Imagining the Impossible

Magical, Scientific, and Religious Thinking in Children

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The Nature and Function of Sympathetic Magical Thinking

CAROL NEMEROFF AND PAUL ROZIN

Although the word magic is common in both scholarly and lay discourse, the variety of things to which it refers is far-reaching, ranging from a social institution characteristic of traditional societies, to sleight-of-hand or parlor tricks, to belief in unconventional phenomena such as UFOs and ESP, to sloppy thinking or false beliefs, and even to a state of romance, wonder, or the mysterious. One must at least entertain the possibility that there is no true category here at all. Instead, the term ''magic'' in current usage has become a label for a residual category – a garbage bin filled with various odds and ends that we do not otherwise know what to do with.

Yet to relegate ''magic'' to this status seems to us to be throwing out the baby with the bath water. Certain meaningful consistencies can be gleaned from a careful review of the historical and current approaches to magic, including our own recent empirical studies of ''magical thinking.'' We turn now to a review of these approaches, with an eye toward outlining a working definition of magic. This is followed by a review of our empirical studies to date and some speculations, based on current thinking in diverse fields, regarding the origins, functions, and implications of magical thinking.

Current conceptualizations of magic in Western society are heavily based on the writings of a long line of anthropologists, sociologists, and historians. These include works from the last century by scholars Tylor (1879/1974), Frazer (1890/1959), Mauss (1902/1972), Durkheim (1915/1965), Levy-Bruhl (1923), Malinowski (1955), and others, as well as more recent writings by, for example, Evans-Pritchard (1937/1976), Horton (1967), Tambiah (1990), and Thomas (1971). In our own work we have attempted to derive a framework that can usefully direct empirical explorations of magic.

Classical Definitions and Distinctions

The classical scholarly view of magic centers on a tripartite division between magic, religion, and science, with magic defined as the most primitive of these institutions. Over time, as man's causal thinking has rid itself more and more of false and mystical elements, religion was born, and eventually science. Magic is seen as false or failed science, and its primary flaw is its assumption that the world of reality functions according to the same principles as our thoughts.

From the classical view we take two major components of our working definition of magic: (1) Magic does not make sense in terms of contemporary understandings of science, and (2) magic typically relies on subjective evidence and involves a conflation of internal and external worlds. We discard, however, the notion of an evolutionary sequence from magic-to-religion-to-science, based primarily on our own evidence of the abundant presence of all three simultaneously in modern Western societies and in the thinking of individuals within those societies (see Thomas, 1971). We also discard the notion of defining magic based on its real-world efficacy or lack thereof. Today's magic sometimes becomes tomorrow's science (as with germ theory), and today's science is sometimes tomorrow's magic (e.g., phlogiston).

The writings of Malinowski (e.g., 1955) provide another key element for our conceptual framework. In his view, magic is a misguided attempt to gain control over nature, applied primarily in cases where technology alone is insufficient to control uncontrollable forces. Although he also agreed with Frazer and Mauss that magic was *false* science – a notion that we have already rejected as a defining feature of magic – Malinowski contributes two critical new ideas to our thinking. The first is that people may comfortably employ multiple modes of thinking and action, blending ''scientific'' with ''magical'' approaches in a complementary fashion. The second is that magic is not simply the result of sloppy thinking, but instead may serve important functions, even when it ''fails'' from a scientific standpoint.

Tambiah's (1990) recent writings on magic provide us with an important clarification of this latter point. Tambiah asserts that many magical acts or components of them are not in fact aimed at accomplishing concrete efficacy, but aim instead for dramatic effect. Their success is most appropriately gauged in terms of whether they effectively serve to create a meaningful structure – whether in terms of social convention, solutions of existential problems, or intellectual

puzzles. Thus magic serves important functions but operates on a different wavelength from science. We add our own speculation that magic may have evolutionarily adaptive value. In short, we consider magic as worthy of respect as an important and potentially beneficial human function.

Sympathetic Magic

Within the general framework described above we have chosen to focus our own work on a subset of magic that is more or less prototypical and unambiguous in its ''magical'' status, namely, sympathetic magic. Sympathetic magic is characterized by three basic principles: the *law of similarity* (homeopathic magic); the *law of opposites* (the ''inverse'' of similarity and generally considered a subcase of it), and the *law of contagion* (contagious magic) (see Frazer, 1890/1959; Mauss, 1902/1972; Taylor, 1879/1974). It is also characterized by the concept of ''mana,'' which can be described as the driving force, or essence, that travels along the lines determined by sympathy. We see the sympathetic magical laws and mana as comprising the core of the ''magic'' category. Abstracted from magical rites and beliefs from cultures worldwide (Frazer, 1890/1959), they were considered to be basic and universal features of ''primitive'' human thought. We tentatively agree with this premise (Frazer, 1890/1959; Mauss, 1902/1972).

