

FOOD FOR THOUGHT: THE ROLE OF TEXTURE
IN THE DISGUST RESPONSE

By

Laura H. Kushner

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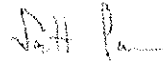
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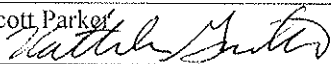
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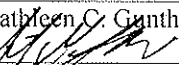
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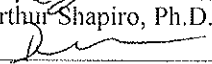
Scott Parker



Kathleen C. Ganthert, Ph.D.



Arthur Shapiro, Ph.D.



Debra Zellner, Ph.D.



Dean of College of Arts and Sciences

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ABSTRACT

Disgust is a universally recognized basic emotion. Core disgust is defined by Rozin, Haidt, and McCauley (2008) as the revulsion at the thought of incorporation of an offensive object. They suggested that there are three features necessary to elicit a core disgust response: there must be a threat of ingesting the stimulus, the disgusting product must be related to animals, and finally, the disgusting product must have the power to contaminate an otherwise neutral product or food.

The current study examined whether texturally aversive non-meat foods engender core disgust. In the stimulus selection portion of the study, 100 subjects listed foods they found disgusting and rated disgust for 27 specific foods. Eight non-animal stimuli were then chosen for the experiment.

In the main experiment, 50 subjects were presented with the eight non-animal stimuli and asked how disgusting they found the foods, what about the foods were disgusting, and how willing they would be to eat the foods. Subjects were then asked to actually taste the stimuli. If a subject was unwilling to eat a particular stimulus, there was a test for contamination. The subject placed a small amount of the food on a small portion

of the cracker and then removed the stimulus from the cracker. Subjects were asked to eat various portions of the cracker to determine whether contamination occurred.

Finally, subjects filled out the Disgust-Sensitivity-Scale-Revised, a picky eating inventory, and the Obsessive-Compulsive inventory. Kauer (2002) suggested these measures might correlate with eating behaviors.

Non-animal foods can elicit core disgust. Nearly 80% of subjects indicated that at least one of the foods was “very disgusting”, 30% would not eat a part of the cracker that the disgusting stimulus had touched, and 10% would not eat a part of the cracker that the disgusting stimulus had not touched. Behavioral results were correlated with scores on the picky eating inventory. Subjects who scored high on the picky eating inventory exhibited more disgust-sensitive behaviors. Although what subjects stated they would eat and what they actually ate were correlated, that correlation was far from perfect. Future research on disgust should include behavioral assessments.

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First and foremost, my advisor Scott Parker has been by my side on this project throughout each of its 100+ drafts (I counted). While his detailed-oriented approach may have created some of my own “disgust responses”, I truly value his attentive eye and willingness to always provide helpful comments. Additionally, I am thankful for Scott’s desire to let me play in a new area of research that truly reflected my interests. I sensed Scott’s wish to let me develop into my own researcher, and throughout this project I obtained more of my own research skills and sensibilities.

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The emotional support of my friends and family has been invaluable throughout this process. My parents have been supportive of this project before it even was a project. I remember sitting in our favorite little Italian restaurant, Luigi's, when my mom stated, "Hey, why don't you write a dissertation about food!? You love food!" My dad supplanted ideas and the project was born.

Once the data collecting and writing was underway my friends were an enormous support. Cory supplied me with the fridge to keep all my "gross foods" from becoming "dangerous foods." My Lobas served as subjects and generated continual disgusting ideas. Mary always provided a listening ear. Erin and Mario treated me to dinners for every milestone. Jill distracted me with graduate school humor. Adi and Robert listened were there to high-five me through the final hurdles.

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CHAPTER 1

OVERVIEW

The present study investigates whether disgust can be induced by non-meat foods with unappealing textures. Before exploring this topic, it will be useful to have some background. First, the definition of disgust and its various sub-types will be described. Next, some basic theories of food rejection with an emphasis on disgust and contamination will be explained. Finally, some factors that may interact with a disgust response, namely the texture of foods and individual differences, will be outlined. This will provide a clear picture of the previous literature on food and disgust and the motivation for the current study.

Defining Disgust

Disgust is universally recognized as a basic emotion. Paul Ekman (1992) described nine requisite criteria for a basic emotion and disgust fulfills all nine. In particular, when disgusted, people demonstrate: a distinct facial expression (closed nostrils and open mouth) (Ekman & Friesen, 1975), a particular action (movement away from that which is disgusting), a physiological reaction (nausea), and a typical feeling (revulsion) (Izard, 1971).

In early attempts to precisely define the construct of disgust, Charles Darwin (1872/1965) deftly noted that disgust has its origins in food, “The term ‘disgust,’ in its simplest sense, means something offensive to the taste” (p. 256). He more broadly

described the idea of disgust as, “Something revolting, primarily in relation to the sense of taste, as actually perceived or vividly imagined” (p. 253). Darwin related that disgust not only elicited feelings of revulsion, but he observed that disgust has a characteristic facial expression. Later, Andras Angyal (1941) conceptualized disgust as a specific avoidance reaction to waste products of humans and animals. Another early construct of disgust proposed by Tomkins (1963) held that disgust was an emotion used to protect oneself from unwanted closeness by a repellent object.

Rozin and Fallon (1987) consolidated these earlier ideas and defined disgust as, “Revulsion at the prospect of (oral) incorporation of an offensive object. The offensive objects are contaminants; that is, if they even briefly contacted an acceptable food, they tend to render that food unacceptable” (p. 23). Rozin, Haidt, and McCauley (2008) argued that although disgust began with food it has evolved to occur in other situations. Although this study will focus on the more primitive food related disgust (“core disgust” in Rozin, Haidt and McCauley’s terms), it will be useful to have some background on disgust in all of its forms.

Different Kinds of Disgust

Core Disgust

The disgust that will be the focus of this study is known as core disgust. According to Rozin, Haidt, and McCauley (2008, p. 759) core disgust has three distinct, necessary components. First, there must be a sense of oral incorporation of the disgusting entity. The disgust response is much stronger when the elicitor is imagined to be in the mouth versus on the surface of the body (Rozin, Nemeroff, Horowitz, & Voet, 1995). For

example, the thought of ingesting dog feces will be more aversive or disgusting than the thought of touching dog feces.

Rozin, Haidt, and McCauley (2008) said that the second characteristic of core disgust is offensiveness and that the disgusting product will often, in some way, relate to animals or their waste. They argued that in any given culture, humans only eat a small subset of all of the potentially edible animal species. Animals may be considered disgusting for a variety of reasons. Some anthropologists argue that animals are likely to lead to a disgust response as an indirect protective feature for the ecological sustainability of an environment. For example, Harris (1985) commented animals may be avoided if eating the animal is ecologically destructive or uneconomical. More concretely, animals may be more likely to be disgusting if, at some point, consuming them might have been dangerous. In this vein, it has been suggested that ancient Jews chose not to eat pork because of the fear of trichinosis (Douglas, 1966).

Likewise, Angyal (1941) said that it is typical for humans to prepare foods so as to disguise the animal product they are eating. For example, small pieces of cut up chicken breast no longer resemble the chicken. Additionally, animals may be called something different when they are served as food as opposed to their anatomical parts. For example, a cow's thymus gland is referred to as "sweetbreads" and cow testes are sometimes referred to as "Rocky Mountain Oysters" when served as food (Bronner, 1981). Perhaps if animals were not likely to cause a disgust response, the change of name would not occur.

Some animals, e.g., a sea slug, may themselves resemble a waste product. Others may be disgusting because they routinely come in contact with rotting animals or waste,

e.g., a cockroach or a rat (Rozin, Haidt, & McCauley, 2008). Interestingly, in 1993, Japanese scientists determined a method to turn recycled sewage into a “healthy, edible sausage”; however, the product was not commercially manufactured because of an “image problem” (Perry, 1993).

Additionally, animals that are most similar to humans are typically avoided, e.g., monkeys. Finally, there is a group of animals that produce a mixture of both danger and disgust, such as snakes or insects. Davey (1993) argued that avoidance of eating these animals may be related more to the notion of disgust than danger. Evidence will be presented later that questions whether animals and their waste are a prerequisite for feelings of disgust.

The third feature of core disgust is that the disgusting product must have the power to contaminate (brief contact from a disgusting food rendering an initially neutral food inedible) a potential food even if it only touches the food for a brief period. As contamination is a central feature of this study, it will be further explained in a later section.

Animal-Nature Disgust

While core disgust centers on food and eating, people often report things other than food as disgusting. When North American and Japanese subjects were asked to list things they found disgusting, only 25% of the responses came from the core disgust category (Haidt, Rozin, McCauley & Imada, 1997). Some of the other responses tended to fit four other categories: “Inappropriate sexual acts, poor hygiene, death, and violation of the ideal body envelope” (p. 641). Within this particular category, the idea of ingestion

is no longer a defining feature of the disgust response. Instead, what is offensive are certain actions (further defined by particular culture) that remind us of our animal nature. For example, “Humans must eat, excrete, and have sex, just like animals” (p. 642).

Interpersonal Disgust

Rozin, Haidt and McCauley (2008) defined a third kind of disgust as relating to direct or indirect contact with other people. For example, Rozin et al. (1989) found subjects often have strong aversions to clothing that strange or undesirable people have worn. This category is different from the previous two because the idea of ingesting or touching the elicitor is no longer necessary for the disgust reaction. One hypothesized function of this kind of disgust is to create and/or maintain specific social hierarchies. For example, the Caste System in India is impacted by interpersonal disgust; certain foods are rendered inedible if handled by someone of a lower caste (Appadurai, 1981).

Moral Disgust

The final form of disgust functions by “Protecting the soul from threats” (Rozin, 1990, p. 107). In the previously mentioned study in which North American and Japanese subjects were asked to list things they found disgusting, the most common concepts mentioned were moral offenses. Subjects provided responses that included: “Racists, child abusers, hypocrites, Republicans, and liberals” (Haidt, Rozin, McCauley & Imada, 1997). It is thought that moral disgust might function as a means of socialization. If something immoral is also thought of as disgusting, there will be less temptation to engage in particular activities. Rozin, Haidt and McCauley (2008) cited smoking as a negative value in the United States that often engenders feelings of moral disgust.

Although much literature on disgust has expanded beyond the core disgust paradigm, there remain many unanswered questions regarding food and disgust (especially in the core disgust sense). Before examining how food and disgust have been explicitly investigated it will be useful to understand why it is thought that people choose to reject foods.

Development of the Theory of Food Rejections

Rozin and Fallon (1980) began to explore the reasons why humans choose to reject certain foods. Based on, “intuition and informal interviews” they hypothesized three criteria for rejection: distaste, danger, and disgust (p. 194). They originally defined distaste as, “Rejection primarily because of taste, smell, or texture”, danger as, “Rejection primarily because of anticipated negative post-ingestional consequences”, and disgust as, “Rejection primarily because of knowledge of the origin or nature of the substance” (p. 195).

In order to investigate these categories, subjects were asked to fill out a questionnaire that explored reasons for food rejections. The questionnaire had 13 sections each of which referred to a food of a specific type or a food that gave rise to a specific reaction in the subject. The sections asked subjects to think about:

(1) A food that you consider disgusting (e.g., a cockroach or specific excretory product);

(2) A food that you strongly dislike because of its taste, but that does not disgust you. (e.g., quinine water, strong black coffee, hot chili peppers);

(3) A canned food that you like which may contain small amounts of a dangerous microorganism;

(4) Cold human mother's milk;

(5) Cold milk;

(6) A food to which you are allergic;

(7) Roast pork (for kosher subjects);

(8) Body temperature milk;

(9) A food that you strongly like but that you would dislike as your first food of the day;

(10) Meat and dairy combinations (for kosher subjects);

(11) A combination of two foods that you like individually but strongly dislike in combination (e.g., catsup and ice cream, hamburger and whipped cream, chocolate and strong beans);

(12) A dislike that you can trace to a particular experience in your past; and,

(13) Meat (for vegetarian subjects) (p. 195).

For each of the 13 sections, subjects were presented the same eight specific statements about the food and replied, "true", "false", or "uncertain." For example, one statement asked: "The thought of eating this food makes me nervous" (p. 195).

After the questionnaires were administered, the experimenters created a profile for each of the 13 types of foods. Rozin and Fallon (1980) found that the response patterns for danger, disgust, and distaste were quite different. As expected, rejections based on distaste were limited to aversive taste, smell, and texture. No other factor mapped onto this category. Rejections based on danger were based on potential harmful consequences

and on the idea that a tiny amount of the presence of the dangerous food in a liked food rendered the liked food inedible (this represents the idea of contamination). Rejections based on danger typically had little to do with the taste of the item. The disgusting food item represented the strongest food rejection as evidenced by the most ‘true’ responses across the eight specific statements. Nevertheless, the foods that were considered disgusting were not typically considered dangerous.

For the disgust category subjects were asked to select, “a food that you consider disgusting (e.g., a cockroach or a specific excretory product)” (p. 195). Not surprisingly, 30% of the subjects chose a roach or excretory products as the example of the disgusting food. Also, 86% of the disgust food selections were animals or animal products. Rozin and Fallon did not consider that perhaps subjects were primed with the idea of cockroach to produce other animal responses. Rozin and Fallon noted that the strength of the rejecting responses (based on the number of ‘true’ statements) was highest if subjects selected cockroach or feces as the disgusting food. The number of rejecting responses (again, based on the number of ‘true’ statements) was slightly lower if subjects selected an animal (e.g., other arthropods or mammals) as the disgusting food and lowest if subjects selected a vegetable or mineral as the disgusting food.

Rozin and Fallon noted that their results echoed earlier theories of disgust that argued that disgust elicitors are almost always likely to be animals (Angyal, 1941). Fessler and Navarrete (2003) furthered confirmed this finding. They collected data from 78 cultures and found that although animal food is often revered in society it is also the most likely to be subject to taboo; they reported that approximately 85% of all food taboos are of animal origin. However, one might argue that even though many people

tend to list animals as disgusting or taboo, non-animal products might also elicit disgust but not so strongly (and hence, the stronger animal products get mentioned).

It is also noteworthy that Rozin and Fallon (1980) considered whether indications of decay might contribute to whether or not subjects find a particular substance disgusting (however, only nine responses described an item that was decayed so an analysis was not completed).

Later research by Rozin and Fallon (1987) broadened ideas from the original 1980 study and included another category of food rejection. A food could be rejected if it was considered inappropriate. Inappropriate foods are not classified as foods by a given culture. They are typically inorganic matter or plant products; for example, paper, rocks, tree bark would all be considered inappropriate.

