

205

# **HEURISTICS AND BIASES**

The Psychology of  
Intuitive Judgment

Edited by

**THOMAS GILOVICH**

*Cornell University*

**DALE GRIFFIN**

*Stanford University*

**DANIEL KAHNEMAN**

*Princeton University*

 **CAMBRIDGE**  
UNIVERSITY PRESS

2002

that a number of researchers have devised techniques to measure an individual's level of implicit racial prejudice (e.g., Dovidio, Kawakami, Johnson, & Johnson, 1997; Fazio, Jackson, Dunton, & Williams, 1995; Greenwald, McGhee, & Schwartz, 1998). Might these measures index an individual's propensity to engage in unconscious discrimination? Might they also be used some day in the legal arena?

Such a day is clearly not yet here because these techniques are in their infancy and their reliability, validity, and controllability are still an open question. Quite possibly these tests will have the same status as the polygraph, a tool of some interest to psychological researchers but of little use in courts of law. It is not inconceivable, however, that some day experts will administer implicit tests to a defendant to determine his or her level of implicit prejudice, just as clinicians now administer psychological tests to assess a defendant's mental health. Whether such a day will be a welcome one depends, of course, on the construct and predictive validity of the tests.

Even if valid implicit tests are developed, it may be that the nature of the human cognitive system precludes complete decontamination. If so, the best hope may lie in educating people about the causes of mental contamination so that they are able to (1) identify, after the fact, those cases in which contamination has most likely occurred; and (2) when possible, structure their decision-making environments so as to reduce the likelihood of contamination in the first place. This strategy has been met with some success in the domain of eyewitness identification (see Wells, 1993, for a review). Researchers have determined, for example, that some lineup procedures and configurations produce more mistaken identifications than others. By using this information when devising lineups, the police are able to reduce the number of "contaminated" identifications that occur. Of course, not all factors that influence the accuracy of eyewitness identification are amenable to control. The police cannot manipulate the quality of the viewing conditions under which the witness saw the perpetrator or whether the suspect looks familiar because the witness saw him earlier that day at the bus stop. In such cases, educating people – jurors, the police, attorneys, and perhaps even the witnesses themselves – about potential contaminants can help them determine the appropriate weight to give to an individual eyewitness' identification.

In sum, although we are pessimistic about people's natural ability to willfully control and correct their judgments, we are by no means suggesting that reducing mental contamination is a lost cause. Researchers are making promising advances in the detection of nonconscious biases and may ultimately devise some effective debiasing strategies. The challenges of eliminating contamination are great, but so may be the personal and societal costs of ignoring the problem.

## 11. Sympathetic Magical Thinking: The Contagion and Similarity "Heuristics"

*Paul Rozin and Carol Nemeroff*

### THE LAWS OF SYMPATHETIC MAGIC

The *laws of sympathetic magic* constitute a small but central subset of what might be called *magical thinking*. They share with the larger category that they promote beliefs about the world that are generally contrary to current scientific beliefs. However, unlike most other examples of magic, the laws of sympathetic magic do not necessarily invoke a sense of human or animate agency as a device to account for events in the world (see Nemeroff & Rozin, 2000; Tambiah, 1990, for a discussion of magical thinking in a broader context). In contrast to the larger category of magical thinking, the laws of sympathetic magic may be more tractable to experimental study for three reasons: (1) they are clearly defined; (2) they are present in abundance as modes of thought among contemporary people in developed societies; and (3) they invoke principles (e.g., contact, resemblance) that are easy to manipulate in the laboratory.

Edwin Tylor (1879), James Frazer (1895), and Marcel Mauss (1902) proposed three laws of sympathetic magic that they took to be universal principles of thinking. The *law of contagion* holds that "once in contact, always in contact": when objects make physical contact, essences may be permanently transferred. Thus, fingernail parings contain the "essence" of the person to whom they were previously attached, and foods carry the "essence" of those who prepared them. The *law of similarity* holds either that like causes like (causes resemble their effects) or appearance equals reality. 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 it represents. The *law of opposites*, which is not discussed further in this chapter, is the opposite of the first reading of the law of similarity, and holds that causes are the opposite of their effects.

On some important dimensions, contagion is the opposite of similarity. Similarity bears a relation to the principle of generalization, and surely is manifested in nonhuman animals; "appearance equals reality" is a very useful heuristic.

Preparation of this paper was assisted by NIDA grant R21-DA10858-0 to Paul Rozin, and grant #HS-038 from the Arizona Department of Health Services funded through the Centers for Disease Control and Prevention to Carol Nemeroff.

Contagion, however, holds that things may not be what they seem. Their history, which may not be represented in their appearance, endows them with important properties.

Recent psychological research on these laws dates from their involvement in the analysis of disgust. For Americans, harmless replicas of disgusting objects are treated as disgusting (similarity), and brief contact with a disgusting entity renders an edible food unacceptable (contagion) (Rozin, Millman, & Nemeroff, 1986). Subsequent work (e.g., Rozin, Nemeroff, Wane, & Sherrod, 1989) established that the laws of sympathetic magic characterize some types of cognitions, even among educated, Western adults. Thus, what has been generally interpreted as a peculiar feature of the thought of "traditional peoples" now appears to be a basic feature of human thinking.