Similarity may be summarized as ''like produces like'' (Frazer, 1890/1959), ''the image equals the object'' (Mauss, 1902/1972), or, more generally, ''appearance equals reality;'' it rests on the premise that things that resemble one another at a superficial level also share deeper properties. A prototypical example of similarity is the voodoo practice of burning a representation of an enemy to cause the enemy harm. Action on the image is believed to result in effects on the object that it represents. The law of opposites has the same form and content as similarity but relates opposite and opposed to similar entities.

The law of contagion is more complex. We begin by identifying one object as a source and another object as a target or recipient. The law of contagion holds that *physical contact between the source and the target results in the transfer of some effect or quality (essence) from the source to the target*. Qualities may be physical, mental, or moral in nature, and negative or positive in valence. When qualities and their effects are negative in valence, the terms ''contamination'' or ''pollution'' apply, while positive effects are sometimes referred to as ''transvaluation.''

Effects may be symmetrical, in that the same object, in the same contact, may act as both a source and a target. Furthermore, the contact between the source and the target may be direct, or it may be mediated by a third object (''vehicle'') that contacts both the source and the target, either simultaneously or successively.

Critical to the law of contagion are the ideas that the *transfer of essence establishes a continuing ''sympathetic connection'' between the target and the source* (hence the summary description ''once in contact, always in contact;'' Mauss, 1902/1972) and that *essence contains all of the important properties of the source* (''the part equals the whole;'' Mauss, 1902/1972). Following contact the target is changed in the direction of being more like and/or more connected to the source. In the case of a negative source, the target is contaminated, debased, or otherwise harmed. In the case of a positive one, the target is purified, elevated, or otherwise benefited. The continuing connection allows for the possibility that action taken against a vehicle or even against the target will affect the source. Thus typical examples of contagion include the voodoo burning or defacing of a garment, lock of hair, or fingernail parings from an enemy to effect some negative influence on him or her. Obviously there are real-world, scientifically validated instances of contagion, most notably germ and illness transmission. However, ''magical'' contagion is far broader than its scientific counterpart in terms of what may be transmitted and how.

Magical contagion shares two key characteristics with magical similarity. First, both involve a conflation of the internal/subjective and external/objective worlds. In similarity, perceived resemblance is taken to reflect a deeper level identity between two objects (or between an object and its representation). In contagion, the most relevant feature of a source – in the mind of the perceiver or practitioner – is what is believed to be transmitted; furthermore, both properties and modes of transmission may be metaphorical. Second, both similarity and contagion depend on the notion of a shared essence (''mana''), between the object and the representation in similarity, and between the source and the target in contagion.

Mana, then, may be understood as pure efficacy or identity (hence ''essence''). It is the driving force behind the effects, the stuff that travels along the routes laid out by similarity and contagion.

A Working Definition of Magic

To summarize, our delineation of magic is comprised of the following elements:

1. Magic is an intuitive, and possibly universal, aspect of human thinking. As corollaries, (a) magic is defined in terms of a belief or set of related beliefs, and (b) these beliefs may be held at different levels of explicitness, ranging from spontaneous, vague, ''as if'' feelings, all the way to explicit, culturally taught beliefs.
2. Magic generally does not make sense in terms of the contemporary understanding of science.
3. Magic typically relies on subjective evidence and involves the assumption – whether explicit or implicit – of correspondence or conflation between the subjective, internal world and the world of reality.
4. Magic may serve important functions (e.g., cognitive, emotional, social, or adaptive functions.)
5. Magic in its most prototypical form involves the sympathetic principles of similarity and contagion, and the notion of an imperceptible force (essence) that drives, carries, or provides the mechanism for effects.

These elements can be loosely summed up as: Magic is a cognitive intuition or belief in the existence of imperceptible forces or essences that transcend the usual boundary between the mental/symbolic and physical/material realities, in a way that (1) diverges from the received wisdom from the technocratic elite, (2) serves important functions, and (3) follows the principles of similarity and contagion.

Sympathetic Magical Thinking

Our research on the laws of sympathetic magic was stimulated by the observation that the contamination properties of disgusting stimuli, for Americans, manifested themselves according to the laws of sympathetic magic: Replicas of disgusting objects are treated as disgusting (similarity), and brief contact between disgusting entities and acceptable foods renders those foods disgusting (contagion) (Rozin, Millman, & Nemeroff, 1986). In fact, Rozin and Fallon's (1987) definition of disgust included the contagion feature. Subsequent work has estab-

lished that both laws of sympathetic magic operate in a salient and frequent way in the thinking of educated, Western adults. In the following sections we will provide evidence for this claim and analyze the properties, origins, and functions of the two laws.

The Law of Similarity

In a first study Rozin, Millman, and Nemeroff (1986) demonstrated various reactions consistent with the law of similarity among American undergraduates. In the domain of disgust, most participants showed a preference for a normally shaped piece of fudge over fudge shaped like dog feces. Many were far less willing to hold fake ''vomit'' made of rubber in their mouths than a clean new rubber sink stopper. Examples of similarity in the interpersonal domain included poorer accuracy in throwing darts (aiming between the eyes) at photographs of good (e.g., John F. Kennedy) or imagined liked persons, relative to evil (e.g., Adolph Hitler) or imagined disliked persons.

