

Operation of the Laws of Sympathetic Magic in Disgust and Other Domains

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Two laws of sympathetic magic were described by Frazer and Mauss at the beginning of this century to account for magical belief systems in traditional cultures. In this study, we show that these laws fit well with a variety of behaviors in American culture, in responses to disgusting, dangerous, or valued objects. The first law, *contagion*, holds that "once in contact, always in contact." That is, there can be a permanent transfer of properties from one object (usually animate) to another by brief contact. For example, in this study we show that drinks that have briefly contacted a sterilized, dead cockroach become undesirable, or that laundered shirts previously worn by a disliked person are less desirable than those previously worn by a liked or neutral person. The second law, *similarity*, holds that "the image equals the object," and that action taken on an object affects similar objects. In this study, we demonstrate this law by showing, for example, that people reject acceptable foods (e.g., fudge) shaped into a form that represents a disgusting object (dog feces), or that people are less accurate at throwing darts at pictures of the faces of people they like. With these and other measures, we found a great deal of evidence for the operation of the laws of sympathetic magic in all 50 of the subjects we studied. The laws of sympathetic magic correspond to the two basic laws of association (*contiguity* and *similarity*). We discuss the parallel and report a disgust conditioning study to develop this parallel.

In this article, we argue that the principles of sympathetic magic, thought to be a characteristic of many "primitive" belief systems and rituals, are also operative in some aspects of daily life in modern Western culture.

The two laws of sympathetic magic were propounded most clearly by Sir James Frazer (1890/1922/1959), in "The Golden Bough," and Marcel Mauss (1902/1972), in "A General Theory of Magic." They were proposed to describe widespread magical practices and rituals in traditional cultures. According to the first, the *law of contagion*, things that once have been in contact with each other may influence each other through transfer of some of their properties via an "essence." This influence remains after the physical contact has ceased, and may be permanent (hence, "once in contact, always in contact"). The "contact" may be directly between an offensive or revered person or animal and a previously neutral object, as when a person grows, cooks, or touches a food. In magical practices, contact is frequently manifested as a personal residue; fingernail parings, spittle, or other personal residues retain essential properties of their original owner (source). The "essence" remains in these residues in some form of nonphysical contact with its source. This allows for the possibility that action taken against the essence contained in a residue or recipient can affect the original source, and is the basis for a major form of sorcery.

The second law, *similarity*, holds that things that resemble one another share fundamental properties ("the image equals the object"). As with contagion, the image is believed to contain the essence of its "source," so that action on the image can produce similar effects on the source ("like produces like"). In a special case of similarity, the name of the object (written or spoken), being an attribute of the object, is held to contain the object's essence. The two laws together are illustrated in the Malay custom (Frazer, 1890/1922/1959) in which a clay figure of an enemy (similarity) is constructed, incorporating residues (e.g., hair, fingernail parings) from that person (contagion). The figure is then scorched, causing harm to the enemy by the action of both laws.

By our analysis, the laws of sympathetic magic have two basic dimensions. First, the "magic" can be positive or negative; thus, in contagion, contact of an object with a loved or respected person can enhance the value of the object (positive contagion), whereas contact with a disliked or despised person (or an offensive substance such as feces) can devalue the object (negative contagion). Second, transmitted essence can mediate effects either in its source or in its recipient. In forward causation, the essence influences the entity it has contacted (the recipient). This is a powerful force in Hindu India, where the past history of a food (who has contacted it) determines whether it is acceptable to an individual and serves as a major way of maintaining the social (caste) structure (Appadurai, 1981). Another example of forward contagion, widespread in traditional cultures (Frazer, 1890/1922/1959; Crawley, 1902), is the belief that one takes on the properties of the food one eats ("You are what you eat"). In backward causation, action on the residue (essence) reflects back on its source, as in the practice of scorching the hair or fingernail parings of an enemy. Although there may be a rational basis for forward causation (e.g., true microbial contamination), because the residue is in physical contact with the recipient, backward causation

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cannot be accounted for in terms of known physical principles. We shall examine both the positive-negative and forward-backward dimensions in this study.

The phenomenon of disgust offers a special opportunity to study the laws of sympathetic magic, because disgusting stimuli produce strong effects that are in accord with these laws. Furthermore, these effects are easy to produce in the laboratory under ecologically valid but controlled conditions. This is much harder to accomplish with interpersonal relations.

Expanding on a definition of Angyal (1941), we define disgust as a revulsion at the prospect of (oral) incorporation of an offensive substance (Rozin & Fallon, 1985). The objects of disgust vary from culture to culture, but include feces universally, and in most cultures, other body products as well. They also include the meat of most animal species (e.g., in our culture, insects and worms) and certain parts (e.g., eyes) of some edible species (Angyal, 1941; Rozin & Fallon, 1981, 1985). A striking feature of disgusting substances is that they can render a perfectly good food inedible by brief contact, even if there is no detectable trace of the offensive item. The idea (history) of contact is sufficient. We have called this the *principle of contamination* (Fallon, Rozin, & Pliner, 1984; Rozin & Fallon, 1981, 1985). So far as we know, this effect is universal among adults.

In this study, we examine the operation of the two laws of sympathetic magic in American adults, using both measurements in the laboratory and questionnaire responses. We include responses to disgusting stimuli, dangerous stimuli, and interpersonal situations. We recognize that findings that are in accord with the laws of sympathetic magic may also be accounted for in other ways. We will deal with alternative accounts, particularly the laws of association, in the Discussion section. Our aim is to discover whether the set of phenomena that gave rise to the formulation of the laws of sympathetic magic are present in American culture. In the event of positive findings, a next step is to determine the extent to which these laws of magic are an effective and economical way of accounting for the phenomena.

Method

Subjects

Subjects were 50 people, approximately half students, from the University of Pennsylvania community. There were 17 men and 33 women, whose ages ranged from 17 to 50 years (mean 23.6). They were recruited primarily from advertisements for studies of food preferences. The 50 subjects represent approximately half of the subjects who agreed to participate; the remaining half failed to come to their experimental session. All who came completed the session.

Procedures

The study took place in a laboratory room (4 × 4 m). Care was taken to give the room and the experimenter a clean appearance. All glasses, plates, and utensils used were disposable, were conspicuously taken out of their original commercial packaging at the beginning of each trial, and were discarded promptly after use. The subject sat at a table covered with a tablecloth, in the center of the room. The experimenter sat at the table at a 90 degree angle to the subject. All experimental materials not in current use were shielded from subject's view by a .5-m high barrier across the table. The study consisted of two parts. The first part was in vivo, with subjects participating in ratings or activities with appropriate

stimuli present. In the second part, they completed a questionnaire. The first part lasted about 40 min, the second about 15 min. The first part consisted of a series of ministudies always presented in the same order: roach contamination (negative contagion, disgust), roach conditioning (negative contagion and similarity, disgust), dart throwing (positive and negative similarity, interpersonal), cyanide labels (negative similarity, danger), and imitation dog feces and vomit (negative similarity, disgust). Each procedure is described later.

