JOURNAL OF RESEARCH IN PERSONALITY 29, 318–340 (1995)

The Borders of the Self: Contamination Sensitivity and Potency of the Body Apertures and Other Body Parts

PAUL ROZIN

University of Pennsylvania

CAROL NEMEROFF

Arizona State University

AND

MATTHEW HOROWITZ, BONNIE GORDON, AND WENDY VOET

University of Pennsylvania

Three surveys of American undergraduate students explore a central aspect of the concept of "physical self:" the vulnerability or sensitivity of different parts of the body surface, especially apertures, to intrusion and contamination. The basic measure used was rated displeasure at imagined contact of various body parts of the subject with plain neutral objects (e.g., a Q-tip or a poker chip) or with that same object after imagined contact with a potentially offensive site (e.g., a stranger's mouth). All contaminated objects were described as sterilized by dry heat before contact with the subject. The principal findings from these studies are: (1) Contact with apertures is more unpleasant than contact with unbroken skin. (2) Displeasure at contact with apertures can be analyzed into two components: intrusion sensitivity and contamination sensitivity. (3) The anus is the aperture that is most intrusion sensitive, while the mouth and vagina are the most contamination sensitive points on the body. (4) In general, the more susceptible an aperture is to contamination, the more potent it is as a contaminant for other persons. (5) Within the mouth, the sense of offensiveness of an intruding object increases with both physical contact (especially of the tongue) and the sense of "inclusion," that is, being within the mouth cavity even in the absence of contact. (6) Heterosexual males display

This research was supported by the John D. and Catherine T. MacArthur Foundation Network on Health Related Behaviors, and by the Whitehall Foundation. Address correspondence and reprint requests to Paul Rozin, Department of Psychology, 3815 Walnut St., University of Pennsylvania, Philadelphia, PA 19104-6196.

0092-6566/95 $12.00

strong negativity to any sort of contact with other males, while they seem to sexualize contact with unknown females. For heterosexual females and homosexual males, the pattern of sensitivity (by aperture) to cockroaches is like that to strange males or females. However, for heterosexual males, strange male contact is like cockroach contact, but strange female contact is not.

The physical or "bodily" self appears to be a particularly important aspect of the self-concept (Harter, 1988). The bodily self is neatly defined by a "sheath" called the skin (Goffman 1971), punctuated by various apertures that blur the distinction between inside and outside and hence the self and the world. These apertures have been described as points of special vulnerability (Douglass 1966). Some of these apertures, in particular the mouth, anus, penis, and vagina, take on special importance in the psychology of Freud and some of his followers.

There are seven total, and five types of aperture in the body. These are the mouth, anus, ear canals (2), nostrils (2), and the vagina (for females) or the tip of the penis (for males). These apertures have very different properties. In terms of protectedness (degree of direct interaction with the material outside world), the mouth is by far the most exposed. The nostrils and ear canals are a middle category, and the anus, penis tip, and vagina are the least exposed. In terms of allowing access to the inside of the body, the mouth and vagina are probably the highest, with the ear canal lowest. It seems likely that degree of access to the inside is related to the degree to which an aperture is related to the sense of self. Although apertures have not been studied in this regard, Belk (1988) has shown in the context of organ transplantation that different body parts are differentially related to the sense of self (e.g., heart is more "self" than kidneys, and eyes are even more "self" than heart).

The mouth and vagina are perhaps the most intimate of apertures, but they differ widely in degree of exposure to the external environment, that is, traffic with the outside world. Oral entry (e.g., via eating and drinking) is a much more common experience than vaginal entry for all or almost all humans. One purpose of this study is to explore the consequences of these differences by examining reactions to contact of various contaminants, with different apertures and other points on the body surface.

Given the centrality of the notions of bodily and social self in psychology, it is surprising how little the sense of physical boundaries of the body has been investigated by psychologists. The major effort has been by Seymour Fisher and his colleagues (e.g. Fisher & Cleveland 1958; Fisher 1986a, 1986b), in an extensive series of studies that has spanned over three decades. The focus of this work, which has a psychodynamic framework, has been on individual differences in the sense of importance and definiteness of the body boundary (barrier and penetration scores) as well as allocation of attention to specific body areas (body focus) and to the body in general (body prominence). An impressive series of studies establishes psychometric instruments for measuring these factors and relates them to a variety of personality variables. Barrier, penetration, body focus, and body prominence scores are shown to have both trait and state prop-

erties. State properties are demonstrated by studies showing that the scores on these measures can be changed by experiences that threaten body boundaries, call attention to specific areas, etc. Fisher's approach is complementary to the approach taken in this study: the emphasis in this study is on general attitudes, rather than individual differences, and the focus is on apertures, whereas in Fisher's work the mouth is the only aperture that is specifically examined or included in the body focus questionnaire.

In our first two studies, we explore the vulnerability (contamination sensitivity) of different locations on the body surface to contact with offensive objects. We use offensive objects because they easily and reliability elicit strong reactions both *in vivo* and in imagination, and a strong basic reaction is necessary if we are to be able to explore subtle differences in magnitude of reaction. Further, the specific offensive objects we use are basically neutral objects that have become offensive by virtue of coming into intimate contact with another person, either a stranger, or a disliked individual. We have shown in previous work that ratings of objects reliably drop after contact with such individuals (Rozin, Nemeroff, Wane, & Sherrod 1989; Rozin, Millman, & Nemeroff, 1986), a finding which we attribute to implicit belief in a "magical" version of contagion described by Sir James Frazer (1959/1890). In magical contagion physical and moral properties may be transmitted through even brief contact. The transmission is accomplished through a personal "essence" (which is carried by personal/bodily residues, among other things). As we have discussed elsewhere (Rozin & Nemeroff, 1990; Nemeroff & Rozin, 1994), magical contagion has to do with a "contagious" model of self, i.e., a self with permeable boundaries and transmissable properties.

Given such a model of self, apertures should be seen not only as places particularly vulnerable to intrusions from without, but also as places where self is particularly likely to emanate or leak out from within, and thus we would anticipate substantial symmetry between those bodily parts that are maximally sensitive on one's own body and those that one considers to be maximally contaminating on another person's body. We therefore also explore in these studies the relation between an area's contamination sensitivity and its own ability to induce negative reactions in others via contact (contamination potency).

The first study compares the contamination potency and sensitivity of various locations on the bodily "sheath," including three apertures. The second study considers all of the natural body apertures, as well as some "artificial" routes of entry into the body (e.g., injection).

The third study explores one aperture, the mouth, in more detail. In a material sense, the mouth is the principal, if not the only incorporative organ (Rozin & Fallon 1981, 1987). That is, if we divide the world of any individual into the self and the rest, then virtually all material transaction from world to self is accomplished at one aperture, the mouth. (The only exception, in normal life, is entry through the vagina, a much less frequent event, and one experienced by about half of all persons.) Under the circumstances, it is not surprising that people feel strongly about oral contact with objects.

It is obvious that offensive entities are unpleasant in the mouth and equally obvious that they are much less offensive, if offensive at all, when outside of but near the mouth (think of a fly flying by in front of the mouth versus flying into the mouth). The mouth is much more than a simple aperture linking the outside with the inside. It is a complex and highly structured entity, including lips, teeth, gums, and a tongue. It is not obvious at what point an object is thought to be incorporated, that is, *in* the self. It is possible that there is a sharp, sudden psychological boundary of the self at some point. It may be that contact with any part of the aperture constitutes incorporation (e.g., touching lips). Or, actual entry into the oral cavity may be required such that passing the outermost edge of the aperture constitutes incorporation. Alternatively, the internal mouth space might serve as a buffer zone between inside and outside with full passage beyond the aperture (actual swallowing) required to give the sense of incorporation. Or finally, there might be a much more graded function, with increasing degrees of contact and entry producing increasing senses of incorporation.

