the results of different experiments with each other because of the different methods and setups employed in them, it is remarkable that six of Skinner’s eight pigeons developed “superstitious” behavior (and such demonstrations have become classroom routine) and seventy-five percent of preschoolers did so in Wagner and Morris’ experiment, but only three of the twenty Japanese students behaved in that way in the score collecting game. The explanation for this difference might be that (everything else being equal) the ability and willingness to use explicit reasoning based on natural causation

in connection with a task (which we can expect of university students in the given setting) seems to diminish the chance of developing a “magical” response.

Further we can ask if there is a connection between the development of magical behavior and the “reinforcement schedule” of the conditioning. In particular, the unexpected success of variable reinforcement schedules (such as found in gambling and fishing) raises the question of whether a similar effect is at work in magic. Whereas experiments on “superstitious conditioning” manipulated reinforcement intervals and applied random reinforcement, no experimentation has been dedicated to the problem of variable schedules under such circumstances, to my knowledge. There are at least some hints, however, that certain reinforcement schedules may particularly support the development of magical behavior. We will approach this problem from the perspective of probability in reinforcement schedules.

In 1960, the French-American mathematician Benoît Mandelbrot introduced the word “fractal.” A fractal is a recursive geometrical structure: it is a shape that can be subdivided into parts, each of which is a reduced-size copy of the whole, such as the famous “Sierpinski triangle.” In other words, fractals are based on self-similarity. Such geometrical shapes are widespread in nature; one only has to examine the structure of a snowflake through a magnifying glass. Fractals fascinate us and have been widely used in architecture, for example in gothic cathedrals, long before Mandelbrot came up with the notion (cf. Csermely 2006, 231–237). Following a similar pattern, we can create fractal-like structures in other domains, as well. For example, scholars have found that both the pitch and the volume of Bach’s music display fractal-like self-similarity (Voss and Clarke 1975, 1978; Hsü and Hsü 1991; Shi 1996).

Now let us see how fractal-like structures appear in reinforcement schedules. Tossing coins is a simple form of gambling. Mathematician Daniel Bernoulli (1700–1782) analyzed a game where the player wins one ducat if a tossed coin lands “heads,” two ducats if it lands “heads” for a second time, four if it lands “heads” for the third time, with the payoff doubling as long as the coin keeps landing “heads” (Bernoulli 1738 [1954]; cf. Dehling 1997). It can be easily realized that whereas the reward keeps doubling, the chance of winning the doubled reward is half the chance of winning the original amount. In other words, the chance for different payoffs follows a so-called “power law” distribution (in which the independent variable is raised to a constant power, with some simplification). As a consequence, the probability distribution of the expected return is scale-free (such as the fractals seen above) and has no typical value. The game is also known as the “St. Petersburg paradox,” because the bank should ask an infinite price for participation in it, but no sensible player would pay even a moderately high price for it. Recently it has been suggested that other forms of gambling and exciting games in general also involve such regularities (Csermely 2006, 25–31). In fact, scholars have demonstrated that the distribution of dividends in various horse races follows such a rule (Park and Domany 2001; Ichinomiya 2006).

In sum, gambling may be addictive not only because it has a variable reinforcement schedule, but also because this variability, at least in some forms of gambling, follows a fractal-like (power-law) distribution. If operant conditioning is a relevant factor for the development of magical practices, and variable schedules following a power-law distribution strengthen this effect, some especially widespread forms of magic may be good candidates to demonstrate this relation. Let us take rainmaking as an example.

Rainmaking is a universally known form of magic that is performed even in developed countries (Bownas 2004; Dunnigan 2005; Boudon 2006). In Greco-Roman antiquity, the official and private practice of rainmaking is attested since archaic times and continues