The two laws we discuss qualify as cognitive heuristics; they are rules of thumb that generally work to make sense of the world and promote adaptive behaviors. Generally, causes do resemble their effects, appearance is usually a very good indicator of reality ("If it looks like a tiger, it is a tiger"), and some important entities, such as germs, do pass along some of their nature by virtue of physical contact. However, the laws differ from most of the now classic heuristics, such as availability and anchoring, in two critical ways: (1) invocation of sympathetic magical intuitions is typically associated with a substantial affective component; and (2) people are usually either aware, or can be easily made aware, of the "irrational" aspects of these laws. Thus, when educated Americans refuse to eat chocolate shaped into realistic-looking dog feces, or refuse to eat a food touched by a sterilized cockroach, they are acutely aware that this "makes no sense," yet acknowledge their feeling of aversion. They can often overcome this aversion and "be rational," but their preference is not to. They willingly acknowledge their feelings and respond to them, unless pressed. For instance, if the issue of avoiding a harmlessly contaminated object (as with a sterilized cockroach) or a similarity based aversion (e.g., reluctance to use sugar from a bottle labeled cyanide when the individual is certain the bottle contains sugar and never contained cyanide) is tied to money (e.g., "How much would you pay to avoid doing this?"), some college students who acknowledge uncomfortable feelings will perform the act rather than pay anything at all (Rozin, Grant, Weinberg, & Parker, 2000). In other words, money promotes leading with the head as opposed to the heart. Similarly, if one asks a question in an affective way (e.g., "How worried are you?") as opposed to a cognitive way (e.g., "How likely is it?"), one can either elicit magical thinking or not (e.g., Nemeroff, 1995; Nemeroff, Brinkman & Woodward, 1994). Thus, Nemeroff (1995) found that participants think a disliked person's germs are more virulent than a loved one's germs when asked an experiential question, such as, "How sick do you think you would get [from contact]?" However, the effect is not significant if they are asked instead, "How likely would you be to get sick?"

In Western developed cultures, there is more conflict than in traditional cultures between magical thinking and prevailing cultural beliefs, and perhaps a greater inclination to support feelings or beliefs with a logical/rational account. Thus, educated and less-educated Westerners and more traditional folk all experience disgust at the prospect of consuming road-kill dog meat. However, educated Westerners, after careful consideration of the situation, overrule their feelings to the extent that they hold that the feelings of disgust do not require a negative moral judgment (because no organism was hurt in this process), whereas less-educated folk are more inclined to move from the emotion or feeling to a moral judgment (Haidt, Koller, & Dias, 1993).

In one form or another, the laws of sympathetic magic have appeared in the theories of a number of scholars. Freud (1950) saw them as part of the primitive, intuitive mode of thought that he called the *primary process*. For example, Freud claimed that the primary process does not distinguish between hallucination and reality, somewhat akin to the law of similarity. Piaget (1983) identifies *magical thinking* as a feature of childhood, and describes the principle of *realism*, in which the symbol of something is confused with what it represents (similarity).

In line with both Freud and Piaget is the more general position that sympathetic magical thinking is an example of a set of natural and intuitive modes of thought. This idea has been developed in important ways in the contributions of Shweder (1977), Nisbett and Ross (1980), and the very productive line of research on heuristics and biases stimulated by Kahneman and Tversky (1979, 1984) and Kahneman, Slovic, and Tversky (1982). Along with this tradition and in keeping with Simon's (1982) principle of *satisficing* (using shortcuts that usually approximate ideal analyses), it is recognized that these intuitions, or *heuristics*, may be adaptive and function well in a wide variety of situations. Perhaps the shortcomings of these intuitive modes of thought have become highlighted by the creation of the modern world, laden as it is with images (two- and three-dimensional representations/imitations) that challenge the law of similarity, or scientific accomplishments that are hard to understand intuitively (e.g., who could ever imagine the speed of light, or risks of 1 in 1,000,000?).

## THE LAW OF SIMILARITY

### Two Versions of the Law of Similarity

*Like causes Like.* As described by Tylor (1879), Frazer (1895), and Mauss (1902), the law of similarity essentially holds that causes resemble their effects. For instance, the treatment for a disease should have some surface relation to the presumed cause of the disease, or the cause of the disease should have a surface relation to the symptoms of the disease. Thus, the Zande people of Africa believe that fowl excrement cures ringworm because fowl excrement and ringworm are similar in appearance. The modern medical predilection to assume (with little evidence) that dietary cholesterol is a causative factor in



accumulation of cholesterol-containing plaques in arteries might be considered another example of like causes like. This cause-effect likeness principle is at the foundation of the tradition of homeopathic medicine.

Shweder (1977) notes that the distinction between likeness and cooccurrence likelihood is frequently absent not only in magical thought, but also in "our own mundane intellectual activities" and concluded that "magical thinking is an expression of a universal disinclination of normal adults to draw correlational lessons from their experience, coupled with a universal inclination to seek symbolic and meaningful connections (likenesses) among objects and events." (p. 637).

"Like causes like" is related to the representativeness heuristic (Kahneman & Tversky, 1972). In accordance with "representativeness," an event or entity is assigned to a category based on the similarity of its principle features to other members of that category. If the category in question is causes and their effects, this reduces to like causes like. Thus, one manifestation of representativeness is the tendency to expect a cause to resemble its effects. For example, in current lay thought, it is believed by many that because AIDS is lethal and extremely resistant to attempts at cure, the infectious agent (HIV) should have the same potent and indestructible qualities. In fact, the virus itself is generally very fragile outside of an appropriate host, and usually not especially potent (a substantial dose is required to induce a high likelihood of infection).