A sharp increase in sensitivity to entry at the mouth, as compared with either pre- or post-mouth contact, would correspond to the sensory phenomenon of a Mach Band, in which perceptual contrasts are exaggerated, making borders more salient. The mouth might act in a similar way, exaggerating the inside–outside transition, with heightened emotional response to entry. Functionally, it would make a great deal of sense for this to be the case because, on the input end, entry into the mouth is generally under voluntary control, so that objects not in the mouth are a minimal threat to the organism. On the output side, once food has passed the mouth, it has passed the major options for rejection (though forced vomiting is still a possibility), so strong negative reactions would be less adaptive. To explore the Mach Band issue, we compare reactions to various degrees of oral contact with reactions to approaching objects near the mouth, and with the presence of the object in the stomach.

We also explore the parallel issue of symmetry between vulnerability and contamination potency in the third study. Having determined the relation between degrees of entry into the mouth and psychological intrusion into the self, we then ask whether the negativity of an entity is predicted by the degree to which it has intruded in another person's mouth. That is, are the oral entry sensitivities parallel to the contaminating potency of these same degrees of oral entry? If so, this would add a simplifying symmetry to the understanding of the mouth as the entry point to the body, and suggest a similar symmetry for other body apertures.

EXPERIMENT 1

Method

Subjects. Subjects were 90 undergraduate students in psychology classes at the University of Pennsylvania (46 female). Survey forms were distributed in class, completed at home, and returned anonymously in blank envelopes provided with them. A cover sheet on the questionnaire made clear

that some might find the questions unpleasant, but urged completion of the questionnaire nonetheless. The cover sheet had the designation "female" or "male" on it, and students were instructed to take a form that matched their gender. Approximately one-third of the questionnaires distributed were returned.

Survey. The questionnaire examined reactions to imagined contact with a clean poker chip. The chip was described as having come into contact with any of 10 parts of a clean, healthy stranger of the same sex as the subject. For each type of contact with the stranger, the chip was then imagined to be touched to each of the same 10 body parts of the subject. Thus, a 10 × 10 matrix was generated. For females, the 10 parts were the bottom of the foot, the top of the hand, the tongue inside the mouth, the palm of the hand, the cheek, the elbow, the outer edge of the opening in the ear, the armpit, just inside the vagina, the scalp hair, and resting on the hand. For males, the same set of parts minus the vagina was used; hence, for males, there was a 9 × 9 matrix of parts. The parts chosen represent two emotionally "changed" apertures (mouth and vagina), one presumably uncharged aperture (ear canal), and several places on the body surface that differ extensively in their degree of contact with the outside world.

There were four forms of this questionnaire, two for females and an equivalent two for males. All forms contained identical items (except for the omission of vagina for males), but the order was permuted. We will describe below one of the female forms and then describe what varied in the different forms.

The rating scale was described at the beginning of all forms of the questionnaire as follows: "For the following questions, your answer should be given on a scale that runs from −100 to +100. Think of −100 as the most unpleasant experience you can imagine actually happening to you, and +100 as the most pleasant one. 0 would be neutral. Remember, you can assign any number between −100 and +100 (for example: −42, −7, 83)."

"Rate how you would feel if a clean, new poker chip made contact for 5 seconds with you at the following places. Assume a new chip at each contact, that is, each chip makes contact with you at only one place."

This was followed by a list of the 10 places, in the following order: (1) your scalp hair, resting on your head; (2) just inside your vagina; (3) your armpit; (4) the outer edge of the opening in your ear; (5) your elbow; (6) your cheek; (7) the palm of your hand; (8) your tongue inside your mouth; (9) the top of your hand; (10) the bottom of your foot. Subjects rated their feelings about a *new* poker chip contacting them at each location.

The questionnaire then continued with a set of 10 cycles, always presented in the same order, for a poker chip that had been contaminated by contacting another person in each of the same 10 locations. Instructions were as follows:

"Rate the following experiences on the previously described scale (−100 to +100). Imagine a person you do not know (i.e., someone of whom you have no opinion, no like or dislike for) of your sex, age and peer group. Assume that she has just showered and is healthy (carries no illnesses). This person will be the reference for all of the remaining questions.

"A clean, new poker chip rests (makes contact with) on this person's (elbow or other part) for 30 seconds. Rate how you would feel if the chip now made contact for 5 seconds with your body at the following places, assuming a new chip at each contact, that is, each chip makes contact with the person at only one place." This was followed by the list of 10 locations on the subject, presented in the same order as described above.

This cycle, describing a first location on the other person, was followed by cycles covering the same 10 locations indicated above, presented in the following order: (1) rests on this person's elbow; (2) makes contact with the bottom of her foot; (3) rests on the top of her hand; (4) rests on the hair on the top of her head; (5) rests on her tongue inside her mouth; (6) rests on the palm of her hand; (7) makes contact with her armpit; (8) has contact with the outer edge of the opening in her ear; (9) makes contact with her cheek; (10) makes contact with her just inside her vagina. After this last cycle, one more cycle was added using a clean, new poker chip (repeating the initial series), so that, in all, there was a new chip "cycle" at the beginning, followed by 10 cycles of a chip that had touched one

of the other person's ten parts, cycling through all 10 of the Ss parts, followed by another new chip cycle.

The forms of the questionnaire differed in the ordering of items. The form as described above was A (female). In form B, the order of the ten parts of the subject was presented in reverse order. The two male forms were identical to the four female forms, except that the vagina items were not included.

Results

Reactions to imagined poker chips touching different parts of the subjects' body are displayed in Table 1 (by gender) and Fig. 1 (overall). The values presented are the means of a set of means. Thus, for mouth sensitivity, for example, a mean is determined for the chip entry into the mouth of the subject, for each of the nine types of bodily contact with the same-sex other person (all locations except vagina, since this score is only available for the female subjects). The scores presented in Table 1 and Fig. 1 are the means of these sets of nine mean scores. This same calculation, carried out for each location on the subject, comprises the set of contamination sensitivity scores. Contamination potency is determined in a similar manner, by averaging the nine means associated with any particular location on the other person. The means from vagina are only included in the vagina measures, so that male and female scores are comparable.

The sensitivity of different body parts to intrusion by a presumably noncontaminating neutral object (the new, clean poker chip) serves as a baseline against which to judge the "contaminated" poker chips. As indicated in Fig. 1 (squares), there is substantial negativity to contact of this chip with the vagina and some

TABLE 1
CONTAMINATION SENSITIVITY AND POTENCY OF DIFFERENT BODY PARTS

	Contamination sensitivity		Contamination potency	
Body part	Male	Female	Male	Female
Vagina	—	−65.4	—	−68.6
Mouth	−34.7	−42.0	−30.5	−37.6
Armpit	−9.7	−18.5	−22.8	−30.4
Ear canal	−12.0	−16.1	−10.1	−15.4
Cheek	−8.3	−14.2	−6.9	−10.3
Top of head	−8.1	−13.4	−8.1	−14.3
Palm of hand	−1.7	−9.9	−5.4	−10.7
Top of hand	−5.5	−9.6	−4.8	−11.0
Elbow	−5.8	−9.4	−5.4	−11.6
Bottom of foot	−5.0	−7.8	−15.6	−22.7
First new chip	—	—	0.0	−6.1
Last new chip	—	—	−0.5	−8.4

Note. Entries are means of the means for the 9 or 10 items in each relevant cycle. Parts listed in order of decreasing contamination sensitivity for females. N = 40–44 for males, N = 45–46 for females. All means other than vagina do not include the vagina component for females.