Part 1: Direct Measurements

The same rating scale was used for all studies in Part 1. The scale was a line 200 mm long, labeled *dislike extremely* at the left end and *like extremely* at the right end. There were no other marks on the line. Subjects could not see the lines with their previous ratings.

During each of the sequences in Part 1, the experimenter maintained a somewhat formal, pleasant, and calm demeanor, and was unexpressive even during the presentation of unusual (e.g., disgusting or dangerous) stimuli.

Roach contamination. In this procedure, the effects of contact between juice and a sterilized, dead cockroach were assessed. The experimenter said:

I'm going to offer you some juices. I'd like you to taste them and rate how much you'd like to have another sip of the same juice (show rating line). Notice that this line goes from dislike extremely to like extremely. Just mark the line at the place that indicates how much you'd like to drink some more of the sample we offer. [Experimenter demonstrates marking with a pencil slash mark in the middle of the line.] This would mean that you were neutral about this item. After each rating, we'll turn the rating sheet face down and move on to the next sheet.

Two distinctively shaped, transparent plastic disposable glasses were each removed from their new plastic wrappings and placed in front of the subject. New, unopened 8-oz cartons of a standard brand of grape and apple juice were opened in front of the subject, and a few ounces of each were poured into separate glasses. The cartons were placed behind the appropriate glasses, so that the subject could see them and their brand markings. The experimenter then said:

Take a sip of this (the apple juice) and indicate your rating of how much you'd like to drink some more on this rating sheet. [Wait] Now the same for this other juice. [Wait] Now please tell me which of the two juices you prefer; that is, the one you would prefer to drink some more of. [Wait for subject's response.] Now please take another sip of the juice you prefer. [After each statement of preference, in this choice and all that follow, the subject was asked to sample the preferred item. This was done to produce the expectation in the subject that the consequences of his stated preference would be real.]

Apple juice was always tested first. For 30 subjects, the preferred juice was selected as the target for the roach, and for 20 subjects, the roach was placed in the nonpreferred juice. One juice was contacted by a plastic birthday candleholder (the control), the other by a dried, sterilized cockroach (*Periplaneta americana*), about 4 cm in length. The apple juice was always contacted first. We will describe the sequence in which the roach contamination occurred first.

The experimenter placed a tray covered with paper towels in front of her. She then removed part of the paper towel cover of the tray, exposing the roach in a small plastic cup, lifted the roach with a pair of forceps lying next to it, and said: "Now I'm going to take this sterilized, dead cockroach, it's perfectly safe, and drop it in this juice glass." The roach was dropped into the glass, and stirred with the forceps for 5 s. The subject was then asked to count the roach's legs (to assure his attention). The roach was then removed with a new plastic spoon that came from a new spoon container, and placed back in its original cup. The spoon

was discarded. This sequence was repeated with the plastic candleholder in the other juice, using a different forceps. Subjects then repeated the ratings of each juice, stated their preference, and sipped from the preferred juice. (For some subjects the first contact, always with apple juice, was with the candleholder.)

Roach conditioning. This continuation of the previous manipulations was designed to determine whether a new sample of the kind of juice contaminated by a roach on the previous trial would display any negative properties. (We call this *roach conditioning* because, although it can be accounted for by a sequential application of the laws of contagion [roach in juice] and similarity [test with similar juice], it also fits well with a classical conditioning paradigm.)

The roach, candleholder, and two glasses of "contaminated" juice were removed from subject's view. Two new plastic glasses, of the same types used initially, were filled with juice from the apple and grape cartons, such that the same shape and size of glass held the same juice as before. Subjects then went through the standard rating and preference measurement.

Dart throwing. We measured subjects accuracy in throwing darts at photographs of liked or disliked people and neutral (blank) targets. Because a person's picture is similar to the real person, by the law of similarity, people should be more disturbed and hence less accurate in throwing darts at a picture of a liked person than at a neutral target (see the Discussion section).

Subjects stood at a mark on the floor. A dart board was hung on a wall, with its midline roughly at shoulder level. The board was 182 cm from the subject. Targets on pieces of standard $8\frac{1}{2} \times 11$ in. pieces of white paper were pinned to the center of the board. For each target, subjects threw four darts twice. After the first four darts were thrown, they were removed from the target, and four more were thrown. The holes left in the paper by the darts were used later to measure accuracy. The first target was a black dot about 1 cm in diameter, in the center of an otherwise blank piece of paper. Subjects got eight "practice" throws at this target. It was then removed, and a second, identical target was used (Blank 1). Five experimental targets followed, in a random order that varied from subject to subject (discussed later). Finally another black dot target (Blank 2) was presented to allow correction for improvement due to practice. The five experimental targets were high quality xeroxed copies of front views of the faces of Adolf Hitler, John F. Kennedy, and the experimenter (each approximately 20 cm high), and two additional blank targets with black dots, on which subjects were asked to project images of the faces of the person they liked and disliked most in the world, so that the black dot fell between the eyes. For the faces, subjects were instructed to aim for the spot "between the eyes," marked by the black dot for the imaged faces. For the blanks, subjects were told to aim for the black dot. In summary, subjects were presented with one practice blank target, one blank, five experimental targets, and another blank. Subjects threw eight darts at each.

Cyanide label—1. In this procedure, we ascertain whether the label "sodium cyanide" imparts its quality to the substance it labels (by the principle of similarity; see the Introduction and Discussion sections).

Subjects returned to their seat at the table and were presented with two brown glass 500 ml "chemical" bottles, each about one-quarter filled with a white powder, which was, in fact, sucrose. One had a typed label on it that said "Sucrose (Table sugar)," the other a typed label that said "Sodium Cyanide" with a red printed "Poison" sticker below it. The experimenter said:

Here we have two bottles with powder in them. The powder in both bottles is sucrose, that is, table sugar. These are brand new bottles that we just bought. They never had anything in them but sugar. This bottle (on the subjects' left) has a sucrose label that we put on it. It's a brand new label, that was never on any other bottle. This other bottle (on the subjects' right) has a brand new sodium cyanide label on it. This label was never on any other bottle and was never even near cyanide. Remember, sugar is in both bottles.