Rozin, Millman, and Nemeroff (1986) and Rozin, Markwith, and Ross (1990) also explored the phenomenon of nominal realism, identified by Piaget (1983) as a feature of thinking in young children. Nominal realism involves the child's failure to appreciate the arbitrary relationship between a word and its referent. Rather, toddlers assume that the name of an entity carries its very nature within it (i.e., the name/image equals the referent/object). We demonstrated this in undergraduates, who saw two empty, clean bottles and watched while some sugar powder from a commercially labeled sugar box was poured into each. The participant was then given two labels, one with ''sucrose'' written on it and the other with ''sodium cyanide, poison'' written on it. Participants were instructed to attach one label to each bottle, as they preferred. After powder from each bottle was stirred into a separate glass of water, participants were asked to rate their willingness to take a sip from each glass, and then to do so. Many were reluctant to drink from the glass with the cyanide-labeled sugar in it, and there was a significant preference for the sugar-labeled bottle (Rozin, Millman, & Nemeroff, 1986; Rozin, Markwith, & Ross, 1990). Participants acknowledged that their negative feelings were unfounded, in that they knew only sugar was in both glasses. In a subsequent study it was shown that this similarity-based rejection occurred even if the ''cyanide'' bottle was labeled ''not sodium cyanide, not poison'' (Rozin, Markwith, & Ross, 1990), potentially sup-

porting Freud's (1920/1966) claim that the unconscious does not process negatives.

These demonstrations raise a particularly important issue in the study of magical thinking, namely, that notions of magic may exist at different levels of awareness and explicitness, depending on the individual, situational, and cultural contexts. Thus magical responses can range from a spontaneous, ineffable, intuitive sense of connection between things, all the way to an explicit, rationalized, culturally supported belief in such a connection.

The similarity magic mode of thought seems ''primitive,'' and indeed Flavell (1986) has shown that a confusion of appearance and reality characterizes the thinking of young children. Similarity magic is related to the principle of generalization. This is a property that, appropriately constrained, is fundamental to survival across species, because even the same thing rarely looks exactly the same from moment to moment, and different exemplars of a category usually differ to some extent. Thus treating appearance as reality, as young children have been shown to do (Flavell, 1986), or ''like as like,'' is generally very useful. This strategy occasionally goes awry in nature (as in cases of mimicry), but goes awry more often in *Homo sapiens*, where three- and two-dimensional images of real objects are commonly produced, and where symbols are often utilized. The possibilities for magical similarity are abundant in humans largely because of the world of artifacts (words, symbols, images, etc.) that humans have produced.

The Law of Contagion

In a sense, contagion is the opposite of similarity. Contagion holds that things are often not what they seem. Rather, their history, which is not necessarily manifested in their appearance, constitutes an essential part of them. Contagion has to do with what and whom we wish to merge with, versus separate from, in the world. Contact with a host of negative things, including unknown strangers, malicious others, their possessions or bodily residues, death, and physical ''corruption'' of any kind (e.g., rotting matter, most insects, and virtually any other disgusting item), is felt to be physically endangering and/or morally debasing to the self. Contact with a smaller set of positive things – loved ones or kin in a nontabooed relationship, personifications of goodness or holiness (e.g., Mother Theresa), or their possessions or residues, can be felt to enhance or elevate the self. Proscriptions, ta-

boos, and various forms of physical and symbolic purifications are utilized cross-culturally to manage negative contagion, while mementos, tokens, and avoidance of purification are used to maximize positive effects. We will first review magical contagion, and then examine the characteristic conflation of moral and physical realms, the basic principles of contagion, and typical ways of managing and conceptualizing it.

Contagion operates very powerfully in the food domain, within both traditional and modern cultures. Rozin, Millman, and Nemeroff (1986) demonstrated this with young adults. In one manipulation, a dead, sterilized cockroach was placed in a glass of the participants' preferred flavor of juice, and then removed. A strong aversion to drinking juice of a preferred flavor after it had been ''roached'' in this fashion was demonstrated.

There are abundant examples of food contamination of this sort. The contaminants are typically disgusting (rotting things, contact with a disliked person) or dangerous (contact with something that is toxic at high levels). Thus, people are reluctant to consume juice that had sodium cyanide added, at a dose level 1/1000 of the lethal level, a level that will have no harmful effects (since cyanide is not a cumulative poison), and a level that is common in everyday foods.

If contagion is based in contact, ingestion is certainly the most intimate form of contact – namely, the complete incorporation of an item into one's body. In a very concrete sense, the mouth is the principal incorporative organ, where almost all of the material transaction between self and world occurs, and ingestion is a major activity and concern of humans (Rozin, 1996). The mouth serves a particularly important function for omnivores as the final checkpoint where toxins can be distinguished from foodstuffs and rejected. It is small wonder that disgust is such a powerful emotion, or that food taboos are so common and important cross-culturally – or that the magical maxim ''you are what you eat'' can be identified cross-culturally (Frazer, 1890/1959; Nemeroff & Rozin, 1989). This principle states, in brief, that one will take on the properties of the things one ingests. For example, Meigs (1984) cites the belief of the Hua of Papua New Guinea that young male initiates should eat fast-growing leafy green vegetables to help them grow fast.