beyond the Christianization of the Empire (Graf 2005, 298). According Tertullian (ca. 160–ca. 220), Christians were able to obtain rain through prayer (*Apology* 5). Rainfall obviously follows a variable schedule; therefore, we may think about rain dances as responses to a variable reinforcer. A closer look at this schedule also reveals that it has a fractal-like (power-law) distribution: both the time intervals and the amount of rainfall are distributed in such a way (Peters and Christensen 2002). A rainmaking ritual that is accidentally followed by rain may motivate the repeated use of the ritual, launching a chain of ritual responses to the variable (and fractal-like) reinforcement schedule of rainfall. The plausibility of “making rain” with a ritual is somewhere between the “efficiency” of magical cures for headache and the elicitation of earthquakes that ruin prisons, examples frequently occurring in ancient magic. But even the latter form of magic, which is surprisingly important in both Christian sources and the Greek Magical Papyri, has some relation with power-law distribution: the frequency and magnitude of earthquakes are also described by power-laws. Experimental work on conditioning examines short-term effects in individuals. Additional theoretical and experimental work is needed in order to reveal the possible effects of long-term reinforcement schedules, such as the distribution of rainfall or earthquake.

Miracle Stories Generate Belief in Magic

Miracle is one of the most widespread genres of early Christian literature. Miracles make up the bulk of the Gospels, two of them starting with Jesus’ miraculous birth and all four of them (in their present form, at least) ending with his resurrection. The apostles perform numerous miracles in the Book of Acts. Miracles fill the pages of the Apocryphal Acts of the Apostles, apocryphal gospels, and the Acts of the Martyrs. The tradition goes on unbroken in hagiography and continues in present day (evangelical) preaching and the Roman Catholic cult of the saints.

In general, miracle stories in early Christian literature pay little if any attention to how miracles were performed. The story of Eutychus contains one of the few hints we have. When the apostle Paul was teaching in the city of Troas, a young man called Eutychus was overcome by sleep, fell out of a window of the third floor, and was picked up dead. “But Paul went down, and bending over him took him in his arms, and said: ‘Do not be alarmed, for his life is in him’ ” (Book of Acts 20: 9–10). The healing power of Peter’s shadow and of pieces of clothes that touched Paul’s body provide some further technical references. We have already discussed the latter episode (Book of Acts 19: 11–12); in the former narrative (Book of Acts 5: 15–16) we read that people “carried out the sick into the streets, and laid them on cots and mats, in order that Peter’s shadow might fall on some of them as he came by. A great number of people would also gather from the towns around Jerusalem, bringing the sick and those tormented by unclean spirits, and they were all cured.” In the *Acts of Peter* 26 we read that Simon Magus bowed three times over the head of a young man before he raised him. In another passage that we discussed above, Jesus mixed saliva with sand to cure a blind man (Gospel of John 9: 6–7).

In spite of the inclusion of some technical details, these accounts were obviously written with the purpose of demonstrating the power of Jesus’ apostles and not as recipes that believers could imitate. We do not read, for example, about new converts accomplishing such deeds. These miracle stories do not necessarily imply any actual magical performance. The circulation of such narratives, together with the fact that even today’s readers understand and appreciate them, demonstrates that both ancient and contemporary readers

have cognitive structures which enable them to process stories about magical acts and find them interesting. This also implies that for the circulation and successful transmission of these narratives it is not necessary that the practices described in them were ever actually performed. To mention an analogy, widespread narratives about speaking animals in the apocryphal Act of the Apostles (Matthews 1999; Czachesz 2008) do not necessarily mean that such speaking animals have ever been seen or ever existed.

In my studies about the use of grotesque imagery in early Christian literature (Czachesz 2007b; 2009, 2011) I have argued that many of the fantastic details in early Christian texts (and probably in other religious traditions) can be explained with reference to two archaic cognitive mechanisms of our minds. First, grotesque images tamper with cross-cultural ontological expectations, either by creating things that violate such expectations or by describing transformations of things (metamorphoses) in ways that violate such expectations. Second, grotesque images trigger involuntary imitation and activate archaic alarm systems in the brain that produce fear and disgust. I will show that these two mechanisms are also responsible for the success of miracle stories. Both mechanisms that underlie the popularity of miracle stories are deeply rooted in evolutionary history. Our minds, as evolutionary psychologists have argued (e.g. Barkow *et al.* 1992), did not develop to think about just anything in the world, but primarily to secure our survival in an ancestral environment in face of a particular set of challenges. Therefore, we are predisposed to pay attention to certain aspects of the world around us (e.g., predators, prey, human faces, depth), and react in particular ways to that information (e.g., fighting, fleeing, cooperating, mating). The human mind is not a blank slate when we are born but it is rather a well-adapted organ, which we can use to solve specific tasks in the world. Whereas the influence of the environment on child development is certainly important, it can be argued that the most archaic structures of the mind will nevertheless emerge in a wide range of cultural and environmental conditions.