The experimenter set out two different colored plastic cups, one in front of each bottle, and poured water from a glass pitcher into both, until they were about half full. Now, using separate, new plastic spoons for each bottle, the experimenter put a half spoonful of powder from the "sugar" bottle into one cup, and stirred it. The spoon was discarded, and the same was done with the sugar in the cyanide bottle, with a new spoon. The subject then rated, on the 200 mm line, how much he would like to drink from each of the cups, and stated a preference between the two. The subject was then asked to take a sip of the sugar water from the preferred cup, and subsequently to account for his or her choice.

Cyanide label—2. We thought avoidance of the cyanide-labeled bottle might be motivated by doubts about the real contents of the bottle (though it seems absurd that the experimenter would try to poison the subject by offering a poison-labeled bottle). For this reason, in the second sequence, the subject himself labels the bottles. Initially, we performed this second test only for subjects who indicated a substantial preference for the sugar-labeled bottle's contents. The last 20 subjects, however, were run on this procedure independent of their results on the first sequence. The total N for the second sequence was 38; that is, 12 subjects were eliminated on the basis of their performance on the first cyanide test.

Previously used bottles and glasses were taken away, and two similar, empty bottles were brought out. The covers were removed, and sugar from a 5-lb box of locally sold "Domino" sugar (sucrose) was poured into each bottle (to a level of about one-third full). The subject was then given two peel off labels on a piece of paper. One read "Sucrose (table sugar)," the other read "Sodium Cyanide." (Through an error, this cyanide label did not have a red "Poison" sticker affixed to it.) The subject was asked to put one label on each bottle, in any way he wanted. Then, the procedure used for Cyanide Label 1 was repeated (mixing sugar water, rating of both solutions, indicating a preference, and sipping the preferred solution).

Similarity: Dog feces. Subjects were offered a piece of high-quality chocolate fudge, in a square shape, on a paper plate. They ate the piece, and rated on the standard line, their desire to eat another piece. (If the subjects said they were dieting, they were asked to ignore this fact in rating their desire for another piece). Two additional pieces of the same fudge were presented, each on its own paper plate. One piece was shaped in the form of a disc or muffin, and the other in the shape of a surprisingly realistic piece of dog feces. The pieces were of approximately the same size. The experimenter said: "Here are two more (present both) pieces of the same fudge. One (pointing) is moulded in the shape of a disc or muffin, and the other (pointing) in the shape of a dog doo." The subjects rated their desire to eat more of each (disc first, then dog feces), indicated the one they preferred, and were then asked to take a bite from the preferred piece.

Similarity: Vomit. A similar procedure compared a flat rubber sink stopper (about 13 cm in diameter) and a piece of rubber imitation vomit, of about the same size, purchased in a novelty store. This procedure, unlike the procedure with fudge, involved no prior exposure to a "blank" piece of rubber. The experimenter said:

Here is a clean rubber sink stopper. Here is a rubber imitation vomit, sold by novelty stores. Both are clean. Rate how much you would like to hold the sink stopper between your lips for 10 seconds. [Wait] Now rate how much you would like to hold the rubber vomit between your lips for 10 seconds. [Wait] Now indicate which you would prefer to hold between your lips.

Part 2: Questionnaire

This part of the study consisted of a 53-item questionnaire dealing primarily with disgust and contamination. In this article, we will discuss only a small number of items that deal directly with magical issues. For most of the questions, subjects were asked to use a scale that ran from -100 (*most unpleasant experience you can imagine*) through 0 (*neutral*)

to +100 (*most pleasant experience you can imagine*). They were encouraged to select intermediate values. In contrast to Part 1, ratings here were numerical, rather than on a line, and subjects could see previous ratings on the questionnaire. Subjects responded to a series of questions by placing the appropriate number next to each question. Questions 1 to 5 dealt with interpersonal contamination (positive and negative), and Questions 6 to 10 with contamination in disgust. The questions were as follows:

(For Items 1-3, the subject was asked to think of a blouse/shirt of a style she or he liked, and to consider each of the questions to be about another instance of that *same* blouse style.)

1. Wearing a cleaned blouse (shirt) of a style you like that comes from the racks of a used clothing store.

2. Wearing a cleaned blouse (shirt) of a style you like that belonged to someone you dislike.

3. Wearing a cleaned blouse (shirt) of a style you like that belonged to someone you like.

4. Using a toothbrush that belongs to (and has been used by) the person you are most sexually attracted to.

5. Using a brand new toothbrush.

6. Blowing your nose using a clean, new piece of facial tissue.

7. Blowing your nose using soft toilet paper from a brand new roll.

For Items 8-10, the subject was asked to "consider a bowl of your favorite soup" and then rate:

8. Eating the soup.

9. Eating a new bowl of fresh soup after you have spit into it.

10. Eating a new bowl of fresh soup poured into a brand-new bedpan.

Subjects also completed a brief disgust-contamination sensitivity questionnaire that we had used in previous studies (Rozin, Fallon, & Mandell, 1984), and that reveals large individual differences in this population. This questionnaire contains 10 items, all asking for ratings on a 9-point hedonic scale from *like extremely* (9) to *dislike extremely* (1). Eight of the questions deal with contamination of a bowl of favorite soup by a thoroughly washed used fly swatter, a brand-new fly swatter, a thoroughly washed used comb, a brand-new comb, a grasshopper (after it was removed), new soup in the same (grasshopper) bowl after the bowl was washed in a dishwasher, a leaf from a houseplant, and new soup from the same, unwashed (leaf) bowl. For the last 2 items, subjects rated a highly preferred (9 rating) cookie after a bite had been taken by a waiter in a restaurant, and after a new instance of it had fallen on a lawn while picnicking.

Results

We begin by describing the results from the direct measurements of Part 1 of the study. We then consider the direct measurement and questionnaire data relating to each law of sympathetic magic, in negative and positive forms, in turn. Finally, we consider the relations among the various measures and individual differences in magical "behaviors." Unless otherwise indicated, probabilities reported for findings are based on two-tailed *t* or binomial tests.