Nemeroff and Rozin (1989) looked for evidence of belief in ''you are what you eat'' among American undergraduates, creating scenarios of two fictitious cultures within which was embedded information

about the foods typically eaten by members of each culture. There were two versions of each scenario (the Asch impressions technique), which were identical *except* for the specific food staple identified as eaten by culture members. The Chandoran islanders were described as hunting both marine turtles and wild boars, but in version 1 the turtle was a favorite food and the boar hunted only for its tusks. In version 2 this was reversed, with the turtle hunted only for its shell. Participants read the description, and then rated the average Chandoran on an adjective checklist including items descriptive of boars and turtles (e.g., hairy, aggressive, good runners). Boar eaters were rated as more boarlike than turtle eaters. In a replication of this effect, the Hagi were either vegetarian but hunted elephants to sell their tusks, or consumed elephant meat but grew vegetables to sell. Elephant eaters were rated more animal-like in general, and elephantlike in particular, relative to vegetarians. Although the pattern of ratings was clear, the magnitude of individual effects was small and the belief seemed to operate at an implicit level. That is, few of our participants would have admitted to, or been aware of, holding such beliefs.

The idea that one takes on properties of the things one ingests is not preposterous. It is in accord with daily experience; generally, when two entities combine, the product shows characteristics of both entities. In a few cases, you are what you eat actually holds true: Ingestion of high levels of orange-colored (beta-carotene containing) foods may lead to an orange-pigmented skin; similarly, ingestion of high fat foods may lead to becoming fat.

Given the power of magical contagion to elevate or debase the self, and the potency of ingestion as a form of contact, it is hardly surprising that food and the act of eating are almost universally moralized. A familiar example is the quasi-moral attitude to obesity and ''bad foods'' in many segments of American culture. In an American version of ''you are what you eat,'' Stein and Nemeroff (1995) asked undergraduates at a southwestern university to identify several ''good'' and ''bad'' foods and explain what made them so. Their answers were cast in terms of the healthiness and fatteningness of foods. New students then read one of two scenarios describing a fictitious undergraduate. The scenarios were identical except for the foods usually eaten, which were ''good'' in one case (e.g., fruit, salad, chicken) and ''bad'' in the other (e.g., steak, french fries, doughnuts). After reading one version of the description, the students rated the target person on an adjective checklist that included a series of moral traits. Good food eaters were

seen as strikingly more moral than bad food eaters. Contagion beliefs, specifically, ideas about moral and/or physical pollution resulting from ingestion of the foods, accounted for much of the moral-food effect.

The contagious world view assumes a notion of ''self'' that is both shed continuously (therefore, contagious and potentially polluting) and permeable to outside influences (therefore, potentially vulnerable), particularly at the apertures of the body (mouth, nostrils, etc.) (Rozin, Nemeroff, Horowitz, Gordon, & Voet, 1995). Noting that eating disorders are characterized by identity deficits on the one hand, and a strong tendency to moralize food on the other, Schupak-Neuberg and Nemeroff (1993) speculated that contagious thinking might play an important role in bulimia nervosa. They hypothesized that (1) bulimics binge in part to obliterate their sense of self by flooding it with outside ''stuff;'' (2) purging helps to expel a sense of negativity or pollution from the body-self; and (3) bulimics should be hypersensitive to contagion scenarios in general, not just those pertaining to food. In a questionnaire study comparing bulimics with binge eaters and normal controls, all of these predictions were supported. A follow-up study comparing anorexics with restrained eaters (dieters) and controls (Nemeroff, Schupak-Neuberg, & Graci, 1996) is producing similar findings with regard to general avoidance of contagious contact.

Microbial contamination can be viewed as an empirically validated subcase of magical contagion, wherein an influence (i.e., illness) is transmitted from a contagious source to a recipient through contact that allows a contagious entity (in this case, microbes) to travel from one to the other. It is possible that the danger of microbe-borne physical illness, particularly via the mouth, is the original domain of contagion. Some of the basic properties of contagion (particularly contact and dose insensitivity, described below) make adaptive sense with respect to infection. Part of the contagion of decayed food may be attributed to an appropriate fear of illness, as can the contaminating value of many insects, other people and their residues, and contact with a dead body (e.g., Rozin, Markwith, & McCauley, 1994). Many illness sources have disgust properties, including food, body products, poor hygiene, body malformations, and death (Rozin et al., 1993). However, in the pure case of presence of microbes, the contagion fear seems directly linked to the threat of physical illness, rather than disgust.

