Rubber hands and astral bodies:

An argument for the reality of a cognitive science of magic

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Abstract

Recent academic discussion of magic has largely fallen into three camps: the psychological study of magical thinking, in an effort to explain it away; the sociological or anthropological study of magical beliefs and practices, remaining agnostic about their efficacy; and some attempts to make magic presentable as a subject of serious cognitive science. The present paper presents an alternative approach to the empirical study of magical practices. Rather than present an apologetic for magical practitioners or argue for a future area of research, the present paper argues that magical practices, by many other names, are already subject to serious scientific investigation, and to pretend otherwise is disingenuous. Through evidence from the history and anthropology of magic and the psychological study of cognitive biases, the body schema, meditation, suggestion, ritual, and mystical experiences, it is argued that there already exists robust areas of empirical research dedicated to studying phenomena that have been historically folded under the umbrella of “magic.” It is further argued that increased communication and theoretical integration amongst these areas of research, forming a strong nomological network, could lead to both improved understanding of mechanisms underlying each phenomenon, as well as fruitful areas for future clinical and knowledge-driven research.

Public Significance Statement

The present paper reviews research in psychology to argue that magic has been a serious topic of research for many years, however split between research programs on imagination, embodiment, meditation, hypnosis, and ritual. This paper argues that collaboration between these researchers could lead to a fruitful interdisciplinary study of magic and esoteric practices.

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Recently, there has been increasing psychological and sociological interest in the experience of, and belief in, supernatural phenomena (Josephson-Storm, 2017; Luhrmann, 2012), as well as adjacent areas of study such as the influence of psychedelics (Haijen et al, 2018; Hartogsohn, 2018) and the mind-enhancing effects of practices such as meditation (Vervaeke & Ferraro, 2016) and ritual (Hobson et al, 2018). Historically, such phenomena were part of a single set of skills: that of the magician, the practitioner of magic (Otto & Stausberg, 2013).

While the study of magic called as such is experiencing increasing interest in its own right, rarely has this study concerned the empirical effects of magical practices. The use of the term magic in empirical study has typically revolved around investigations of magical thinking (Irwin, 2009), sociological arguments for the perennial nature of such practices (Josephson-Storm, 2017), or anthropological studies of modern-day practitioners of magic (Greenwood, 2009; Luhrmann, 1989). Where magical practices have been considered an area of empirical psychological study, the focus has been on the attempt to make magic a subject worthy of serious scientific inquiry (Sørensen, 2007, 2013).

The present paper takes a different route entirely, by arguing that magic is already a subject of serious scientific investigation (albeit disguised by many other names), and to pretend otherwise is disingenuous. Through evidence from the history and anthropology of magic and the psychological study of cognitive biases, the body schema, meditation, suggestion, ritual, and mystical experiences, this paper is intended to provide a strong case for the reality of an empirical science of magic. That people persistently believe in the supernatural despite all the attempts of positivist science to eradicate the phenomenon is indisputable (Irwin, 2009; Josephson-Storm,

2017). As this paper will demonstrate, some of the practices that emerge from a belief in supernatural forces are genuinely efficacious in a completely naturalistic and empirically validatable manner. In fact (though this may come as a surprise) this is already accepted as true. By making this case, we wish to provide a compelling case for increased communication and collaboration between researchers investigating the phenomena under review here to the end that we may achieve a genuine science of magic and the enhanced agency that magical practice is typically intended to impart to the practitioner.

The Present Paper

By this point the reader may be experiencing an aversive reaction to the use of the word “magic”. This is understandable. Popular culture has loaded the term well beyond its original meanings, which were many and varied to begin with. While the flexibility of the word “magic” is an integral part of its history (Copenhaaver, 2015), we understand that this flexibility does not a helpful scientific category make. There have been numerous attempts to define magic in several millennia of academic writing on the subject, with the most recent consensus appearing to be that defining magic is difficult. However, Otto and Stausberg (2013) argue that while the specifics of what is called “magic” vary heavily across time and place, there are nevertheless what might be called “patterns of magicity”: recurrent themes that create an identifiable family resemblance between magical phenomena, differentiating magic from its usual contrast classes of “science” and “religion”. Indeed, much academic work on magic has focused on attempting to identify these patterns, beginning in the late 19th and early 20th century.

Further, there has been much ado made about the distinction between mysticism and magic. From a scientific perspective, this can be viewed as historical curiosity surrounding the boundaries

between approved and unapproved practices between different traditions. The reliable difference between those called magicians and those called mystic tends to be a difference in the intent of the practitioner (Versluis, 2007). The magician wishes to change the world, the mystic wishes to transcend it (Underhill, 1911; Versluis, 2007). Following Versluis (2007), we think that the distinction between magic and mysticism from the perspective of the practices involved is not altogether very meaningful as the cognitive processes involved are the same. For those curious about the historical comparisons made between the categories of mysticism and magic, we direct you to the above cited works.