*Appearance Equals Reality.* Another, perhaps even more basic realization of the law of similarity is that "appearance equals reality" – If it looks like a tiger, it is a tiger. Here, similarity promotes categorization rather than cause-effect inference, but as in the case of like causes like, surface properties are used to infer deeper properties. Thus, in the voodoo practice of harming the image to effect the object, the action on the image is taken as acting on the actual object, because at a deep level they are seen as one. Piaget (1983) described the child's tendency to presume that words or names embody the properties they refer to as *nominal realism*. This can be construed as an extension of appearance equals reality; the label "poison" is neither poisonous itself, nor does it necessarily imply that the entity labeled is poisonous. For example, in some of our studies, subjects were reluctant to consume a bottle of sugar labeled as "Poison," even though they knew the label was meaningless (see page 205 for more details; Rozin, Millman, & Nemeroff, 1986; Rozin, Markwith, & Ross, 1990).

#### Adaptive Value of Similarity

The idea that appearance equals reality is eminently reasonable because, in the world we evolved in, causes often do resemble effects, and most things that look like tigers are tigers. In the natural world, of course, mimicry takes advantage of this general tendency as a way to induce misidentification of a species. However, this generally useful heuristic becomes more of a bias in the worlds created by cultures, which invariably include art, symbolic language,

and images. With images and words to represent objects, extensions of the law of similarity would cause us to fear a picture of a tiger or a toy gun.

#### Domains and Range of Operation of the Law of Similarity

*Similarity* is a general principle that came to the attention of modern psychologists in the framework of responses by educated Americans (undergraduates) to disgusting stimuli. Rozin, Millman, and Nemeroff (1986) showed that most students preferred a round piece of chocolate fudge to a piece with the same content, but realistically shaped to look like "dog doo." Similarly, most undergraduates were disinclined to put in their mouth a fake vomit, clearly made of rubber, in comparison to their willingness to put in their mouth a flat rubber sink stopper of about the same size.

Similar effects can be observed with the willingness to eat things that only appear to be harmful. This was demonstrated most clearly in the context of nominal realism. Subjects observed sugar from a commercial container being poured into two bottles, and then placed a "sugar" label on one, and "cyanide" on the other, at random (Rozin, Millman, & Nemeroff, 1986; Rozin, Markwith, & Ross, 1990). Undergraduate subjects were reluctant to consume sugar taken from the bottle labeled "Sodium Cyanide, Poison" even though they had arbitrarily placed that label on it. This effect was even observed when the label read "Not Sodium Cyanide," supporting Freud's (1966) contention that the unconscious does not process negatives. In these studies, subjects realized that their negative feelings were unfounded, but felt and acknowledged them anyway.

As noted previously, a common exemplification of similarity in traditional cultures occurs in voodoo practices, in which one does harm to an image (effigy) of a person, and presumes that this harms the actual person (like causes like). We have demonstrated this type of effect in the laboratory, with undergraduates (Rozin, Millman, & Nemeroff, 1986). Students showed poorer accuracy in throwing darts at a picture of John F. Kennedy's face (with the "desired" target the spot between the eyes) than they showed for a plain target or a picture of Adolph Hitler's face. Furthermore, when a dart did hit near the target on Kennedy's face, subjects would sometimes cringe. Finally, it is common knowledge, which we have confirmed in unpublished studies in our laboratory, that people are reluctant to throw out or tear up duplicate photographs of loved ones.

#### Development of Similarity

The principle of similarity, at least in its expression as "appearance equals reality," is undoubtedly a useful heuristic in animals as well as humans. It is related to the principle of generalization in learning, and is almost certainly part of our genetic endowment and present at birth. Flavell (1986) showed that a confusion of appearance and reality characterizes the thinking of young children.

### Summary

The law of similarity is fairly straightforward, primitive, and reasonable. There is little that need be said about the mechanism, when the law is viewed as an extension of the widespread feature of animal learning that we call *generalization*. The law of contagion, discussed next, is much more complex and apparently absent in animals and in young children. It seems to have been created by humans in the course of their cultural evolution.

## THE LAW OF CONTAGION

### A Framework for Discussing the Law of Contagion

Explication of the law of contagion requires some definitions. One object, usually of an animate nature, is a *source*; a second object, usually human, is a *target* or *recipient*. The law of contagion holds that *physical contact* between *source* and *target* results in the transfer of some effect or quality, which we call *essence*, from source to target. The source and target may mutually influence each other (exchange essence). The qualities exchanged may be physical, mental, or moral in nature, and negative or positive in valence. The contact between source and target may be direct, or may be mediated by a third object, or *vehicle*, that makes simultaneous or successive contact with both source and target. Common vehicles are food, clothing, and other possessions.

### Characteristics of Contagion

Unlike similarity, contagion involves a rich set of assumptions and properties. Beginning with the idea of transfer of essence through physical contact, we proceed to explicate these features. We provide examples in each case, typically referring to modern, Western reactions to contact with AIDS. The basic phenomenon, very salient in American culture, is that objects (vehicles) that have contacted someone with AIDS, including a house formerly lived in by someone with AIDS, acquire negative properties (Nemeroff, Brinkman, & Woodward, 1994; Rozin, Markwith, & Nemeroff, 1992).