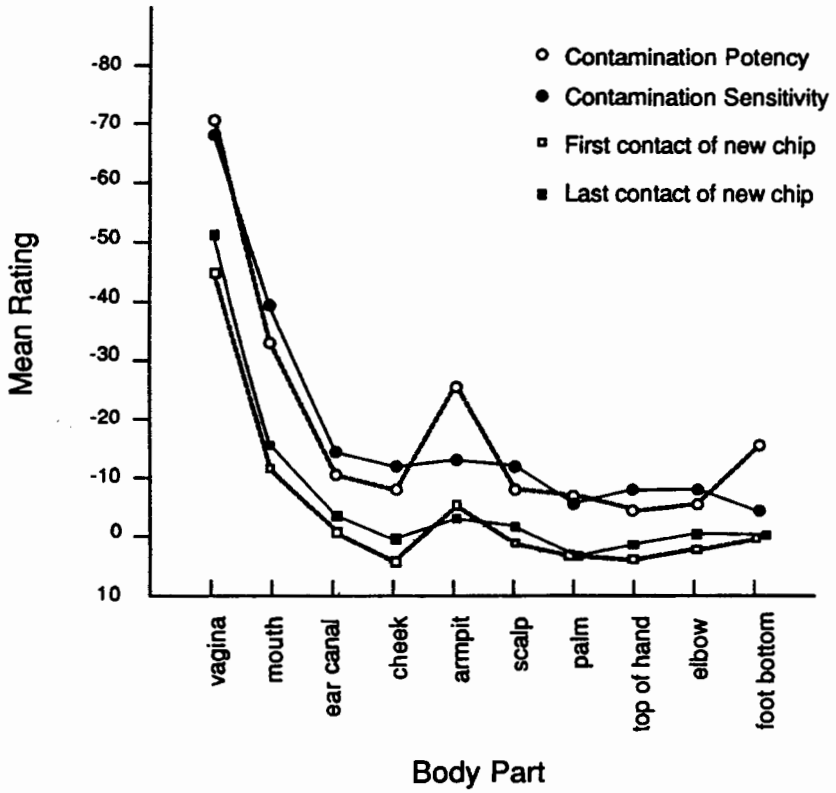

FIG. 1. Contamination potency and contamination sensitivity of different body parts. Open circles represent contamination potency, and closed circles represent contamination sensitivity. All data but the values on vagina represent the combined results of males and females. The data on vaginal contacts are not included in the means for all body parts other than vagina. Closed squares represent the mean sensitivity of subjects to contact with a clean, new poker chip, assessed at the beginning of the questionnaire. Open squares represent the same values determined at the end of the questionnaire, after subjects had rated poker chips that had touched all 9 or 10 parts of the other person's body.

negativity in the mouth as well. The mean rating for contact of the clean poker chip with any other body part was approximately zero. This baseline effect did not change substantially over the course of completion of the questionnaire, as indicated by the mean scores for the new chip taken at the beginning and at the end of the questionnaire (closed and open squares in Fig. 1; excluding mouth and vagina, the mean score for the 8 other sites of contamination of the initial new chip was +.6; the corresponding value of the last clean chip was −1.1, on the 200-point scale). The *patterns* of sensitivity to the initial and final new chips are also almost identical; for males the scores across nine types of contact for each show a correlation (Pearson *r*) of .88, and the corresponding value for females (across 10 types of contact) is .99. Hence, in terms of either size or pattern of effect it is unlikely that there was a substantial order effect.

Clearly, the vagina has the highest contamination sensitivity and potency by far, and the mouth is as clearly second on these same measures. There is a large gap between these two apertures and all other locations. In terms of sensitivity, there is a second group of locations (armpit, ear canal, cheek, and top of head)

which is slightly more sensitive than a third group (palm or top of hand, bottom of foot, and elbow). Results for contamination potency are extremely similar: there is a remarkable parallel between sensitivity and potency of the two scores ($r = .94$ across the 10 scores for females, and $r = .80$ across the nine scores for males). The only exceptions to almost perfect parallelism are the greater potency than sensitivity of armpit and bottom of foot.

Across all scores, females score slightly higher on both contamination sensitivity and potency, but the differences never exceed 10 points on the 200-point scale, and none are statistically significant.

Sensitivity of different body areas to bodily contaminated chips (Fig. 1, filled circles) is similar in pattern to the sensitivity of these same areas to intrusion by an ostensibly neutral object, the new, clean poker chip (Fig. 1., squares), in the sense that for both cases, vagina and mouth constitute the main effect. However, the correlation between the contamination sensitivity pattern (of means) and the scores on the initial new, clean poker chip is zero for the male data and .29 for the female data. This low correlation results from small variations around almost identical values for the new chip on all values but mouth and vagina.

EXPERIMENT 2

Introduction

The results of experiment 1 bear out the predicted special psychological vulnerability of body apertures relative to other areas of the "sheath." A more thorough survey of the full set of body apertures seems in order, so that comparisons between the different apertures can be made. In the next survey, we included all body apertures, that is, mouth, vagina/tip of the penis, ear, nostril, and anus. We also included an "artificial" aperture, a cut on the arm, and as a comparison, the same point on the arm without a cut. The specific significance of apertures as guardians or "borders" was also assessed by including two "aperture bypasses": intragastric and intravenous administration of a contaminant. Because the poker chip vehicle in Experiment 1 may itself have negative connotations for some subjects, we replaced it in this study with a sterilized Q-tip. Finally, to explore the issue of sexualization of contacts, we include one sex-neutral contaminant (cockroach) and two sex-marked contaminants (contact with the mouth of a healthy male or female). Further, to allow a more complete analysis of sexualization, we included male homosexual subjects in the study, along with male and female heterosexual subjects. We predicted that males are more likely to sexualize contacts with the sex that they are attracted to than are females and hence would show a larger difference in response to male vs female contaminants than would females. We also predicted that, since the anus is rarely if ever intruded upon in the normal life of heterosexuals, it would prove to be very sensitive to intrusion; we expected this effect to be reduced in male homosexuals, because of the higher frequency of anal contact (intercourse) in this group.

Methods

Subjects. Subjects were undergraduate students at the University of Pennsylvania. The majority were volunteers who agreed to complete the survey in an introductory psychology class. All but two of the male homosexual subjects were obtained by distributing the survey to males at a Lesbian/Gay/Bisexual Alliance meeting on campus. Return from this group was enhanced by asking a few gay participants to distribute surveys to some of their gay friends. Survey forms, whether distributed in the class, the meeting, or by friendship networks, were returned anonymously in blank, sealed envelopes. Subjects were told to take a questionnaire that matched their sex (female questionnaires included vagina, male questionnaires tip of the penis). About 95% of distributed questionnaires were returned. Altogether, there were 74 heterosexual male subjects, 69 heterosexual females, and 22 homosexual males. Because our analysis depended on measures of negativity in terms of drops from the effects of a plain Q-tip, we eliminated subjects who found even one form of contact with the plain Q-tip extremely negative. Using as criterion a score of −90 or less for any plain Q-tip, we eliminated about one-third of subjects, for final usable ns of 54 heterosexual males (20 eliminated), 42 females (27 eliminated), and 20 homosexual males (1 eliminated on this criterion, and 1 because the survey was incomplete). For females, 58% of all scores at −90 or less were for anal contact, and 38% were for vagina. For heterosexual males, 76% of the disqualifying scores were for contact with the anus. (A subseries of analyses, described below, was also done on the eliminated "hypersensitive" group, to determine whether this restriction in the sample markedly biased the pattern of sensitivity to apertures.)

Survey description. The survey began with a description of the aims of the study: ". . . . We are interested in the feelings people have about their various body openings and what influences these feelings." Subjects were once again asked to rate the questions ". . . on a scale from −100 to +100 . . ." with anchors described as in study 1.

The survey consisted of three parts. In part one, a sterilized or "contaminated" Q-tip was touched to seven body parts (six apertures). In part two, the same contaminated Q-tips (but different instances of them) were involved in intravenous (IV) and intragastric (IG) administrations. The third part collected demographic information, including sexual preference.

Male and female forms of the questionnaire were identical, except for the inclusion of penis or vagina. There were two forms of male and female surveys. In one, the order of apertures was as indicated below; in the other, the order was reversed (including reversal in the order of IV and IG exposures).