To avoid these difficulties experienced in the academic study of magic, let us begin by getting clear about our terminology. First and foremost, when this paper refers to "magic" it refers to something that is above all else a skillset or practice, as studied in the anthropological literature on the subject. "Magic" does not refer to supernatural forces or entities, which the present paper will - again following the anthropological tradition - remain agnostic about. Second, to riff on Tolkien, do not take the subjects of this review for conjurers of cheap tricks. While there is excellent work on the psychology of stage magic (Kuhn, Amlani, & Rensink, 2008), the present paper is not concerned with it.

In *The Golden Bough*, possibly the most well-known anthropological text on magic, Frazer disparagingly identifies magic as "the bastard half-sister of science" (Frazer, 1922/1993, pg. 50), and argues that magic runs on misapplication of the same reasoning and principles of correlation and causal association that underlie science. The cognitive process that underlie these scientific principles become the Law of Sympathy (two sufficiently similar objects are connected and may influence each other causally), and the Law of Contagion (two objects that were once in contact

remain connected and may influence each other causally) when they are applied within a magical framework.

There are two aspects of Frazer's thought that are important to the present argument. The first is a distinction made between Theoretical and Practical Magic, or the metaphysical and ontological claims of a given magical system and its actual behavioural workings. Frazer notes that while the two are connected, the average magician rarely considers the actual theoretical underpinnings of what it is they are doing. Practical magic, then, can be considered independently of the metaphysical or ontological theory behind it. The second is Frazer's concession that while magic is "mistaken", it does ultimately run on rational principles of observing cause and effect, tying it closely to the mental processing underlying science. In *Witchcraft, Oracles, and Magic Amongst the Azande*, Evans-Pritchard (1937) similarly observes that if one accepts the axioms of a magical system, then the system itself follows in an eminently rational fashion.

This distinction between the practical and theoretical elements of magic, coupled to the argument that magic does as a general rule rationally follow from the underlying principles, provides the thesis of the present paper. The present paper argues that our understanding of the mind has come to a point where we can agree with some such principles of magic without compromising the integrity of a naturalistic worldview. That is, we can replace the theoretical side of many magical practices with evidence drawn from cognitive science, while preserving the practical side of magic with regards to its intended and observed effects. We argue that we have now sufficiently rectified our understanding of the mind to reverse Frazer's claim that science improperly performed is magic. Rather, we claim that magic, properly studied, becomes science, and that revisiting our understanding of magic in light of recent advances in cognitive science can provide a helpful overarching framework for the future study of associated phenomena.

We now move on to review empirical psychological research programs which, we argue, have been the study of magic by another name. We will address the specifics of a scientific category of magic in the discussion section, and argue that using the term “magic” has the pragmatic consequence of allowing researchers to make the most of the techniques of mental manipulation that the magician and mystic are renowned for.

Cognitive Processing and the Laws of Magic

Given the claim by the anthropologists that magic has its origins in the same mental processes that give rise to science, it seems prudent to begin with the study of those mental processes. Here it is important to note that we are concerned with mental processes specifically, and not with the content of those processes. There has, indeed, been a significant amount of work done on supernatural and paranormal beliefs, both in the psychological study of religion and the study of magical thinking in general (Irwin, 2009; Josephson-Storm, 2017). However, for the present paper we are not interested in scientific apologetics of people's propositional beliefs or attempts to justify apparent aberrations in modern rational thought. Rather, we are concerned with the actual underlying processing itself, and the actions that such naturally occurring quirks of human cognition drive. There is a distinction, we argue, between magical thinking and thinking that drives magic. We are specifically interested in the latter.

Conveniently, two such processes that drive magic have been described by Frazer: 1) the laws of sympathy and 2) the law of contagion. These so-called laws have been operationalised for experimental studies, and have been found in a multitude of conditions. The initial work explicitly testing sympathy and contagion as psychological phenomena was by Rozin, Millman, & Nemeroff (1986), who examined sympathy and contagion with regards to disgust reactions. Perhaps

unsurprisingly, they found that participants were significantly less willing to consume juice that had been exposed to a sterilised desiccated cockroach (contagion), and far less willing to consume chocolate fudge that had been sculpted to resemble dog feces (sympathy). Several other conditions examining both sympathy and contagion demonstrated the reliable occurrence of these effects in their subjects. Other studies (Rozin, Nemeroff, Wane, & Sherrod, 1989) found additional evidence for the law of contagion as a psychological phenomenon, finding that participants were far less enthused to receive a valuable item or food from someone they disliked than someone they favoured. Consideration of the latter condition was largely treated as a favourable event, though positive contagion appears to be otherwise understudied.

While the work of the Rozin and Nemeroff group predominantly focused on the law of contagion (Nemeroff & Rozin, 1994; Rozin, Markwith, & Nemeroff, 1992; Rozin & Royzman, 2001), there is additional work regarding the law of sympathy. For instance, Hood and colleagues (2010) found significant stress-related electrodermal activity in participants when they observed the destruction of photos of sentimental objects that were taken for the purpose of the experiment. This effect occurred even for photos of items that merely resembled a valued object, such as a cell-phone.

The law of sympathy has also been made use of in therapeutic contexts. Explicitly invoking the above work on sympathy and contagion, DeWall and colleagues (2013) developed a new test of both state and trait measures of aggression, usable across a wide variety of contexts and relationships: the voodoo doll task (VDT). In this task, participants are invited to damage a voodoo doll representing a range of persons. It could be a close friend, a total stranger, or a hated adversary. Later study of the VDT found that retaliation on a voodoo doll representing an abusive supervisor

improved participants' feelings of justice regarding the relationship (Liang et al, 2018), suggesting the VDT provides not just a test of aggression, but also possible treatment.