*Physical Contact Is Critical.* In magical contagion, actual physical contact (as opposed to mere proximity) – whether direct or indirect – is critical in accomplishing transmission of essence. People are more concerned about wearing a sweater that had been worn but was not owned by someone with AIDS (and then washed) than about a sweater owned but never worn by someone with AIDS (Nemeroff et al., 1994; Rozin et al., 1992). A cockroach that runs near one's plate is not nearly as contaminating as one that runs over one's food.

*Once in Contact, Always in Contact.* A core feature of the law of contagion is that once joined through direct or indirect physical contact, a transfer of essence occurs that is often permanent; hence "once in contact, always in contact." Consider a bowl of mashed potatoes that a cockroach briefly runs across. If the potatoes are placed in a freezer for 1 year, they are still inedible (assuming the person in question remembers their history). With respect to

AIDS, 92% of the negative 1-day effect remains after 1 year. Similar results are obtained with a piece of silverware that had been used 1 day or 1 year ago by someone with AIDS (Nemeroff et al., 1994; Rozin et al., 1992).

*The Holographic or Metonymic Nature of Essence.* All of the properties of the source pervade the entire source and are contained in its essence. Magical contagion is "holographic" in the metonymic sense of the whole being equivalent to the part ("the part equals the whole"). As a result, contact with any part of the source transfers essence, including fingernail parings or a lock of hair. Hitler's fingernails are as contaminating as his brains. This property, which can be called *route insensitivity*, is illustrated by the fact that 43% of subjects reported that there was no place at all on the body of a person with AIDS (including elbow and lock of hair) that they would feel as comfortable touching as the corresponding place on the body of a healthy stranger (Nemeroff et al., 1994).

*Dose insensitivity.* Minimal contact is usually sufficient to transmit near maximal amounts of essence. A sweater worn for 5 minutes by a person with AIDS (and then washed) yields a drop in desirability that is 71% of the effect of use for 1 full year; similar results hold for a fork vehicle (Rozin et al., 1992). We have also found that, in the view of 68% of our subjects, the function relating the probability of contracting AIDS to the number of viruses entering the body is flat (dose independence). According to these subjects, a single live AIDS virus that enters the body has a potency of infection (measured as probability of induction of AIDS) that is the same as 10,000 or 1,000,000 viruses (Nemeroff, Brinkman, & Woodward, 1994). Depending on the way the holographic principle is construed, one might consider dose insensitivity a consequence of the holographic nature of essence. Even a fraction of a hologram contains information sufficient to recreate the whole image.

*Negativity bias.* We argued for a general principle, applying across many human domains, that negative effects are stronger than positive effects; we call this general phenomenon *negativity bias* (Rozin & Royzman, 2001; see also Baumeister, Bratslavsky, Finkenauer, & Vohs, 2000). In one manifestation of negativity bias, which we call *negativity potency* (related to loss aversion), negative events are more negative than corresponding positive events are positive. This principle is illustrated with particular clarity in the domain of contagion. There is no positive entity that is as strongly positive as a cockroach, poison, or Hitler is negative. That is, contact with a butterfly, vitamin, or Mother Theresa does not produce positive effects as strong or reliable as the negative effects produced by the previously mentioned negative entities (Nemeroff & Rozin, 1994; Rozin, Nemeroff, Wane, & Sherrod, 1989). Furthermore, in what we describe as *negativity dominance*, combinations of contact with negative and positive entities (e.g., touching the target with a cockroach and an antibiotic or a valued object; touching of the target by a disliked and a liked person) result in a net effect more negative than would be expected from the sum of the negativity and positivity of the sources (Rozin et al., 1989; Rozin & Royzman, 2001).



Ethnographic reports corroborate this claim. Even among the Hua of Papua New Guinea (Meigs, 1984), who are among the world champions in contagion sensitivity and have many instances of positive contagion, negative contagion is clearly more potent and dominant than positive; in Hindu India, contact with a lower caste is polluting, whereas contact with a higher caste has no purifying effect, all of which relate to Stevenson's (1954, p. 50) claim that "pollution overcomes purity" (see also Appadurai, 1981). In studies of American undergraduates and a general sample of American adults, although almost everyone showed negative contagion effects, only about one-third showed positive contagion effects (Rozin et al., 1989; Nemeroff & Rozin, 1994).

*A Wide Range of Properties of the Source Are Potentially Contagious.* Questionnaire (e.g., Rozin et al. 1986; Rozin et al., 1989; Nemeroff & Rozin, 1994), laboratory (Rozin et al., 1986, 1999) and ethnographic data (e.g., Meigs, 1984) indicate that physical attributes (e.g., size, growth rate, color, illness), abilities (strength, coordination, visual acuity), dispositions (personality characteristics), and moral qualities are believed to be subject to transmission by contact. Intentions may also be thought to be transmitted in the sense that contact with a source person who has a harmful intent toward the target can bring bad luck to the target.

*Backwards Action.* In what has been described up to this point, influence flows from a contagious source to a recipient in much the same way that germs are transmitted from one individual to another. *Backward contagion* reverses the causal arrow, and challenges the normal sense of causation. Thus, in traditional magic, a target may cause harm to a source by burning a lock of the source's hair or fingernail parings from the source, or may attract a source by placing these same entities in a love potion. We obtained substantial evidence for such backward contagion in American college students. A substantial number (approximately one-third, but not the virtual unanimity of response we get for forward contagion) were uncomfortable about the prospect that their hairbrush or a lock of their hair (neither to be seen again) came into the possession of a personal enemy (Rozin et al., 1989). The reluctance of many Americans to donate blood since the beginning of the AIDS epidemic might conceivably be accounted for by backward contagion.