Direct Measurement Studies

Roach Contamination

Not surprisingly, contact with a sterilized roach had a massive effect on the acceptability of a particular type of juice (Figure 1). The mean drop on the 200-point rating scale was 102 points. The contagion does not generalize to the juice contacted with the candleholder (drop of 3 points). The net change of the "roached" juice (compensating for changes in the control juice;

CONTAGION

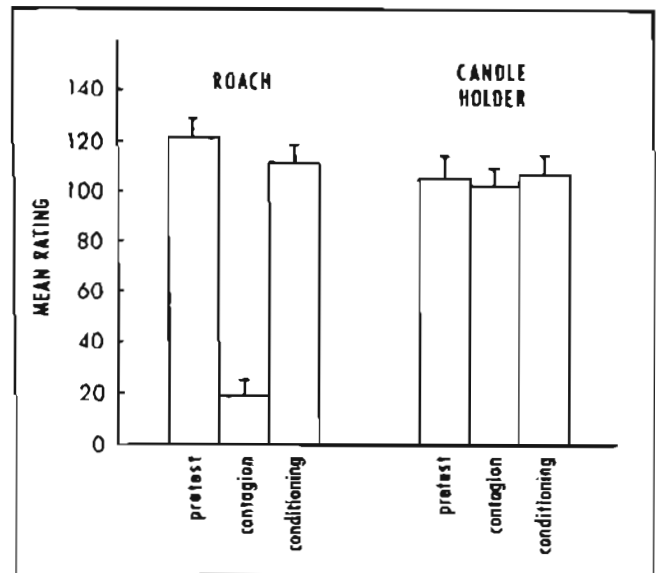


Figure 1. Mean rating by 49 subjects (on 200 mm scale) of juices before (pretest) and after (contagion) contact with a cockroach or birthday candleholder, and of new instances (conditioning) of these same juices. (Error bars represent standard errors.)

see Table 1) was -98.8 points ($p < .001$). This net change was negative for 46 of 49 subjects.

Roach Conditioning

A new glass of the juice that was previously "roached" (called new roached) is rated a mean of 10 points lower than the original juice, in contrast to a 2-point increase in the rating of the control juice (Figure 1). Again, there was no evidence for generalization to the control juice. The overall conditioning effect, compensating for change in the control juice, is -11.33 points ($t = 1.74$, $p < .05$, one-tailed). An effect in the directions predicted by conditioning (drop in new roached juice preference in comparison to controls) took place in 30 of 49 cases (*ns*). Ratings of the new roached juice dropped substantially (either 50 points or 50% with respect to original levels) in 6 subjects.

Similarity in Disgust

Both the dog feces and vomit imitations were rated much lower than the same substance in more innocuous form (Figure 2, panels A and B). The drops in ratings (compared with the control disc fudge or rubber sink stopper) were -47.18 for dog feces fudge ($p < .001$) and -49.26 for rubber vomit ($p < .001$) (Table 1). Almost all subjects showed both effects (Table 1).

Similarity in Danger

The sugar labeled as "Sucrose" was preferred to the sugar labeled as "Sodium Cyanide" by 41 of 50 subjects ($p < .001$). The mean difference between the cyanide- and sugar-label ratings was -30.58 ($p < .001$) (Figure 2, panel C; Table 1). When asked

Table 1
Evidence for Different Types of Sympathetic Magic

Category	Measure ^a	N	M ^a	SD	Cases
Contagion Negative	Roach overall ^b	49	-98.82**	71.62	46**
	Soup: spit - plain	50	-93.26**	57.87	49.5**
	Blouse: dislike - used (Toothbrush, see Footnote c)	50	-36.44**	42.90	43.5**
	Blouse: used - like	49	-12.86††	37.06	35*
Positive	Toothbrush ^c : new - like	50	19.68*	46.56	36.5 ^{no}
	Fudge: dog feces - disc	50	-47.18**	49.42	45**
Similarity Negative	Rubber: vomit - mat	50	-49.26**	38.14	49**
	Label: cyanide - sugar	50	-30.58**	44.52	41**
	Soup: bedpan - bowl	49	-92.78**	57.88	49**
	Dart ^d : Hitler - blank	47	2.11	30.48	23
	Dart ^d : disliked - blank	47	-4.91	29.69	28
	Tissue: toilet - facial	50	-4.30††	12.00	30.5
	Dart ^d : blank - Kennedy	47	-11.32††	31.84	30
Positive	Dart ^d : blank - liked	47	-11.02††	28.22	34*

† $p < .05$. †† $p < .02$. * $p < .01$. ** $p < .001$.

^a All scores are calculated so that a negative score means a magical effect in the predicted direction. ^b Roach overall refers to the change in the "roached" juice minus the change in the control juice. ^c Predicted to be an instance of positive contagion, but results show a significant negative contagion effect. ^d The dart score is the median distance from the target for 8 throws. Hence, larger numbers mean poorer accuracy. Here, as opposed to Figure 3, all dart scores are presented so that a negative score means a magical effect in the predicted direction.

to explain their choice, the most common responses were reference to the label ($N = 23$), and no response ($N = 17$). Only 1 subject suggested the possibility that there might be cyanide in the cyanide-labeled bottle. The second cyanide manipulation, in which the subject put the labels on herself (with a smaller N , see the Methods section), showed a much smaller but still significant effect, with a net difference of 16.5 points between cyanide and sugar (Figure 2, panel D) ($t = 2.60$, $p < .02$).

SIMILARITY

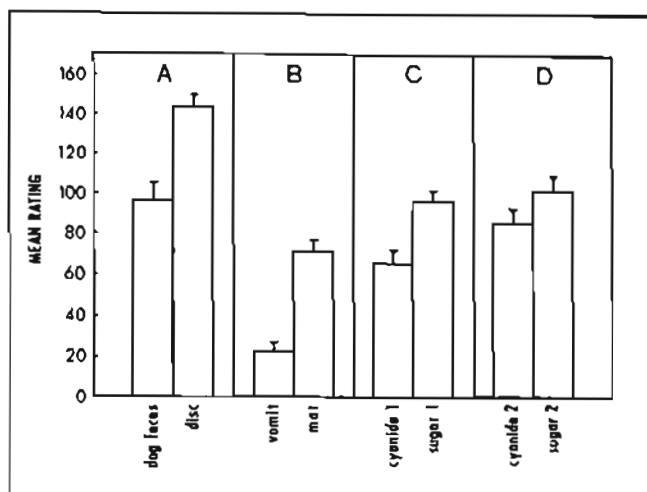


Figure 2. Mean rating (on 200 mm scale) by 50 subjects of four pairs of items. [(A) Fudge shaped in the shape of dog feces or a disc. (B) A flat piece of rubber in the shape of a sink stopper (mat) or vomit. (C) Bottles filled with sugar, and labeled either "Sodium Cyanide" or "Sugar." (D) Same as (C), but subject put the labels on the bottle. Error bars represent standard errors.]