In a series of experiments conducted in the 1970s, Frank C. Keil (1979, 46–62) has demonstrated that humans share a number of ontological categories that make sense of their environment. Keil (1989, 196) argued that ontological categories represent “the most fundamental conceptual cuts one can make in the world, such as those between animals and plants, artifacts and animals, and the like.” His experiments have also shown that “at the ontological level there are clusters of properties that unambiguously and uniquely belong to all members of a given category at that level. All animals are alive, have offspring, and grow in ways that only animals do” (Keil 1989, 214). In other words, people have particular expectations toward things belonging to a particular category. Psychologists have not yet reached a final agreement regarding the set of basic ontological categories, but the following list is widely supported: HUMAN, ANIMAL, PLANT, ARTIFACT, and (natural) OBJECT (Keil 1979, 48; Atran 1989, 7–16 and 2002, 98; Boyer 1994b, 400–401, 2001, 90).

One of the core hypotheses of the cognitive science of religion is Pascal Boyer’s theory of “minimal counterintuitiveness,” which suggests that religious ideas violate intuitive expectations about ordinary events and states, inasmuch as they “combine certain schematic assumptions provided by intuitive ontologies, with nonschematic ones provided by explicit cultural transmission” (Boyer 1994a, 48, 121, and *passim*). Or, as he more recently summarized his theory, “religious concepts generally include explicit violations of expectations associated with domain concepts,” that is, they violate the attributes that already children intuitively associate with ontological categories (Boyer and Ramble 2001, 538). The idea

of a ghost that can go through walls, for example, is based on the ontological category of human beings, but violates our expectations about intuitive physics that should otherwise apply to humans. Concepts that contain such violations, Boyer suggests, “are more salient than other types of cultural information, thereby leading to enhanced acquisition, representation, and communication.”

For the purposes of this article, it is important briefly to survey the experimental work related to Boyer’s theory. The first experiments, conducted by Justin Barrett and Melanie Nyhof (2001) as well as by Charles Ramble and Boyer himself (2001), seemed to confirm that minimally counterintuitive ideas are remembered better than ordinary, bizarre, or maximally counterintuitive ones. Bizarre items (Barrett and Nyhof 2001) included a highly unusual feature that violates no category-level assumption: for example, for a living thing to weigh 5000 kilograms is strange, but not excluded by ontological expectations about living things. Maximally counterintuitive things (Boyer and Ramble 2001) combine multiple violations of ontological categories: “only remembering what did not happen” already violates expectations for objects with a psychology (such as humans or animals), but this feature was added to an object without psychological processes (such as a piece of furniture). Other experiments (Atran 2001, 100–107; Norenzayan and Atran 2004; Gonce *et al.* 2006; Upal *et al.* 2007), however, have yielded two important observations that seem to call for a revision of the original theory. First, it turned out that the overall advantage of minimally counterintuitive ideas in transmission is caused by contextual effects, primarily by narrative frames such as the ones used in both above-mentioned experiments. Second, the experiments have shown that in the long run (after a week) minimally counterintuitive ideas do enjoy an advantage, independently of contextual effects. That is, their memory decays less than the memory of ordinary or maximally counterintuitive objects. A fresh look at Barrett and Nyhof’s results (2001, 85–87, 89–90) reveals that also in their experiment the memory of counterintuitive ideas decayed less; they paid no attention to this factor probably because of the absolute advantage of such concepts in both immediate and delayed recall in the experiment.