We envision two types of explanation of backward contagion: One is that the same types of transferred essence analysis holds in both types of contagion. On this view, backward contagion would require an additional assumption: that essence remains unitary in contact, even when physically separated. Thus, the essence in the cut lock of hair remains forever connected with its source, allowing action on the hair to affect its source. Alternatively, it is possible that an important component of contagion is mere association, in time or space, between target and source. In forward contagion, this association is supplemented by the forward transmission of essence by contact. However, in backward contagion, it could just be the association. This would account for the fact that backward contagion is weaker and less frequent than forward contagion, but leaves many

questions unanswered. One, of course, is why contact is so important in backward contagion?

### Domains, Evolution and Origins of Contagion

Contagion effects appear in domains as diverse as food transactions, contact with microbially contaminated entities, contact with other (especially unfamiliar) persons, contact with morally tainted entities, and contact with loved or greatly admired persons (positive contagion). This breadth raises questions about the evolutionary origin of contagion and the cultural history of expansion of the domain of contagion. We briefly consider four accounts of the origin of contagion, keeping in mind that it appears to be uniquely human. Two accounts are based on an origin of contagion as an adaptive means of avoiding microbial contamination, which shares with contagion the fundamental properties of importance of physical contact, the ability to produce a major effect with a minimal dose, and negativity bias (there is no potent positive opposite to germs).

According to the first account, contagion originated in association with disgust, the rejection of a set of potential foods as offensive. On this view, contagion arose as a means of avoiding microbial contamination from foods. Pinker (1997) notes that animal foods are much more likely than plant foods to be vehicles for the transmission of potentially harmful microorganisms. The principal risk from plant foods is toxins; toxins do not have contaminating properties, in the sense that they cannot multiply, and microbes in plants are much less likely to find a compatible host in animals. Almost all potential food elicitors of disgust are of animal origin (Rozin & Fallon, 1987), and almost all examples of negative food contagion effects involve foods of animal origin. Interpersonal contagion is often manifested in the domain of food because food is a highly social entity that is typically procured, handled, prepared, or eaten and shared by others. These multiple other-contacts with one's food allow for widespread interpersonal contagion influences, no doubt enhanced by the particular intimacy of the act of ingestion. There is evidence for a widespread traditional belief in "You are what you eat" – that is, the idea that one takes on the physical, behavioral, intentional, and moral properties of what one consumes (Nemeroff & Rozin, 1989; Stein & Nemeroff, 1995). This belief is a very concrete form of contagion. In the interpersonal domain, taken literally, it would apply only to other humans for the rare cases of cannibalism. However, when coupled with the principle of contagion, "You are what you eat" promises an enormous range for passage of personal influence by food (Rozin, 1990). Now, the food someone has raised or prepared becomes a vehicle for their essence.

A second account locates the origin of contagion in the interpersonal as opposed to the food domain. Illness transfer in humans usually involves a human vector, and therefore is interpersonal. Common vehicles are food, air, physical contact with infected persons, and shared objects and residues. On this account, there is no reason to specially privilege the food vehicle as the original source of contagion. Widespread avoidance of physical contact with or close

proximity to ill or dead people suggests the possibility that the core issue in the origin of contagion is microbial contamination, whatever the source.

The third account does not attribute the origin of contagion to negative, microbial effects, but rather to positive effects. Although the relative weakness of positive contagion suggests that it might be an accidental overextension of the negative contagion principle, it is also possible that positive contagion has its own origin or adaptive value. An obvious function for positive contagion is in the support of kin relations and love bonds. It could well function to strengthen important blood bonds, with their obvious link to fitness. Sharing food is a particularly common behavior that centers on kin-related groups, and sexual intimacy involves highly contagious contact. Positive contagion includes valuing objects that belonged to and were in contact with ancestors, living loved ones, or greatly admired persons; Grandmother's ring, food prepared by a loved one, or Princess Diana's clothing are salient examples.

The relative weakness of positive contagion could be simply a result of the negativity dominance discussed previously. Alternatively, it could be a result of the fact that positive contagion virtually always competes with illness risk and disgust. The microbial risks of intercourse are well illustrated by sexually transmitted diseases. A deep kiss involves exchange of saliva, which is both a disgusting body fluid and a potential disease vector, when examined out of the context of love or lust (Nemeroff, 1988; Nemeroff & Rozin, 1994, 2000).

A final account of the origins of contagion is based in the work of Johnson and Lakoff (e.g., Johnson, 1987; Lakoff, 1987; Lakoff & Johnson, 1980), who write about the "embodied" nature of cognition. Our bodies, they say, provide us with preconceptual structures that shape our abstract thoughts. Body movements and perceptual interactions with the world, which are fundamentally based in the experience of having a human body, give rise to "image-schemata" that are "metaphorically projected" to structure our domains of thought. By this account, the contagion principle would arise from our phenomenological experience of our bodies as containers (having an inside, a boundary, and an outside), combined with other schemas such as trajectory, force, links, and so on. This account easily explains the breadth of magical contagion, although it does not address the negativity bias.