A principal domain of both disgust and contagion is other people (Nemeroff & Rozin, 1994; Rozin et al., 1993; Rozin, Markwith, & McCauley, 1994). Generally, people other than those in one's immediate family and friendship group are treated as negative entities, at least with respect to the prospects of contact. For example, in the United States and Japan, there is a marked reluctance by many people to wear used clothing. Of course there is a special positive value – and positive contagion – about direct or indirect contact with highly admired persons; this is reflected in the monetary value of clothing worn by famous people, or their possessions.

Questionnaire studies of undergraduates confirm the high negative value of contagious contact with negative others (e.g., disliked or unsavory persons) and an apparently weaker and less universal positive value of contact with respected or loved others (Nemeroff & Rozin, 1994; Rozin, Nemeroff, Wane, & Sherrod, 1989). Undergraduates often show an aversion to wearing laundered clothing worn once for a brief time by an unknown healthy person (in comparison to new, otherwise identical items) (McCauley, Markwith & Rozin, 1997, Rozin, Markwith, & McCauley, 1994). While this negativity is not shown by everyone, a stronger negativity is shown by virtually all participants if negative information about the former wearer is communicated. For example, if a sweater was worn (for one hour, followed by laundering) by someone who experienced a misfortune (e.g., an amputated leg), had a disease (e.g., tuberculosis), or had a moral taint (e.g., a convicted murderer), there is usually a strong aversion to wearing the sweater. Similar results are reported for objects other than clothing (Rozin, Markwith, & McCauley, 1994).

It is worth noting, considering the centrality of germs and illness in contagion, that illness transfer in humans usually involves a human vector, and hence is interpersonal. Common vehicles are food, air, and shared objects and residues. Interpersonal contagion is manifested in the domain of food, because food is a highly social entity that is procured, handled, prepared, or eaten and shared with others. These multiple other contacts allow for widespread interpersonal contagion influences, no doubt enhanced by the particular intimacy of the act of ingestion. The ''you are what you eat'' principle, in the pure sense, would apply to other humans only for the rare cases of cannibalism. But when coupled with the principle of contagion, you are what you eat promises an enormous range for the passage of personal influence by food (Rozin, 1990).

Cross-culturally, one finds an extraordinary elaboration of interpersonal contagion. In Hindu India, for example, the caste system is maintained, in large part, by food transaction rules based on avoiding consumption of foods that bear contagious essences of lower castes (Appadurai, 1981; Marriott, 1968). Other forms of contact with lower castes are also shunned. There is a weaker, positive contagious experience that results from sharing food with close relatives or deities (via the donation of foods at a Temple).

The limits of the moral domain are fuzzy, at best. Consistent with our working definition of ''magic,'' we regularly find what we call moral/physical conflation (Rozin & Nemeroff, 1990), that is, extensive spill-overs from the hypothetically separate moral and physical domains. There is a large literature suggesting that physical afflictions, such as illness, are interpreted in moral or quasi-moral terms by individuals in many cultures (reviewed in Brandt & Rozin, 1997). For example, the extent of an aversion to wearing a convicted murderer's sweater correlates substantially with the aversion to wearing the sweater of someone with an amputation, or tuberculosis (Rozin, McCauley, & Markwith, 1994). There seems to be a common, shared negative core to both moral and physical shortcomings.

This is not to say that moral contagion is indiscriminable from ''physical'' contagion. For example, for most people the moral contagious entity has somewhat different properties than the disease contagious entity; only the latter is effectively purified by washing or sterilization (Nemeroff & Rozin, 1994). However, in applying these models of contagious entities, about 15–30% of people ascribe a physical essence to negative moral sources (enemies or evil people) and/or think about illness (hepatitis, AIDS) in terms of a moral entity.

Failure to distinguish moral from physical causes can result in ''immanent justice'' beliefs. Immanent justice refers to the notion that one's behavior will inevitably lead to appropriate rewards or punishments – essentially, that God's judgment or ''cosmic justice'' will prevail. Such beliefs can make people feel more or less vulnerable to illness (illness representing ''cosmic punishment'') as a function of how personally guilty or innocent they feel. Nemeroff et al. (1994) explored the relative contributions of people's sense of guilt, their knowledge about how AIDS is transmitted, and their actual behavioral risk factors to determining how worried they felt about contracting AIDS. In this study, guilt actually accounted for more of the

variance in the worry measure than did the participants' knowledge and behavioral risk factors combined.

Interestingly, the effect was reduced when the ''worry'' outcome measure was replaced by a ''likelihood estimate'' as an outcome measure (i.e., ''how likely do you think you are to contract AIDS? . . .'' rather than ''how worried are you about contracting AIDS?''). Guilt predicted likelihood estimates far less than it predicted worry, and knowledge and behavioral risks proved to be the more powerful predictors for likelihood. We interpreted these discrepancies in terms of a ''head'' versus ''heart'' distinction. When one asks a question in emotion-laden terms – ''How worried are you?'' – one seems to be accessing an emotional or ''gut-level'' response system, which follows magical principles, and immanent justice is evoked. In contrast, when one asks a more cognitively/objectively worded question (as in a mathematical probability estimate) more ''rational'' processes come into play.