The original purpose of developing the notion of minimally counterintuitive ideas has been to explain widespread beliefs in ancestors, spirits, and gods (Boyer 2001, 58–106; Pyysiäinen 2003, 9–23). But the theory (as understood in light of the growing body of experimental data) has a broader implication: texts, especially ones (initially) transmitted orally, tend to develop minimally counterintuitive features. Along those lines one can explain, for example, the dominance of particular types of narratives about the death and resurrection of Jesus (Czachesz 2007c). Consider the following two hypothetical alternatives to the episode of Paul and Eutychus. (1) “The boy fell out of the window and broke his leg. Paul hurried downstairs, lifted him up, and laid him on a bed. He took a piece of wood and cloths and secured the broken leg by splints.” (2) “The boy fell out of the window and died. Paul did not go down but prayed to God. The boy came back to life, turned into an owl and flew back to the third floor. From that day he could remember everything he heard.” In terms of what we know about memory and counterintuitiveness, my prediction is that the first narrative would fare quite well in short-term recall, but would decay quickly thereafter. The second version, in contrast, contains too many counterintuitive details (rising from the dead, turning into an animal, remembering everything), and would not be faithfully encoded in memory. A single counterintuitive detail, Paul raising the dead boy (violating the ontological expectation that dead bodies do not revive), is necessary but also enough so that the episode would be advantaged in long-term (and due to context ef-

fects, perhaps even in short-term) recall and therefore transmitted with more success than the other two.

A minimally counterintuitive element can be identified in many other biblical and apocryphal miracle narratives. We mention only a few examples. According to the *Arabic Infancy Gospel* 36, Jesus in his childhood modeled animals from clay and then made them behave (run, fly, eat) like real animals. The apostle Peter brings a smoked tunny fish back to life in *Acts of Peter* 13 (cf. Herodotus 9.120.1). In addition to Paul's example mentioned above, Jesus, the apostles, and Simon Magus raise dead people on several occasions (e.g. Gospel of Luke 7: 11–17; Gospel of John 11: 38–44; *Acts of Peter* 28). Healing from a distance is also counterintuitive, because people are not supposed to act on anything without being physically present (at least this seems to follow from expectations about physicality; Spelke 1990; Spelke and Kinzler 2007; Barrett 2008). Such a violation of intuitive expectations occurs when Paul's pieces of clothes are taken to the sick and heals them or the sick are put under Peter's shadow. Jesus (in the Gospel of John 4: 46–54) also heals from a distance. The absence of stories about raising a dead person from a distance supports this interpretation. For example, when Jesus is underway to Bethany and learns his friend Lazarus has died, he finishes his journey, comes to the tomb, and only then he raises Lazarus (Gospel of John 11: 38–44). A combination of acting from a distance *and* raising someone from the dead would be excessively counterintuitive and therefore not advantaged in the transmission. Notice that the cognitive processing of such narratives does not require an explicit theory of the causal mechanisms that bring about healing. Ancients might have had quite different theories about such operations than do modern Westerners. Also the substantial differences between the medical views of ancient elites (as recorded in the works of Hippocrates and Galen, for example) and of the non-elite and mostly illiterate majority cannot be stressed enough (Pilch 2000, 103). The very occurrence of minimally counterintuitive elements makes these narratives successful in ancient as well as modern cultural environments, regardless of the variety of explanations that people would provide for them if asked.

Not all attention-grabbing details are necessarily counterintuitive. The healing of a lame person is certainly spectacular (Gospel of Mark 2: 1–11), but there is nothing about it that contradicts our expectations related to cross-cultural ontological categories. Also healing a blind person by applying saliva to the eyes (Gospel of Mark 8: 22–26; Gospel of John 9: 6–7) is remarkable but not counterintuitive. Saliva does contain healing substances and we intuitively make use of it when we put a wounded finger into our mouth. There is a tendency, especially in the Gospel of John, to make “normal” instances of folk medicine more impressive by emphasizing some extraordinary circumstances: the man healed in Gospel of John 9 was born blind and the one healed at the pool of Bethesda had been crippled for thirty-eight years (5: 1–20).