Although there are four distinct categories of reasons for food rejection, it is important to consider that there is often a high degree of overlap among the categories. To begin, disgust and distaste share some common features. Most notably, the term disgust literally means “bad taste”. Most disgusting items, even if not tried before, are presumed to taste bad. In other words, many items that would be labeled disgusting would likely also be labeled distasteful. Also, rats and humans that have been exposed to bitter or other unpleasant tastes display a facial reaction that is similar to disgust (Parker & Limebeer, 2006). Because they have so many features in common, it can be difficult to distinguish disgust and distaste in some instances.

Disgust and distaste are different in that the main reason for a rejection based on disgust is ideational. The knowledge of the nature of the origin of the elicitor is the primary reason why the food is rejected; not simply that it tastes bad. For example, fecal

matter is rejected primarily on ideational reasons, not only its sensory properties. Distasteful items are rejected mainly when they are in the mouth, but they are typically not rejected in the world at large (Fallon & Rozin, 1983). Disgusting items are ideationally offensive whether they are in the mouth or anywhere else. Again, fecal matter, thought of as a universal disgust elicitor is thought of as disgusting whether or not it is in one's mouth (Angyal, 1941). Likewise, Rozin et al. (1989) found that subjects often find it disgusting (or at least contaminating) to wear clothing previously worn by an undesirable person. Martins and Pliner (2005) also clarify the distinction between distaste and disgust by affirming that only disgusting items have the ability to contaminate; distasteful items do not. Even if a small amount of a disgusting item is present in a dish of food it should render the rest of that dish inedible (while the same is not true of distaste).

Disgust and danger are also important constructs to distinguish. Both disgust and danger center on fears regarding anticipated consequences if a particular item is consumed. Also, both disgusting and dangerous items have the power to contaminate otherwise neutral items, rendering a neutral item unacceptable. Many disgusting foods are also considered dangerous; however, when a purely dangerous item (one that is not disgusting, perhaps a poisonous mushroom) is detoxified, the item then becomes an acceptable product. In contrast, a disgusting product does not become acceptable even if the dangerous elements are removed. When asked to consume a disgusting product or a product that has been contaminated by a disgust elicitor (juice touched by a sterilized cockroach), people first tend to question whether or not the product could cause harm (Rozin & Fallon, 1987). When the safety of the product is confirmed, only then will the offensive nature of the disgusting product be the sole reason for rejection.

Throughout the course of the research on disgust, there have been a number of different methods of assaying it. Many studies have used self-report or questionnaire of the disgust response (Pliner & Pelchat, 1991; Rozin & Fallon, 1980, Martins and Pliner, 2005, etc.). Other studies assess the contamination response as a method to measure disgust (Rozin & Fallon, 1987; Morales & Fitzsimons (2007), etc.). The author knows of one study in which disgust self-report was directly compared to subjects' willingness to engage in various disgusting behaviors (Rozin et al., 1999). Finally, some studies have measured subjects' disgust by assessing the muscles in their face when exposed to disgusting stimuli. As mentioned previously, disgust is defined as a basic emotion and as such, is thought to elicit a specific facial response. For example, Chapman et al. (2009) found that disgusting stimuli (both core and moral) activated the levator labii muscle region of the face.

Complicating the ability to distinguish whether something is dangerous, distasteful, or disgusting is that the theoretical definition of disgust (defined above) may be different from the lay definition of disgust. In a 2002 study, Nabi found that the word "disgust" tended to produce free-form responses that captured not only the theoretical construct of disgust but also the construct of anger. Interestingly, the phrase "grossed out" more closely elicited responses that mapped onto the theoretical construct of disgust. In other words, for many people the term disgust does not just refer to concepts that are repulsive or nauseating, but that are also "irritating or annoying" (p. 695). As a result of these findings, the present study uses the words "disgust" and "grossed out" interchangeably to best convey to the subjects the theoretical definition of disgust.

Additional Studies Examining Food Rejections

In a series of experiments, Pliner and Pelchat (1991) examined subjects' willingness to consume animal and non-animal food products. In the first experiment, twenty fictitious foods and their fictitious descriptions were presented to participants. Each subject saw descriptions of animal and non-animal foods; animal foods included not only meat/poultry products, but dairy/egg products as well. One example of an animal food description was "Langula Steak"; it was defined as, "Broiled steak from a small South American game animal" (p. 209). Following the description of each food, subjects were asked about not only their willingness to eat the food but also about why they might reject the food.

Pliner and Pelchat (1991) based the food rejection portion of the questionnaire on the aforementioned study by Rozin and Fallon (1980) that distinguished rejections based on danger, distaste, and disgust. After each food description, nine statements about the foods were posed to the participants. Examples of the statements included: "The thought of eating this food makes me nauseous", "I would dislike the taste, smell, or texture of this food", and "I would dislike any dish that contained even the tiniest amount of this food, even if I could not taste, smell, feel or see it" (p. 208). Each statement was evaluated on a seven-point rating scale that ranged from "not at all" on one end to "extremely" on the other.

Pliner and Pelchat (1991) found that subjects were more willing to eat (or report that they would eat) the novel non-animal food products than the novel animal food products. Also, novel animal foods were more likely to elicit a disgust response than were novel non-animal foods. Specifically, novel meat/poultry products were the foods

subjects were least willing to eat and caused the most disgust, followed by novel dairy/egg products, and finally the novel vegetable/fruit/grain products. Pliner and Pelchat commented that perhaps, “The foods of animal origin seem somehow more unsavory, independent of their nature or origin” (p. 211). For example, one of the unfamiliar dairy products was described as coming from a “dog-like animal” (p. 209); the fact that the product came from something dog-like might have made it even less appealing than did its unfamiliar origin (and, in addition, dairy products from a dog are an unfamiliar food for humans). Interestingly, novel non-animal foods and novel animal foods did not significantly differ from each other in either the amount of distaste or amount of danger they evoked.

In Pliner and Pelchat’s (1991) second experiment, subjects were presented with actual food products and asked the same series of questions. All subjects received the same kind of food products; however, half of the subjects were told the food was something familiar (such as spinach), while the other half of the subjects were told the food was something unfamiliar (such as Frango greens).

Surprisingly, subjects were overall less willing to try dairy/egg foods in this experiment than either meat/poultry or vegetable/fruit/grain foods. Looking at only unfamiliar foods, subjects were less willing to try meat/poultry than any other food; whereas, subjects were less willing to try familiar dairy/egg foods than any other food. Pliner and Pelchat (1991) indicated that perhaps the lack of willingness to eat the two familiar dairy/egg products had more to do with the description of the products than its dairy origin. For example, the familiar egg product was described as a “pickled hen’s egg” (p. 216). Subjects’ reluctance to eat the egg might have been linked more to the

concept of “pickled” than “hen’s egg.” Additionally, one of the cheese products, labeled “Brynza” was described as being “usually eaten with a spoon” (p. 209). As such, it is unclear whether the cheese was more disgusting because of its dairy origin or because of its semi-liquid texture. Finally, the other cheese, “Gjetost” was stated to have a “strong unusual flavor” (p. 209).

Again, the description of these items might have contributed more to subjects’ neophobia than its their origin. Pliner and Pelchat (1991) stated that more research would have to be done to clarify how subjects evaluate dairy products. It seems that they might be capable of giving rise to disgust.

There was no difference in disgust response between familiar animal and familiar non-animal foods. However, as noted in the first experiment, disgust ratings for non-familiar animal foods were higher than those for non-familiar, non-animal foods. These findings echoed the theory by Rozin and Fallon (1980) that animal foods were more likely to evoke disgust than were non-animal foods.

Martins and Pliner (2005), in a study similar to Pliner and Pelchat (1991), examined specific factors that contributed to food acceptance. As in the second experiment of Pliner and Pelchat, subjects were presented a variety of foods. The participants were presented foods from three of four groups: novel animal foods, novel non-animal foods, familiar animal foods, and familiar non-animal foods. In this study, the experimenters actually used non-familiar foods (as opposed to a familiar food with a non-familiar name/description). Subjects were asked to rate their familiarity with and willingness to eat the foods. Additionally, subjects were presented the questionnaire items constructed by Rozin and Fallon (1980) to assess reasons for food rejections.

Finally, subjects were asked about their emotional reaction to the thought of eating the foods (using the Differential Emotions Scale IV). (A second experiment was also conducted in Australia with only minimal difference in methodology and results.)

Regression analysis indicated that for both familiar animal and non-animal foods the sensory-affective (distaste) factor (from the DES-IV) was the best predictor of willingness to eat the food. In contrast, for unfamiliar non-animal and animal foods, the disgust attributes subscale was the best predictor of willingness to try foods. Specifically, participants' perceptions of the disgusting attributes of the unfamiliar foods accounted for over 55% of the variance in willingness ratings (Martins & Pliner, 2005).

As in the Pliner and Pelchat (1991) study, participants had stronger disgust responses to the novel animal foods than to the novel non-animal foods. Again, in this study dairy/egg products were considered animal; there was no information regarding separate disgust evaluations of meat/poultry products versus dairy/egg products. This study showed that disgust mediated willingness to try novel non-animal foods (to a lesser degree than the novel animal foods). Corroborating this finding, Miller (1997) suggested that it is not necessarily animals that disgust us, but rather anything living that is "oozy, slimy, gooey, smelly" (p. 58). He suggested that it is not necessarily animals that disgust us, but rather humans are particularly sensitive to the idea of death and decay because it reminds us of our own mortality. Jones (2000) also reflected that vegetable matter might disgust when it, "smells bad, look oily or feel slimy, stringy, mushy, gooey, filmy, viscid, or squishy" (p. 57). This theory of disgust supports the idea that dairy foods are not a priori disgusting, but when any food (including dairy) is described as "usually eaten with

a spoon” (Pliner & Pelchat, 1991, p. 209) subjects might be repulsed by its slimy runny texture.

As a result of these findings and observations, it is worth considering that the concept of disgust is a continuous rather than a dichotomous variable. In other words, although meat products often are rated as more disgusting, non-meat products could be disgusting as well.

Both the Pliner and Pelchat (1991) and the Martins and Pliner (2005) studies suggested that the disgust response mediates one’s willingness to try novel foods. Martins and Pliner (2006) sought to clarify what exact characteristics made both animal and non-animal foods disgusting. This study used two subject samples. In the first sample, subjects were shown twenty-four scenarios that were created to describe potentially disgusting animal and non-animal foods. Within these twenty-four scenarios, there were twelve categories of disgust elicitors. One scenario in each category had the food stimulus as the disgusting object, while the other twelve scenarios depicted a situation in which the food was in contact with something disgusting.

For each scenario subjects were presented four statements that they were asked to rate on a 1 “not at all” to 7 “extremely” scale. Each statement related to the disgust construct adapted from Rozin and Fallon (1980). For example, one of the statements read, “The thought of eating this makes me nauseous” (p. 77).

The second sample of participants read the same twenty-four scenarios as the first sample. However, instead of responding to four statements, these participants rated each scenario on a 7-point scale that depicted each of the twelve disgust elicitors (e.g., not at all slimy {1} ... extremely slimy {7}).

Results indicated that there were two specific factors that predict a disgust reaction: aversive textural dimension and perceptions of livingness. This was the first study to indicate that features of the textural dimensions of food map onto a disgust response. Interestingly, in contrast to previous research, both animal and non-animal foods were perceived in the study as similarly disgusting. Again, these findings suggest that perhaps non-meat foods can elicit disgust as well as meat foods, and that a key variable worth further investigation is how texture contributes to disgust.

Research from an unpublished dissertation (Kauer, 2002) also supplemented the idea that texture plays a large role in food rejection (and potentially disgust). In the study, Kauer interviewed 489 people (from a representative sample of Philadelphia residents) about their eating habits. 39% of the respondents reported that they rejected foods based on the textural dimension of whether the foods were “slippery or slimy”. This particular food characteristic was endorsed by the largest number of people in terms of reasons for food rejection (i.e. only 9% of respondents reported rejecting food of a particular color).

Interestingly, only 22% of respondents said that they rejected food based on a “particular texture” (one would assume that “slippery or slimy” would be considered a “particular texture” and that was endorsed by many more participants.) Additionally, most people responded that the particular texture that led to rejection was “gelatinous” or “like Jell-O”. Although this research does not demonstrate that texture produces a disgust response, it does show how powerful the role of texture is (perhaps more than visual appeal or even taste) in the rejection of foods. Additional research by Schyver and Smith (2005) suggested that soy products are also often rejected because of their textural

properties. For example, one subject reported that soy “is white stuff that would shake in jelly and it was just gross” (p. 295).

Kauer (2002) also reported that 18% of people said that they rejected raw tomatoes (a relatively high rate of rejection for a common food). A prior study (Koken & Rozin et al., unpublished data) showed tomato rejection was heavily texture-driven: participants disliked the juxtaposition of the solid outside and liquid inside; also, participants generally disliked the mushy interior. Interestingly, these textural properties also have the power to contaminate other nearby foods. For example, a piece of bread or salad next to the tomato became inedible. The feature of contamination is central to a disgust reaction and demonstrates that perhaps reaction to the texture of foods is more than simply a distaste or sensory reaction. Other texturally aversive foods have not yet been examined for their power to render other (non-aversive) foods inedible.

Finally, a relatively new theory posits that disgust functions as a disease-avoidance mechanism (Oaten, Stevenson, & Case, 2009). This theory focuses less on the ideational nature of disgust, and more on the physical attributes of potential disgust elicitors. The theory asserts that our sense organs monitor the presence of pathogens in our environment. When these sense organs perceive something that may be dangerous we learn to avoid such stimuli and, in turn, may be disgusted by it. As such, foods that have certain textural cues perceived through vision (slimy looking) or touch (the feel of mucus) might engender disgust. The authors stated that, “certain perceptual modalities (notably smell and touch) may be especially associated with disgust” (p. 313). For example, the textural properties of an over-ripe banana (mushy) may lead to a disgust reaction because of the possibility the banana may be infected with pathogens. While it

may be useful to conceptualize disgust based on qualities of disgust elicitors (nausea associated with idea of ingestion, related to animals, power to contaminate) an alternative way to think about disgust relates to its potential function (disease avoidance). The authors also indicated that the tactile sense may be particularly connected to disgust because of its interaction with the region of the brain (the insular cortex) that is associated with disgust.