Given some initial locus for the origin of contagion, an account is still needed for the great breadth of contagion in contemporary humans. The problem of the spread of contagion is paralleled by the spread of disgust from its likely original food origin to a wide range of elicitors, including interpersonal contacts and especially contacts with ill or immoral persons. The range of disgust in contemporary humans overlaps substantially with the range of contagion. Indeed, our definition of disgust invokes contagion as a critical feature: Contact with a disgusting substance renders an otherwise acceptable entity (e.g., a food) unacceptable (Rozin & Fallon, 1987). Our account of the cultural evolution of disgust invokes the process of *preadaptation*; that is, the application of an

adaptation that evolved for one purpose to a new purpose. We trace the cultural evolution of disgust as an expansion of elicitors from its origin as a response to distasteful foods through reactions to offensive foods, other animal properties of our existence (e.g., sex, death), interpersonal contacts, and certain types of moral offenses (Rozin, Haidt, & McCauley, 1993; Rozin, Haidt, McCauley, & Imada, 1997). The extension of contagion could have occurred by this same type of process, whatever its origins. Of course, once contagion became linked to disgust, either in origin or later on, its domain could have spread as the domain of disgust spread.

We commonly ask people why they reject juice that had brief contact with a cockroach. The answer almost always refers to toxins and microbes, the disease-generating properties of the roach. This, of course, relates to some of the views we have expressed about the microbial origins of contagion. However, in the laboratory, we often follow up this response by repeating the process with a new glass of juice, now contaminated by a sterilized roach – that is, a germ-free roach just removed from an autoclave. This roach, we point out, is safer than the average fork, such that juice that touched it should be totally safe to drink. Subjects almost always continue to reject the juice, while admitting, in an embarrassed way, that their initial microbial harm account must have been invalid or at least incomplete. It is the offensive roach properties that have been passed into the juice, somewhat independent of any physical threat of harm. We find the same sort of results with hypothetical sweaters (on questionnaires) that have been worn by someone with an infectious disease. They are rejected even after sterilization (Nemeroff & Rozin, 1994; Rozin, Markwith, & McCauley, 1994). Furthermore, the pattern of rejection is quite similar to the rejection of sweaters previously worn by morally tainted but healthy individuals. Also, those who are most inclined to reject "hepatitis sweaters" are generally the same as those most inclined to reject "healthy murderer sweaters."

### Mental Models of Contagion

What are the properties that the mind attributes to the contagious entity? We enumerated the principles of contagion previously; these constrain but do not fully dictate the manner in which the contagious entity is conceived. Furthermore, given the wide range of contagious entities, from germs to individuals with compromised morals, it is likely that there might be different mental models, varying within individuals across domains of contagious entities, among individuals within a culture, and between cultures. We explored this possibility in an in-depth interview study with 36 more or less representative American adults (Nemeroff, 1988; Nemeroff & Rozin, 1994). Participants were asked to imagine various source people coming into contact with a sweater (and various other objects), and then imagine their reaction to wearing this sweater. We then asked them to further imagine a set of "purifications" of that sweater (such as laundering or changing its color or appearance) and asked participants



to estimate their willingness to wear the sweater after each of the designated "purifications." Our logic was that one could deduce the nature of the contagious entity by discovering how it could be neutralized.

The source people were one's lover, a good person, and a sex symbol (positive interpersonal sources); one's enemy and an evil person (negative interpersonal sources); a person with contagious hepatitis and a person with AIDS (physical illness sources); and an imperceptible amount of dog feces on the sweater (physical disgust). Purification methods included physical cleansing (e.g., deodorizing, washing by hand, sterilizing); physical/symbolic transformations (e.g., unraveling the sweater and reknitting it into a scarf; gashing it); and spiritual "opposite-contacts" (i.e., having an opposite-valenced source wear the sweater, such as Mother Theresa wearing Hitler's sweater). Templates were devised for five possible models of contagion:

1. A physical germ model, in which contagion is seen as carried by a living invisible entity (particularly vulnerable to boiling, and to a lesser degree to washing).
2. A physical residue model, in which contagion is dependent on residues such as sweat, dandruff, and so on (particularly vulnerable to washing).
3. A symbolic interaction model, in which contagion is the result of the meaning implied by interaction with an object (symbolic actions like gashing or otherwise destroying or reconstituting should be effective).
4. An associative model, in which the reminding value of an object is the key to effects (change in appearance cues rather than substance, which would be expected to be moderately efficacious).
5. A spiritual essence model, in which the source's "nonmaterial essence" or "soul-stuff" are believed to be in the object (here, the only effective purifier might be an opposite force of the same type; that is, Mother Theresa's positive essence neutralizing Hitler's negative essence).

We had a separate set of subjects read a description of each model and rank order the set of purifications in terms of their effectiveness for/within each of the models. We then tested these template orders against the actual rank orders provided by participants in the study to determine the best-fitting model for each subject and each source.

The predicted purification potency for the two physical models (germ and physical residue) turned out to be highly similar, as did the potency ordering for the three nonphysical models (associative, spiritual, and symbolic interactional). Because of this relative similarity and the small sample size, we combined the models into two broad classes, henceforth termed *physical* (material) and *nonphysical* (spiritual).