Some miracle stories also trigger involuntary imitation and activate archaic alarm systems in the brain that produce fear and disgust. Let us have a quick look at how these cognitive mechanisms work. Children imitate facial expressions and other bodily movements at a very early age, indeed, right after birth (Meltzoff 2002; Hurley and Chater 2005). Imitation enables us to engage in joint action and sophisticated cooperation (Brass and Heyes 2005; Uddin *et al.* 2007). We can also use imitation when we do not actually carry out the imitated actions. On the analogy of the mirror neurons in monkeys, it has been found, that also in humans the observation of actions performed by others activates cortical motor representation—that is, brain areas are activated that are responsible for the movement of different parts of the body (Gallese *et al.* 2004). There are similar findings about emotion:

the same brain parts that are involved in the feel of disgust and pain are also activated when we empathize with such emotions (Keysers *et al.* 2004; Singer *et al.* 2004). Not only do we not actually have to carry out actions or be exposed to pain in order to empathize with them, but also a limited amount of information is sufficient to activate the relevant brain areas and elicit empathy (Gallese *et al.* 2004).

I suggest that various details of the healing miracles in early Christian texts act on our involuntary system of imitation and empathy. We read about people who are seriously ill and desperately seek healing (e.g. Gospel of Mark 2: 1–12). Parents seek help for their sick or already dead children (e.g. Gospel of Mark 1: 21–43). These effects are further amplified by the presentation of extreme (e.g. lameness, blindness), repulsive (e.g. “leprosy”), or spectacular (e.g. “demoniacs”) symptoms and diseases. Many of the stories and vivid details are likely to elicit fear and disgust. These are two basic emotions that have deep (if not the deepest) evolutionary roots (Ward 2006: 315). Fear is responsible for detecting threat and occurs rapidly and without conscious awareness: for example, people suffering from phobias react to the images of snakes or spiders even when they see them without noticing it (that is, subliminally). Disgust is thought to be originally responsible for avoiding contamination and disease by eating, but its usage has extended with time. In sum, many healing miracles include details about conditions and symptoms that are likely to produce empathy and trigger basic emotional systems. Further, it is logical to assume that after such starting conditions, healing stories evoke more positive feelings when problems are miraculously solved in the end. I suggest that these effects direct attention to healing miracles and generate a set of emotional memories (Eichenbaum 2002: 261–281) about them, which increases their memorability. This hypothesis is further supported by the recent experimental finding that emotionally arousing details in stories enhance the memorability of the gist and details (both central and peripheral) of the narrative (Laney *et al.* 2004).

We can conclude that miracle stories spread for reasons that are independent from both the actual practice of magic and explanations connected to magic and miracle. This does not mean, however, that magic is completely independent from miracle. Repeated exposure to miracle stories obviously familiarizes listeners with magical concepts and provides them with narrative patterns and other means to make sense of them. Such stories may be embedded into social and institutional contexts (ancestral tradition, mythology) that enhance their credibility and significance. In this way, miracle stories provide cultural interpretation and positive feedback to the superstitious behavioral patterns that develop from a completely different background.

Adding an Explanatory Framework to Magic

What kind of evidence do we have about actual magical practice among early Christians? Already from a very early period, as early as 53 or 54 CE, we can gain evidence of magical activity among Christian believers from Paul’s first epistle to the Corinthians (Köster 1980, 554; Wolff 1996, 13):

To each is given the manifestation of the Spirit for the common good. To one is given through the Spirit the utterance of wisdom, [...] to another gifts of healing by the one Spirit, to another the working of miracles, to another prophecy, to another the discernment of spirits, to another various kinds of tongues, to another the interpretation of tongues.” (1 Corinthians 12: 7–10)

In this passage, Paul writes about magical specialists: healers, miracle workers, and exorcists, who are in the company of teachers, prophets, and other Church officials. This is a very interesting source also because the epistle predates extant texts about the miracles of Jesus and the apostles. What was the relation between magical practice and miracle stories in earliest Christianity? One can argue that tradition about Jesus and the apostles could have circulated in oral transmission before Paul's time—but such a hypothesis is impossible to test because of the lack of evidence. It is also possible, however, that it was magical practice that inspired the miracle stories about Jesus and the apostles. Christianity could have incorporated already existing magical lore. Magical specialists who converted to Christianity could be among the healers and miracle workers mentioned in 1 Corinthians.