Such findings likely result from a fairly simple quirk of the mind's underlying functions. As it is impossible to directly determine causal relationships, we can only know them by inference, through a significant amount of reinforcement learning over the course of the lifespan. We do not think it is necessary to review the entire literature on associative and reinforcement learning in the present paper, or the recent Bayesian predictive processing advances on the theory (for full review, see Clark, 2013), but it is worth a reminder of how fundamental it is to cognition. In a paper conveniently titled "'Superstition' in the pigeon," Skinner (1948) demonstrates exactly how basic this kind of reinforcement learning is, observing the formation of "superstitious" behaviours in a pigeon regarding the behaviour by which it may obtain food, if the availability of food is always preceded by arbitrary behaviour. It can be inferred from above "voodoo" experiments that, given an item that is registered as sufficiently similar to the real object on which prior associations were formed, the association machinery will trigger regardless. The word "trigger" here is used quite intentionally; in extreme cases, this associative machinery may underlie the flashbacks and triggers of post-traumatic stress disorder.

This associative machinery allows for a significant degree of flexibility with regards to forming these associations, accounting for both the weakness of the ability as well as its greatest utilities. For instance, sufficient similarity and the mapping of associations allows for the use of metaphor, which underwrites a significant degree of our capacity for language (Liu & Kennedy, 1997; Luhrmann, 2012; Vervaeke & Kennedy, 2004). Humans make use of a significant degree of metaphorical, analogical, and symbolic bundling to process complex stimuli, making use of the combination and bundling of different senses to create perceptions of phenomena for which we

have no dedicated sensory system; in essence, making the general population more synaesthetic than they realise (Hubbard & Ramachandran, 2005). This will be explored in detail below.

Rubber Hands and Astral Bodies

As explored in the previous section, the mind does not form connections between phenomena through identifying causal linkages; we can only form such associations by inferring them by association. These associations, given a sufficiently similar stimulus to that on which they were developed, can “slip”, allowing associations formed on one stimulus to be transferred over to another. This is the case even with experiences one might consider extremely fundamental, for instance, the basic sense of having a body. This, too, is learned only through association, and nowhere is that clearer than in the symbolic manipulation of that sense of embodiment in the rubber hand illusion (RHI).

Originally described in 1998 by Botvinick and Cohen, the set-up for the RHI is simple. The participant’s hands are laid out in front of them on a table, along with a third, artificial arm placed between them, closer to the hand it matches. A screen and blanket are then used to block the verum hand from the participant’s view. Using a pair of paint brushes, the experimenter then synchronously strokes the outline and down the extremities of both the verum and rubber hand. After some time, additional stimuli applied to the rubber hand, which is in view of the participant, will be “felt” by the out-of-view verum hand.

While it sounds potentially unbelievable at first, the illusion is an extremely robust one, and has been replicated numerous times in a variety of ways as a means of experimentally isolating the phenomenological sense of embodiment (Constantini & Haggard, 2007; Ehrsson, Holmes, & Passingham, 2005; Kammers, de Vignemont, Verhagen, & Dijkerman, 2009; Suzuki, Garfinkel,

Critchley, & Seth, 2013). Simply by disrupting and rerouting the usual expected connection between visual and tactile stimulation, matching visual stimulation from the rubber hand to tactile stimulation from the verum hand, it is possible to induce a sense of ownership over the rubber hand.

Perhaps the most interesting finding is that the target need not be a rubber hand, or indeed, a hand at all. The illusion has been induced by brushing a robotic hand (Caspar et al., 2015), a virtual reality hand (Slater et al, 2009), and empty air, resulting in the “invisible hand” illusion (Guterstam, Gentile, & Ehrsson, 2013). The illusion has also been scaled up to encompass a full body mannequin, through the use of a range of mirrors (Preston, Kuper-Smith, & Ehrsson, 2015) or a headset (Petkova, Khoshnevis, & Ehrsson, 2011). Combining the previous two, the illusion has also been used with a body-sized volume of empty air, producing an “invisible body” (Guterstam, Abdulkarim, & Ehrsson, 2015).

The last case is particularly important, as it is a case of experimentally inducing an out-of-body experience (OBE). This is a phenomenon in which people report experiencing “leaving” their bodies, in some cases including the experience of seeing their own body in third person. OBEs have been reported across cultures (Shushan, 2016), making them another rare example of a genuinely universal human experience. Neurological evidence implicates seizures in the right temporoparietal junction (rTPJ) in connection with spontaneous out of body experiences (Fang, Yan, & Fang, 2014), with the rTPJ being the same structure hypothesised to be responsible for the feeling of body ownership, further implicating it in phenomena such as the RHI and invisible body illusions (Blanke & Arzy, 2005; Tsakiris, Costantini, & Haggard, 2008).