On average, the nonphysical models were the best match for all interpersonal sources, both positive and negative, and the physical models were the best match for physical sources (illness and disgust). Thus, the idea of at least two

broad models of contagious essence was supported. One is material/physical and is effectively moderated by washing; the other is spiritual/nonphysical, is reduced much less by washing, is very difficult to erase, and is most effectively reduced by opposite valence contact. Because positive contagion sources are almost entirely interpersonal, positive contagious essence is typically spiritual/nonphysical.

The associative model of contagion, which we have included in the nonphysical category, is problematic. It does not capture many of the properties of contagion, particularly the physical contact principle. Although physical contact may promote association, it is hardly necessary, and unlike the symbolic and spiritual essence models with which it is grouped, there is no "spiritual" aspect to it. In a sense, the association model is an alternative to contagion because it does not depend on physical contact and the transfer of essence. Unfortunately, it is a difficult model to distinguish from other nonphysical models. Two observations support the claim that there is something besides association going on in cases of non-physical contagion. First, ownership without contact, although heavy on association, seems less potent in transferring negativity than brief contact without ownership (Nemeroff, 1988; Rozin et al., 1992). Along the same lines, similarity, based on images or representations, and hence on association, is generally less potent than contagion, in which reminding cues are less salient. In the extreme, a book about Hitler's life with his photograph on the cover and quotes of his words inside is less offensive to many people than his worn sweater would be, even though the sweater is not uniquely linked to Hitler in its sensory properties.

#### Managing Contagion with Framing: Inattention and Ritual Rules

Unlike other heuristics, the contagion heuristic or principle is potentially crippling on the negative (as opposed to positive) side. One is continuously faced with abundant situations that present the possibility of negative contagion: the air breathed out by others around us; the necessarily shared objects, such as doorknobs, plates, and silverware in restaurants; money; and seats in public places. We propose that negative contagion is generally managed under the general aegis of framing, with two particular strategies: inattention and ritual rules.

*Inattention.* *Inattention* is like the Freudian defense mechanism of denial, except that it may be much more passive. We simply do not think much about the interpersonal history of most objects we deal with. When we receive change in the store, we do not think of the long string of humans, no doubt some unsavory, who handled it previously; likewise for the interpersonal history of a public bathroom doorknob or a seat on a train. The domains of inattention vary across individuals (see later) and across cultures. For example, the contamination produced by the bottoms of shoes bringing outside filth into the home is salient for most Japanese, but not attended to by most Americans. However,



Japanese traditionally sequentially share their bath water with family members and guests, while Americans find that offensive.

**Ritual rules.** Typically in religious systems, problems of contagion may be handled by establishing rituals to decontaminate and setting limits on the range of contamination. Such rules seem most prevalent in Judaism and Hinduism; not accidentally, these are arguably the two most contagion-sensitive religions, and the only two major world religions in which membership is primarily determined by biology; that is, by blood rather than beliefs (Morris, 1997). A particularly clear example of a ritual boundary is the 1/60th rule of Kashrut, relating to contamination of kosher foods by non-kosher 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. We have shown, however, that for a majority of Jews, the ritual boundary does not align with feelings; that is, although such people understand that a food accidentally contaminated at a level of less than 1/60th remains kosher, they find it offensive and reject it. There was a weak indication in the results from this study that the more kosher/orthodox Jews were more likely to be willing to consume technically kosher contaminations (less than 1/60th contaminant). This suggests that deep commitment to the Jewish dietary laws may successfully aid in the alignment of ritual boundaries and feelings, and set limits on emotional/magical contagion reactions.

### The Development of Contagion

We know little about the development of contagion, or of other heuristics and biases for that matter. Contagion is a sophisticated idea. Because the history of an entity is important, contagion often holds that appearance is not equal to reality (the opposite of similarity). It frequently invokes invisible entities and abstract conceptions that are not available to young children (Au, 1993; Rosen & Rozin, 1993). Most work on contagion in children involves insect contaminants and food vehicles - that is, negative contagion in the food domain. Early work suggested that contagion became an active principle, at least in the domain of food and disgust for American children, at 6 to 8 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 4 years of age may show negative contagion sensitivity in the food domain (Siegal, 1988; Siegal & Share, 1990).

We do not yet know much about the development of the child's mental models of contagion. However, it is clear that association and true contagion are less differentiated in young children than they are in adults (Springer & Belk, 1994; Hejmadi, Rozin, & Siegal, 2000), and that in both the Hindu Indian and the American cultures, the earliest models of contagion seem to be material essence (Hejmadi, Rozin, & Siegal, 2000).

### Individual Differences in Sympathetic Magical Beliefs

There are large individual differences in the extent of sympathetic magical thinking both within and between cultures. Of the 36 participants in the study on the nature of contagious essence (Nemeroff & Rozin, 1994), 24 displayed dual models-material essence for illness contaminants, and spiritual essence for interpersonal and moral contaminants. However, 6 of subjects seemed to have a material essence model for everything, including moral contagion; for these subjects, washing was generally effective. Another 6 subjects used a spiritual essence model for everything, so washing or boiling were quite ineffective, even for illness sources.

As well as differences in the quality of contagion, there are large individual variations in contagion sensitivity. Wide variations were demonstrated in American college students and their parents on a scale designed to measure disgust responses to neutral entities after contact with disgusting entities (Rozin, Fallon, & Mandell, 1984).