Similarity in Response to Photographs

Accuracy of dart throwing was determined by measuring (in mm) the distance between the hole made by each of the eight darts and the target center. Inaccuracies of more than 200 mm were scored as 200 mm. The median distance for the eight throws at each target was computed for each target. On the basis of the accuracy for the first and last blank targets, a linear estimate was made of expected accuracy, assuming another blank target was present for each subject, for each of the five order positions of the face targets. The accuracy score used was the subjects' accuracy for the target in question minus the predicted accuracy based on our linear projection. There was a significant drop in mean accuracy for Kennedy (11.32 mm) and liked person (11.02 mm), $p < .02$, in both cases (Figure 3; Table 1). The more neutral (experimenter) or negative stimuli (Hitler or disliked person) showed no significant effects (Figure 3; Table 1).

Evidence for Laws of Sympathetic Magic

Negative Contagion

Table 1 lists results from all measures that could show a negative contagion effect. Significant negative contagion effects were seen for all three predicted cases (roach in juice, disliked person's blouse, and spit in soup; Table 1).

Positive Contagion

Two questionnaire items were selected to show positive contagion. There was a significant positive contagion effect for a laundered blouse previously worn by a liked person (Table 1). For 7 subjects, there was an enhancement in value of at least 50 points, whereas 8 subjects reported a more negative rating for

SIMILARITY-DARTS

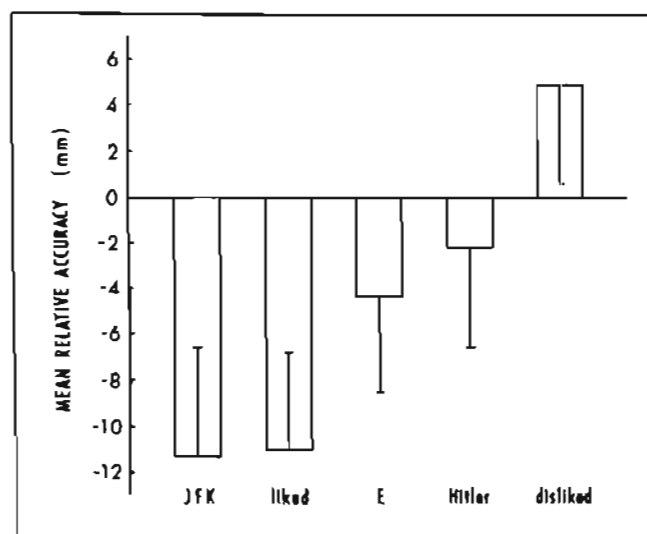


Figure 3. Mean accuracy (in mm), compared to expected performance with a blank target, for 47 subjects throwing darts at face targets. [The target was a spot between the eyes. The targets were (in order along the X axis) a xeroxed photograph of John F. Kennedy, the imagined face of the person the subject likes most, xeroxed photograph of the experimenter, xeroxed photograph of Adolf Hitler, the imagined face of the person the subject dislikes most. Error bars represent standard errors.]

the liked person's blouse than for a used blouse of unknown history. Rather than a net enhancement of one's lover's toothbrush over a new toothbrush (positive contagion), we found a significant effect in the opposite direction (Table 1). Although 4 subjects showed substantial enhancement effects for the lover's toothbrush of at least 50 points, the majority of the subjects preferred the new toothbrush (Table 1).

Negative Similarity

Of seven measures predicted to show negative similarity, five (dog feces fudge, rubber vomit, cyanide label [1 or 2], bedpan, and toilet tissue) showed significant decreases in ratings in comparison to more neutral equivalents; (Table 1). Neither of the negative photographs (Hitler or disliked person) significantly altered dart throwing accuracy (Table 1).

Positive Similarity

Both measures (picture of Kennedy and liked person image) showed the predicted effect, a significant decrease in accuracy (Table 1).

Patterns of Response and Individual Differences

The relations among the measures, expressed as Pearson r s, are displayed in Table 2. (We leave out the conditioning data and the toilet tissue results because in both cases most subjects showed no effects; and the second cyanide label data, because it was carried out with only 38 subjects). For convenience, correlations of .3 or greater (significant at $p < .02$, one-tailed with $N = 50$) are starred in the table, and will be the focus of the discussion. We examine first whether there is a tendency for an individual to be generally influenced by a particular law of sympathetic magic. Two of the three intercorrelations of the three negative contagion items (roach, spit-in-soup, and blouse-of-disliked person; Table 2) are substantial ($r = .42$ and $.52$) and one (between disliked person's blouse and roach) is small and not significant ($.07$). The $mdn r = .42$. If we add into our calculations the one item (blouse-of-liked-person) of positive contagion, the coherence of the category decreases markedly ($mdn r = .20$; Table 2), because correlations across positive and negative contagion are low (varying between $.17$ and $.21$). (Note, we score instances of positive contagion or similarity such that more negative scores mean more enhancement of value, i.e. more magical effect. Hence, if

Table 2
Correlation (Pearson r) of Basic Measures

Measures ^a	spi	bld	bll	tbr	cns	dfe	vom	bpa	dt+	dgt
Roach ^d	.42*	.07	.17	.02	.18	.27	.06	.48*	.10	.49*
Spit		.52*	.20	-.36	.41*	.48*	.10	.89*	-.12	.53*
Blou-dis			.21	-.33*	.40*	.27	.27	.52*	-.13	.20
Blou-lik ^b				-.06	.15	.32*	.22	.22	-.03	.36*
T-brush ^b					-.44*	-.39*	-.24	-.34	.20	-.29
Cn-sug						.52*	.38*	.40*	-.15	.45*
Dog feces							.21	.45*	-.11	.43*
Vomit								-.11	.06	.25
Bedpan									-.07	.61*
Dart ^{b,c} ; +										-.08
Disgust score										

Note. ^a Row measures are abbreviations of column measures, which are abbreviations of the items in the second column of Table 1. The measures are as follows (row abbreviation in parenthesis): roach (see Footnote d); spit (spi) Soup: spit minus plain; blou-dis (bld) Blouse: dislike minus used; blou-lik (bll) Blouse: used minus like; t-brush (tbr) Toothbrush: new minus like; cn-sug (cns) Label: cyanide minus sugar; dog feces (dfe) Fudge: dog feces minus disc; vomit (vom) Rubber: vomit minus mat; bedpan (bpa) Soup: bedpan minus bowl; dart + (dt+) (see Footnote c); disgust (dgt) Score on 10 item disgust (contamination sensitivity) questionnaire. ^b For "positive" items, blouse like, toothbrush, and dart +, scores are calculated so that positive magical effects yield negative scores. Thus, if positive and negative magic go together (e.g., dart + vs. blouse dislike comparison), the correlation will be positive. ^c The dart + score is the combined accuracy score for Kennedy and liked person (see Table 1). ^d Roach overall refers to the net negative effect of roach contamination, corrected for any effects of candleholder contamination. * $r \geq \text{abs}(.30)$, $p < .02$.

positive and negative magic covary, correlations should be positive.)