This example suggests that the relation of magic and miracle might be less linear than we have outlined above. It seems rather a dialectical relationship, in which miracle stories generate belief in magic, and magical practice creates an interest for miracle stories. It might be also useful to make a distinction between individual magical practice, on one hand, and the social and historical development of traditions, on the other. At the personal level, miracle stories (and superstitious cultural traditions) can confirm spontaneously developed superstitious behaviors. At a historical level, magic can be institutionalized and use miracle stories as a justification of existing practices: believers imitate Jesus and the apostles.

The so-called long ending of the Gospel of Mark suggests that not only specialists, but all believers could perform magic: “these signs will accompany those who believe: by using my name they will cast out demons; they will speak in new tongues; they will pick up snakes in their hands, and if they drink any deadly thing, it will not hurt them; they will lay their hands on the sick, and they will recover” (Gospel of Mark 16: 17–18). This passage can be likely dated to the first half of the second century (Metzger 1971, 125; Kelhoffer 2000, 234–244). It would have been meaningless to add such a sentence to the Gospel unless there was an actual interest in at least some of the practices on the list. This passage therefore provides indirect evidence that at least some second century Christians were performing some kind of magic. If you believe, you can do it yourself.

Can we also say something about the actual form of early Christian magic? The question is not easy to answer because it is difficult to establish criteria to separate Christian and non-Christian magic. The only case when it is possible to make such a distinction with certainty is the mention of a holy name in a text, such as the name of Christ or Mary. Examples of Christian magic from the early second century onward are numerous and we restrict ourselves to a few examples. The famous Gold Lamella from the second century was used to cure headache: “Turn away, O Jesus, the Grim-Faced One, and on behalf of your maid-servant, her headache, to (the) glory of your name, IAÔ ADÔNAI SABAÔTH I I I <...> OURIËL <...> OURIËL GABRIËL” (Kotansky 2002, 37–46; cf. PGM XVIIIa.1–4). The following two texts describe how to evoke earthquake and rescue people from prison:

I praise [you, I glorify] you, I invoke you today [God, who is alive] for ever and ever, who is coming upon [the clouds] of heaven, for the sake of the whole human race, Yao [Sabaoth] <...>, [Adon]ai Eloï <...>. I am Mary, I am Mariham, I am the mother of the life of the whole world, I am Mary. Let the rock [split], let the darkness split before me, [let] the earth split, let the iron dissolve <...>. (London Oriental Manuscript 6796[2], 9–25; Meyer 2002; 2003; cf. idem 2006).

Copy the power [of a figure drawn on the manuscript] on sherds [?] of a new jar. Throw them to him. They will force him out onto the street, by the will of God. Offering: mastic, alouth, koush. (Heidelberg Coptic text 686, 14.251; Meyer and Smith 1999, 339)

These two examples are especially intriguing because in the Acts of the Apostles, the apostles together, then Peter alone, and finally Paul and Silas are miraculously delivered from prison (see above). These texts bring us back to the concept of the *parhedros*, a supernatural assistant who collaborates with the magician (Graf 1997, 107–115; Scibilla 2002). To acquire a *parhedros* one has to undergo specific initiatory rituals. The *parhedros* can assume one of four different forms: it might be (temporarily) materialized in human shape; assimilated to a deity, e.g. “Eros as assistant”; identified with an object, such as an iron lamella inscribed with Homeric verses; or represented by a demon. According to one of the Greek Magical Papyri, the *parhedros* might be used for the following purposes: to bring on dreams, to couple women and men, to kill enemies, to open closed doors and free people in chains, to stop attacks of demons and wild animals, to break the teeth of snakes, to put dogs to sleep (PGM I. 96–130). The *parhedros* can also bring forth water, wine, bread and other food (but no fish and pork). The Holy Spirit often appears as a *parhedros* assisting magic, such as in Paul’s description of magical activities in the Corinthian congregation or in the miracle stories of the Book of Acts. A similar function is often fulfilled by “God’s name” or “Jesus’ name.” Early Christian sources mention various instances of magic that we can identify with ones that could be typically achieved with the help of *parhedroi*, such as delivery from prison, exorcism, killing enemies (Book of Acts 5: 1–11), as well as magical manipulations of wine and food. As we have noticed, miraculous rescue from prison is mentioned particularly frequently in Christian sources; this motif is widely attested in ancient literature (Euripides, *Bacchae* 447–448; Ovid, *Metamorphoses* 3.699–700; Josephus, *Jewish Antiquities* 18.29). The general idea that we can gather from many examples of early Christian magic is that Christians were superior to their competitors in their methods of using supernatural assistance as well as the *parhedroi* who assisted them were superior to those of their competitors. The relation between magic and its explanation was complex: on one hand, explanations supported the practice of magic; on the other hand, the theological content was piggybacked onto the success of miracle stories and magical practices.