The rTPJ is one component of a neurocognitive network hypothesised to be responsible for maintaining the brain’s online model of the body: the body schema (Tsakiris, 2010). The emergent

result of the synaesthetic binding of multisensory inputs from the body with a multitude of motor commands, the body schema underlies a number of useful capacities, such as the feeling of body ownership and the capacity to recognise ourselves in mirrors. The body schema also extends to the mapping of space surrounding the physical body, referred to as peripersonal space (Holmes & Spence, 2004), which aids in our ability to navigate our immediate surroundings and incorporate tools, allowing for the projection of the sense of touch through tools such as canes (Maravita & Iriki, 2004). This latter expansion of the sense of embodiment into tools and devices has recently been shown to expand to virtual objects (Ma & Hommel, 2015), following the successful integration of a virtual balloon into the body schema of healthy participants. The key to this sort of integration appears to be a sense of voluntary control; if a person perceives causal influence over something, even something as remote as a virtual balloon, it can be integrated into the body schema. This was further demonstrated in the lab by the successful induction of a body transfer illusion into the virtual body of a monkey (Javorský et al, 2018) with the authors suggesting that this sense of causal connection appears to be the *only* criteria for successful embodiment.

In a rare case of convergence between laboratory and naturalistic studies, we gain further evidence for the connection between sense of control and sense of embodiment from ethnographic study of the NASA Mars Exploration Rover operator team. As Vertesi (2012) explains, due to the significant signal lag between the rovers on Mars and the operator team on Earth, operation of the rovers cannot make use of a joystick or other real-time control system. Rather, operators must consider the last information received about the rovers' immediate surroundings and program precise movement instructions. To create these instructions, the operator team gets, as Vertesi puts it, totemic. Drawing explicit connection to Durkheim's (1915/1995) description of totemic rituals, wherein practitioners of the ritual imitate a totemic animal in order to take on its characteristics,

Vertesi describes how NASA rover operators engage in a wide variety of visualisation, imitative, and embodiment exercises with the rovers as a focus, learning to model the rover's senses and physical movements using their own. To do this, they must learn to perceive the world in new ways, compensating for the differences in what a rover can perceive and what they can perceive through their own human senses, as well as the use of physical props or devices to mimic the rovers' limited movements. In short, by entraining their movements and senses to those used by the rovers, they are able to gain an increased sense of control over the machines. Given the above work on the body schema, we may hypothesise that the operator team is manipulating their own body schema to conform to that of the rovers, so as to increase their sense of causal connection.

Relatedly, across the magical traditions of the world, there is a consistent phenomenon variously referred to as the subtle, true, or astral body, as well as various techniques in which the magician (frequently a practitioner of a shamanic tradition) induces this astral body to leave the physical, as in the practice of "astral projection" or shamanic "soul flight" (Asprem, 2017). Similar phenomena appear among the list of Hindu and Buddhist *siddhi*, special powers attained through meditative practice, which include manipulation of the apparent size of the body as well as bilocation. The astral projection technique is further tied to practices regarding mediumship or the possession of animal familiars, both of which involve the same behavioural and physical mimesis as the above case of the Mars rover operators.

While we again note our agnosticism regarding the metaphysical nature of these practices, from a phenomenological standpoint, it is interesting to note the striking similarity between the astral body and related practices and the phenomena surrounding the body schema. Through the scaling up of our basic associative machinery, we gain a sense of possession of our bodies and the immediate space around us, and can through the use of a trained imagination skillfully manipulate

our sense of embodiment, both to experience leaving our own bodies and to experience becoming something else. Given the extensive curriculum of most magical traditions, as well as evidence from the Mars rover team, these abilities appear to be not only malleable, but indeed, in some form, trainable. The potential trainability of these embodiment skills again has a number of useful implications in any field that requires the piloting of a remote body, from exploration to virtual reality. The malleability of the underlying network has its own implications, many of them medical. These will be explored in the next section.

Absorption, Suggestion, and Cognitive Malleability

We have so far seen that the mind's nature as an association machine gives rise to psychological phenomena that follow two core theoretical laws of magic, sympathy and contagion, as well as matching a core theoretical magical construct, the astral body. We have additionally seen empirical grounds for several core magical practices, and some of their potential applications in science and medicine. These applications will be further explored in the present section. We must first, however, cover a key principle in the burgeoning academic study of “magical-like” practices: the personality trait of absorption.

Originally beginning life as a measure of hypnotisability, the Tellegen Absorption Scale (TAS; Tellegen & Atkinson, 1974) is a 34 item true/false scale that assesses an individual's tendency to become engrossed or absorbed in sensory or imaginative experiences. High scorers on the scale demonstrate a proclivity towards total sensory engagement, gravitating towards the sort of experiences that will demand their full sensory and imaginative attention. Recently, the scale has found new cateche in the study of spiritual experiences, particularly in the research program spearheaded by Tanya Luhrmann (1989; 2012). Luhrmann's research program, which Asprem

(2017) refers to as “the *only* major attempt to embed occultist magical practice in an explanatory framework consistent with contemporary cognitive science”, began with a landmark study of ceremonial magicians in contemporary England (Luhrmann, 1989) before moving on to studying kataphatic prayer practices in American evangelicals. In this community, kataphatic prayer is used as a means by which to experience God as more “person-like” and present, with those skilled at experiencing God as person-like being considered more skilled at prayer. Through the latter period of study, Luhrmann used the TAS as an ersatz measure of what she called “proclivity” for the sorts of visualisation practices involved in kataphatic prayer. She found that absorption was strongly correlated with the vividness of an individual’s visualisations during prayer and experience of God as person-like; those high in absorption were acknowledged by the community as being very skilled; the reverse was also true (Luhrmann, 2012).