The first sequence (PLAIN) read as follows:

"Assume a different, new sterilized Q-tip for each contact. Rate how you would feel if a clean Q-tip sterilized by dry heat made contact for 5 seconds with each of the following: 1. just inside your nostrils, 2. your tongue inside your mouth, 3. skin on your forearm, 4. just inside the opening of your ear (ear canal), 5. just inside the opening of your anus, 6. a fresh cut on your forearm which is insensitive to pain, 7. [for males] (painlessly pressed against) the opening at the tip of your penis; [for females] just inside of your vagina."

The same set of aperture ratings, in the same order, were then made three more times, with "contaminated" Q-tips. The Q-tip descriptions follow, in the order in which they were presented.

"Imagine a man whom you do not know and have no opinion about. He is your age and in your peer group. Assume that he has just showered and is healthy. Think of a Q-tip that was held in this person's mouth for 30 seconds and was then sterilized by dry heat (the Q-tip will be dry to the touch). Rate how you would feel if the Q-tip made contact for 5 seconds with each of the following:" (followed by the same 7 parts of the subject's body indicated above).

The third scenario was identical to the man scenario above, except that it involved a woman.

The fourth scenario involved contamination with a cockroach. "Rate how you would feel if a Q-tip that had made contact with a cockroach for 5 seconds and then was sterilized by dry heat, made contact for 5 seconds with each of the following:"

The second part of the questionnaire began with the following introduction: "The rest of this study

will involve imagining an intragastric tube and an intravenous needle. An intragastric tube is a tube with a diameter less than that of a straw, that goes into your mouth, down your esophagus and into your stomach. A liquid that enter your body through this tube will completely by-pass your mouth and will not make contact with your mouth. The intravenous needle to be imagined will be connected to a tube which is inserted into one of the veins in your forearm. The forearm area will be swabbed with alcohol before the intravenous needle is inserted. The needle and tube will be new and sterile. Imagine that both the intragastric tube and the intravenous needle are painless. They both will be installed before any other experimentations begin. These devices will be present throughout the rest of this study."

"A clean Q-tip, sterilized by dry heat is used to stir a cup of clean water. The water is then sterilized."

(1) "Rate how you would feel if one teaspoon of this water was administered to you through the intravenous needle."

(2) "Rate how you would feel if one half a cup of this water was administered to you through the intragastric tube."

"Imagine the previously described male. A Q-tip that was held in his mouth for 30 seconds and then was sterilized by dry heat is used to stir a cup of clean water. The water is then sterilized."

(Questions 1 and 2 as above, follow).

The identical description, for female, is then repeated, and followed by the identical procedure with exposure of the Q-tip to a cockroach for 5 s.

Results

Aperture sensitivity: OVERALL APERTURE SENSITIVITY. The data described here are restricted to those subjects that did not rate any of the plain Q-tip contacts as −90 or less.

In order to get a general picture of the relative sensitivities of different points of contact, we have calculated the mean negativity for each contact point across all contaminants (plain, male mouth, female mouth, cockroach) and all subjects. These means require combination of the one item that differs across genders, vagina and penis. Results are displayed in the first, "overall" column in Table 2. The anus is clearly the most sensitive contact point. A second group of points, in order of decreasing negativity, are penis/vagina, intravenous, mouth, nostril, cut arm, and intragastric. The ear is a much less markedly negative point, and the unbroken skin of the arm is the least negative contact point. Our procedure in analyzing the results was to take apart this crude comparison, bringing to bear the information at hand on type of contaminant, type of person (gender and sexual orientation), and meaningful groupings of the contact points (e.g., natural versus artificial apertures).

INTRUSION AND CONTAMINATION AS TWO COMPONENTS OF THE NEGATIVE RESPONSE. The contact scenario that our subjects rate can be analyzed into two components: (1) the actual contact, or entry into an aperture, by itself (the plain Q-tip), and (2) the bringing together of some negative entity (the contaminant) with a particular body location (the contaminated Q-tip). The overall response discussed above can be thought of as a combination of these two effects. The second column of Table 2 shows the overall negative response (across all subjects) to contact with the plain Q-tip. Note that while the general pattern of sensitivity is similar to that

TABLE 2
OVERALL CONTACT POINT SENSITIVITY, INTRUSION SENSITIVITY, AND CONTAMINATION SENSITIVITY (MEANS) ACROSS ALL SUBJECTS

Contact point	Overall [a]	Sensitivity: Plain Q-tip (intrusion)	Roach minus plain (contamination)
Anus	−46.3 (1)	−24.3 (1)	−44.9 (5)
Vagina/penis	−35.1 (2)	−3.9 (6)	−60.9 (1)
Intravenous	−32.1 (3)	−13.5 (2)	−42.9 (6)
Mouth	−28.5 (4.5)	−2.0 (7)	−59.4 (2)
Nostril	−28.5 (4.5)	−10.4 (3)	−39.8 (8)
Cut arm	−26.8 (6)	−9.2 (4)	−40.2 (7)
Intragastric	−26.0 (7)	−4.9 (5)	−48.8 (4)
Ear	−14.6 (8)	11.0 (8)	−53.3 (3)
Arm	−3.8 (9)	12.1 (9)	−35.9 (9)

Note. Rank in each column given in parentheses. Contact points are arranged in order of decreasing sensitivity for overall score. $N = 117$.

[a] Average score across plain, male, female, and roach Q-tips.

for the contaminated Q-tip (Table 2, column 1), there are a few marked departures in ordering. While the anus remains the most sensitive aperture to intrusion, and the ear and arm the least sensitive, the mouth becomes relatively less sensitive to pure intrusion (moving from a rank of 4 to a rank of 7 in the nine contact points), as does the vagina/penis. In contrast, nostril, cut skin, and intravenous are relatively more negative on pure intrusion.

We can now determine a "pure" contamination sensitivity effect by subtracting the plain Q-tip intrusion effect from the contamination effect. We elected to do this for the roach contaminant, since it is not directly gender/sexual orientation linked. The third column of Table 2 shows the mean difference score between the response to roach contact and plain Q-tip contact, for each contact point. Again, the arm remains least contamination sensitive, but the most sensitive points have changed. The vagina/penis is most sensitive, followed by the mouth. There is a gradual decline after mouth from ear canal to arm. Thus, in terms of contamination contact sensitivity, the vagina/penis and the mouth are the most sensitive points, the highest overall sensitivity of anus being in large part due to negative response to a noncontaminated intrusion into this aperture.

As in study 1, we were interested in the relation between intrusion and contamination sensitivity; that is, the extent to which sensitivity to intrusion is correlated with sensitivity to contamination. To answer this question, we felt it necessary to break apart the data by group (gender/orientation) and type of contaminant (roach or gender-specific interpersonal). Each correlation is based on nine pairs of points, namely, each of the nine plain Q-tip mean ratings paired with the corresponding contaminant ratings (total negativity minus intrusion negativitity). The nine correlations (three gender/orientation groups by three

types of contaminants) vary between .53 and .93 (with all but one above .67), indicating that intrusion sensitivity accounts for more than 50% of the variance in response to contaminants, on average. This amount does not vary much across gender/orientation.

Hypersensitive (eliminated) subjects. We wished to examine whether the elimination of 30% of subjects because of −90 or lower scores on at least one contact point for the plain Q-tip might have biased our overall results on intrusion contact sensitivity. We therefore computed means by group for each aperture for the heterosexual male (20) and female (27) subjects who were eliminated. They, of course, show much higher scores on anus plain-Q-tip negativity (−95 for males, −89.4 for females) since most of them were eliminated because of high scores on anus. However, the correlation of the heterosexual male overall aperture pattern for the subjects included in the bulk of the analyses in this study and those eliminated was .79; the corresponding r for females is .94. We conclude that, although potential ceiling effects for contamination caused us to eliminate 30% of the subjects, we have little reason to think that this omission materially affected the pattern of sensitivity we report, though absolute values are surely affected.

Specific contact-point comparisons. We will now consider our data separately in terms of gender/orientation groups, examining critical contact-point pairings that illustrate basic aspects of body boundary sensitivity.