This same head versus heart distinction was found by Nemeroff (1995) in a study where the participants imagined themselves coming into brief contact with one of three people with the flu: a lover, an enemy, or a stranger. The participants rated the likelihood that they would get the flu from the contact, and then how sick they would get if they did contract it. They felt that they would get most severely sick from their enemy's germs and least severely sick from their lovers' germs (moral-germ conflation); but intriguingly, there were once again no significant differences in likelihood estimates.

Moral-germ conflation may provide an explanation for some of the high AIDS-risk behaviors engaged in by young adults who would otherwise appear to be fully aware of the dangers of unprotected sex. Young adults have been shown to draw a distinction between ''regular'' and ''casual'' partners in terms of their likelihood of using condoms with those partners. It has been unclear whether this is a reasonable strategy borne of AIDS-relevant differences between partner types (e.g., explicit agreements about monogamy, degree of knowledge of one's partner's sexual history, etc.) or the result of illusory feelings of physical safety based in a sense of emotional safety. Comer and Nemeroff (in press) demonstrated that, among undergraduates, perceived physical risk follows emotional safety rather than objective risk factors, apparently reflecting the belief that ''my lovers' germs won't hurt me, though a stranger's might well.''

The head versus heart distinction routinely comes up in laboratory studies on both contagion and similarity. Participants often acknowledge that their feelings (e.g., negativity toward a beverage touched by a dead, sterilized cockroach) are ''irrational.'' But they still do not want to drink the juice, wear the Nazi garment, or hear that their enemy has their hairbrush.

Principles of Contagion

We elaborate here on what we take to be the basic principles of contagion (Rozin & Nemeroff, 1990), based on evidence principally from our empirical work. We have typically included AIDS as a contagious entity in part because, in people's minds, AIDS involves a potent mix of infectious and moral factors.

In magical contagion, actual *physical contact* – whether direct or indirect – is critical in determining transmission. We have had participants rate, on a scale ranging from −100, the worst feeling you can imagine, to +100, the best feeling you can imagine, how they would feel about wearing a sweater worn (but not owned) for a day by someone with AIDS (and then washed), as opposed to a sweater owned, but never worn, by someone with AIDS (Rozin et al., 1992). The ratings are uniformly much lower for the worn sweater.

The effects of even minimal contact tend to be relatively *permanent*. We demonstrated this by having participants rate a sweater one day to one year after it had last been worn by someone with AIDS: 54% of the participants showed a flat function over time, and overall 92% of the one-day effect remains after one year. The results were similar with an eating utensil as the vehicle (Nemeroff et al., 1994; Rozin et al., 1992).

Magical contagion is isomorphic, in the metonymic sense of the part being equivalent to the whole. We have referred to this as the *holographic* property of essence, and noted that it results in relative *dose insensitivity* (i.e., even very brief contact is capable of transmitting substantial effects) and *route insensitivity* (i.e., any part of Hitler, from heart to fingernails, is equally evil and can transmit his evil). A sweater worn for only five minutes by a person with AIDS (and then washed) manifests a significant drop in desirability (Rozin et al., 1992). Participants rated their feelings about learning that a single live AIDS virus had entered their body as equal with 100, 10,000, or 1,000,000 viruses (one was as bad as one million). For route insensitivity, 43%

of the participants reported that there was no place at all on the body of a person with AIDS that they would feel comfortable touching, compared with the same places on the body of a healthy stranger (Nemeroff et al., 1994).

Ethnographic evidence, most strikingly from societies such as Hindu India (Appadurai, 1981) or the Hua of Papua New Guinea (Meigs, 1984) suggests that *negative contagion may be more prevalent and more powerful than positive contagion.* In India, while contact with a lower caste is polluting and diminishing, there is virtually no enhancement effect of contact with a higher caste (although various products of the cow – considered a lower order deity – including milk, urine, and dung, can be used as purifiers). American undergraduates on average show substantially stronger contagion effects for objects (sweaters, hairbrush, food) that have contacted negative interpersonal sources (an unsavory person or a disliked individual) than objects that have contacted positive sources (friends or lovers). Furthermore, while virtually all participants show negative contagion effects, only about one-third show positive contagion effects in these contexts (Nemeroff & Rozin, 1994; Rozin, Nemeroff, Wane, & Sherrod, 1989), even when they are allowed to select their own personalized, positive source person (e.g., Mother Theresa, Princess Diana) to ensure the best chance of identifying a potent one. This apparent *negative bias* may be based in adaptive considerations: Few things are as strongly positive as contagious illness or as negative as death.

Almost any type of property is considered transmissible in *magical contagion*, including physical attributes (color, growth rate), abilities (strength, coordination), and dispositions (personality characteristics, moral worth, and intentions). The basic principles of contagion seem to hold independent of the property.