At first sight it might seem that this ancient theoretical framework into which the episodes were inserted is in diametrical opposition to the world-views of the modern readers and should be a reason to dismiss the narratives as superstition. Many modern Westerners reject the supernatural as an explanatory framework. On this account, ancient stories of magic might be entertaining episodes but lack referentiality to the actual state of affairs. Alternatively, they are expressions of psychological contents and not of external realities. Other modern Westerners, particularly theologians, might hold a consistently monotheistic view of the world. In this framework, the supernatural is acceptable as long as there is one God, but also, according to them, demons belong to the superstitions of the past. On this account, the underlying mechanism of the stories is that God controls natural and psychological forces.

Whereas contemporary Western thought prefers such alternative theories about magic in early Christian texts, we have good reasons to believe that the traditional conceptual framework did not lose its explanatory power. How can we explain that? Among members of the cross-culturally shared ontological categories, animals and humans are thought about as self-propelling, intentional agents: they perceive what is going on around them, react to those events, have goals and form plans (Leslie 1994; 1996). The needs of both social life and predation might have contributed to the development of mental modules which focus on agents in the environment (Barton 2000). In our evolutionary past, the dangers of not detecting an agent were much more serious than mistakenly detecting one that was not

there. Consequently, intentional agency provides one of the most fundamental explanatory frameworks to make sense of the world around us (cf. Dennett 1971; 1983; 1987). According to Stewart Guthrie, Justin Barrett, and other representatives of the cognitive science of religion, humans' oversensitive reaction to the (potential) presence of agency in the environment has substantially contributed to the emergence of belief in gods and spirits (Guthrie 1993; Barrett 1996 and 2000; Pyysiäinen 2009; cf. Burkert 1996). Although modern Westerners are educated to reason about their environment in terms of mechanistic causality, they are able to do so only if they have ample time and resources. It is likely that our first hand reactions are based on intentional agency as much as the reactions of our ancestors were. Although we do not think about sickness as caused by demons, we still speak about it as something that attacks, tortures, and finally leaves us...

In an experiment conducted by Emily Pronin, Daniel M. Wegner, and their collaborators, participants were instructed to perform a "voodoo ritual" with a doll (Pronin *et al.* 2006, 220–223). They were introduced to a confederate who behaved either offensively or neutrally, and who later played the role of the "victim" of magic. Then participants were asked to generate "vivid and concentrate thoughts" about the victim (who was in the neighboring room) and prick the doll in particular ways. Finally, the victim came back and reported having a slight headache. It turned out that participants who had ill thoughts about their victims (because of the victims' offensive behavior) were likely to think that they caused the victims' headache, whereas participants meeting neutral victims were less likely to think so. In sum, university students, especially ones who were motivated to have evil thoughts about their victims, were easily made to believe they could curse victims by performing magic. What can we conclude from this experiment for our discussion of magic? We have suggested that intuitive reasoning about agency supplies a cross-cultural explanatory framework for processing stories of magic. The experiment of Pronin and others shows that modern Westerners, who have no explicit beliefs about demons, are able to use such reasoning in connection with their own behavior: ill thoughts combined with magical manipulation can damage other people's health.

What the experiment did not examine was the influence of information that participants received about the potential effects of voodoo: all participants equally received such information. Would participants in the experiment have come to the same conclusion if they had not been told about the potential effects of voodoo? Since the experimenters did not pay attention to this factor (familiarity with voodoo was not tested and everybody received the same introduction), we can only speculate about the role of previous knowledge. It is likely, however, that without introduction to the possible effects of voodoo the feeling of magic would have been less significant.