Contamination

While much of the research on food and disgust has begun to shed light on various factors that contribute to the disgust response, one factor that has not been thoroughly reviewed is contamination. As mentioned above, Rozin, Haidt, and MacCauley (2008) defined a necessary component of core disgust as contamination. It separates foods that people find simply distasteful from foods that people find disgusting. Contamination occurs when a disgusting entity even briefly contacts an otherwise edible food; the disgusting product then renders the food inedible (Rozin & Nemeroff, 1990).

Before Rozin and Nemeroff (1990) constructed the link between contamination and disgust, contamination was more broadly defined within anthropological literature as part of a series of laws of sympathetic magic. These laws were thought to explain both how the world works and how people think about the world around them. Tylor ([1974] 1871) first described these laws; they were further explained by Frazer ([1890] 1959) and Mauss ([1902] 1972). One of these sympathetic laws is known as the law of contagion, which says that objects or people may impact each other simply by touching. The change that these contaminating objects or people have on other each other may extend past the

termination of contact (Rozin & Nemeroff, p. 206). The law of contagion is often summarized as, “Once in contact, always in contact” (Frazer [1890] 1959).

Rozin, Millman, and Nemeroff (1986) first tested how the law of contagion may impact disgust. In one study, subjects were offered a sip of two kinds of juice (apple and grape) and asked how much they would like to have another sip of juice. They rated their desire for another sip of juice based on a rating scale (a 200-mm line) with “dislike extremely” on the left end and “like extremely” on the right end. They were also asked which of the two juices they preferred. All of the subjects were next shown a dried, sterilized cockroach (about four cm in length). For some subjects the experimenter placed the cockroach in the preferred juice for five seconds, for the remaining subjects the experimenter placed the cockroach in the non-preferred juice for five seconds. For all subjects, the juice that did not have the cockroach in it was stirred by a plastic candleholder (serving as a control) instead.

Next, subjects were asked to rate each juice on the aforementioned scale, to state which of the two juices they now preferred, and to take a sip of the preferred juice. Contact with the sterilized roach significantly impacted subjects’ ratings of acceptability of the juice. When the cockroach was stirred into the juice, the mean drop in rating of the juice was 102 points (on a 200-point scale). The juices that were stirred by the candleholder were not similarly affected and dropped a mean of only three points in the acceptability rating. Interestingly, the subjects were often unable to verbalize their feelings that the juice had, in some way, been contaminated because the idea seemed foolish or unacceptable (the cockroach had, after all, been sterilized).

Similar to the 1986 study, Rozin and colleagues (1989) demonstrated that non-food objects can also be contaminated by a person who previously contacted the object. For example, subjects rated a laundered sweater as far less desirable if it had been previously worn by an “unsavory” individual than if it had been worn by a friend or lover. The foods that served as stimuli, hamburgers and apples, produced analogous results; if an “unsavory” individual took bite of a hamburger or apple these foods became far less desirable than if a friend or lover took a bite.

Rozin and Nemeroff (1990) explained that not all kinds of contamination make a particular product less desirable. For example, for the Hua people of Papua New Guinea, it is possible for well-liked people in the society to positively “contaminate” the food that they touch (Meigs, 1978, 1984). This food is then positively enhanced and thought to bring good luck to those who consume it. Generally though, it is more common for magical thinking to exist for negative contamination. Rozin and Nemeroff (1990) proposed that negative information may be more salient; if something is contaminated, it has a greater possibility to carry harmful microorganisms than to add any beneficial properties.

Rozin and Nemeroff (1990) also described what exactly is transmitted via the process of contamination. They argued that “essence” is transmitted from source to recipient. Essence then, has a number of properties. First, only a small part of a contaminant is needed to transfer the essence. For example, a lock of hair can transmit good or bad essence of a whole person. Essence has some physical properties. For instance, in order for essence to be transferred from one object to another physical

contact has to occur. Also, there are physical actions that can affect the power of the essence. For example, its strength can be reduced by washing the contaminated product.

Despite its physical properties, essence is not believed by Rozin and Nemeroff (1990) to have solely physical qualities for a number of reasons. First, essence does not seem to be dose dependent. A very small amount of a particular substance has the capability to render the recipient contaminated. Also, while the physical act of washing the recipient can limit the power of the contaminant, it does not fully cleanse the recipient. As mentioned earlier, a sweater worn by an “unsavory” character becomes less desirable to wear even if it has been laundered.

Likewise, it is possible that the concept of contamination relates to the disease avoidance theory of disgust posited by Oaten, Stevenson, and Case (2009). For example, if an object that potentially contains pathogens contacts an innocuous object, the germs (or essence) of the dangerous object may be transmitted. In fact, Curtis and Biran (2001) reported foods that might potentially be contaminated by parasites were often categorized as disgusting (for example, rotten and moldy food). These researchers also noted that rot and decay were also consistent elicitors of disgust across cultures. Oaten, Stevenson, and Case (2009) stated that disease threat cues are so powerful that even when there is no actual risk of harm, disgust (and contamination) may occur. For example, Rozin & Nemeroff (1990) found that students were unwilling to drink from a thoroughly sanitized dish if they knew the dish previously held dog feces. It is unclear how and whether cleaning a particular object may or may not render it acceptable vis a vis the disease avoidance theory of disgust.

Rozin and Nemeroff argue that, “Most sources of contagion are living things” and that, “Animals are much more potent sources of contagion; animal products are particularly potent sources of pollution” (1990, p. 212). They reasoned that because contaminating objects are more likely to be of animal origin, disgusting objects are nearly always of animal origin as well. While it may be true that animals and/or their waste products are more likely to elicit disgust than are non-animal products, this idea has not been definitively proved. As mentioned earlier, Martins and Pliner (2006) found that both animal and non-animal products were equally likely to elicit a disgust response. As mentioned above, Martins and Pliner (2006) asked subjects to imagine disgusting scenarios involving foods, some of animal and some of non-animal origin. There was not a significant difference in subjects’ ratings of these two types of scenarios.

Also, Morales and Fitzsimons (2007) (to be discussed in more detail later) were able to elicit disgust responses with common grocery store items that were both animal and non-animal in origin. Finally, as mentioned previously, Koken and Rozin et al. (unpublished data) were able to elicit a contamination response from a raw tomato.

While there are a number of kinds of products that can be contaminating, another area of interest is how these objects actually contaminate. There are three common methods for contamination: inhalation of disgusting odors, surface contact with a disgusting item, or somehow incorporating the disgusting item into the self (most commonly by ingesting the item) (Rozin & Nemeroff, 1990).

Crawley (1902) studied various reports on scent and odor and concluded that many groups of people believe that someone’s scent may contain certain properties of the person. Therefore, scent and essence may be strongly linked. However, because scent is a

variable that is difficult to fully control, most research has examined direct physical contact between something disgusting and something neutral.

There are many different levels of possible contact with a disgusting object. For example, touching something disgusting may be seen as far less aversive than putting that object in one's mouth. Again, the smell of dog feces may be somewhat disgusting, but consider the thought of physically touching the feces or worse yet, putting the feces in one's mouth.

Rozin, Nemeroff, et al. (1995) specifically examined the role of how various kinds of contact with items influenced people's ratings of disgust. Subjects imagined a scenario in which a grape was put in a disliked person's mouth for 15 seconds. Subjects next imagined a series of 19 situations in which the subject's degree of contact with the grape varied. For example, subjects rate how they would feel about the grape 10 inches in front of their mouth, actually chewing the grape, having it be in their stomach, etc.. Subjects were asked to rate each situation on a -100 to 100 bipolar scale where -100 represented, "The most unpleasant situation you can imagine" and +100 was "The most positive experience you can imagine". Subjects had the most negative reaction to the idea of chewing the grape. Rozin explained one potential reason for this result is that, "The mouth accounts for almost all of the overt material transaction between the rest of the world and the self" (Rozin & Nemeroff, 1990, p. 213).

The present research will use a hierarchy of degrees of proximity to the disgusting and contaminated substances. Subjects will be asked to make physical contact with a disgusting object (or an object that has physically been contaminated) by touching the

object with a spoon, by touching it with their finger, putting it in their mouth, and finally, by ingesting it. The scent of a remote substance (Crawley, 1902) will not be tested.

Contamination has generally negative effects; specifically, Rozin and Nemeroff (1990) addressed ways that a contaminant may be a threat. First, an animal product may be threatening because it reminds humans that we are similar to animals. Rozin and Fallon (1987) concluded that foods that were most disgusting were from animals. They hypothesized that the thought of eating these animals leads to the possibility of acquiring animal-ness. Additionally, some contaminants are threatening because they may be perceived as morally offensive. For example, when subjects are hesitant to drink juice that a sterilized cockroach has touched they may at first contend that the cockroach is dangerous, perhaps a disease carrier, but then later transition to a response of “It’s just wrong”. In the current study, foods of animal origin will not be used. As a result, it will be interesting to see whether these non-animal products can elicit a disgust response and what about these disgusting foods may be threatening to people.

It is worth emphasizing that the phenomenon of contamination is not synonymous with the phenomenon of disgust. While the constructs are likely related, they should still be regarded as distinct. Disgust is characterized as an emotion that tends to produce particular facial expressions and an avoidance reaction. Contamination, on the other hand, is a process that may lead to specific actions (Oaten, Stevenson, Case, 2009). Contamination also may engender more emotions than disgust (such as fear or surprise). The current study examines several ways to measure disgust. In addition to asking subjects directly about whether certain foods are disgusting, it will also test whether they

would eat the foods, and (if not) whether these foods have the ability to contaminate a neutral food.

It is also worth noting that the phenomenon of contamination is different than the concept of negative association. If the simple presence of a disgusting product makes a non-disgusting product less desirable a negative association has occurred. On the other hand, if a disgusting product comes into physical contact with a non-disgusting product and thereby renders a product less desirable contamination has occurred.

Recently, Morales and Fitzsimons (2007) examined the differences in the two aforementioned constructs (contamination and negative association) and also investigated the role of how product contagion impacts consumer evaluations. In the first of a series of experiments, they examined how physical contact with a disgusting product might alter the evaluation of several target items (that are not disgusting). Subjects observed four items in a shopping cart. One of the four items was a disgust elicitor: a feminine napkin. Subjects also saw two non-target items (laundry detergent and cereal). Target products differed across conditions. Some of the subjects saw cookies while some saw a notebook. Also, for some subjects the target product was physically touching the feminine napkins, while for others the target product was simply next to the feminine napkins. All subjects were asked, “How much would you like to try/use the target product?” and “What is the quality of the item?” (p. 275). Subjects rated their responses on a 1 “not at all” to 10 “very much” scale.

There was a main effect for physical contact. There was less desire to try the target if the target touched the disgusting product than if the two items did not touch; likewise, the quality of the target was rated lower if it touched the disgusting product than

if it did not. The two other non-target items were rated the same no matter which condition they were in. Also, there was no interaction between contact and product category. Morales and Fitzsimons (2007) believed that the feminine napkin might have a greater effect on something that could potentially be ingested, but results were to the contrary. This series of results show that the actual touching of two objects is necessary for contamination to occur. Finally, a product that merely has a negative connotation (such as tax software) need not contaminate. Only certain products have the power to contaminate the target items.

In addition to demonstrating the strength of the contamination response, Morales and Fitzsimons (2007) also examined the features of the contaminant that were passed to the target item. Specifically, the experimenters wanted to see whether a disgusting product (lard) would transmit some of its disgusting properties (fat) to a target product (a rice cake). Some subjects were presented with lard that was touching a rice cake. The remaining subjects were shown the same stimuli, but in this condition they did not touch. As in the first experiment, subjects were asked to rate their desire to consume the target product as well as the quality of the target product. Additionally, subjects in both conditions were asked to evaluate the fat and calorie content of the target item. The scale ranged from 1 “very low in fat (calories)” to 10 “very high in fat (calories)”.

Results echoed experiment one. The desire to try and the quality of the rice cake were rated much lower when it was touching the lard than when it was simply next to the lard. Interestingly, when the lard was touching the rice cake people rated the fat content of the rice cake as significantly higher than when the rice cake was merely adjacent to the lard. However, the estimates of calorie content did not rise when the lard was touching

the rice cake. Perhaps the presence of the lard made the construct of fat more salient in people's minds; however, people did not take the cognitive leap and recognize that items with more fat also contain more calories.

The current study will adopt many facets of Morales and Fitzsimons' work, such as the focus on contamination and product evaluation, but it will extend beyond their work by actually asking subjects to engage in ingestive behavior. Finally, the current study will focus on one facet that makes food disgusting: texture.

Texture Evaluation

The evaluation of the texture of food extends beyond the disgust literature. The International Organization for Standardization has broadly defined texture as the structural characteristics of a product perceptible by mechanical, tactile, visual and/or auditory receptors (ISO, 1981).

Texture is often used to identify food quality. For example, with some foods, texture is of utmost importance; the idea of eating soggy potato chips, tough steak, or a mealy apple is unappealing to most people. Nevertheless, with other foods, such as wine, soup, or soda, texture is less important (Lawless and Heymann, 1998). Differences in texture evaluation of food vary across cultures. Yoshikawa et al. (1970) found that Japanese subjects used many more words to describe texture of foods than did American subjects. The researcher suggested that Japanese foods tend to have more textural variety and that there are more subtle nuances in Japanese language to describe different textures.

According to Lawless and Heymann (1998), we perceive food texture by a number of senses including: sound (auditory texture), sight (visual texture) and touch

(tactile texture). Sometimes the texture of food is evaluated by only one of these senses, while other times a combination of senses is involved. First, Lawless and Heymann reported that our auditory evaluation of food is typically formed by the loudness and evenness of the sound of food as we eat it. If food is evaluated auditorily it tends to be assessed on either a crispy or crunchy dimension (Vickers, 1987). Typically, the sound of food is associated with the teeth making contact with the food product. In other words, the food is generally already in one's mouth (or in the mouth of another) when its auditory texture is evaluated. In the current study, we are more concerned with whether a subject will try something that seems texturally disgusting before it comes into contact with the mouth. As a result, subjects will not be assessing texture of food based on auditory perception. Nevertheless, when subjects are willing to eat a stimulus, they may include its auditory textural characteristics in a post-behavior questionnaire (to be described in a later section).

Visual texture of food is assessed by the appearance of its surface characteristics. Research by Hutching and Lillford (1988) suggested that there is often a high correlation between visual assessments and tactile assessment of certain foods (e.g., cake moistness). In the current study, subjects will be presented the foods to look at before being asked to sample any of the foods. Therefore, food texture will be primarily assessed via vision.