There are substantial relations among the four negative similarity items (rows 6–9 of Table 2). The six intercorrelations between them vary from .11 to .52, with a *mdn* $r = .39$. We note with surprise that the correlation between the dog feces and vomit scores, using similar types of disgust items and identical procedures, was only .21, in contrast with a .52 correlation between dog feces and the cyanide bottle. If we add into the similarity correlation matrix the positive similarity data (the mean accuracy score on Kennedy and liked person, combined), the coherence of the category is weakened; three of the four correlations between dart and negative similarity are negative, and none are significant (*mdn* $r = .16$ for combined similarity category).

Looking across laws of magic, we compared the three examples of negative contagion (roach, spit-in-soup, and blouse-of-disliked-person) with the four instances of negative similarity (fudge dog feces, rubber vomit, cyanide label, and soup-in-bedpan). These correlations varied between .06 and .89, *mdn* = .40 (Table 1). The largest correlation in the matrix, .89, was between soup-in-bedpan (negative similarity) and spit-in-soup (negative contagion). In general, the within-contagion or within-similarity correlations were not notably higher than the between-contagion similarity measures. There were no significant correlations between positive and negative measures of contagion or positive and negative measures of similarity.

Correlations between each of our measures and our previously developed contamination sensitivity score (10 items, 8 of which are clear cases of contagion without similarity, 2 of which include both contagion and similarity) were high for two contamination measures (roach-in-juice, .49; spit-in-soup, .53) but also for three of the four nonpersonal negative similarity measures (cyanide, .45; dog feces, .43; and soup-in-bedpan, .61) (Table 2).

Anecdotal reports and our own measurements (Rozin, Fallon, & Mandell, 1984) indicate substantial individual differences in disgust and contamination sensitivity, based on questionnaire results. We examined the issue of individual differences in magical "thinking" in this study, by looking at the 11 measures displayed in Table 2, plus the degree of conditioning in the roach juice study, across all 50 subjects. We divided each measure into quintiles, and assigned a quintile to each subject for each measure, with the lowest quintile always assigned to the scores representing the most magical outcomes. Three subjects were in the bottom quintile on 8 (of 12) categories. The exact probability of 8 or more bottom quintiles for any individual is .0006. One subject had 7 bottom quintiles (exact $p = .0039$). The probability that 4 or more out of 50 subjects would achieve an event of .0039 probability is less than .0001. Hence we conclude that there is a tendency for some people to be particularly sensitive to the laws of sympathetic magic. As to insensitivity, only 1 subject had as many as 7 top quintile scores. The probability of one or more such event out of 50 subjects is .177, a nonsignificant effect.

Discussion

We have demonstrated results consistent with the operation of the laws of negative similarity and negative contagion across a number of domains, including results from both questionnaires

and direct measurements. All three measures of negative contagion, covering both interpersonal and object contamination, showed substantial effects. Five of seven measures of negative similarity showed significant results in the predicted direction. These effects include the cyanide label result, in which similarity is transmitted by a written word, rather than physical similarity. The two results that failed to show significance (dart throwing at Hitler and disliked person) probably suffered from ceiling effects. Subject's motivation to perform on the dart task was high, and they were probably throwing as well as they could at a blank target, so that an enhancement with a negative target may not have been possible. In addition, there may be some reluctance to throw darts at any pictured face (perhaps based on similarity to living people, in general), so that there is no clear prediction from the magical laws of the relative scores on negative faces and blank targets.

Data illustrating positive manifestations of the laws are weaker. Of two predicted cases for the law of contagion, one (blouse worn by liked person) was significant in the predicted direction, and the other (lover's toothbrush) was significant in the opposite (negative contagion) direction, although some subjects showed large enhancements in the positive direction. One might expect this effect to be largest for those currently in a romantic love situation; many of our subjects probably did not qualify. The positive blouse data can be questioned because the comparison situation was a laundered blouse from a used clothing store. Such a blouse has potential negative contagion properties, and this possibility may have influenced responses.

The evidence for positive similarity comes from the drop in accuracy of dart throwing with the Kennedy and favorite person targets. There were no failures to attain positive similarity, but we did not even try an example of possible nonpersonal similarity (e.g., enhancement in the value of mud as food if presented as chocolate pudding) because it seemed obvious that such manipulations would fail. In our culture, at least, it seems that the interpersonal domain is where one would expect to find positive magic effects. This is true of our meager data on positive contagion and similarity. A possible exception is the positive contagion effect associated with "lucky charms."

Even within the interpersonal domain, negative effects (of contagion) appear more potent than positive effects. This positive-negative asymmetry seems to be part of a more general tendency in humans and other animals to learn more rapidly and respond more strongly to negative events (Rozin & Zellner, 1985; Rozin, in press). Indeed, it is striking that although disgust is generally considered a basic "negative" emotion, there is no basic "positive" emotion that represents its opposite (Rozin & Fallon, 1985; Rozin, in press). In the words of what we have been told is a Nebraska car mechanic, "A drop of sewage spoils a barrel of wine, but a drop of wine does nothing for a barrel of sewage." It is also possible that modern Western cultures devalue the personal history of objects and hence selectively reduce positive magic effects, given that positive effects seem to depend more on interpersonal factors. Positive contagion is prevalent in some cultures, such as the Hua of New Guinea (Meigs, 1978, 1984), where the personal history of objects, in terms of contact with people with positive or negative relations to an individual, powerfully influences behavior. For example, the value of a food for a particular person is enhanced if it is spat on by someone

in a positive relation to that person. However, even among the Hua, negative effects seem more potent.