THE MINIMAL EFFECT OF APERTURE. The ear is clearly the least sensitive natural aperture, so we can use ear/arm comparisons as the most challenging test of the hypothesis that a natural aperture is more sensitive than the unbroken surface of the body sheath. Across all four types of Q-tips and all three groups (12 comparisons in all), the ear is always rated as more negative than the arm. In 6 of the 12 comparisons (never for male homosexuals [on account of the smaller n] or plain Q-tips), the ear/arm difference is significant at the $p < .01$ level or better (dependent t tests). The difference is primarily related to contamination sensitivity rather than pure intrusion sensitivity. Overall, for the plain Q-tip, ear is only 1.1 point more negative than arm, while for the residual roach contamination effect (roach-plain difference) the overall difference is 17.4 points.

ARTIFICIAL APERTURES. The only difference between arm and cut/arm is whether there is an artificial aperture (cut) at the point of contact. This makes a great deal of difference, a total of 23.0 points on the overall sensitivity score (Table 2). This effect is almost entirely due to an intrusion effect since the roach contact effect, with plain subtracted out, shows only a 4.3 point difference (Table 2). The cut score is more negative than the arm score in all 12 (four Q-tips by three groups) individual comparisons, with the difference significant at least at the $p < .01$ level in 11 of these cases.

We can also compare the artificial aperture (cut) with the least threatening natural aperture, ear. This comparison is complex, because the cut is more sensitive to pure intrusion (plain) by 12.2 points, but the pure contamination effect (roach–plain) is higher for ear (by 13.1 points, Table 2).

APERTURE BY-PASS. The intragastric procedure is a mouth bypass. The contaminant gets further into the system than in the mouth case, but it does not *contact* the gateway, the mouth. We can ask which is more threatening: contamination at the gate (mouth) or contamination which constitutes actual incorporation in the body (intragastric). For these comparisons, we must factor out the intrusion effect, since the highly unfamiliar and intrusive intragastric route cannot be directly compared to the commonplace oral route. IG is more negative than mouth for all three plain cases, whereas mouth is more negative than IG in all three groups for roach–plain (combining all groups: $n = 117$, $t = 2.959$, $p < .01$). The overall roach–plain (pure contamination) effect is 10.6 points more negative for mouth than for IG.

GENITAL SENSITIVITY: THE PENIS/VAGINA COMPARISON. In analyses up to this point, we have collapsed the genital categories over males and females. But these apertures are vastly different, both anatomically and in their interactions with the environment. In particular, while the vagina can be an input organ as a result of sexual intercourse and insertion of tampons, contraceptives, and cleansing substances, the penis is virtually never entered, and its inner surface is rarely exposed. Thus, in a sense there is both more vulnerability and more environmental interaction at the vagina. There is a nonsignificant tendency for the vagina to be more sensitive to pure intrusion (plain Q-tip, male versus female heterosexuals: 12.9 point difference, $t = 1.488$, n.s.). The effect remains in the same direction, though still nonsignificant, in the case of pure contamination (roach–plain) ($t = .839$, n.s.).

Differences between gender/orientation groups: SENSITIVITY OF CONTACT POINTS. Given the more common instance of anal entry in male homosexual sexual interactions, one might expect the anus to be less sensitive to intrusion in homosexuals, and indeed it is. While the anus is the most sensitive contact point for the plain Q-tip in male and female heterosexuals (and this value is reduced by the elimination of 30% of heterosexual Ss primarily for very low plain/anus scores), it ranks seventh for homosexual males. The pure intrusion (plain Q-tip) anus ranking for male homosexuals is 9.5, as opposed to −29.0 for male heterosexuals ($t = 3.67$, $p < .001$). In terms of a pure contamination effect (roach–plain), the corresponding values are −61.0 for male homosexuals and −35.6 for male heterosexuals ($t = 2.20$, $p < .05$, not significant by the .01 standard we are employing). The pure anal contamination effect for male homosexuals (a drop of 70.5 from pure intrusion) is much higher than the corresponding effect for male heterosexuals (−6.6). This large difference may be, in part, an artifact; since intrusion sensitivity is low for male homosexuals, there is a much larger range for a possible contamination effect, while ceiling effects may limit the range for male heterosexuals. Thus, the decreased anal sensitivity for male homosexuals may hold only for intrusion.

REACTIONS TO MALE VERSUS FEMALE CONTAMINANTS. Unlike the cockroach contaminant, the male and female mouth contaminants have different sexual significance, that might relate to both gender and sexual orientation. The gender that

is most sexually attractive to a group is always a less negative contaminant than the non-sexually attractive gender. However, whereas the differences are small and nonsignificant for females (3.3 points) and male homosexuals (6.0 points), the difference is substantial and significant for heterosexual males (33.2 points, $t = 6.678$, $p < .001$).

If we examine sensitivity across apertures, a striking contrast emerges. The correlations between patterns of sensitivity (measured by Pearson *r*s taken across the 9 pairs of scores representing each contact point; see Table 3), across the three different groups, are quite high. The three lowest correlations are informative. Two refer to correlations for the plain Q-tip between male homosexuals and either females (.21) or heterosexual males (.32). These result largely from very different responses to the anus in male homosexuals. The other is the low correlation (.28) between heterosexual males and females for the female mouth contaminant. Heterosexual males sexualize contacts with anonymous females, which changes their pattern of aperture sensitivity (see next two paragraphs and Tables 4 and 5), while for females, contacts with strangers are roughly equally aversive independent of the gender of the stranger.

Table 4 shows that the pattern of aperture sensitivity is highly similar *within* each group, across pairs of contaminants (male and female mouths, cockroach), with all but two correlations above .64. The two exceptions involve the female contaminant (female mouth–male mouth and female mouth–roach) for male heterosexuals. Heterosexual male response to the female mouth is qualitatively different from the response of all other groups to all of the contaminants (and heterosexual males to male mouth or roach). In short, mouth contact with strangers behaves like cockroach for all subjects except for heterosexual male contacts with females.

The source of this difference is apparent in Table 5, which indicates the order of aperture sensitivity for each group, for male and female mouth contaminants. The anus, vagina/penis and mouth constitute the most vulnerable contact points for females, independent of the sex of the contaminant, and for males with male contaminants. However, for heterosexual male subjects and the female mouth contaminant, there is a marked drop in negativity to the two apertures that might be thought of as most sexualized; the mouth and the tip of the penis. For mouth,

TABLE 3
CORRELATION OF APERTURE PROFILE ON DIFFERENT CONTAMINANTS FOR EACH GENDER/ORIENTATION GROUP

Contaminant	Hetero–Homo	Hetero–female	Homo–female
Plain	.32	.93	.21
Roach	.92	.94	.83
Male	.36	.97	.42
Female	.58	.28	.69

TABLE 4
RELATION OF CONTACT SENSITIVITY WITHIN GROUPS, ACROSS DIFFERENT CONTAMINANTS

Groups	Contaminant pairs		
	Male–Female	Male–Roach	Female–Roach
Females	.99	.96	.96
Heterosexual males	.38	.94	.49
Homosexual males	.89	.64	.79

Note. Pearson correlation of aperture profiles across contaminants, by group.

heterosexual males find contamination by a female 43.3 points better than contamination by a male, whereas females find contamination by a male only 3.8 points better than contamination by female. A congruent result is that the major differences in overall contamination sensitivity between groups have to do with the response to males between male heterosexuals and male homosexuals (34 points) and response to females between heterosexual males and females (28 points). Both are interpretable as sexualization of stranger contacts by males.