Experimenting further, Luhrmann and colleagues (Luhrmann & Morgain, 2012; Luhrmann, Nusbaum, & Thisted, 2010; 2013) found that training in kataphatic prayer resulted in increased sense of God as a person after a month of practice regardless of individual differences in absorption, but that absorption marked a person as more likely to engage in practice independently and for longer. They argue that proclivity (as measured by absorption), practice, and expectations provided by a cultural framework provide the basis for training in what they call “inner sense cultivation”: the cultivation of the ability to experience the divine as real.

Asprem (2017), using the framework of Bayesian predictive processing mentioned in the first section, draws a continuum from absorption to skill at the technique of astral flight described in the preceding section, making use of Luhrmann’s model of kataphatic practice as inner sense cultivation. Asprem notes that Luhrmann and colleagues’ framework isn’t only applicable to the experience of God, but to all spiritual and esoteric phenomena, including magic. It is here where

absorption, correlative predictive processing, and the body schema begin to intersect. Asprem argues that inner sense cultivation could be used to freely manipulate the experience of body schema by retraining expectancies based on a theoretical magical framework. That is, by altering expectancies and priors by using an external framework to determine what is possible and what is a “real” experience, perception can be retrained to the point of being able to voluntarily induce the experience of leaving one’s body (among other atypical experiences).

Absorption has been implicated in a range of interesting esoteric phenomena (Lifschitz, van Elk, & Luhrmann, 2019), including the experience of paranormal phenomena such as seeing ghosts (Parra, 2006) and aura vision (Parra, 2008). Perhaps most interestingly, absorption tracks susceptibility to mystical experiences, induced by psychedelics (Haijen et al, 2018) or even through suggestion (Maij & van Elk, 2018; Maij, van Elk, & Schjoedt, 2019). These will be covered in more detail later, but for now, tying back to the previous section, it is important to note that absorption has been theoretically tied to the efficacy of mind-body practices. Menzies, Taylor, & Borguignon (2008) argue that while absorption serves as a risk factor for psychophysiological stress disorders, given the vivid imagination and resultant physiological responses in individuals with high absorption, this same pathway opens up options for treatment not available to those with low absorption. These include relaxation meditation, guided imagery practices for anxiety, pain, and self-efficacy, and anything else that involves a strong visualisation component. These practices also include hypnosis, a practice which has undergone something of a clinical renaissance in recent years, but which has also been used to modify cognitive processing. For example, hypnosis can be used to attenuate the famous Stroop effect, deautomatising the otherwise highly automatic process of literacy (Raz, Shapiro, Fan, & Posner, 2002). It has also been found to be effective in modifying other perceptual illusions, such as the McGurk effect (Lifschitz et al, 2013), and even the basic

process of colour vision (Kosslyn et al., 2000). Recent work also suggests possible use of hypnosis for improving working memory (Lindeløv et al., 2017), and, perhaps more importantly to the present paper, induce out-of-body experiences (Facco et al, 2019), further tying hypnotism to the network of techniques for manipulating the body schema.

While there is increasing interest in the cognitive and perceptual effects afforded by hypnotic suggestion, the primary uses of hypnosis therapies thus far have been in the treatment of pain (Hilgard & Hilgard, 2013; Jensen & Patterson, 2006) and addiction (Potter, 2004, it has also been recently found that it is possible to hypnotically induce mystical experiences in the laboratory (Lynn & Evans, 2017). This, coupled with older and more recent findings of the interconnection between mystical experiences, hypnotisability, and absorption in both clinical and naturalistic settings (Haijen et al, 2018; Spanos & Moretti, 1988) suggests that we are uncovering a series of connected psychological processes; those underlying magic, and perhaps even the perception of an enchanted world.

We now move to add one more process to the mix, one already suggested by Menzies, Taylor, and Borguignon (2008): mindfulness, and associated states of meditation. Farb (2012) has argued that meditative mindfulness and hypnotic suggestion may be best understood as sibling processes, with both having connections to processes of expectation, suggestion, and the efficacy of the placebo. This will be further explored in the following section.

Meditation, Ritual, and the Tools of Self-Enhancement

Meditation and breathwork in one form or another, is common to all spiritual and esoteric traditions (Kristeller, 2011; Levin, 2008; Vujičin, 1995). These basic manipulations of mind and physiology provide the foundations for more complex practices. This is clearly seen in the Jewish

mystical tradition of Kabbalah. Practitioners first learn to clear their mind in meditation, so that it approximates the “nothing” from which God creates the universe. After learning to achieve this clarity, the practitioner can then engage in creative manipulations of reality through imaginative permutations of Hebrew letters (Kaplan, 1990). While commonly put in the category of mysticism, Kabbalah has inherently magical qualities (such as the alteration of reality beyond the practitioner), which provides weight to the argument by Versluis (2007) that the distinction between magic and mysticism is not always that clear or meaningful.