In forward contagion, influence flows from a contagious source to a recipient in much the same way that germs are transmitted from an individual contagious with the flu to a new victim. *Contagion effects* can also occur in the opposite direction. Thus a target may cause harm to the source by burning a lock of the source's hair, or attract the source by placing it in a love potion. A questionnaire explored *backward contagion* beliefs among undergraduates by describing their own hairbrush (given away, and never to be seen again) or lock of hair coming into the possession of either an unsavory or disliked person, or a good friend or lover. Although the effects were small, there was clear evidence of feelings consistent with belief in backward

contagion, with about 30% of the participants showing some discomfort at the idea of negative people possessing these objects and about 37% showing some pleasure at the thought of friends or lovers having them (Rozin et al., 1989). The widely publicized reluctance of many Americans to donate blood since AIDS may be caused by backward contagion beliefs.

Mental Models of Contagion

We have noted that all sorts of properties, ranging from influenza to goodness or evil, are transmitted in magical contagion. While all of these properties follow the basic laws of contagion, we thought it possible that the ''mana,'' that is, the contagious essence involved, might be different for different types of properties. This concern motivated an intensive interview exploration of the psychological nature of the contagious entity.

Nemeroff and Rozin (1994) had participants imagine various source people coming into contact with several objects including a sweater, and then rate how they would feel about wearing the sweater after it had been ''purified'' in different ways – based on the logic that one can deduce the nature of the contagious entity by seeing what is most and least effective at undoing it. Sources included both positive and negative interpersonal ones (e.g., lover, good person, enemy, evil person); physical illness (hepatitis, AIDS); and disgust (dog feces). Purifications were physical (e.g., sterilize the sweater), symbolic (e.g., unravel or gash it), or ''spiritual'' (e.g., have Mother Teresa wear Hitler's sweater, to basically cancel out his ''vibes'' or ''soul-stuff'' with her own). Individual and averaged response patterns were compared to five possible models of contagious essences: germ, residue, symbolic interaction, associative, or spiritual essence models. The first two are both physical models, and differ primarily in terms of whether a living entity is involved (germ), as opposed to trace residues of substances that are not alive, such as sweat. The latter three are nonphysical models, with symbolic interaction referring to the meaning inherent in, or implied by, the particular interaction with the sweater (e.g., wearing Hitler's sweater as a statement supporting his views); association referring to the elementary notion of things being ''paired'' in one's mind (i.e., the ''reminding value'' of the sweater); and spiritual essence referring to Frazer's notion of personalized ''soul-stuff'' resid-

ing in the sweater (perhaps analogous to new-age ''vibes,'' as well as to the ''causal essence'' discussed by Gelman & Hirschfeld, 1999).

On average, the residue model was the best match for all physical sources (i.e., illness and disgust) while the three nonphysical models were better matches for all interpersonal sources (including all positives). Thus, there seem to be at least two broad models of contagious essence: One is material and is effectively moderated by washing; the other is nonphysical, is reduced much less by washing, is very difficult to erase, and is most effectively reduced by opposite valence contact.

Individual Differences in Contagion

The thirty-six participants in the above study on contagious essence (Nemeroff & Rozin, 1994) did not think uniformly about contagion. Only about two-thirds behaved as described on average, with a material type of essence for illness sources and a spiritual type of essence for interpersonal-moral sources. However, one-sixth of the participants seemed to employ a spiritual essence model for all types of contact, and another sixth employed material essence models for all types of sources. Besides such variations in the quality of the contagion, there are large individual variations in sensitivity to contagions. This was gauged initially by a twenty-one-item measure of contagion sensitivity (Rozin, Fallon, & Mandell, 1984). Interestingly, parents' scores correlate significantly with their children's scores. More recent results, based on a more sophisticated, reliable, and valid instrument (the D-scale; Haidt, McCauley, & Rozin, 1994; see also Rozin, Haidt, McCauley, Dunlop, & Ashmore, 1997) confirm wide variability in contagion sensitivity across a number of different American samples. In general, sensitivity is higher in females than males.

Managing Contagion: Framing

The world is filled with contagious entities, especially negative ones, such as traces of unknown, other human beings. Every piece of money or doorknob is a veritable storehouse of interpersonal contagion. An attentive, contagion-sensitive person could be literally crippled into inaction by the prospects. Yet, even in highly contagion-conscious cultures, like Hindu India or the Hua of Papua New Guinea, life goes on. Two fundamental mechanisms seem to be at work to contain

contagion. One has to do with the establishment of ritual boundaries to limit low levels of contagion, and related ritual purifications to eliminate contagious effects. A particularly clear ritual boundary is the one-sixtieth rule of Kashrut, relating to the contamination of kosher foods by nonkosher entities (Nemeroff & Rozin, 1992). According to this rule, if contamination occurs by accident and the contaminant is less than 1/60th of the total volume of the contaminated entity, the food remains kosher. A second, more mundane way to cope with contagion threats is through framing and associated attentional effects. Thus, most Americans just do not think of the past interpersonal history of the doorknobs or the money that they encounter. Here, there are substantial within and between-culture differences. For example, the contamination produced by the bottoms of shoes bringing outside filth into the home is salient for most Japanese, and not attended to by most Americans. On the other hand, Japanese traditionally share their bath water with family members and guests, while Americans find that offensive.