EXPERIMENT 3

Introduction

In the third study we focused on one aperture, the mouth, and examined contamination sensitivity and potency of the subparts of this particularly complex aperture. We were interested in distinguishing between two possibilities. Ac-

TABLE 5
ORDER OF CONTACT-POINT SENSITIVITY FOR MALE AND FEMALE CONTAMINANTS, BY GROUP

Group					
Females		Male heterosexuals		Male homosexuals	
Male	Female	Male	Female	Male	Female
Anus	Anus	Anus	Anus	IV	Penis
Vag	*	Penis	IV	IG	IV
*	Vag	Mouth	*	Cut	IG
Mouth	*	*	IG	Penis	Anus
IV	Mouth	Nostril	Nostril	Nostril	Cut
Nostril	IV	Cut	Cut	Anus	Nostril
Cut	Nostril	IV	Mouth	Mouth	Mouth
IG	Cut	IG	Ear	Ear	Ear
Ear	IG	Ear	Penis	Arm	Arm
*	Ear	*	Arm		
Arm	*	Arm			
	Arm				

Note. Asterisks indicate a difference between neighboring points significant at $p < .01$.

cording to one, there is a gradual increase in negativity as a contaminant makes more and more contact with the mouth. According to a second view, there is a rather sharp increase in negativity at the point where a person feels that the contaminant is "in" his/her body or mouth, with less concern before and after that point. This would exaggerate the boundary between inside and outside as in the "Mach Band" phenomenon.

Methods

Subjects. Subjects were 129 undergraduate student volunteers (39 males) from an introductory psychology course at the University of Pennsylvania.

Survey. The questionnaire consisted of two sections, one addressing contamination sensitivity and the other contamination potency. In the sensitivity section, the instructions were as follows:

"Imagine the most disliked, repulsive (but healthy) person that you know personally. A grape has been placed on this person's tongue. His or her mouth is closed for 15 seconds and the grape is then removed whole and intact.

"Next, imagine a grape treated in this way ('mouthed by a repulsive person') in each of the situations described in the following questions. Each situation lasts for 15 seconds. Rate your feelings toward being in each situation with this grape, using the scale described. Assume that a new instance of a 'mouthed' grape is used in each situation."

There were 19 degrees of contact to be imagined, as arrayed in a conceptually meaningful order in the first column of Table 6, each sentence preceded by "A mouthed grape is . . . ." (e.g., "touching the roof of your open mouth"). Students rated their reactions on a scale running from −100 to +100, according to the following instructions:

". . . . please use a scale which goes from −100 to +100. −100 is the most unpleasant situation you can imagine, and +100 is the most pleasant. Zero is neutral. Feel free to use any values in between, for example: 47, −32, or 86." Additionally, in this study, as a guide to using this rating scale, a linear scale 16.5 cm long was displayed below this instruction, with markings as follows at equal distances: −100 extremely unpleasant, −75 very unpleasant, −50 moderately unpleasant, −25 mildly unpleasant, 0 neutral, +25 mildly pleasant, +50 moderately pleasant, +75 very pleasant, and +100 extremely pleasant.

Subjects were first asked: "Using the scale described above, please rate your feelings about chewing a green, seedless grape." This question was repeated at the end of the questionnaire, and the mean of the two values was used as baseline for all other measurements.

In the contamination potency part of the questionnaire, the instructions were: "Now consider the disliked, repulsive (but healthy) person you imagined in Part I. Imagine that a grape is placed in the following situations with respect to this disliked person. The grape is then to be chewed by you. Please rate your feelings about chewing this grape, using the same scale as before, after it is placed in the following situations. Assume a new grape is used in each situation. Each situation lasts for 15 seconds." The alternatives were each preceded by "A grape was . . . ." They are the same set of exposures as for contamination sensitivity, except that swallowing and in stomach could obviously not be used.

Presentation of the sections was counterbalanced, with the potency section preceding the sensitivity section in half of the questionnaires, with appropriate minor changes in instructions. In addition, to control for within-section order effects, the order of questions was randomized and presented in that order in one half of the questionnaires, and the reverse order in the other half.

Results

Results are indicated in Table 6 and displayed in Fig. 2. Types of contact are arranged in order of increasing degree of sensitivity, as measured by the results of this study, except for the last two items, swallowing and in the stomach.

TABLE 6

REACTIONS TO A GRAPE WITH DIFFERENT DEGREES OF CONTACT WITH SELF (CONTAMINATION SENSITIVITY) OR WITH DIFFERENT DEGREES OF CONTACT WITH ANOTHER (CONTAMINATION POTENCY)[a]

Degree of contact of grape with self (sensitivity) or other (potency)	Sensitivity		Potency	
	Mean	*SD*	Mean	*SD*
Plain grape, prequestionnaire	59.8	25.2		
Plain grape, postquestionnaire	54.9	35.2		
10″ in front of closed mouth	−8.4	25.5	8.3	38.6
1″ in front of closed mouth	−22.6	27.5	−8.6	37.3
1″ in front of open mouth	−30.2	27.3	−14.4	36.5
Just in front of closed mouth, almost but not quite touching lips	−32.7	28.9	−20.5	39.2
Touching outside of cheek, mouth closed	−34.0	31.1	−27.9	35.2
Suspended inside open mouth on a spoon, not touching any part of mouth	−42.3	30.5	−35.9	35.8
Touching lips, mouth closed	−50.0	27.3	−47.5	34.9
Held lightly between front teeth with mouth open	−52.3	30.6	−53.3	33.0
Touching lips with mouth open	−52.3	29.2	−54.8	30.9
Held lightly between back teeth with mouth open	−59.9	27.6	−63.9	30.5
Touching the tip of extended tongue	−61.1	27.8	−59.3	31.2
Touching inside of cheek with mouth open	−67.0	26.0	−62.7	29.4
Touching the roof of open mouth	−68.5	26.2	−59.9	29.8
Resting on tongue, mouth is open	−72.0	26.0	−68.7	30.1
Between cheek and gum with mouth closed	−72.6	26.6	−69.7	30.0
On tongue, mouth closed	−77.2	23.9	−74.4	30.2
Being chewed	−86.3	20.8	−92.0	24.1
Being swallowed	−83.6	23.6		
In stomach	−62.4	37.6		

[a] In order of increasing sensitivity, except for last two degrees of contact. *N* varies from 112 to 129 due to missing data.

Sensitivity: factors determining the sense of incorporation. Examination of the data suggests that three factors contribute to the negative response to an undesirable object and/or the sense of intrusion: general contact with oral structures, contact with the tongue, specifically, and the sense of entry into the oral cavity. We will consider the evidence for each, in turn.

There is evidence for a general contract effect, with the grape touching the lips with mouth closed being 7.7 points more negative (minimal incorporation threat) than suspended in the open mouth ($t = 4.067$, $p < .001$), and touching the extended tongue being 18.8 points more negative than suspended in the mouth ($t = 9.00$, $p < .001$). Finally, touching the closed lips is 17.3 points more negative than almost touching the lips with mouth closed ($t = 8.18$, $p < .001$).