As another example, one of the foundations of Western magic is the practice of *theurgy*, which has its clearest articulation in the ancient world through the philosopher Iamblichus (Kupperman, 2014). Iamblichus follows the neoplatonic tradition initiated by Plotinus. Where Plotinus focuses on meditative contemplation as the primary means of spiritual practice, Iamblichus develops his framework in relation to the Chaldean Oracles to develop a system where the meditative adept utilizes ritual to act on the minds of his community members in order to bring them into contact with the divine (Shaw, 1995). Here, the meditative adept uses the skills of meditative practice not only to expand one’s own power and practice, but to awaken wisdom in others as well. Meditation also forms a core component of Sufism through the practices of *dhikr* (remembrance of God) and *muraqabah* (observation of mind; Kugle, 2012), and in Hindu esoteric practice through contemplation of mantras (verbal sounds representing the gods) and yantra (visual signs representing the gods; Feuerstein & Kak, 1998).

As is hopefully clear, the forms of meditative practice are many and complex; certainly moreso than the simplified mindfulness meditation most commonly studied by psychological researchers. However, while mindfulness is not the core feature of some of these practices, each of them contain an element of the training of awareness and concentration as a basic requirement

for moving on to more advanced practices, and even this very basic training is known to have powerful facilitatory effects on insight and creativity (Capurso, Fabbro, & Crescentini, 2014; Colzato, Szapora, Lippelt, & Hommel, 2017; Ostafin & Kassman, 2012), working memory capacity (Quach, Mano, & Alexander, 2016), and other aspects of cognition (Zeidan et al, 2010).

Drawing on the similarity of their induction and outcomes, Farb (2012) has argued for an overlap between the mechanisms of hypnotic induction and mindfulness meditation, observing that meditative training employs some aspects of hypnotic induction. These include the tone of voice of the instructor/hypnotist, somatisation, and in some cases imagery, creating a very strong overlap between hypnosis and guided meditations (recall, also, that both hypnosis and guided imagery meditations benefit from absorption; Menzies, Taylor, & Borguignon, 2008). Farb argues that the most salient difference between hypnosis and meditation is the locus of control. In hypnosis, the locus of control is ceded to the hypnotist, while in meditation it remains with the practitioner. The basic mechanisms, however, appear very much the same: the subject is placed into a state of relaxed but intense concentration wherein their thoughts and habits become more malleable and open to suggestion, from either an external or internal source. Similar to changes reported through long-term meditation practice, it has been found to be possible to hypnotically induce lasting changes in habit and personality, as in the case of addiction treatment, and even, in rare cases, temporarily overwrite personality altogether, as in the case of induced dissociative identity disorder in hypnotic virtuosos (Facco et al, 2019). For an example of a similar phenomenon from the Tibetan Buddhist meditative tradition, Geshe Kalsang Gyatso reports a case where, after extensive practice with a horned deity, a practitioner would duck beneath door frames so as to protect the horns that he felt were a part of his body map (Gyatso, 1996).

Following on this, Vervaeke and Ferraro (2016) argue that there is an additional practice that may run on the very same basic cognitive machinery of mimicry and embodiment: ritual practice. Drawing on seminal work on the cognitive science of ritual by Rossano (2007; 2010) and Winkelman (2010), Vervaeke and Ferraro argue that the practice of ritual in groups combine aspects of both hypnosis and meditation, and that each share aspects of one another. Building on the work of Rossano (2007; 2010) and Farb (2012), it is argued that 1) ritual bridges hypnosis and meditation in its training of attention and induction of trance states, 2) hypnosis uses ritual actions to induce states similar to those found in meditation, and 3) meditative practices make use of ritual elements in their training to ease the achievement of self-hypnotic states. In the case of the latter, adding ritual elements to meditative practice helps induce encoding specificity, the well-studied psychological mechanism by which cues in the environment or mental state of an individual can facilitate recall of information, skills, or capacities encoded to memory in the presence of those cues (McLaughlin, 2019; Yanes, Frith, & Loprinzi, 2019)

Beyond the more anthropological work on ritual of Winkelman and Rossano, recent work on the psychological aspects of ritual by Hobson and colleagues (Hobson et al, 2018) finds theoretical concurrence with the above arguments from anthropology and cognitive science. Hobson and colleagues argue that ritual serves to regulate a) emotions, b) performance goal states, and c) social connectedness, through the use of collective intention-setting and mimicry to facilitate group integration. By using collective action to set emotional tone and focus intent on a goal, ritual makes use of the predictive processing and body schema machinery discussed above to “match” the body schemas of participants in a ritual through individuals mirroring cues from the environment in the manner argued for by Carr and Winkelman (2014). McNamara (2009; 2019) argues that a major component of ritual is decentering, allowing for a shift in the locus of

control of individual thought and action from a personal to a collective level. Feeding back into Hobson and colleague's (2018) arguments, we know from research on the psychology of wisdom that a shift in the perspective taken on a problem from immediately personal to a more diffuse, third-person perspective, as might be accomplished by shifting the locus of control, facilitates wiser reasoning and better collective problem solving (Grossmann, Brienza, & Bobocel, 2017 Grossmann & Kross, 2014), which Hobson and colleagues argue is part of the entire purpose of ritual activity, and is, to an extent, the point of magical practice to begin with.