The final way food texture is assessed is tactile: either the feeling of the food in one's hand or the feeling of the food in one's mouth. In the current study, if a subject is willing to incorporate the object into the mouth, the food is not producing a disgust reaction. As a result, there will be little focus on mouth feel. Instead, more focus will be placed on how a subject assesses the feelings of potentially disgusting foods with their

hands (by poking the foods with a spoon and by touching some of the foods with their fingers).

According to Lawless and Heymann (1998), very few studies have investigated evaluations of food based on how a food feels in one's hand. These kinds of evaluations are more common in the textile literature. For instance, Yenket et al. (2007) found that subjects who both viewed and felt fabrics described the sensory properties differently than subjects who only felt the fabrics. When thinking of texture evaluation of food based on physical contact, it is helpful to consider the image of a small child poking at his/her dinner option with a fork. In the current study, subjects will be presented various food options and given a fork or spoon to evaluate the texture of the food before being asked to sample the product.

Individual Differences in Eating Patterns

While one goal of the current research is to understand food texture and disgust, another goal is to consider how individual trait differences may also affect the disgust response (especially regarding the response to food texture).

Some of the earliest research on individual differences in disgust focused primarily on food and contamination. For example, Rozin et al. (1984) developed a scale to measure fears about food contamination (e.g., willingness to eat soup out of a bowl that had been previously eaten out of by a dog), and found that parents and children had responses that were significantly correlated ($r = .3$ to $.6$ for most items). Davey, Forster and Mayhew (1993) used the same scale, and replicated the finding of significant parent-

child correlation. The use of the contamination scale was (as far as this author knows) not examined past these preliminary studies.

The Disgust Scale (Haidt et al., 1994) was developed in order to build on the earlier research by Rozin et al. (1984) and assessed not only contamination fears, but also other facets that the authors believed contributed to a disgust response. The scale is composed of thirty-two items, four items in seven specific disgust-related categories (food, animals, body products, sex body envelope violations, death, and hygiene) and four items that relate to the overarching theme of contagion. Within the scale, half the items ask people to assess whether a particular situation is disgusting; while the other half assesses whether or not a participant believes he/she would be willing to engage in a particular disgusting behavior.

From the original research (Haidt et al., 1994) the mean score on the disgust scale was approximately one half standard deviation higher among women than men. Second to gender, the demographic variable that most affected scores was social class. Haidt et al. (1994) found that blue-collar workers were more disgust-sensitive than were students or middle-class managers. This result was echoed by Doctoroff and McCauley (1996) who found that education negatively correlated with disgust scale scores ($r = -.32$).

Disgust sensitivity has also been linked to a number of psychopathologies. For example, Quigley et al. (1996) showed that for undergraduate students disgust sensitivity was positively correlated with Obsessive-compulsive personality type. Additionally, Kauer (2002) found that there was a significant correlation between the Padua Inventory (a measure of obsessive-compulsive disorder) and the Disgust Scale (except for the sex

subscale). Interestingly, the correlation was particularly strong between the scores on the Padua Inventory and the food subscale of the Disgust Scale ($r=.55$).

Kauer (2002) has also shown a connection between people's general eating behaviors and their disgust sensitivity. In the first part of her study, subjects filled out a survey addressing their food habits and attitudes. Results from the study indicated that there were two factors that accounted for 18.7% of the total variance of reasons for food rejections: picky eating and sensory rejection.

A number of items loaded onto the factor of picky eating including: "Others consider me to be a picky eater", "I worry that there will be nothing for me to eat if I go out", "I avoid one or more major food groups" (p. 69). After the initial survey, Kauer (2002) selected the people who fell in the top and bottom 26% of the pickiness factor. These people participated in a second survey that more closely examined the difference between picky and non-picky eaters.

In the second phase of her study, Kauer found that there was a significant difference between the non-picky and picky eaters for scores on the Disgust Scale, indicating that the picky group was more disgust-sensitive than the non-picky group. In particular, there was a significant difference ($t = 2.69, p < .01$) in the subscale of Food and Magical Thinking between picky and non-picky eaters. Kauer hypothesized that, "The difference on the magical thinking subscale may indicate that picky individuals are more likely to attribute particular values to the foods that they accept/reject, based on their beliefs/eating habits" (p.140).

Additionally, Kauer (2002) also found that picky eaters were significantly more food neophobic (characterized as afraid of trying new foods) than non-picky eaters;

however, there was not a difference in non-food neophobia between the picky and nonpicky eaters. Finally, 63% of picky eaters in Kauer's study scored above the given mean for non-clinical college students on a measure of obsessive compulsive tendencies (Kauer, 2002).

Kauer (2002) did not investigate differences between groups who tended to reject foods on the basis of sensory factors and those who did not. The current study will investigate whether there are differences in disgust sensitivity among those people who are more texture sensitive and those who are less so.

While there have been a number of studies that have examined how various individual differences correlate with disgust sensitivity, there have been very few studies that actually measure people's willingness to engage in disgusting behavior. Rozin et al. (1999) demonstrated that the disgust scale significantly predicted people's willingness (or lack thereof) to engage in 26 hands-on disgust-related behaviors ($r = -0.41$). Examples of disgust tasks in the study included: putting the tip of a tampon in one's mouth, wearing a hat that a Nazi wore, and taking a bite out of fudge shaped like dog feces. This is the only study known to the author that measures a correlation between scores on the Disgust Scale and participation of in-vivo behaviors. Although it was not a study explicitly involving disgust, Raudenbush and Frank (1999) did examine people's willingness to try, expected liking for, actual liking of, and intake of several types of foods. Their subjects were neophobics and neophilics. While neophobics tended to have both more pessimistic expectations about unfamiliar foods and lower intakes than did neophilics, the authors did not investigate the correlation between those two measures. The current study will attempt to connect people's beliefs about how they anticipate they would respond to

texture-related disgusting tasks with the degree to which they actually engage in the tasks.

Motivation for the Study

The theory of food and disgust may be missing some details. Early literature suggested that only animal products produce core disgust. The current theory (Rozin, Haidt, & McCauley, 2008) posits that animal foods are more disgusting to us than plant foods or dairy foods because animal foods remind us of our animal nature. But Martins and Pliner (2005, 2006) have suggested that vegan and dairy matter can disgust and their textures are likely to be the source. This study seeks more evidence on that point. Must an entity be an animal in order to disgust?

There is little literature regarding the role of texture sensitivity and different psychological responses. It would be interesting to see how texture sensitivity corresponds to various psychological measures. For example, if someone has a disgust reaction to texture he/she might be more generally disgust sensitive as well. Also, there have been no studies to see how texture sensitivity relates to other kinds of individual differences such as pickiness or Obsessive Compulsive Personality (although evidence from previous studies suggests that these constructs may well correlate with texture sensitivity). This topic could produce some interesting connections.

Finally, very few studies of food and disgust have examined the relation between people's beliefs about their willingness to engage in certain activities and whether they will actually engage in the activities. It could be that people might believe that they

would be willing to try disgusting foods and contaminated foods, but that they are actually more reluctant than they anticipate, or vice versa.

Brief Summary of the Study

The current study will examine whether dairy or vegan foods with specific textures can elicit a disgust response and render neutral foods inedible via the process of contamination. Additionally, the study will investigate whether sensitivity to texture correlates with other measures. Finally, the correlation between what subjects state they will do and what they will actually do will be measured.

In the experiment, participants will first complete a brief survey about the kinds of foods they eat and whether they have food restrictions or allergies. Participants will then be shown a wide variety of both vegan and dairy foods with perhaps unappealing textures (that will be described to them). They will be asked about their initial impressions of the foods (for example, whether they find the foods disgusting and whether they would be willing to consume the foods). Participants will then be asked to consume these foods. If subjects are unwilling to consume the disliked or disgusting food, they will be asked to consume a neutral (non-disgusting) food that was previously touching and/or adjacent to the disgusting food. Finally, subjects will complete several personality inventories that will attempt to link individual food-texture sensitivity with specific personality measures (including a disgust sensitivity scale , a picky eating inventory, and an obsessive-compulsive personality measure.)

Principal Questions

(1) Can a vegan or dairy food product that is texturally aversive to people produce a disgust reaction that includes contamination?

Although Koken and Rozin et al. (unpublished data) preliminarily showed this was possible with tomatoes, what about with other foods?

It is the hope that some subjects will have a disgust response to at least one of the presented foods. These subjects will choose not to eat certain disgusting foods, and they will also not eat the foods that the disgusting foods touched. This finding would demonstrate that the construct of disgust is not simply related to “animal-ness”. Instead, there is something about texture that can lead to disgust. Likewise, the results would indicate that texture is not linked only to distaste and tell us if dairy and vegan foods are similar in their likelihoods of evoking disgust.

(2) Does sensitivity to texture correlate with other measures?

A.) Do people who are more food-texture sensitive (those who end up rejecting foods that have been contaminated) score higher on the Disgust Scale? Perhaps people who are particularly sensitive to texture are also very sensitive to ideational food disgust. The possibility also exists that there might not be much overlap between the two groups.

(B) Do people who are more food-texture sensitive also have higher scores on a picky eating inventory? Texture sensitivity may help explain why people tend to be picky eaters. As stated previously Kauer (2002) showed that picky eaters tend to score higher on disgust scales

(C) Do the subjects who are more texture sensitive also score higher on the Obsessive Compulsive Inventory? Again, Kauer (2002) found that picky eaters were more likely to have a high score on an Obsessive Compulsive Disorder (OCD) measure. Because thoughts of contamination are prevalent with OCD, it is possible that texture sensitivity may relate to OCD.

(3) In many studies, people have reported willingness (or lack of willingness) to eat certain foods, but what happens when subjects are asked to actually eat the foods? Do they really eat the foods?

As previously mentioned, Rozin et al. (1999) found a moderately strong inverse correlation ($r = -0.41$) between scores on a disgust inventory and what subjects would actually do at a later point in time. However, in the Rozin et al. (1999) study, the stimuli were not texturally disgusting foods (or at least described as such).

CHAPTER 2

PRELIMINARY STUDY: STIMULUS SELECTION

The objective of the stimulus selection study was to find a set of foods that are reliably rated as disgusting and that could therefore be used to investigate whether they can act as contaminants.

Subjects

One hundred people (ranging from college age to older adults) participated in this experiment. Participants (a convenience sample) were e-mailed by the experimenter and asked if they would be willing to participate in a psychology survey about food disgust that would take approximately ten minutes. Subjects were not offered compensation for their time.

Procedure

A survey was created to examine food disgust in two ways. The first part of the survey asked subjects to generate their own responses about food and disgust. Subjects were asked to name foods they found disgusting. Subjects were also asked to explain what about the foods they selected they found disgusting. The second part of the survey asked subjects to rate how disgusting they found particular foods. Twenty-seven foods were listed based on anecdotal accounts of disgusting foods as well as a review of the literature on food-related-disgust. Examples of foods listed included: testicles, okra, raw

tomatoes, and lard. Of the 27 foods, 18 were of animal origin and 8 were non-animal (dairy products and gelatin will be considered non-animal foods here). The non-animal foods were: over-ripe bananas, Kimchi (pickled, fermented spicy cabbage), raw tomatoes, blue cheese, mushrooms, Jell-O, okra, tofu, and sauerkraut (See Appendix A for full list of foods). Subjects were asked to rate each food's disgusting level on a five-point scale ranging from 0 ("not disgusting at all") to 4 ("extremely disgusting"); there was also an option stating "I do not know what this food is". Next, for the foods the subjects rated disgusting (1 through 4 on the scale), subjects were asked what about the foods they found disgusting. For this purpose, subjects were provided with six distinct disgust possibilities: "The idea of what it is, texture, I don't like the smell, how it looks, reminds me of death, reminds me of decay, or other."

Results

98 subjects provided a response to the open-ended question, "What foods do you find disgusting?" Of these 98 subjects, 65 subjects indicated at least one animal product disgusted them. Common examples of animal foods that people reported disgusting were: brains, organ meats, bugs, squids, oysters, and worms. Additionally, of the 98 subjects, 43 reported that at least one dairy or vegan product disgusted them. Common examples of dairy or vegan foods that people reported disgusting were: cottage cheese mayonnaise, okra, and lima beans.

When subjects were asked: "What about the disgusting foods you listed, makes them disgusting?" 92 subjects responded. Of these responses, 61 subjects reported that at least one of the foods they found disgusting was because of the texture of the food, 33

reported that the reason they found a particular food disgusting was because of the idea of the food, 31 reported that the reason they found a particular food disgusting was because of the taste of the food, 8 reported that the reason they found a particular food disgusting was because of the smell of the food, the remaining 5 responses did not easily fit into one of the aforementioned categories.

The second part of the survey (with the 27 pre-selected foods) provided somewhat similar results. In general, the meats were considered more disgusting than the dairy or vegan foods. The average rating of disgust on a 5-point Likert scale ranging from “not disgusting at all” to “extremely disgusting” scale was 2.84 for meats, 1.72 for dairy the food (only one dairy, blue cheese) and 1.59 for vegan foods. Of the non-meat foods, over-ripe bananas had the highest average rating of disgust (2.14). Jell-O (not categorized as meat, vegan, or dairy here) had the lowest average disgust rating among all stimuli (1.04). (See Appendix A for full list of stimuli and their disgust ratings).

Out of the six aforementioned choices as to why a particular item was disgusting, the “idea of what the item is” and “the texture of the item” were the two most common responses. In order to determine this, for each stimulus, the particular choice for the disgust response was divided by the total number of disgust responses for that given stimulus. For example, 41 people reported that bananas were disgusting and 33 of them attributed the disgust to the texture of the item; the proportion of rejections based on texture for the bananas is thus 73%. These proportions were then averaged (across all stimuli) to get a sense of the overall proportion of reasons for disgust responses. When all stimuli were aggregated, 49% of the total disgust responses were due to the idea of the item, 38% of the disgust responses were due to the texture of the item, 20% were due to

the visual appearance of the item, 19% were due the smell of the item, 6% were due to being reminded of death, 4% were due to the look of decay, and 10% were due to other reasons.