Another study exploring individual differences examined contagion and similarity thinking about kosher-relevant and -irrelevant contaminations in a sample of Jews of varying levels of orthodoxy (Nemeroff & Rozin, 1992). Generally, it was found that sensitivity to contagion items intercorrelated quite highly with each other, and the same for similarity items, but the two did not correlate substantially with each other. Some individuals were sensitive to contagion but not similarity such that, for example, they would reject a meat dish into which less than 1/60th volume of milk fell, but have no problem eating beef stroganoff made with non-dairy creamer (a similarity item in that the combination appeared nonkosher, but was, in fact, kosher). Other individuals were sensitive to similarity but not contagion. We also developed a series of questionnaire measures of the combined action of both contagion and similarity; for example, a drop of non-dairy creamer falling into a beef stew ("contagion via similarity"). A surprising number of people were put off by even this very weakened magical effect.

More recently, we created a scale of disgust sensitivity, in a more orthodox psychometric framework, including a number of items that deal with similarity and contagion (Haidt, McCauley, & Rozin, 1994). There is very wide variation in sensitivity to disgust, similarity, and contagion in both American and Japanese cultures (Haidt, McCauley, & Rozin, 1994; Imada, Haidt, McCauley, & Rozin, 2000, unpublished data). At extremes in American culture are persons who feel uncomfortable blowing their nose in a piece of brand-new toilet paper, handling money, or sleeping on a laundered pillowcase in a hotel, versus persons who are incredulous that anyone would have such concerns. We created a hands-on validation of this paper-and-pencil disgust scale, using college students (Rozin, Haidt, McCauley, Dunlop, & Ashmore, 1999). These students spent over an hour in the laboratory in a situation in which they were simply asked to indicate whether they would be willing to do 30 tasks; if they agreed, they actually

performed the task. An example for similarity magic related to disgust was to present students with a brand-new bed pan, into which the experimenter poured some apple juice from a commercial apple juice bottle. Participants were asked if they would be willing to drink some of the apple juice: only 28% complied. For a typical contagion item, subjects were asked if they would be willing to drink water from a glass after it had been stirred by a used but washed comb: 30% complied. Norms for college students were established for a wide range of negative contagion and similarity situations.

There has been little attention paid to individuals who show minimal sensitivity to magical principles. However, there is a clinical entity, the cleaning variety of obsessive-compulsive disorder (OCD), that seems to represent excessive concern about negative contagion. Appropriately, persons with OCD show high scores on the disgust scale (Tolin, Brigidi, & Foa, 1999), and obsessive-compulsive tendencies in normal persons correlate positively with disgust scale scores (Rozin, Taylor, Ross, Bennett, & Hejmadi, 2000).

## CONCLUSION

Magical thinking generally provides a way to promote meaning and understanding of the many baffling events that occur in the world of any human. In this respect, it serves some of the same functions as religion and science. For the sympathetic magical principles, a case can be made that these are useful heuristics that guide behavior adaptively in at least some domains. Before germ theory, although the medical profession held that contact with infected individuals was not threatening, lay persons behaved as if it was. The material essence of some aspects of contagion has a basis in fact; the spiritual essence does not, according to current doctrine, but we must be humble about things like this. "Action at a distance," a hallmark of magical thinking in the past, is a scientifically accepted aspect of modern physics, and "mind over matter," another such hallmark, is now recognized in areas such as psychoneuroimmunology. The contagion principle represents a truth about microbial contamination. The extension of this to moral contagion may have important and adaptive consequences for the establishment or maintenance of society and the social order.

## 12. Compatibility Effects in Judgment and Choice

*Paul Slovic, Dale Griffin, and Amos Tversky*

One of the main ideas that has emerged from behavioral decision research is a constructive conception of judgment and choice. According to this view, preferences and beliefs are actually constructed – not merely revealed – in the elicitation process. This conception is entailed by findings that normatively equivalent methods of elicitation often give rise to systematically different responses (e.g., Slovic, Fischhoff, & Lichtenstein, 1982; Tversky, Sattath, & Slovic, 1988). To account for these data within a constructive framework, we seek explanatory principles that relate the characteristics of the task to the attributes of the objects under study. One such notion is the compatibility hypothesis, which states that the weight of a stimulus attribute is enhanced by its compatibility with the response.

The rationale for this hypothesis is twofold. First, noncompatibility between the input and the output requires additional mental operations, which often increase effort and error and may reduce impact. Second, a response mode may prime or focus attention on the compatible features of the stimulus. Common features, for example, are weighted more heavily in judgments of similarity than in judgments of dissimilarity, whereas distinctive features are weighted more heavily in judgments of dissimilarity (Tversky, 1977). Consequently, entities with many common and many distinctive features (e.g., East and West Germany) are judged as both more similar to each other and as more different from each other than entities with relatively fewer common and fewer distinctive features (e.g., Sri Lanka and Nepal).

The significance of the compatibility between input and output has long been recognized by students of human performance. Engineering psychologists have discovered that responses to visual displays of information, such as an instrument panel, are faster and more accurate if the response structure is compatible with the arrangement of the stimuli (Fitts & Seeger, 1953; Wickens, 1984). For example, the response to a pair of lights is faster and more accurate if the left light is assigned to the left key and the right light to the right key. Similarly, a square array of four burners on a stove is easier to control with a

This is an edited and condensed version of a chapter that first appeared in R. M. Hogarth (Ed.), *Insights in decision making: Theory and applications*. Copyright © 1990 University of Chicago Press. Reprinted by permission.