Development and Adaptive Value of Contagion

Contagion is a sophisticated idea, since it overrides appearances, and frequently invokes invisible entities. Since contagion involves the apparently rather complex notion of an imperceptible quality based in a history of contact, persisting in its effects over time, we do not find it surprising that very young children do not show contagion, per se. That is, although they may reject a disgusting source (e.g., a cockroach), and when just a bit older, reject an item that is currently in contact with that source, they will readily drink a beverage that has previously contacted a cockroach. Early work suggested that contagion in its full-blown sense becomes an active principle, at least in the domain of food and disgust for American children, at six to eight years of age (Fallon, Rozin, & Pliner, 1984; Rozin, Fallon, & Augustoni-Ziskind, 1985; 1986). More recent work on Australian preschoolers, using more sensitive measures, suggests that children as young as four years of age may show a degree of contagion sensitivity in the food domain (Siegal & Share, 1990), for example, rejecting moldy bread even if the mold is hidden by jam. No systematic research that we know of has been done to date investigating positive contagion in young children, but this may be a fruitful area for exploration, given the anecdotally common phenomenon of special objects of attachment

such as soft blankets or stuffed toys. Also, little is known as yet regarding how socialization, specific experience, and so on might contribute to the development of contagion sensitivity. However, assuming that contagion follows a development course similar to essentialism, the available research does not appear to support a major role for the direct teaching of the concept (see Gelman & Hirschfeld, 1999).

Contagion has an adaptive value in at least three domains. In the food domain, it protects against microbial infection, and perhaps against potent toxins as well. In the interpersonal domain, it also protects against the transmission of infectious diseases and serves an important function in the defining and maintenance of social boundaries between groups. Finally, contagion thinking is salient as a representation of kin relations and love bonds. With the exceptions of tabooed relationships or states (e.g., menstruation), close kin are generally less contaminating and may give rise to positive contagion, hence cementing closeness and commitment among related individuals. Sharing food, for example, is a common behavior that centers on kin-related groups, and sexual intimacy involves highly contagious contact.

Possible Origins of Magical Thinking

We believe that magical thinking is universal in adults; although the specific content is filled in by one's culture, the general forms are characteristic of the human mind. However, we have not yet addressed the question of the origins of such thinking. Historically, Tylor, Frazer, and Mauss saw magical similarity and contagion as based in the (psychological) laws of association of ideas, with the additional step of assuming that the external world followed the same pattern as one's thoughts. Freud (e.g., 1913/1950, 1920/1966) and Piaget (e.g., 1983) both discussed magic as a primitive level of confused thinking. Freud related it to the ''primary process,'' which he described as unconstrained by the objective world, and antithetical to linear, logical, and adaptive ''secondary process'' thought. Piaget construed it as based in a childlike failure to fully differentiate self from world, resulting in the tendency to mistake ideational connections for real ones. Both described magical thinking as more or less operating uniformly across content domains.

Modern theorists appear to be converging on the idea that magical thinking is a very natural and intuitive way of thinking, arising as a

natural by-product of the adaptive functioning of the mind. In the following section, we will review relevant ideas from theorists who have not explicitly related their work to magical thinking, as well as ideas from those working directly in this area.

Information-Processing Accounts of Magic

Although the field of cognitive psychology has not explicitly discussed or explored magical thinking, we can fruitfully apply a cognitive approach to similarity and contagion based on inquiries into the limits of human cognitive capacities. The main thesis of such approach begins with the claim that there are normatively appropriate strategies that should guide inferences pertaining to correlation and causality. A good deal of evidence has demonstrated that people underutilize these strategies and overutilize more primitive, intuitive ones in making daily life judgments. Two views (not mutually incompatible) have been presented to explain why we make these ''profound, systematic, and fundamental errors'' in judgments and inferences (Nisbett & Ross, 1981). The first claims that they are labor-saving devices allowing a limited cognitive system to take short-cuts (Kahneman, Slovic, & Tversky, 1982) while the second construes them as cognitive illusions, comparable to visual illusions that are the inevitable result of the structure of the system. As Nisbett and Ross (1980) note, the visual system generally works extremely well to extract a constant, interpretable, and useful visual world from a shifting morass of stimulus energies. However, because of the built-in strategies used to accomplish this, the system will inevitably be fooled under certain circumstances. Analogously, the cognitive system can be construed as having a particular architecture that works well for everyday purposes but will inevitably fail on occasion. Central to both the successes and failures of the cognitive system is the operation of judgmental heuristics, or ''rules of thumb.''

The representativeness heuristic (Kahneman, Slovic, & Tversky, 1982) results in the assignment of a case or event to a category based on the similarity of its principle features to other members of that category. One version of representativeness is the tendency to expect a cause to resemble its effects. Thus, if AIDS is incurable and lethal, highly menacing and tenacious, we are likely to consider HIV to be the same, so that information about its fragility outside the human