Discussion

The primary motivation for this survey was to investigate what foods people found disgusting. Based on the responses to the first phase of the survey, “What foods do you find disgusting?” it is apparent that both animal and non-animal foods come to mind as disgusting to a number of subjects. Interestingly, when subjects gave reasons for finding a particular food disgusting (whether it was animal or non-animal in nature) the second highest proportion of reasons for disgust (second to the idea of the food) concerned the texture of the food. As Martins and Pliner (2006) and Kauer (2002) suggested, texture might play a greater role in the disgust response than previously appreciated.

Although in the forced-choice portion of the survey the animal products were typically found to be more disgusting than the non-animal products, there was still evidence to suggest that non-animal foods could also elicit disgust. Additionally, in the second part of the survey, when subjects found a particular food disgusting, they often noted that the texture of the stimulus contributed to the disgust response. Several stimuli that many subjects agreed were disgusting were used as stimuli in the main experiment (cottage cheese, mayonnaise, okra, tomatoes, and bananas).

CHAPTER 3

MAIN EXPERIMENT

Subjects

Fifty people (31 females, 19 males, ranging in age from 18-37 years with an average of 21) participated in this experiment. Participants were recruited via a flyer posted on campus, via an e-mail to the American University community, and via word of mouth. In both the flyer and the e-mail participants were told that the topic of the study was food and disgust, the experiment would take approximately an hour, psychology students could earn a unit of extra credit for their participation, and participants were entered to win one of two \$50 prizes. The following categories of people were excluded from participation: people with food allergies, children, prisoners, pregnant women, cognitively impaired individuals, and non-English speakers.

Materials

Subjects were presented with nine stimuli over the course of the experiment: one neutral control (C), four dairy products (D), and four vegan products (V). The products were always presented in the following order: wheat crackers (C), rice pudding (D), boiled okra (V), mayonnaise (D), graham crackers soaked in skim milk (D), large curd cottage cheese (D), organic chunky peanut butter (V), a section of over-ripe banana (V),

and a raw tomato cut in half (V). Each stimulus was shown to subjects in a transparent glass container with a plastic lid. (See Appendix B, Stimuli Details).

Repeatedly during the experiment subjects filled out a post-behavior questionnaire about each stimulus explaining their unwillingness to eat it (if they were unwilling) or their impressions of its texture (see Appendix C, Post-Behavior Questionnaire). At the end of the experiment, subjects completed three additional brief questionnaires: the Disgust Sensitivity Scale-Revised (DS-R) (Haidt et al., 1994), a 10-item picky eating scale, and the Obsessive Compulsive Inventory (OCI, Foa et al., 1998). (See Appendices D, E, and F).

The Disgust Sensitivity Scale-Revised (Haidt et al., 1994), is a 27-item scale that is subdivided into three subscales (a 12-item core disgust scale, an 8-item animal-reminder scale, and a 5-item contamination disgust scale). According to Olatunji et al., (2008) The DS-R has relatively good internal consistency and convergent and discriminant validity; however, specific details regarding the validity of these scales or normative properties have not yet been published.

The picky eating scale was modeled after a dissertation by Kauer (2002) that examined the range and variation of human food selection specifically focusing on picky eating. A factor analysis was performed by Kauer to examine the structure of variation of human food selections. Three factors emerged as contributing to food selections: picky eating (accounting for 9.9% of the total variance), health concerns and food pleasure. The ten items on the picky eating scale used here were chosen because they loaded highest (out of 43 items) on the picky eating factor.

The Obsessive Compulsive Inventory (OCI; Foa et al., 1998) is a self-report measure that assesses the amount of distress associated with obsession and compulsions. The inventory can be used to aid in the diagnosis of Obsessive Compulsive Disorder (OCD). The OCI was chosen as a measure because it does not need to be administered by a trained clinician, it can be administered in a relatively short amount of time, and has good psychometric properties. Specifically, the OCI has excellent internal consistency (.92) and test re-test reliability ($r = .87$) in a sample of patients with OCD (Foa et al., 1998). Finally, the OCI was also able to successfully discriminate between those with PTSD, Generalized Social Phobia, or no anxiety (Foa et al., 1998).

These questionnaires assessed three different constructs: disgust sensitivity, picky eating, and obsessive compulsive tendencies.

Procedure

Subjects began the experiment by completing an informed consent form and a brief demographic form that also asked about their food habits and restrictions.

Following the completion of the initial forms, the experimenter read aloud a short lecture on the difference between distaste and disgust (see Appendix G). In this experiment, it was essential that subjects understood the distinction between the two constructs. Before subjects began the experiment they answered three questions that assessed their understanding of the difference. If a subject answered a question incorrectly, the reason for the correct answer was explained.

Next, the pre-behavior assessment began. Subjects were presented with the nine stimuli one at a time: a wheat cracker (Brand “34 whole grain crisp-bread”, neutral taste

and texture, no ridges such that the stimuli would not settle between the ridges, round and 2.25 inches in diameter), rice pudding, boiled okra, mayonnaise, graham crackers soaked in skim milk, large curd cottage cheese, chunky peanut butter, a section of over-ripe banana, and the two parts of a raw cherry tomato cut in half. Each stimulus was shown to subjects in a transparent glass container with a plastic lid. Stimuli were presented in the aforementioned order and a series of questions about each stimulus was asked: whether the subjects were familiar with the food, whether or not they had eaten the food before, whether or not they enjoyed eating it, how disgusting they found the food, what about the food was disgusting (if the food was disgusting), and how willing they were to consume the food.

Following the pre-behavior assessment, the behavioral portion of the study began. First, subjects were asked to eat a small bite of the wheat cracker (which served as a control). All subjects complied. Subjects then completed the post-behavior questionnaire (and skipped the remainder of the behavior section) for the cracker stimulus. The post-behavior questionnaire had questions that examined subjects' experience with the stimulus (in this case, a cracker). The particular questions that each subject answered for each stimulus depended on what each subject was willing or unwilling to eat, as follows.

The procedure for the remaining stimuli followed the steps in the flowchart in Appendix H. Subjects first were asked to poke the stimulus with a spoon. Next, they were asked to chew and swallow a bite of the stimulus. If they said they were willing to eat or taste a bite (knowing they could spit it out) of a stimulus and did so, they moved onto the post-behavior questionnaire for that particular stimulus and were asked about the texture of the tasted stimulus. If a subject was unwilling to eat or taste a bite of a

particular stimulus, the stimulus was placed on top of the cracker, covering about half of it. Subjects were asked whether they would eat a bite of the stimulus and the cracker together. Any subject who was willing to eat the combination of cracker and stimulus then filled out the post-behavior questionnaire for that particular stimulus (e.g., describe the texture of the okra). Subjects who were unwilling to eat a bite of the stimulus on top of the cracker were asked to scrape off as much of the stimulus from the cracker as possible (with a spoon and/or napkin) and asked if they were now willing to eat it.

Subjects were then asked to touch a separate portion of the stimulus with their finger. Regardless of whether subjects were willing to touch the stimulus, the subjects were then asked whether the part of the cracker that was not touching (but adjacent to) the stimulus was as good as a plain cracker (that had never touched the stimulus). They were also asked how much worse that piece of cracker was than a non-contaminated cracker. Subjects were then asked to break off a piece of cracker that did not touch the stimulus (which they could easily do without touching the stimulus) and eat that “clean” piece of cracker (hereafter called “adjacent” cracker). Subjects who were unwilling to eat the cracker then filled out the post-behavior questionnaire for that stimulus. Subjects who were willing to eat a bit of the adjacent cracker were asked whether the part of the cracker that did touch the stimulus was as good as the part of the cracker that was adjacent to but did not touch the stimulus and they were asked how much worse the former part of cracker was. Finally, subjects were asked to eat a bite of the part of the cracker that the stimulus had touched (and had been scraped off). Regardless of whether subjects were willing to eat the cracker or not, they filled out the post-behavior questionnaire for that stimulus. In sum, subjects were presented a hierarchy of possible

activities for each stimulus. When a subject reached their limit of proximity for each stimulus (whether it be eating the stimulus, eating an adjacent portion of cracker, or not eating any portion of stimulus or cracker) subjects filled out the post-behavior questionnaire for that stimulus

After the behavior tests and post-behavior questionnaires for all stimuli were completed, subjects were then asked to complete the three brief questionnaires that assessed disgust sensitivity, picky eating, and obsessive compulsive tendencies. At the end of the experiment, all subjects were given a thank you form that provided the e-mail address of the Principal Investigator and head of IRB if the participant had any additional questions or concerns.

Results

Stimulus Disgust

On average, subjects rated the over-ripe banana (V) as most disgusting (7.28) on the 0 (not disgusting at all) to 10 (extremely disgusting) scale, followed by the okra (V) (5.50), and the cottage cheese (D) (4.96). Subjects rated the tomatoes (V) as least disgusting (0.76), approximately equivalent to the cracker control (0.44). The across-stimulus pattern of anticipated willingness to eat a particular stimulus resembled that of rated disgustingness. Subjects rated the over-ripe banana as what they were least willing to put in their mouths (2.16) on a 0 (“no way”) to 10 (“sure, sounds great”) scale, followed by the okra (3.84), and the mayo (4.14). Those were all rated high on Disgust. Subjects were most willing to put the tomato in their mouths (8.48), and it was rated lowest on Disgust (See Table 1). The average disgust rating for dairy stimuli (4.31) was slightly higher than the average disgust rating for the vegan stimuli (3.82) (See Table 1).

Table 1

Disgust and Willingness to Eat Ratings

	Disgust	Put in Mouth?	Chew?	Swallow?
Cracker (C)	0.44	9.06	9.06	9.14
Rice pudding (D)	3.54	5.82	5.78	5.80
Okra (V)	5.50	3.84	3.74	3.70
Mayo (D)	4.18	4.14	4.14	3.90
Graham cracker (D)	4.54	4.66	4.60	4.66
Cottage cheese (D)	4.96	4.14	4.04	4.12
Peanut butter (V)	1.72	7.72	7.72	7.70
Banana (V)	7.28	2.16	2.10	1.94
Raw tomatoes (V)	0.76	8.48	8.48	8.46
Averages for dairy stimuli	4.31	4.69	4.64	4.62
Averages for vegan stimuli	3.82	5.55	5.51	5.45

There were 86 instances (out of a possible 450: 50 subjects x 9 foods) in which subjects rated an item to be very disgusting (an 8, 9, or 10 on the 0-10 point disgust scale). Of the 86 instances, 42 were dairy stimuli and 44 were vegan stimuli. For 39 of the 86 instances (45%), texture was the primary reason why the food was declared disgusting. Of those 39 texture disgust responses, 13 were vegan and the remaining 26 were dairy. For 18 of the instances (21%), rot/decay was the primary reason why the food was disgusting. For 11 of the instances (13%), the idea of the food was the primary

reason why the food was disgusting. Also noteworthy, 39 subjects (out of 50) rated at least one food as an 8, 9, or 10 on the disgust scale. So nearly 80% of subjects said they found at least one stimulus very disgusting.

Fifteen subjects were unwilling to eat at least one cracker that a disgusting object had touched. Of those fifteen, seven subjects rejected one cracker/stimulus, four subjects rejected 2 crackers/stimuli, one subject rejected 3 crackers/stimuli, two subjects rejected 4 crackers/stimuli, and one subject rejected 6 crackers/stimuli. Also, of those 15 subjects, two subjects rejected only dairy foods, six subjects rejected only vegan foods, and the remaining seven subjects rejected a combination of both dairy and vegan foods. The average disgust rating on the 0 (not disgusting at all) to 10 (extremely disgusting) scale for the 26 specific stimuli that the subjects were unwilling to eat was 8.22.

Five of the fifty subjects chose not to eat (take a bite and swallow) at least one part of a cracker that the disgusting object had been adjacent to but not touching. In these instances the mayo (V), rice pudding (D), cottage cheese (D), banana (V), and tomatoes (V) were the stimuli that caused the contamination of the cracker. Among these five subjects, two subjects rejected eating foods contaminated only by dairy products, two rejected foods contaminated only by vegan products, and one subject rejected eating foods contaminated by both dairy and vegan products. For all of those five subjects, each stimulus that elicited contamination was rated very disgusting (an 8, 9, or 10) on the aforementioned disgust scale in the pre-behavior assessment. Finally, three subjects would not taste (take a bite and spit out) at least one cracker that a disgusting object had been adjacent to (See Table 2). Specifically, one subject rejected one vegan item

(tomato), one subject rejected one dairy item (mayo), and one subject reject two vegan items (banana and tomato) and two dairy items (mayo and cottage cheese).

Table 2

Frequency Distribution of Subjects who Were Unwilling to Eat or Taste Various Portions of Adjacent Cracker

Number of “no's”	0	1	2	3	4	5	6	7	8
Eat adjacent portion of cracker	45	4	0	0	0	1	0	0	0
Taste adjacent portion of cracker	47	2	0	0	1	0	0	0	0

Another way to examine the data is to note subjects’ refusals of particular stimuli. For example, mayonnaise (D) and bananas (V) were the two stimuli that subjects most often refused to eat (29 subjects would not eat mayonnaise and another 29 would not eat bananas). Rice pudding (D) and tomatoes (V) were the two most eaten stimuli (only four subjects would not eat these). Also, the rice pudding (D), mayo (D), cottage cheese (D), banana (V) and tomatoes (V) were the stimuli that served as contaminants (instances when subjects refused to eat the adjacent portion of cracker).

When we look at subjects’ reactions to dairy foods and vegan foods, we do not see major differences. There were 63 instances when a subject refused to eat a dairy stimulus and 56 instances when a subject refused to eat a vegan stimulus. Likewise, there were 13 instances when a subject reused to eat a portion of a cracker touched by a dairy stimulus and 18 instances when a subject refused to a portion of cracker touched by a vegan

stimulus. Finally, there were four instances when a subject refused to eat a dairy stimulus and four instances when a subject refused to eat a vegan stimulus. (See Table 3).

The subject who rejected the rice pudding indicated on Kauer's Picky Eating Inventory that he/she tended to reject foods with odd textures; however, the subject who rejected the cottage cheese indicated on the Picky Eating Inventory that he/she did not tend to reject food with odd textures.