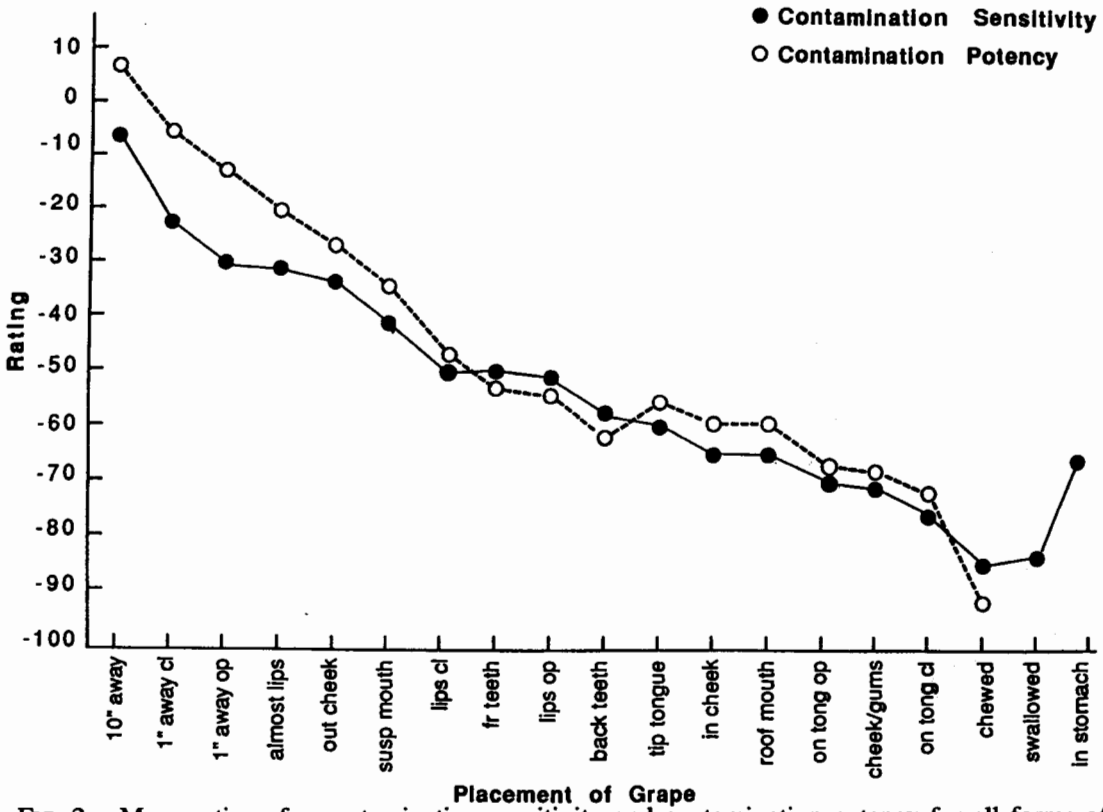

FIG. 2. Mean ratings for contamination sensitivity and contamination potency for all forms of contact with the mouth and the area around it. Degrees of contact on abcissa are arranged in order of decreasing contamination sensitivity.

The tongue seems to be a point of special sensitivity. Contact with the extended tongue is 8.8 points worse ($t = 5.64$, $p < .001$) than touching the lips with the mouth open, and 18.8 points worse ($t = 10.45$, $p < .001$) than suspended in the mouth. Also, contact with the tongue in the closed mouth is more negative than contact with any other part of the interior of the mouth.

Finally, degree or threat of entry seems to be an important determinant of negativity. The contaminated grape one inch away with the mouth open is 7.6 points more negative than 1″ away with the mouth closed ($t = 9.00$, $p < .001$). The same direction of effect (not statistically significant) occurs, with touching the lips when they are open being 2.3 points more negative than touching them when they are closed. On the other hand, when something is in the mouth, mouth open should reduce rather than increase the sense of entry or incorporation, and it does; on the tongue with the mouth closed is 5.1 points more negative than on tongue with mouth open ($t = 4.44$, $p < .001$). More related to threat of entry per se, 1″ away with the mouth closed is 14.7 points more negative than 10″ away with the mouth closed ($t = 7.14$, $p < .001$), and on the tongue when it is extended is 10.9 points less negative than on the tongue in the open mouth ($t = 6.38$, $p < .001$).

Looking very broadly at the pattern of response, there is some evidence that the mouth acts as a Mach Band. Approaching objects (the first five items in the figure or table) are much less negative than contacting objects. For example,

there is a 17.3 point difference between touching the closed lips and almost touching the closed lips ($t = 8.18$, $p < .001$). Of particular interest is that, at the other end of the process of ingestion, presence in the stomach is 23.9 points *less* negative than chewing ($t = 9.07$, $p < .001$). Thus, although there is some degree of gradation in the sense of incorporation into the self, mouth entry, or contact produces a marked increase in sense of incorporation, and departure from the mouth (in the stomach) reduces the negativity associated with incorporation.

Contamination potency: Symmetry with contamination sensitivity. The results for contamination potency, as measured by reactions to contact with the grape that had different degrees of contact with the negative "other" indicate, in general, that those degrees of intimacy that produce the greatest degree of contamination sensitivity are also those with the most contamination potency. The correlation (Pearson r) between the two measures, for the 17 degrees of intimacy for which data are available on both, is .99 (Fig. 2).

DISCUSSION

In the first study, we demonstrated the particular importance of apertures in the understanding of body/self boundaries. We also demonstrated at a preliminary level that all apertures are not equal. Those that are naturally *material entry points* to the body seem to be both much more vulnerable and more contaminating than other apertures or "unbroken" areas on the sheath. For female subjects, it is not clear whether the greater vulnerability of the vagina than the mouth is best accounted for in terms of greater usual protection from the world, or in terms of a sense of more intimate connection to the self. We have found in describing these results to males, that they are very surprised that there is any other aperture that compares to the mouth in sensitivity. We suggest that such fundamental differences in sense of self and bodily violation have important implications for phenomena such as date rape.

We also determined in study 1 that the degree of usual exposure to the world seems to be a less powerful variable than we had anticipated. The palm of the hand is about as sensitive and potent as the back of the hand, in spite of the very large difference in contact exposure to the environment. It is, of course, possible that two opposing factors are at work here: the contamination sensitivity of the palm may be reduced by frequent contacts, but it may start at a higher level, because it is seen as more central to the self than the back of the hand (being more integrally involved in exploration of the world) and because it has higher tactile sensitivity.

In the second study, more fine-grained comparison of all the natural bodily apertures and some artificial ones yielded results consistent with those of study 1, except that the greater sensitivity of the vagina relative to the mouth was muted. The results of study 2 further suggest a basic distinction between the sensitivity of apertures to intrusion versus contamination. Although correlated, they are significantly different. Thus, the anus is the aperture that is most intru-

sion sensitive, but not most contamination sensitive. This distinction makes sense, since the anus is virtually never penetrated in most people, so intrusion might be a subject of great sensitivity. On the other hand, given that the anus is almost exclusively an excretory aperture for a highly disgusting (contaminating) substance, it is not surprising that contaminants in this area are less negative than in some other apertures. This analysis of the anus is confirmed by the much lower anal intrusion sensitivity of male homosexuals, who presumably experience such intrusions more often.

In general, the second study shows that all apertures, natural or artificial, are more sensitive than the body sheath (measured here in terms of forearm skin). The ear canal seems, among apertures, to allow least access to the "self," insofar as we think of contamination as an effect which impinges on the self. Less contamination seems to be conveyed by intragastric or intravenous than oral routes, supporting our contention that the body's sensitivity to contamination is highlighted at the natural boundaries (apertures).

A somewhat surprising finding is the high sensitivity of the tip of the penis to contamination. In fact, it is almost as sensitive as the vagina. Intrusion sensitivity might be accounted for by "penetrational naivete," since it as an aperture that is virtually never penetrated, but the contamination sensitivity is not so easily derived. It is after all a habitual exit point for urine, a contaminating substance. We suspect that this pattern occurs because of a closer identification of the penis with the male sense of self, relative to other apertures.

We find that, in general, males are much more inclined to sexualize contacts with the sexually attractive gender than females are. Thus, female contact is much less negative to heterosexual males than male contact is, where there is only a minimal difference for females. In particular, for males, contact with the tip of the penis is much less negative if the contact is with unknown females rather than unknown males. This male tendency to sexualize contacts with anonymous others of the attractive category seemed to hold for male homosexuals as well. Our results seem to be another, relatively unobtrusive measure of what sociobiologists call male promiscuity. Strangers are like cockroaches in terms of aperture sensitivity, except when the stranger is of the sexually desired gender and the subject is male!

In the third study, in-depth exploration of one aperture, the mouth, confirmed it to be emotionally charged as a body entry point. Results further suggest that, overall, the Mach Band analogy fits. However, in terms of its own structure, there are no very sharp transition points in the mouth, with tongue, contact, and entry into the cavity all contributing to the sense of incorporation. The mouths of others proved to be roughly symmetrical to one's own; what makes something count as having been incorporated in another's mouth (hence theirs, hence offensive) is the same thing that counts as incorporation into the self.