Are superstitious conditioning, miracle stories, and the intuition of agency enough to keep magical practice going? In the voodoo experiment, success was guaranteed. The same is true of the stories in the canonical and apocryphal Acts: the success rate of magic is one hundred percent. But how does real-life magic deal with the less favorable chances? In the case of healing (rather than causing) headache there was certainly much probability that the headache ceased after some time. Even harder diseases might be healed and give the impression of successful magic—but what about delivery from chains and imprisonment? Among the explanatory techniques underlying magic we will mention two that increase the "success rate" of magic by manipulating available evidence (cf. Gilovich 1991).

"Confirmation bias" means a tendency to seek evidence that is consistent with one's hypothesis and to avoid seeking falsificatory evidence (Eysenck and Keane 2005, 470–480). In

Peter Wason's classical experiment (1960 and 1968), subjects had to discover a simple relational rule between three numbers (2–4–6) by generating other sets of three numbers which the experimenter checked against the rule. It was discovered that subjects insisted on an initial hypothesis and chose only sets of numbers that matched it. Subsequent experimental work has supported Wason's findings. Recently Martin Jones and Robert Sugden (2001) have shown that information which is interpreted as confirming a hypothesis increases subjects' confidence in the truth of the hypothesis, even if that information has no value in terms of formal logic. Finally, experiments have shown how confirmation bias works in a social context: supporters have seen more fouls with players of the opponent team than with their own players (Eysenck 2004, 328). In sum, information that may be seen as confirming one's hypothesis (or prejudice) is sought for and interpreted as such, whereas information falsifying it is avoided and ignored. It is easy to see that this universal cognitive attitude plays an important role in collecting "evidence" for the effectiveness of magic.

Not only are people biased toward confirming evidence, but they are also extremely good at downplaying counterevidence. Magical practices are not vulnerable to unsuccessful performances, because there is a wealth of explanatory strategies for dealing with such situations. As Boyer pointed out, "rituals can never fail, but people can fail to perform them correctly" (Boyer 1994, 208). Anthropologist E.E. Evans-Pritchard has recorded a number of ready-made explanations among the Zande that can be used to account for the failure of an oracle: "(1) the wrong variety of poison having been gathered, (2) breach of a taboo, (3) witchcraft, (4) anger of the owners of the forest where the creeper grows, (5) age of the poison, (6) anger of the ghosts, (7) sorcery, (8) use" (Evans-Pritchard 1937, 330). In other words, the efficiency of magic is protected by the irrefutable circular reasoning that magic succeeds only when all necessary conditions are fulfilled, and we know that all conditions have been fulfilled only if the magic succeeds.

Magic Explained

The new cognitive explanation of magic is based on the interplay of three components: superstitious conditioning, miracle stories, and explanatory methods. We have argued that magic is based on subconscious learning that generates superstitious behavior, as well as on a subconscious selective process that favors miracle stories, which further reinforce such behavior. We can summarize our findings as follows. (1) By operant conditioning we learn to "manipulate" reinforcers in the environment that are independent of our actions. "Superstitious" behavior develops regardless of any explanatory framework. Not only is the learning procedure subconscious, but also superstitious behavior itself may remain completely unnoticed. This is characteristic of other kinds of conditioned behavior, as well: for example, students can condition a lecturer to move in certain ways by reinforcing his actions by nodding (Vyse 1997, 75–76). As a result, we execute ineffective manipulations routinely, without being aware of them. (2) Miracle stories are memorable and interesting because they manipulate cross-cultural ontological categories (especially by favoring minimally counterintuitive details) and elicit empathy and emotions. These cognitive factors make them successful regardless of whether we practice magic or believe in it. But the vitality of such accounts also makes them important sources of inspiration and justification for magical practices. In turn, people's own superstitious behavior might cause such stories to be more attractive. (3) Various kinds of implicit and explicit explanations are attached to magical manipulations. In addition to analogical reasoning, which has been thoroughly

studied in previous research, we have examined explanations based on agency in antiquity as well as in a contemporary experiment. Other cognitive factors include particular techniques to collect “evidence” about the effectiveness of magic. We have argued that magic is not based on such explanatory techniques and they can differ from one type of magic to the other. They are, however, essential for the integration of magic into individual and shared systems of belief.

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