Table 3

Frequency Distribution of Refusals

	Eat stimuli	Eat touching portion of cracker	Taste touching portion of cracker	Eat adjacent portion of cracker	Taste adjacent portion of cracker
Rice pudding (D)	4	3	2	1	0
Okra (V)	18	8	7	0	0
Mayo (D)	29	3	2	2	2
Graham cracker (D)	9	3	5	0	0
Cottage cheese (D)	21	4	2	1	1
Peanut butter (V)	5	0	0	0	0
Banana (V)	29	9	9	2	1
Tomatoes (V)	4	1	1	2	2
Dairy stimuli	63	13	11	4	3
Vegan stimuli	56	18	17	4	3

As reported during the pre-behavior assessment, we assessed subjects' familiarity with the foods, whether or not they had eaten the foods before, and whether or not they enjoyed eating the foods. There were 42 instances (out of 450) in which a subject stated he/she was not familiar with a particular stimulus. Of those 42 instances of unfamiliarity: there were 25 subjects unfamiliar with okra, 6 unfamiliar with rice pudding, 6 unfamiliar with the graham cracker soaked in milk, 2 unfamiliar with the whole-wheat cracker, 1 unfamiliar with mayo, 1 unfamiliar with cottage cheese, and 1 unfamiliar with peanut butter. The average disgust rating for the 408 familiar instances was 3.44 (out of 10), while the average disgust for the 42 unfamiliar instances was 5.55 (out of 10). None of the six instances of the contamination response had subjects who were unfamiliar with the foods that disgusted them. Also, although okra was the least familiar food, it never served as a contaminant.

If a subject was unfamiliar with a food, we assumed they had never eaten the food before. Thus, we only asked subjects who were familiar with foods whether they had eaten the food before. There were 154 instances in which a subject had not eaten a particular food. For the 254 instances in which a subject had eaten a food, the average disgust rating was 2.57 (out of 10), while the average disgust ratings for foods that had not been eaten was 5.58 (out of 10).

As mentioned previously, there were six instances of contamination (in which a subject was even willing to taste the cracker that had been touched by the stimulus). Of those six instances, there were three instances in which a subject reported that he/she had eaten the stimulus before (two instances with mayo and one with raw tomatoes) and there were three instances in which a subject reported that he/she had not eaten the stimulus

before (once with cottage cheese, once with the banana, and once with the raw tomato). We also asked subjects how much they had enjoyed eating the stimulus (if they had eaten it before). This scale ranged from -10 (I hated it) to +10 (I loved it). For the three instances in which a subject was impacted by contamination and they had eaten the foods before the subjects all reported a -10 (I hate it) reaction to the stimuli. Despite having eaten these foods before, in all three instances subjects rated these foods as very disgusting (10 for cottage cheese, 8 for banana, and 10 for the raw tomato).

An additional analysis assessed how closely a subject's reported willingness to eat a food during the pre-behavior assessment corresponded with whether or not they actually ate it. After seeing each stimulus, subjects were asked to rate their willingness to eat it on a 0 (no way) to 10 (sure, sounds great) scale. For purposes of this analysis, a subject was considered unwilling to eat a particular stimulus if their rating was a 0, 1, or 2 on the scale. Likewise, a subject was considered willing to eat a food if their rating was an 8, 9 or 10 on the scale (a score of 3,4,5,6, or 7 was considered a "maybe" and not analyzed further). As previously stated, in the experiment there were 50 subjects who were each exposed to eight stimuli (plus the cracker), for a total of 450 (50 subjects x 9 foods) separate data points. In most instances, subjects' predicted willingness to eat a stimulus corresponded to what they actually did. However, there were 35 occurrences when a subject predicted that he/she would or would not do something and then actually performed otherwise. Of those 35 instances, there were only three when a subject stated that he/she would be willing to eat a stimulus and then did not (that happened twice with mayonnaise and once with peanut butter). The remaining 32 instances occurred when a subject declared unwillingness to eat a particular stimulus and then ate the foods.

Another analysis assessed whether there was consistency between how disgusting subjects initially rated a stimulus and whether or not they ate the stimulus. For this particular analysis, we examined the preliminary disgust ratings on the 0 (not disgusting at all) to 10 (extremely disgusting) scale for each of the nine stimuli (eight plus cracker). We then compared these ratings to whether or not a subject ate the stimulus. Each time a subject was unwilling to eat a particular food we counted the number of times that the disgust rating for that particular stimulus was lower than the disgust rating for some other stimulus that the subject did eat. Each of these instances was deemed an inconsistency between ratings and performances. For example, stimulus A had been rated more disgusting than B but the subject nonetheless ate A and not B. Because different subjects rejected eating different numbers of foods, the numbers of possible inconsistencies varied between subjects. As a result, we calculated the number of inconsistencies as a proportion of the possible inconsistencies. If no items were found disgusting then the number of possible inconsistencies was zero. If one item was found disgusting then there was a possibility for eight inconsistencies (1 disgusting stimulus compared to each of 8 non-disgusting stimuli), if there were two items that were found disgusting there was a possibility for 14 inconsistencies (2 disgusting stimuli compared to each of 7 non-disgusting stimuli), etc. The average proportion of inconsistencies was .13 and the standard deviation of those inconsistencies was .12.

There were 63 instances when a subject did not chew or taste a stimulus. Subjects were asked what made them unwilling to eat the foods and were told to choose as many reasons (from a multiple choice list {see Appendix C, Post Behavior Questionnaire}) as applied. Thirty-eight of these rejections were due to the stimulus looking disgusting, 35

of these rejections were due to the subject not liking (or thinking they would not like) the taste of the stimulus, 32 of these rejections were due to the subject not liking (or thinking they would not like) the texture of the stimulus, 25 of these rejections were due to the subjects thinking the idea of the stimulus was disgusting.

There were 25 instances in which a subject was unwilling to chew or taste the cracker after the stimulus had been scraped off. Fifteen of these rejections were due to the subject not liking (or thinking they would not like) the taste of the cracker, 13 of the rejections were due to the subject thinking the idea of the cracker was now disgusting, 12 of these rejections were due to the subjects thinking that the cracker looked disgusting after the stimulus had been removed, and 8 of these rejections were reportedly due to the subject not liking the texture (or thinking they would not like) the texture of the cracker.

There were 6 instances in which a subject was unwilling to chew or taste the adjacent part of the cracker (the part that the stimulus had been next to but had not touched). For all six of those instances, rejections occurred because subjects didn't think they would like the taste, didn't think they would like the texture, and thought it looked disgusting. For five of the six instances, subjects reported that the idea of the food was disgusting. Behavioral observations for subjects were also compiled. These are summarized in Appendix I.

Individual Differences

The average score for all subjects on the Disgust Scale-Revised was 59.26. (There is not yet any normative data on the DS-R with the 5-point response scales, so it is not possible to determine whether this average score deviates notably from any norm). The

DS-R score's correlation with the OCI was $r = .27$ (ns). The average score on the OCI for these subjects was 28.76; the normative average score for the OCI was 25.25 (standard deviation = 20.8; Foa et al., 1998) so these subjects are ordinary on this measure. The DS-R did not significantly correlate with any of the behavioral measures within the study. Finally, the subjects' average score on the Picky Eating Inventory was 1.70. As expected the Picky Eating Inventory correlated with people's behavior in various aspects of the study (to be discussed later).

A composite score (Eating Behavior) was developed for scaling subjects' willingness to chew each stimulus, taste a little bit of each stimulus, eat the stimulus with a cracker, and finally touch the stimulus. Each time a subject was unwilling to do any of these tasks (for each stimulus) they accrued a point. As a result, the scale had a possible range from 0 to 32 for each subject (4 activities x 8 stimuli). The mean Eating Behavior score was 5.74 and standard deviation was 6.10. The Eating Behavior score had a correlation of $r=0.41$ ($p<.002$) with the Picky Eating Inventory, $r=0.22$ (ns) with the DS-R, and $r= -0.04$ (ns) with the OCI. Thus, subjects who scored high on the Picky Eating Inventory were less likely to eat the stimuli in this experiment than were subjects who did not score as high on the Picky Eating Inventory (see Table 4 for the Intercorrelation Matrix).

A second composite score (Contamination Reaction) was developed to assess subjects' opinions of and willingness to eat a cracker once it had been touched. Specifically, a point was added to a subject's score when the subject thought the cracker that had touched the stimulus wasn't as good as the part of the cracker that hadn't touched the stimulus, when the subject wasn't willing to eat the cracker that the stimulus

had been touching, when the subject wasn't willing to taste the cracker that the stimulus had been touching, when the subject felt that the adjacent part of the cracker wasn't as good as a plain cracker, when the subject was not willing to eat the adjacent portion of the cracker, and finally when the subject was not willing to taste the adjacent portion of the cracker. Hence, the Contamination Reaction Scale had a possible range for each subject from 0 to 48 (6 behaviors x 8 stimuli). The mean Contamination Reaction score was 2.71 and standard deviation was 4.56. The Contamination Reaction score's correlation with other measures was also assessed. It correlated $r = 0.41$ ($p < .05$) with the Picky Eating Inventory, $r = 0.20$ (ns) with the DS-R, and $r = -0.05$ (ns) with the OCI. These numbers are strikingly similar to the ones in the previous paragraph. The Eating Behavior Score correlated $r = 0.92$ ($p < .05$) with the Contamination Reaction Score. Also of note, the Picky Eating Inventory (PEI) did not significantly correlate with either the DS-R or the OCI (again, see Table 4 for intercorrelation matrix.)

Table 4

Intercorrelation Matrix

	Eating behavior	Contamination reaction	OCI SCORE	PEI	DS-R
Eating Behavior	1.00				
Contamination Reaction	0.92	1.00			
OCI SCORE	-0.04	-0.05	1.00		
PEI	0.41	0.41	0.20	1.00	
DS-R	0.22	0.20	0.27	0.17	1.00

Discussion

One of the principal aims of this study was to determine whether non-meat foods could elicit a disgust response. The results from several aspects of the experiment indicate that these foods can indeed produce disgust.

First, when subjects were initially shown the stimuli, many subjects rated non-meat foods disgusting. As reported above, there were 86 instances out of a possible 450 instances (19% of the time) in which subjects stated that one of the displayed stimuli was very disgusting. Of these 86 instances almost half of the reactions (39 instances) were because the texture of the item was considered disgusting. Also, a full 39 subjects out of 50 (nearly 80%) responded that at least one item was very disgusting (8, 9, or 10 on disgust scale). These results provide evidence that non-meat foods, both dairy and vegan, can be disgusting and that texture plays an integral role in the disgust response.

Within these findings, it is important to consider that there were only eight stimuli (plus the cracker) presented to subjects. The number of non-meat foods available for consumption is nearly infinite. Therefore, the fact that nearly a fifth of the stimuli presented prompted a “very disgusting” response from subjects and that nearly 80% of subjects found at least one stimulus very disgusting is notable.

Subjects not only reported that non-meat foods were disgusting, but they also demonstrated behaviorally that these foods were disgusting. The central way to examine this hypothesis was to determine whether the non-animal stimulus had the power to contaminate the neutral cracker. As described earlier, 15 subjects out of 50 (30%) were unwilling to eat any part of a cracker that a disgusting object had touched. Also, as

reported earlier, there was a mix of whether subjects rejected only dairy foods, only vegan foods, or a combination of the two.

During the behavior phase of the study, the subjects were asked to physically remove as much of the contaminating stimulus from the cracker as possible. The experimenter provided both a clean spoon and a napkin for this task. Thus, it is possible to make the argument that there were only trace amounts of the disgusting food left on the cracker that had been touched by the stimulus. As a result, as many as 30% of the subjects were conceivably affected by contamination. However, it is also important to state that this estimation is likely high because some subjects reported that the cracker's texture had changed as a result of the stimulus sitting on top of it. For example, one subject reported that the cottage cheese sitting on the cracker had rendered the cracker "mushy".

If we more narrowly define contamination as rejection occurring when no physical trace of the item remains on the previously neutral stimulus, this experiment also finds contamination by that definition. Five subjects out of 50 (10%) were unwilling to eat a part of a cracker that the disgusting object had been adjacent to (but not physically touched). In these instances the mayo (V), rice pudding (D), cottage cheese (D), banana (V), and tomatoes (V) were the stimuli that caused the contamination of the cracker. Among these five subjects, two subjects rejected eating foods contaminated only by dairy products, two rejected foods contaminated only by vegan products, and one subject rejected eating foods contaminated by both dairy and vegan products. For the 10% of subjects who were unwilling to eat the adjacent part of the cracker, there was nothing on the cracker that the stimulus had touched. Thus, contamination, a crucial defining feature

of disgust was shown to occur with non-animal foods. It is also important to acknowledge that for each contamination occurrence the particular subject had rated the particular contaminating stimulus during the pre-behavior assessment as very disgusting (i.e., rated it 8, 9, or 10).

As mentioned above, while 30% might be an over-estimate of the contamination response the 10% estimate is likely an under-estimate for the prevalence of contamination by non-meat foods because only eight foods (among the nearly infinitely possible disgusting foods) were chosen as stimuli. Subjects who did not demonstrate contamination in this experiment might have done so with some other (unknown) stimuli not used here.

There is also a statistical reason that 10% is likely an underestimate. Agresti and Coull (1998) argued that a more accurate way to estimate a population proportion from sample data was to perform the “plus four estimate”. In this estimate, one pretends that the sample contains four additional observations of which two are counted as successes and two are counted as failures. Thus, in this experiment, the number of times contamination occurred (successes) would become 7 and the number of observations would rise to 54. The estimate of the population proportion would therefore increase to 13%.

If we wanted to further sub-divide the contamination response into dairy and vegan foods, the Agresti and Coull (1998) study still applies. Three subjects out of 50 experienced contamination with both the dairy stimuli and vegan stimuli. Therefore the raw estimate for contamination occurring with dairy stimuli and vegan stimuli is 6% for

each. If we apply the “plus four estimate” this number rises to 9.6% (or about 10%) for both dairy and vegan stimuli.

Not only does the small number of stimuli contribute to a possible underestimation of the prevalence of the disgust to texture response, so does the fact that subjects voluntarily chose to participate in the study. Many subjects in the experiment were undergraduates who completed the study in order to complete a research requirement. These subjects had access to a web-site that had numerous options for experiments to participate in. As such, these subjects knew that they would be participating in a study about food and disgust. It is possible that the volunteers might have been more interested in trying new foods than the general population. Those who are very disgust sensitive or picky eaters might have been hesitant to participate in the experiment (As mentioned previously, there is not yet any normative data on the DS-R with the 5-point response scales.)