Ritual attempts to facilitate the development of connectedness, primarily to others, but it can be adapted to facilitate cultivation of a connection to the transcendent. This theme of the development of connection brings us to one final component of magical traditions currently under scientific investigation: psychedelics. Carhart-Harris and colleagues (2018) have argued that one possible contributor to the recent boom in interest in psychedelics is that participants report feeling an intense sense of connection after ingesting the drugs, to others, to themselves, and to the world in general. The ritual ingestion of mind-altering substances, from blessed or holy wine to entheogenic compounds, is a common feature of ritual practices as a way to facilitate altered states of consciousness. These include the out of body experiences and alterations of the body schema we have previously discussed, as well as visions of the divine, apparitions, and potentially prophecy. These will be explored further in the next section.

Shamans and Mystics and Magic, Oh My

The study of psychedelic compounds makes it difficult for us to ignore the undeniably magical nature of their use. With only several administrations, compounds like MDMA, psilocybin, LSD and DMT seem to be able to accomplish in months what no other treatments have

been able to in decades, in a range of disorders such as treatment resistant depression, anxiety, obsessive compulsive disorder, and addiction (Carhart-Harris et al., 2018; Dos Santos, Bouso, Alcázar-Córcoles & Hallak, 2018; Moreno et al., 2006). The phenomenology of these states, even within a clinical scientific context, is exactly what would be expected from magical practice. Out of body experiences, encounters with God, visitations by the dead, prophetic visions and more will reliably occur while under the influence of psychedelic compounds.

Carhart-Harris and Friston (2019) propose a model for the efficacy of psychedelics which adds weight to Asprey's idea that atypical experiences, such as the out of body experience, can be learned by altering expectancies and priors. Within a framework they call REBUS (Relaxed Beliefs Under Psychedelics), the authors claim that "psychedelics work to relax the precision of high-level priors or beliefs, thereby liberating bottom-up information flow". Psychedelics seem to offer a shortcut to the process of retraining expectations to enable atypical experience that Asprey describes, through a neurocognitive mechanism that seems to be mediated by 5HT_{2A} receptor agonism. It is perhaps no surprise that at all times where psychedelic compounds have been incorporated into cultural practice, have been employed for the purpose of mysticism, magic and healing. When they have been applied to healing, this healing has been magical in nature. Saints or deities are invoked, spirits visit the sick or the healer, lessons are learned through visions, energy is purged, sometimes physically through vomiting. Further, psychedelics can provide a temporary enhancement of the traits that make for an aptitude in magic, namely absorption and suggestibility. This has the effect of opening up the efficacy of magical practices and techniques to people who may otherwise have a hard time accessing them. Thus, psychedelics can provide an interesting tool for studying the potential for training people in what have often been known as the "magical" arts.

Our discussion of psychedelic compounds would be incomplete without recourse to the character of the shaman. The so-called psychedelic renaissance of recent years has opened an unprecedented market for the services of these practitioners of magic. The shaman is an expert in improvisational phenomenology, making use of a variety of ritual instruments (smokes, smells, costume, music) to operate upon a person's psyche. This is, of course, made much easier by the application of psychedelic compounds such as Ayahuasca, *Bufo Alveris*, peyote, or other chemical tools, which put a person in a dream-like state (Timmerman et al, 2018, Kraehenmann et al, 2017) and enhance absorption (Polito & Stevenson, 2019) and suggestibility (Carhart-Harris et al, 2015) in certain populations. Psychologists and neuroscientists currently studying treatments that make use of psychedelic compounds always emphasize that it is not just the drug alone that is effective, it is the drug plus the preparation, support, and integration offered by the care provider that actualizes the potential efficacy of the drug. A recent study (Renelli, 2018) assessed the experiences of people with eating disorders who sought out healing through the ritualistic use of Ayahuasca (a plant based mixture involving DMT). Participants reported that they were able to access feelings of self love and appreciation in a way that they weren't able to with traditional treatment methods for their condition. As one participant puts it,

“The medicine [ayahuasca] worked with my body, and my soul, my spirit on a deeper level than any other doctor ever could have. “ (Renelli, 2018).”

Perhaps the technologies of magical practitioners have something to offer if only one takes them seriously. Again, claims about the efficacy of certain approaches can be tested, and given the framework of this paper, it is reasonable to claim that an effort should indeed be made to test them.

It is, as we have already stated, entirely possible to preserve the practical methods devised by the practitioners of magical arts, while also explaining those methods through empirically grounded psychology. Research into psychedelic compounds and their therapeutic uses is progressing along a number of different directions, but at least one of these is already taking on a rather magical shape. The guidelines from Watt & Luoma's (2019) *Accept, Connect, Embody Method*, provide instructions for those undergoing psychedelic-assisted psychotherapy to dive into an ocean within, recover a hidden pearl, and to make a promise about how the pearl will be honoured with a change in actions.