It is easy to account for the various factors determining the relative sensitivity of one's own mouth structures in terms of two mechanisms. First, contact no

doubt increases one's sense of intrusion by increasing the perceptual salience of the object. The tongue's particular sensitivity, with the added sense of taste, may add to the salience of contact with it, and hence its high sensitivity scores. Presence in the stomach is associated with the least amount of perceptual salience. Second, the effect of proximity and degree of entry into the mouth cavity can be accounted for in cognitive terms—a sense of the likelihood that the offensive object will successfully bypass one's "perimeter guard" and achieve irrevocable entry into the body. Finally, degree of sensitivity of different mouth parts and degrees of mouth entry correspond closely to the contamination potency of these parts and locations. The implication of this symmetry is that, as Douglas (1966) suggests, we think about orifices as gates at the borders of the body. The different parts of these gates (e.g., different mouth structures) are felt to be differentially permeable, such that more or less interchange between inside (self) and outside (world) occurs depending on the exact place of contact. (This is not to suggest one-way permeability, "in" for self, "out" for others; these structures would also let things out of one's own body, and into the other's body, but normally the concern is likely to be guarding one's own boundaries rather than protecting others from our own exudations).

This notion of permeability and exudation of self, and the symmetry which holds up for both the mouth and for the rest of the body, may be brought to bear to account for many of the rules of physical contact that hold between people. For example, it accounts for why one might not want to touch an enemy at all (why contact hostile exudations?); why strangers might be willing to shake hands with each other, since palms of hands are not especially permeable, but they would clearly not kiss; it suggests that, in general, the more one wishes to merge with or incorporate another individual, the more s/he should seek contact between more vulnerable spots, particularly orifices, on both bodies (as in kissing or genital contact). Finally, it explains why, if one wishes to denote dominance over another individual, an excellent way to do it might be to achieve contact between a vulnerable portion of his/her body and a less vulnerable portion of one's own (as in having one's hand or foot kissed)—such that the individual being submissive exposes himself to incorporation of the self exudations of the dominant individual, while the dominant person maintains the integrity of his/her own boundaries. Numerous other clarifying explanations and predictions can be derived from this approach.

Overall, the results of these three studies suggest that there are two underlying factors that motivate negative responses to bodily contact. One is the sense of intrusion of anything into the body (the clean new poker chip or clean Q-tip effect), and another is the specific contaminating content of the object of intrusion, as clearly indicated in the contamination potency curves (Study 1) and disparities between intrusion and pure roach contamination effects in Study 2. Both rest on the basic conception of the bodily self as permeable. It is important to note that contamination appears to relate less to fear of germs (all objects in

Study 2 were described as sterilized) and more to fear of something alien and interpersonal, or what we have referred to as interpersonal disgust. However, it is also possible that subjects were either unfamiliar with the relation between sterilization and germs, or were doubtful as to the complete effectiveness of the sterilization.

We consider the micro-examination of reactions to types and degrees of physical contact to be a valuable and little-used means of accessing the sense of self, and of mapping relations between selves in interpersonal relations. We have been extending this "mapping" to include social aspects of food exchanges (e.g., Nemeroff & Rozin 1989; Rozin, 1990; Friedman-Miller, Fiske & Rozin, 1994), personal possessions and/or personal space (e.g., Nemeroff & Rozin 1994; Rozin, Markwith & McCauley, 1994; Rozin, Nemeroff, Wane & Sherrod 1989), and the sense of "body as self" in bulimia (Schupak-Neuberg & Nemeroff, 1993), documenting the permeability of self, and the "exchange" of self in everyday life.

Our analysis of apertures and their sensitivity profiles can be applied to the study of individual differences and personality. We have already demonstrated substantial differences between homosexual males and heterosexuals of either gender. But there are no doubt substantial differences as well within gender and within sexual orientation. Freud's focus on the importance of apertures (anus, mouth, and genitals) in personality formation is well known. Freud jumped from his important insights about focal apertures and conflicts in development to personality types, writ large. Our analysis suggests a more modest exploration of aspects of weaning, toilet training, and other key experiences on aperture sensitivity. For example, victims of sexual assaults might be expected to show differential contamination sensitivity, as might individuals with eating disorders (Schupak-Neuberg & Nemeroff, 1993).

Finally, a fruitful area for further investigation concerns the personality dimensions that may be related to both intrusion and contamination sensitivity. Foremost among these might be our disgust sensitivity scale (Haidt, McCauley & Rozin, 1993), and in particular the body-envelope-violation subscale.

The data we present in this paper come from a small segment of one culture. We do not know how representative our results are for Americans, in general, let alone for other cultures. Much of the interest and information on apertures comes from anthropologists/ethnographers. While we expect there to be some universals in thinking about apertures, we also expect that there will be substantial and informative cultural differences in aperture sensitivity. Certainly, Hindu conceptions of the body and permeability of the person (e.g., Daniel, 1984) would provide a particularly appropriate domain in which to further explore issues such as intrusion and contamination sensitivity of apertures in a cultural context.

REFERENCES

Daniel, E. V. (1984). *Fluid signs. Being a person the Tamil way.* Berkeley, CA: Univ. of California Press.

Douglas, M. (1966). *Purity and danger.* London: Routledge & Kegan Paul.

Fisher, S. (1986a). *Development and structure of the body image. Volume 1.* Hillsdale, NJ: Lawrence Erlbaum.

Fisher, S. (1986b). *Development and structure of the body image. Volume 2.* Hillsdale, NJ: Lawrence Erlbaum.

Fisher, S., & Cleveland, S. E. (1958). *Body image and personality.* Princeton, NJ: D. van Nostrand.

Friedman-Miller, L., Fiske, A., & Rozin, P. (1994). *Food sharing and feeding another person suggest intimacy: A study of American college students.* Manuscript submitted for publication.

Frazer, J. G. (1890/1959). *The golden bough: A study in magic and religion.* New York: Macmillan. (Reprint of 1922 abridged edition, edited by T. H. Gaster, 1959).

Goffman, E. (1971). *Relations in public.* New York: Harper & Row.

Harter, S. (1988). Causes, correlates and the functional role of global self-worth: A life-span perspective. In J. Kolligan & R. Sternberg (Eds.), *Perceptions of competence and incompetence across the lifespan* (pp. 67–97). New Haven, CT: Yale University Press.

Nemeroff, C., & Rozin, P. (1989) An unacknowledged belief in "you are what you eat" among college students in the United States: An application of the demand-free "impressions" technique. *Ethos,* **17,** 50–69.

Nemeroff, C., & Rozin, P. (1994). The contagion concept in adult thinking in the United States: Transmission of germs and of interpersonal influence. *Ethos,* **22,** 158–186.

Rozin, P. (1990). Social and moral aspects of eating. In I. Rock (Ed.), *The legacy of Solomon Asch: Essays in cognition and social psychology.* Potomac, Maryland: Lawrence Erlbaum.

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. (1987). A perspective on disgust. *Psychological Review,* **94,** 23–41.

Rozin, P., Haidt, J., & McCauley, C. R. (1993). Disgust. In M. Lewis & J. M. Haviland, *Handbook of emotions* (pp. 575–594). New York: Guilford.

Rozin, P., Millman, L., & Nemeroff, C. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology,* **50,** 703–712.

Rozin, P., & Nemeroff, C. (1990). The laws of sympathetic magic: A psychological analysis of similarity and contagion. In J. Stigler, G. Herdt & R. A. Shweder (Eds.), *Cultural psychology: Essays on comparative human development* (pp. 205–232). Cambridge, England: Cambridge Univ. Press.

Rozin, P., Nemeroff, C., Wane, M., & Sherrod, A. (1989). Operation of the sympathetic magical law of contagion in interpersonal attitudes among Americans. *Bulletin of the Psychonomic Sciences,* **27,** 367–370.

Schupak-Neuberg, E., & Nemeroff, C. (1993). Disturbances in identity and self-regulation in bulimia nervosa: Implications for a metaphorical perspective of "body as self." *International Journal of Eating Disorders,* **13,** 335–347.