In general, it seems subjects reported familiar items as less disgusting than unfamiliar items. Likewise, foods that have been eaten before are generally considered less disgusting than items that have not been consumed before. Nevertheless, these self-reports of familiarity, consumption, and disgust do not directly connect to the behavioral results regarding contamination. All of the subjects who were impacted by contamination reported they were familiar with the particular stimulus. For three of the instances of contamination, subjects reported eating the foods before (and hating them), while for the remaining three instances of contamination, subjects had not eaten the foods before. It is unclear how to attach meaning to these results, more information would be helpful. For example, when the subjects had eaten the foods before, it would be nice to get a sense of

their subjective experience. Would they have reported a disgust reaction with these foods or was it more similar to a distaste response? Perhaps an experience with a distasteful food can evolve into disgust reaction with the addition of a negative affective experience. This idea further muddies the distinction between distaste and disgust. When does a distaste response end and a disgust response begin? Further research should investigate these distinctions more fully.

As discussed previously, when a subject reported that an item was very disgusting, the majority of the reported reasons (on the pre-behavior assessment) were related to the texture of the item.

It is also noteworthy that texture played an integral role in why subjects chose not to consume a particular stimulus. In 32 of the 63 instances when a subject choose not to chew or taste a particular stimulus, the subjects reported that they either did not like, or thought they would not like, the texture of the item. Additionally, of the 25 instances in which a subject would not chew or taste a cracker after a stimulus had touched it, eight rejections were due to the subjects thinking they would not like the texture of the cracker. Finally, in all of the six instances when a subject was unwilling to eat or taste an adjacent segment of the cracker, the subjects thought they would no longer like the texture of the cracker (See page 59 for details in results). Is this page number still correct?

It is interesting to observe that in the six instances in which a subject was unwilling to eat the adjacent portion of the cracker, all of these subjects assumed the texture of the cracker changed (although physically the adjacent cracker remained the exactly the same). As detailed previously, Morales and Fitzsimons (2007) demonstrated that features of the contaminant could be passed to the target item. In their study, the

proximity of lard (contaminant) to a rice cake (target item) not only influenced how subject perceived the quality of the rice cakes; but also, the rice cakes that were close to the lard were perceived as having a higher fat content than rice cakes not touching lard. In the current study the disgusting texture of the contaminating food influenced subjects' perception of the texture of the cracker. Further research could clarify what other qualities of disgusting foods might contaminate neutral foods.

While it is apparent that texture in some way contributes to the disgust response, it is unclear as to its exact mechanism. All of the stimuli chosen for this particular study had textures that were on the softer end of the textural spectrum. For example, all of the foods could be described as soft, gooey, mushy, runny, etc. The cracker and tomato were foods that are not comparatively as texturally soft as the other stimuli and these stimuli engendered the least disgust response.

As Martins and Pliner (2006) suggested perhaps the texture of foods reminds us of rot and decay which could contribute to the disgust response. More specifically, recall that Oaten, Stevenson and Case (2009) theorized foods with physical qualities that are associated with the presence of pathogens may engender disgust as a disease avoidance mechanism. For example, subjects may have been disgusted by okra because of its resemblance to another slimy entity (phlegm or mucus for example) which may contain dangerous pathogens. Future studies could investigate whether there are any crunchy or crispy foods that can produce disgust. Because crispy or crunchy foods are not typically (if ever) thought of as rotted, if a disgust reaction occurred it would provide evidence against a model in which disease avoidance model is the basis for all disgust.

Another facet of texture worth considering is the idea of textural anomaly. Often humans select and prefer foods with textural variety. David Kessler, in *The End of Overeating* (2009), describes the importance of textural variety for the preference of foods. For example, he highlights our preference for the crunch of bacon bits on a salad. However, in some instances it seems that different kinds of textures in one particular item are unappealing. When subjects did not like the rice pudding or the cottage cheese, they often reported lumpiness or irregularity of texture a primary reason for the food rejection. It is curious that texturally different components that are characterized as different entities, for example bacon bits on salad, seem to be better accepted than one food item like rice pudding that consists of two texturally different components: rice and custard.

Interestingly, the mushy banana was a stimulus routinely rejected because of rot/decay; however, most subjects stated that rot/decay was not the sole reason for rejection of the banana. Of note, the banana was the only item that looked different from how it is typically eaten in the United States (yellow and firm). Subjects also might have chosen the rot/decay response because they wanted to use all of the response choices. Also, as Martins and Pliner suggested (2006) it could be that texture and rot/decay are related. Perhaps a food item is potentially disgusting because it reminds us of rot/decay or perhaps the reverse is true.

While the over-ripe banana elicited the most disgust, it is worth noting that the stimulus presentation sequence remained constant throughout all 50 subjects. As such, there is a possibility of contrast or order effects with the stimuli. For example, one subject (#24 in Appendix I) stated, “If the okra was last, I bet more people would eat it. They're

used to eating all sorts of gross things by then.” It is certainly possible that what particular subjects found disgusting would have been different if the order had varied.

Results examining whether or not non-animal foods can produce disgust also promote the idea that disgust may be an emotion that exists more on a continuum than previously believed. Meats are more likely to elicit disgust than non-meats (Rozin and Fallon (1987) and results from Experiment 0). However, based on the results of Experiment 1, non-meat foods clearly have the power to contaminate. As researchers establish disgust scales to measure individual differences in disgust sensitivity, perhaps foods or food-related scenarios should also be assessed in terms of their ability to engender disgust.

These aforementioned findings demonstrate that the construct of disgust is not completely related to previous theories suggested by Rozin, Haidt, and McCauley (2008) that “animal-ness” is the sole source of core or food-related disgust. Instead, other characteristics of food (texture being a likely key component) must contribute to the disgust response, and permit non-meat foods to be disgusting. Again, as suggested by Oaten et al. (2009), perhaps foods are disgusting if they somehow signal a similarity to pathogen carriers.

A second major goal in this study was to investigate how subjects’ responses to the varied stimuli correlated with other measures. The first connection that was investigated was that between results of our experiment and a subject’s score on the Disgust Scale-Revised. The entire Disgust Scale-Revised score did not significantly correlate with any of the behavioral measures in this study ($r=.20$ and $r=.22$). However, the experiment and the Disgust Scale-Revised are measuring different constructs. Core

disgust (which would include food-related disgust) is only one factor (out of three) assessed by the Disgust Scale-Revised (contamination and animal related disgust are the two remaining). As a result, the results from this study might be too specific to correlate to such a global construct.

One might also argue that perhaps disgust is not a global construct, but rather is simply one term that aggregates three distinct factors. However, Rozin, Haidt, and McCauley (2008) stated that the Disgust Scale exhibited positive correlations among different kinds of elicitors-- evidence, they suggested, that the scale tapped a unifying construct. Additionally, research by (Olatunji et al., 2007) assessed the construct validity of the DS by measuring its correlation with the OCI. Both the Core Disgust and Contamination Disgust factors of the DS significantly correlated with the OCI but the Animal Reminder factor did not. Interestingly, as previously mentioned, in this study the OCI and the DS-R were not correlated ($r=.27$, ns) but the non-significant trend was positive.

The second connection assessed was between the Eating Behavior/Contamination Reaction scores and the Picky Eating Inventory. There was a significant correlation between the PEI and the two measures, ($r=.41$, $p<.05$ in each case). Given that the 10 questions on the PEI tapped specifically into subjects' eating habits, it is reassuring that these results correlated with subjects' behaviors. For example, one of the questions on the measure taps specifically into food texture, "I almost always reject foods that are slippery or slimy (for example, okra, oysters, soft boiled egg or fried rice)."

The final measure examined in this study was the Obsessive Compulsive Inventory (OCI). The correlations between scores on the OCI and the two behavioral

scales were $r=-.04$ and $r=-.05$. It is very likely that the OCI is simply too global a construct to connect with subjects' aversions to certain textures. Perhaps there are aspects of obsessions or compulsions around food or contamination specifically that might relate to texture sensitivity. Although Kauer (2002) found that 63% of picky eaters in her sample scored above the reported mean for non-clinical college students on an obsessive-compulsive measure, the picky and non-picky eaters she studied were chosen from extremes on the eating behavior spectrum. For this analysis, Kauer defined picky eaters as those who scored in the top 26% of the picky eating factor; whereas, non-picky eaters were defined as those who scored in the bottom 26% of the same factor. As a result, the picky eaters were particularly "picky", perhaps leading to abnormal scores in other assessments as well.

Regardless of whether or not the DS-R or OCI correlate with results from this study, it is noteworthy how much attention adult picky eating has received in recent years. In summer 2010, Duke University created the first known registry of picky eating. (http://dukedpn.qualtrics.com/SE/?SID=SV_0SP4yhXRGqGb1A0). Additionally, a support-group website currently exists with 1,400 members who claim to suffer from the side-effects of picky eating (<http://www.pickyeatingadults.com/>). Further research should investigate whether those with texture sensitivity or those who are picky eaters suffer emotional or physical repercussions.

It is also possible that there truly is a link between picky eating and disgust sensitivity that does not emerge in this study. As previously described, Kauer (2002) found that there was a significant difference in disgust sensitivity between picky and non-picky eaters. In Kauer's study the picky and non-picky eaters came from the extreme

ends (top 26% and bottom 26%, respectively) of the pickiness factor. However, subjects in the study reported here were self-selected to not be so picky. As reported previously, subjects who volunteered for this experiment knew the focus was food and disgust. Therefore, very picky eaters were likely to abstain from participation. As a result, there is not as much of a correlation between picky eating (in this study) and the other individual traits (OCI measure and Disgust-Scale measure) because there is a restricted range of picky eaters. Because of the likely restricted range, it is particularly impressive that the Picky Eating Inventory does correlate so highly with the behavioral measures in this study.

One sort of individual difference that was not investigated in the current study was how one's culture, ethnicity, and previous food exposure might impact whether stimuli were found disgusting and/or consumed. Perhaps, if a larger sample of subjects were available then it would have been possible to parse out this factor. Anecdotally, one subject who was particularly disgust sensitive (several stimuli served as contaminants for her) stated that her Mexican heritage had much to do with what foods she found disgusting. She stated that she did not want to consume any white foods because she assumed that white foods would be bland. As a result, she found the cottage cheese, rice pudding, and mayonnaise disgusting. She did however try the peanut butter because she associated tan foods with spice and flavor.

Another example of how textural disgust might be a cultural construct comes from Fuchsia Dunlop's memoir, *Shark's Fin and Sichuan Pepper: A Sweet-Sour Memoir of Eating in China* (2008). In it she describes her experience learning to embrace Chinese cuisine. She writes,

The main problem was texture. Texture is the last frontier for Westerners learning to appreciate Chinese food...It will disgust you, disconcert you, and make your compatriots view you with a barely disguised revulsion. Think for a moment, of the words we use to describe some of the textures most adored by Chinese gourmets: gristly, slithery, slimy, crunchy, gloopy. (Dunlop, 2008, pp. 135)

So, performing this study in an area like China, might lead to interestingly different results. In addition, if slimy or gloopy items are preferred in China, it might weaken the disease avoidance hypothesis posited by Oaten et al. (2009) suggesting items with these textural properties remind us of disease carriers.

The final purpose of this study was to assess whether there was a reliable connection between what subjects said they were going to do, and what they actually do. A preliminary conjecture in this study was that people perhaps would state that they would be willing to do certain things, but then would not actually be willing to do them. In general, this hypothesis was not borne out. There were 35 instances (out of a possible 450) when a subject predicted he/she would do or not do something and did otherwise. In only three of those instances did a subject state that he/she would be willing to eat a stimulus but then not eat it. In 32 instances, subjects ate foods they had said they would not.

As discussed above, there was also a .13 proportion (on average) of inconsistencies between subjects' ratings of disgust and what the subjects actually ate. This is additional information over and above the 35 inconsistencies mentioned previously. This particular analysis speaks to the fact that people also are inconsistent in thinking about what things they say that they are more or less disgusted by versus whether they in fact are willing to eat a particular food. Subjects were willing to eat some

things that they say are more disgusting than some other things that they in fact did not eat.

These results suggest that compliance effects might have influenced subjects' behavior. Even though a subject really did not want to taste a particular stimulus, they felt pressured by the nature of the experiment. Anecdotally, there were a number of occurrences in which a subject stated that he or she did not want to try the foods, but wanted to be a good subject. For example, one subject stated, "This food is really gross, but I will eat it for the purposes of science."

In addition to directly asking subjects about their impressions of the foods, disgust was also indirectly assessed by asking subjects how willing they would be to consume a particular food. As described earlier, subjects' reported unwillingness to eat a particular stimulus (on average) mirrored their responses to what foods they found disgusting. As a gross estimate, asking people what they are willing to eat is an adequate measure of what they will eat.

It is noteworthy that while approximately 90% of the time what a subject anticipated he or she would do did match what he or she actually did, in nearly 10% of instances a subject's prediction for what he or she would do was not accurate. 10% remains a sizeable error rate. Additionally, as mentioned above the proportion of inconsistencies between whether a subject rated something disgusting and their actual behavior was .13. To understand topics of food disgust, ratings are not an altogether adequate substitute for actually having subjects perform the specific tasks in question. Ultimately, the specific behaviors in this study provide more critical (and useful) information than how a subject fills out a self-report of anticipated behaviors.

Another distinction this study makes from previous studies of disgust is that it is the first to definitively show that every-day foods can serve as contaminants. Previous studies have demonstrated a contamination reaction with non-foods such as a sweater worn by an unsavory person (Rozin & Nemeroff, 1986), a feminine napkin (Morales & Fitzsimons, 2007) or a cockroach (Rozin & Falon, 1987). This is the first study to demonstrate that every-day foods such as tomato and mayonnaise have the power to contaminate a neutral cracker.

In sum, this experiment clarified a number of features of food-related disgust. First, and perhaps most importantly, non-meat foods have the power to disgust as Martins and Pliner (2006) suggested. This was shown not only in subjects' direct statements that foods were disgusting, but also, in the fact that these non-meat foods had the power to contaminate an otherwise neutral food. Secondly, based on subjects' responses from both the Stimulus Selection study and the Main Experiment, texture clearly plays a role in the disgust response. Results from this study also showed a strong connection with the Picky Eating Inventory: subjects who endorse pickiness are more likely to be disgusted by non-meat foods than are subjects who do not endorse as much pickiness. No correlation was seen between behavioral results of this study and the OCI or DS-R, but future research might find some. Also, although there was a strong association between what subjects stated they would do and what they actually did, these results demonstrate the need for direct behavioral assessments whenever feasible. Finally, it would be interesting and valuable to learn the specific mechanisms for the role of texture in the disgust response.