An imagery-oriented journey into the depths of mind to retrieve a hidden pearl has all the marks of a magical method. It is not much of a stretch to imagine that adding other ritualistic tools (drumming, chanting etc.) could enhance the efficacy of a treatment like this. Indeed, music is well known to predict positive outcomes from psychedelic assisted psychotherapy (Kaelen et al, 2018), which has inspired neuroscientists like Mendel Kaelen, to develop techniques for using “experience as medicine” (Kaelen, 2017). As the previous description of the shaman as an “expert in improvisational phenomenology” implies, this is precisely what such a practitioner has always been doing.

Discussion

In the above sections, we have made the argument that much of what has been historically referred to as “magic” (and therefore dismissed as pseudoscience) is in fact already the subject of several burgeoning or high-profile research programs, meeting high standards of rigor and replicability. In order to make the case that “magic” is a term that should be incorporated into a scientific lexicon, we must make the case that there is something useful about that word. It is not enough to say that a thing called “magic” exists. It is possible to call many extant things useless

names. A book may be properly called a codex, but it offers nothing useful in a contemporary context unless one is simply seeking intellectual self-indulgence. If this paper is to be more than an exercise in intellectual self-indulgence, the burden of proof is on us to demonstrate that there is a uniquely pragmatic application for the term “magic” as we have discussed it here.

The Pragmatics of Magic as a Technical Term

The word magic, as we define it in this paper, offers a parsimonious way to group a collection of human experiences and practices for producing and navigating those experiences. Experiences of these kinds present a unique method for learning, personal growth, and fostering community cohesion. Developing magic into a technical term is part of a much needed integration of a number of areas of study, including the study of mystical experiences, meditation, the cognitive science of religion and more. Not only does the term magic allow us to more readily understand and study a collection of human experiences and practices, retaining the connection to historical use allows us to plumb the historical record to develop practices that can bring about reliable changes in how people think and act. Anthropologist Susan Greenwood, for example, argues that “magic” is a particular way of thinking that enables creative problem solving and argues for the psychological utility of such acts as “becoming an owl” (2013).

Referring to magic in this sense also gives us a Turing Test equivalent. In cognitive science and artificial intelligence, the Turing Test (Turing, 1950) is a test of the indistinguishability of an artificial intelligence from a human or other sapient being. If the success condition for cognitive science is the making of a mind, the success condition for a science of magic is the making of a magician. By this reasoning, a hypothetical magician trained in a naturalistically grounded practice of magic should be equally as skilled as a magician trained in a traditional setting. Should a

naturalistically trained magician eventually be capable of the same feats of “improvisational phenomenology” as the student of a traditional lineage, a cognitive science of magic can be said to have succeeded.

Acknowledging Problems with Defining Magic

As discussed in previous sections, the term “magic” is inherently intercategorical, crossing at times into mysticism, religion, or spirituality in general. So the question arises: If the domain of study does not exhibit systematic import, forming a distinct category of its own, can you have a science of it? Our response to this is as follows: the domain of things that have been referred to as magic is intercategorical, yes, and therefore by definition cannot form a stable category on its own. However, as previously discussed, we are limiting and specifying our use of the word “magic” not to a domain of effects or explanations given for various phenomena, but to magic as a historically and anthropologically defined skillset. Frazer made this same distinction between the theoretical and practical sides of magic in the *Golden Bough*. While elements of the skillset are used by mystics, priests, and even advertisers, this does not cause problems for referring to the skillset in its entirety as “magic”.

We acknowledge that even given these reasons, the reader may be hesitant to admit magic into the scientific lexicon, if for no other reason than that the term “magic” is already in use by the nascent research program that examines prestodigitation (Kuhn, Amlani, & Rensink, 2008). To this hesitant reader, we would like to offer an alternative terminology: thaumaturgy. Thaumaturgy, or “wonder-working,” is the name given to the miracle-working capacities of various saints, as well as used in English writing as a way to refer to the supernormal abilities of Buddhist and yogic adepts. As a term it serves as a workable synonym for magic, with which it has a reasonably long-

standing terminological relationship through the Hermetic and Kabbalistic traditions, wherein the line between “magic” and “religious mysticism” blurs considerably (Versluis, 2007). As such, referring to what we have called “magic” through the length of our argument as “thaumaturgy” achieves most, though not all, of our ends in using the term “magic” as such, and we invite the reader to re-read, or in the future reference, the concepts in this paper with the term “thaumaturgy” acting as a substitute for “magic.”

Conclusions

The present paper has argued, in contrast to previous lines of thought from psychology, sociology, and anthropology, that the study of magic in its disparate components is alive and well in the mental sciences, though called by other names, such as absorption, the body schema, meditation, hypnosis, and ritual. We have also argued for the potential theoretical and empirical utility of reuniting these lines of inquiry under an overarching banner. Doing so, we argue, would allow for the study of the psychological phenomena behind esoteric practices in full spectrum, rather than the current focus on the single pole of mystical experiences. As Versluis (2007) argues, magic and mysticism are two ends of a continuum. It makes little sense to study one without studying the other, and in the research programs and theories reviewed above, we find the sources and methods of a cognitive science of magic, fully realised and readymade.

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