Our weakly significant results on "roach conditioning," allow for interpretation in either Pavlovian or magical terms (discussed later). In either case, they offer a possible experimental approach to the study of the transfer of value. Our finding of a negative evaluative shift in a neutral object "paired" with a disgusting object is supported by a substantial collection of anecdotal reports of real-life situations in which aversions were established by the pairing of neutral items with disgusting stimuli (Rozin, in press). The roach conditioning finding also resembles a response to a questionnaire item in a previous study (Rozin, Fallon, & Mandell, 1984). About 50% of adults reported that they would dislike to eat some of their favorite soup if it had been stirred by a brand new fly swatter. This can be analyzed in conditioning terms. Along with the roach findings, it can also be analyzed in magical terms: a combination of the similarity principle (the brand new fly swatter looks like a used fly swatter) and contagion (the fly swatter contacts and is then separated from the soup). Whatever the interpretation, we have three lines of evidence suggesting a simple transmission of negativity by some sort of contact with disgust. The experimental effect we report is small. However, the other data suggest that this type of process is important in the spread of disgust, and perhaps other evaluative changes. In our demonstration, only one trial (pairing roach with juice) occurred, and the charged element (or US), a dried, sterilized roach, may not have been potent enough to have been maximally effective under these conditions. We are examining this paradigm as a possible model system for the study of evaluative conditioning in humans.

Results of our analysis of clusters of beliefs and individual differences proved somewhat disappointing, but correlations were generally comparable in magnitude to those found in many other personality domains. Although there is some tendency for magical thinking to extend across domains, there is no relation between positive and negative magical thinking, and the occurrences of negative contagion or negative similarity taken separately do not cohere together any more than occurrences that cross the two categories. There is great variation in response to almost all our measures of magical thinking, but individuals do not strikingly sort into consistently strong or weak magical thinkers. On the other hand, the distribution is far from random. Perhaps a broader range of subjects, not restricted to a University community, would reveal more striking and consistent individual differences in magical beliefs.

The measures we have taken were determined by our interest in the laws of sympathetic magic. The results, although consistent with these laws, need not be interpreted as strong support for our claim that the laws operate in a number of domains in our culture. First, the data themselves can be questioned. It is very difficult to make the type of measurements we wish to make while disguising intent from the subjects. Some subjects may have perceived our interest in these measures, so that demand characteristics might account for their results. We do not think demand characteristics are substantial factors in our results because: (a) all subjects showed some clear violations of magical thinking; (b) in general, subjects are somewhat embarrassed about the way they behave or the questionnaire responses they provide; they recognize that what they are doing is irrational; (c) we (the

experimenters) and people we discuss these findings with find the patterns of thinking we report compelling in terms of personal experience; and (d) in the real world, events corresponding to many of those measured do occur, and they seem to be responded to as indicated in our study. It would be desirable to collect solid evidence on this point. Finally, in a recent study (Nemeroff & Rozin, 1985), we report evidence that American college students act as if they believe in the "you are what you eat" principle (an instance of contagion). In this study, we used an Asch (1946) impression formation technique that cannot be faulted on the grounds of demand characteristics.

A second problem with this study has to do with interpretation. Although the results were predicted by the laws of sympathetic magic, they may well be consistent with other formulations. The most likely candidate is the laws of association. Both Frazer and Mauss noted the parallel between the laws of sympathetic magic and the laws of association as propounded by the British empiricist philosophers. The laws of association vary in number depending on the author, but the two laws propounded most frequently and consistently (Warren, 1921) are contiguity and similarity (Hume, 1748/1902; Mill, 1843/1930). According to Mill, the law of similarity holds that "similar ideas tend to excite one another" and the law of contiguity holds that "when two impressions have been frequently experienced (or even thought of) either simultaneously or in immediate succession, then whenever either of these impressions or the idea of it recurs, it tends to excite the idea of the other."

The implication of this "analogy" is that both sets of laws are descriptions of fundamental patterns of human thought. But, whereas the laws of association describe ways of linking thoughts to one another, and so remain inside the head, the laws of magic describe practices that go a step further: people behave as though they believe the world to be organized in the same way as their thoughts. The idea that one can harm an enemy by burning his fingernail parings does not follow from the laws of association.

The phenomena we have demonstrated can be explained by the laws of association. We have no direct evidence for the belief by our subjects that their behaviors actually produced effects at a distance (e.g., that their dart throws actually hurt the targets). The law of contiguity can account for most instances that we have attributed to contagion. The association of negative items (USs; e.g., dog feces or a disliked person) with objects (CSs, e.g., fudge or a sweater) can lead, by a process of evaluative conditioning (Martin & Levey, 1978; Rozin & Zellner, 1985), to devaluation of the object. Associative accounts of backward causation contagion (not demonstrated in this study; but see Rozin, Nemeroff, Wane, & Sherrod, 1985, for suggestive data) are subject to a similar, but more forced account. One's own sweater is devalued when worn by a disliked person because that person (US) is associated with the sweater (CS). But the critical cognition that it is your sweater is essential, and this already carries some of the mark of sympathetic magical formulations. And, of course, the idea (if present) that harm will come to you because your enemy wears your sweater is not derivable from association principles.

In similarity, the rejection of fudge dog feces results from the negative associations produced by the negative appearance of the feces (US). However, the poorer dart performance with the positive faces is not easily explained by an associative account.

Most congenial to an associative account is the phenomenon we have described as roach conditioning. The procedure used is Pavlovian: the CS is the juice, the US is the roach, the CS-US pairing is the roach in juice, and the new juice test represents the CS alone. By the magical account, the negativity of the roached juice arises from contagion, and the negativity of the new juice is accounted for as similarity (to the actually contaminated juice). In this case, unlike some of the others, the conditioning (associative) account seems less clumsy.

Heider's (1958) balance principle provides another account of at least some of the phenomena we have described. For the case of fudge dog feces, the account is subject dislikes dog feces (negative sentiment), the piece of chocolate fudge is similar to dog feces (unit relationship), hence subject dislikes the piece of fudge (negative sentiment). There is a similar formulation for contagion, if one can assume that the roach in the juice can be described as a unit relation. As with associative accounts, the belief (or behavior) that suggests backward causation presents the greatest difficulty for balance theory.

We do not think it is possible, with existing data, to decide definitively among the magical, associative, balance, or perhaps other formulations. The associative framework is the oldest, and perhaps the simplest. The balance framework is the newest, but may be less complex than the sympathetic magic formulation. However, we believe three arguments favor a magical formulation. First, the phenomena in question flow directly from the laws of sympathetic magic, although they are retrospectively accounted for by the other theories. In spite of the great importance of associative theory in psychology, and the significant impact of balance theory, the phenomena we have described have received almost no attention from psychologists, and are essentially unknown in modern psychology. Second, only the laws of sympathetic magic can account for the projection of thoughts into the world ("you are what you eat," or scorching an enemy's hair or putting pins in his image to harm him). This clearly occurs in traditional cultures, where the associative or balance accounts will fail. It seems uneconomical to invoke different accounts for that subset of these behaviors that we have demonstrated in American culture. Third, the potency of animals and interpersonal contact in contagion follows easily from the magical idea that "essence" is more abundant and powerful in animals. The animal predominance finding can be handled in an associative account, but only with an arbitrary additional preparedness assumption.

We do not know the origin of the type of thinking that we have described. At one level it seems rudimentary, and hence might be expected to be more common in children. This would hold particularly for similarity; "the image equals the object" can be viewed as a failure in differentiation. On the other hand, similarity may involve a learned set of conventions. The principle of contagion seems to presume two rather sophisticated notions. One is that matter is composed of tiny and invisible particles, an idea that is not present in children until about age 7 (Piaget, 1974). The other is that two objects identical to the senses may differ significantly because of their individual histories. In this light, it is not surprising that we have found that most children under 7 years of age do not show contagion in disgust (Fallon et al., 1984; Rozin, Fallon, & Augustoni-Ziskind, 1985), or that others (e.g., Nagy, 1953) have found that germ-theory explana-

tions of illness appear at about this same age (Bibace & Walsh, 1980).

At a minimum, we have called attention to some patterns of thinking that have generally been considered to be restricted to preliterate or Third World cultures. (See Shweder, 1977, for a consideration of the possibility that the principle of similarity holds in our judgments of personality, and Jahoda, 1969, for evidence that superstition, another possible manifestation of "primitive" belief systems, is widespread in Western culture.) We believe these patterns of thinking are not uncommon in adults in our society, and that they can influence individual economic decisions (e.g., holding on to an old, malfunctioning car because of one's history with it), health decisions (e.g., avoiding a food because it looks like something offensive, or because it is associated with an undesirable name; or being reluctant to receive blood from a donor of another race, or being reluctant to give blood that might go to an AIDS victim; or practicing homeopathic medicine), and tastes in things like clothing, food, or music. The type of nonrational thinking we have described may extend recent descriptions of other failures of rationality in everyday thinking (e.g., Kahneman, Slovic, & Tversky, 1982; Nisbett & Ross, 1980). However, unlike the phenomena that are the focus of recent work on biases and heuristics (e.g., the availability heuristic), our set of phenomena seem to operate at a "gut level" that is not susceptible to the types of educational interventions that might reverse these other biases.

We are now examining the important dimensions on which an analysis of this type of thinking should proceed: the distinctions between similarity and contagion, positive and negative effects, and forward and backward causation. At the same time, it will be necessary to draw sharper distinctions between magical and other accounts of the feelings and behaviors that we have demonstrated.

References

- Angyal, A. (1941). Disgust and related aversions. *Journal of Abnormal and Social Psychology*, 36, 393-412.
- Asch, S. E. (1946). Forming impressions of personality. *Journal of Abnormal and Social Psychology*, 41, 258-290.
- Appadurai, A. (1981). Gastro-politics in Hindu South Asia. *American Ethnologist*, 8, 494-511.
- Bibace, R., & Walsh, M. E. (1980). Development of children's concept of illness. *Pediatrics*, 66, 912-917.
- Crawley, E. (1902). *The mystic rose: A study of primitive marriage*. London: Macmillan.
- Fallon, A. E., Rozin, P., & Pliner, P. (1984). The child's conception of food: The development of food rejections with special reference to disgust and contamination sensitivity. *Child Development*, 55, 566-575.
- Frazer, J. G. (1959). *The new golden bough: A study in magic and religion (abridged)*. New York: Macmillan (Edited by T. H. Gaster, 1922; Original work published 1890).
- Heider, F. (1958). *The psychology of interpersonal relations*. New York: John Wiley.
- Hume, D. (1748). *Enquiry concerning human understanding*. London (Reprinted: Oxford, Clarendon Press, Oxford University Press, 1902).
- Jahoda, G. (1969). *The psychology of superstition*. Baltimore: Penguin.
- Kahneman, D., Slovic, P., & Tversky, A. (Eds.). (1982). *Judgment under uncertainty: Heuristics and biases*. Cambridge, England: Cambridge University Press.

- Martin, I., & Levey, A. B. (1978). Evaluative conditioning. *Advances in Behavior Research and Therapy*, 1, 57-102.
- Mauss, M. (1972). *A general theory of magic*. (Robert Brain, Trans.). New York: W. W. Norton. (Original work published 1902).
- Meigs, A. S. (1978). A Papuan perspective on pollution. *Man*, 13, 304-318.
- Meigs, A. S. (1984). *Food, sex, and pollution: A New Guinea religion*. New Brunswick, NJ: Rutgers University Press.
- Mill, J. S. (1843). *System of logic*. London. (Reprinted: London, Longmans-Green, 1930)
- Nagy, M. (1953). The representation of "germs" by children. *The Journal of Genetic Psychology*, 83, 227-240.
- Nemeroff, C., & Rozin, P. (1985). Evidence for belief in "You are what you eat" in American culture. Manuscript submitted for publication.
- Nisbett, R., & Ross, L. (1980). *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, NJ: Prentice-Hall.
- Piaget, J. (1974). *Understanding causality*. New York: W. W. Norton.
- Rozin, P. (in press). One-trial acquired likes and dislikes in humans: Disgust as a US, food predominance and negative learning bias. *Learning and Motivation*.
- Rozin, P., & Fallon, A. E. (1981). The acquisition of likes and dislikes for foods. In J. Solms & R. L. Hall (Eds.), *Criteria of food acceptance: How man chooses what he eats. A symposium* (pp. 35-48). Zurich: Forster.
- Rozin, P., & Fallon, A. E. (1985). *A perspective on disgust*. Manuscript submitted for publication.
- Rozin, P., Fallon, A. E., & Augustoni-Ziskind, M. (1985). The child's conception of food: The development of contamination sensitivity to "disgusting" substances. *Developmental Psychology*, 21, 1075-1079.
- Rozin, P., Fallon, A. E., & Mandell, R. (1984). Family resemblance in attitudes to food. *Developmental Psychology*, 20, 309-314.
- Rozin, P., Nemeroff, C., Wane, M., & Sherrod, A. (1985). *Sympathetic magic in everyday life in American culture*. Manuscript in preparation.
- Rozin, P., & Zellner, D. A. (1985). The role of Pavlovian conditioning in the acquisition of food likes and dislikes. *Annals of the New York Academy of Sciences*, 443, 189-202.
- Shweder, R. A. (1977). Likeness and likelihood in everyday thought: Magical thinking in judgments about personality. *Current Anthropology*, 18, 637-658.
- Warren, H. C. (1921). *A history of the association psychology*. New York: Scribners.

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