APPENDIX A

LIST OF FOODS FROM PRELIMINARY STUDY: STIMULUS SELECTION

Answer Options	Not Disgusting	A little	Moderately	Very	Extremely	Rating Average
Testicles	4	4	15	25	45	4.11
Caterpillars	1	6	18	31	37	4.04
Moths	6	6	16	27	38	3.91
Chicken Feet	9	10	21	22	31	3.6
Grasshoppers	5	18	19	19	32	3.59
Sweetbreads (thymus gland of a cow)	14	9	27	23	21	3.3
Blood Sausage	12	16	21	21	23	3.29
Lard	14	18	21	21	20	3.16
Escargots (snails)	28	21	13	17	15	2.68
Steak Tartar (raw hamburger)	39	11	13	14	17	2.56
Chicken Liver	29	22	17	16	10	2.53
Pork Rinds	32	23	18	12	9	2.39
Octopus	38	23	12	10	10	2.26
Anchovies	38	20	19	9	8	2.24
Over-ripe Bananas	33	32	18	5	6	2.14
Squid	48	16	13	8	9	2.09
Kimchi (pickled, fermented, spicy cabbage)	50	17	12	5	9	1.99
Oysters	47	24	10	6	7	1.96
Whole Fish (cooked, with head on)	51	16	12	8	5	1.91
Blue Cheese	63	15	4	3	9	1.72
Sauerkraut	64	13	5	5	5	1.63
Okra	64	14	7	4	3	1.57
Lobster	75	10	4	1	4	1.39
Tofu	74	12	5	1	2	1.35
Raw Tomatoes	83	3	5	2	1	1.24
Mushrooms	80	10	2	1	1	1.22
Jello	89	4	1	0	0	1.06

APPENDIX B

STIMULI DETAILS

1.) Cracker (C):

- a.) Brand, “34 whole grain crisp-bread”. Cracker was selected because of its neutral taste and texture. There were no ridges on the cracker, such that the stimuli would not settle between the ridges. The cracker was round and 2.25 inches in diameter.
- b.) “This is a wheat cracker”

2.) Rice Pudding (D):

- a.) Kozy Shack rice pudding.
- b.) “This is store bought rice pudding”
- c.) If subject was unwilling to sample a small bite of rice pudding, then one teaspoon of pudding was placed on piece of cracker (without spreading it).

3.) Okra (V):

- a.) Frozen okra was boiled in approximately ½ cup of water for one hour
- b.) “This is previously frozen okra that has been boiled in water for one hour”
- c.) If subject was unwilling to sample a small bite of okra, then one teaspoon of okra was placed on cracker (without spreading it).

4.) Mayonnaise (D):

- a.) Generic mayonnaise was purchased from local grocery store
- b.) “This is store bought mayonnaise”
- c.) If subject was unwilling to sample a small bite of mayonnaise, then one teaspoon of mayonnaise was placed on the cracker (without spreading it).

5.) Graham Crackers soaked in milk (D):

- a.) One graham cracker (store brand) were placed in store bought and placed in approximately ¼ cup of skim milk.
- b.) “This is one regular graham cracker that has been soaked in ¼ cup of skim milk”
- c.) If subject was unwilling to sample graham cracker mixture, then one teaspoon of the Graham cracker mix was placed on the cracker (without spreading it).

6.) Large Curd Cottage Cheese (D):

- a.) Large curd cottage cheese was purchased (4% milkfat, store brand)
- b.) “This is store bought large curd cottage cheese”
- c.) If subject was unwilling to sample cottage cheese, then one teaspoon of cottage cheese was placed on cracker (without spreading it).

7.) Chunky Peanut Butter (V):

- a.) Organic, natural, extra chunky peanut butter (Smuckers brand)
- b.) “This is extra chunky peanut butter”

c.) If subject was unwilling to sample peanut butter, then one teaspoon of peanut butter was placed on cracker (without spreading it).

8.) Over-ripe Banana (V):

a.) Bananas were purchased from local grocery store. They were left on the counter until mostly brown (not black). It took anywhere between five and eight days for the bananas to ripen to this point. A ½ to 1 inch slice of banana was cut for each subject and left in its skin.

b.) “This is a banana that was picked ripe and has been left out to ripen for 5 days”

c.) If subject was unwilling to sample the banana, then one teaspoon (approximately) of banana was placed on cracker (banana was peeled by the experimenter with a knife and spoon).

9.) Raw Tomatoes (V):

a.) cherry tomatoes were purchased from grocery store. They were halved.

b.) “These are cherry tomatoes”

c.) If a subject was unwilling to sample the tomato then one half of the tomato was placed seed side down on the cracker while the other half was placed seed side up on the cracker.

APPENDIX C

POST-BEHAVIOR QUESTIONNAIRE (ONE USED FOR EACH STIMULUS)

1.) What made you unwilling to eat the (circle all that apply):

a.): Okra

- i.) Don't like taste (had it before)
- ii.) Don't like the texture (had it before)
- iii.) Don't think I would like the taste (never had it before)
- iv.) Don't think I would like the texture (never had it before)
- v.) Looks Disgusting
- vi.) Idea of it is disgusting
- vii.) Other _____

b.): Cracker that had Okra scraped off it

- i.) Don't like taste (had it before)
- ii.) Don't like the texture (had it before)
- iii.) Don't think I would like the taste (never had it before)
- iv.) Don't think I would like the texture (never had it before)
- v.) Looks Disgusting
- vi.) Idea of it is disgusting
- vii.) Other _____

c.): Cracker that had Okra adjacent (but not touching it)

- i.) Don't like taste (had it before)
- ii.) Don't like the texture (had it before)
- iii.) Don't think I would like the taste (never had it before)
- iv.) Don't think I would like the texture (never had it before)
- v.) Looks Disgusting
- vi.) Idea of it is disgusting
- vii.) Other _____

OR

2.) Describe the texture of ingested okra.

APPENDIX D

DISGUST SCALE-REVISED

Please indicate how much you agree with each of the following statements, or how true it is about you. Please write a number (0-4) to indicate your answer:

0 = Strongly disagree (very untrue about me)

1 = Mildly disagree (somewhat untrue about me)

2 = Neither agree nor disagree

3 = Mildly agree (somewhat true about me)

4 = Strongly agree (very true about me)

- ___1. I might be willing to try eating monkey meat, under some circumstances.
- ___2. It would bother me to be in a science class, and to see a human hand preserved in a jar.
- ___3. It bothers me to hear someone clear a throat full of mucous.
- ___4. I never let any part of my body touch the toilet seat in public restrooms.
- ___5. I would go out of my way to avoid walking through a graveyard.
- ___6. Seeing a cockroach in someone else's house doesn't bother me.
- ___7. It would bother me tremendously to touch a dead body.
- ___8. If I see someone vomit, it makes me sick to my stomach.
- ___9. I probably would not go to my favorite restaurant if I found out that the cook had a cold.
- ___10. It would not upset me at all to watch a person with a glass eye take the eye out of the socket.
- ___11. It would bother me to see a rat run across my path in a park.
- ___12. I would rather eat a piece of fruit than a piece of paper
- ___13. Even if I was hungry, I would not drink a bowl of my favorite soup if it had been stirred by a used but thoroughly washed flyswatter.
- ___14. It would bother me to sleep in a nice hotel room if I knew that a man had died of a heart attack in that room the night before.

How disgusting would you find each of the following experiences? Please write a number (0-4) to indicate your answer:

0 = Not disgusting at all

1 = Slightly disgusting

2 = Moderately disgusting

3 = Very disgusting

4 = Extremely disgusting

- ____ 15. You see maggots on a piece of meat in an outdoor garbage pail.
 - ____ 16. You see a person eating an apple with a knife and fork
 - ____ 17. While you are walking through a tunnel under a railroad track, you smell urine.
 - ____ 18. You take a sip of soda, and then realize that you drank from the glass that an acquaintance of yours had been drinking from.
 - ____ 19. Your friend's pet cat dies, and you have to pick up the dead body with your bare hands.
 - ____ 20. You see someone put ketchup on vanilla ice cream, and eat it.
 - ____ 21. You see a man with his intestines exposed after an accident.
 - ____ 22. You discover that a friend of yours changes underwear only once a week.
 - ____ 23. A friend offers you a piece of chocolate shaped like dog-doo.
 - ____ 24. You accidentally touch the ashes of a person who has been cremated.
 - ____ 25. You are about to drink a glass of milk when you smell that it is spoiled.
 - ____ 26. As part of a sex education class, you are required to inflate a new unlubricated condom, using your mouth.
 - ____ 27. You are walking barefoot on concrete, and you step on an earthworm.
-

The DS-R (Disgust Scale-Revised), Haidt, McCauley, & Rozin, 1994; Modified by Olatunji et al., in press.

To calculate your score: First, put an X through your responses to items 12 and 16 (these items don't count). Then "reverse" your score on items 1, 6, and 10 by subtracting what you wrote from the number 4, and write those numbers in the margin. Finally, add up your responses to all 25 items (using your "reversed" scores on 1, 6, and 10). The total will be a number between 0-100. For more information see:

<http://people.virginia.edu/~jdh6n/disgustscale.html>

APPENDIX E

PICKINESS SCALE (ADAPTED FROM KAUER)

All are True/False Items

I am unusually picky about the foods I eat.

Others consider me a picky eater.

I eat from a very narrow range of foods
(fewer than 10 different foods).

I almost always reject foods that are slippery or “slimy”
(for example, okra, oysters, soft boiled egg or fried egg).

When I am invited to dinner, I worry that there may be nothing that I can eat.

I almost always reject foods that are mixed or combined (e.g., peas and carrots, a sandwich with several things in it, things like tuna salad).

I try not to let different foods touch my plate.

I almost always reject foods if there is something that I can't see in them (e.g., filled foods like eggrolls, dumplings, and ravioli).

I do not like to eat new foods.

I almost always reject foods with “lumps” in them (e.g., a sauce with pieces in it or a stew), even if they are supposed to be that way (so this does not mean lumpy oatmeal or gravy).

APPENDIX F

OCI

Name Date.....

The following statements refer to experiences which many people have in their everyday lives. In the column labeled DISTRESS, please **CIRCLE** the number that best describes **HOW MUCH** that experience has **DISTRESSED** or **BOTHERED YOU DURING THE PAST MONTH**. The numbers in this column refer to the following labels:

0 = Not at all 1 = A little 2 = Moderately 3 = A lot 4 = Extremely

		DISTRESS
1	Unpleasant thoughts come into my mind against my will and I cannot get rid of them.	0 1 2 3 4
2	I think contact with bodily secretions (perspiration, saliva, blood, urine, etc.) may contaminate my clothes or somehow harm me.	0 1 2 3 4
3	I ask people to repeat things to me several times, even though I understood them the first time.	0 1 2 3 4
4	I wash and clean obsessively.	0 1 2 3 4
5	I have to review mentally past events, conversations and actions to make sure that I didn't do something wrong.	0 1 2 3 4
6	I have saved up so many things that they get in the way.	0 1 2 3 4
7	I check things more often than necessary	0 1 2 3 4
8	I avoid using public toilets because I am afraid of disease or contamination.	0 1 2 3 4
9	I repeatedly check doors, windows, drawers etc.	0 1 2 3 4
10	I repeatedly check gas and water taps and light switches after turning them off.	0 1 2 3 4
11	I collect things I don't need.	0 1 2 3 4
12	I have thoughts of having hurt someone without knowing it.	0 1 2 3 4
13	I have thoughts that I might want to harm myself or others.	0 1 2 3 4
14	I get upset if objects are not arranged properly.	0 1 2 3 4
15	I feel obliged to follow a particular order in dressing, undressing and washing myself.	0 1 2 3 4
16	I feel compelled to count while I am doing things	0 1 2 3 4
17	I am afraid of impulsively doing embarrassing or harmful things.	0 1 2 3 4
18	I need to pray to cancel bad thoughts or feelings.	0 1 2 3 4
19	I keep on checking forms or other things I have written.	0 1 2 3 4
20	I get upset at the sight of knives, scissors and other sharp objects in case I lose control with them.	0 1 2 3 4

DISTRESS

21	I am excessively concerned about cleanliness.	0 1 2 3 4
22	I find it difficult to touch an object when I know it has been touched by strangers or certain people.	0 1 2 3 4
23	I need things to be arranged in a particular order	0 1 2 3 4
24	I get behind in my work because I repeat things over and over again.	0 1 2 3 4
25	I feel I have to repeat certain numbers.	0 1 2 3 4
26	After doing something carefully, I still have the impression I have not finished it.	0 1 2 3 4
27	I find it difficult to touch garbage or dirty things.	0 1 2 3 4
28	I find it difficult to control my own thoughts.	0 1 2 3 4
29	I have to do things over and over again until it feels right.	0 1 2 3 4
30	I am upset by unpleasant thoughts that come into my mind against my will.	0 1 2 3 4
31	Before going to sleep I have to do certain things in a certain way.	0 1 2 3 4
32	I go back to places to make sure that I have not harmed anyone.	0 1 2 3 4
33	I frequently get nasty thoughts and have difficulty in getting rid of them.	0 1 2 3 4
34	I avoid throwing things away because I am afraid I might need them later.	0 1 2 3 4
35	I get upset if others change the way I have arranged my things.	0 1 2 3 4
36	I feel that I must repeat certain words or phrases in my mind in order to wipe out bad thoughts, feelings or actions.	0 1 2 3 4
37	After I have done things, I have persistent doubts about whether I really did them.	0 1 2 3 4
38	I sometimes have to wash or clean myself simply because I feel contaminated.	0 1 2 3 4
39	I feel that there are good and bad numbers.	0 1 2 3 4
40	I repeatedly check anything which might cause a fire.	0 1 2 3 4
41	Even when I do something very carefully I feel that it is not quite right.	0 1 2 3 4
42	I wash my hands more often or longer than necessary.	0 1 2 3 4

APPENDIX G

PRESENT SUBJECTS WITH INFORMATION ON THE DIFFERENCE BETWEEN DISTASTE AND DISGUST.

DISGUST is a strong, negative reaction to a food. The reaction is so strong, that you might not even want to touch the food, let alone eat it. The thought of eating this food really grosses you out and may even produce nausea. There are other reasons for rejecting a food. For example, you may not like the taste of a certain food (or you may think you wouldn't) or you may have a strong physical reaction when eating it (like allergies).

Before you begin the study, it is ESSENTIAL that you understand the distinction between food rejections based on disgust and other reasons for food rejection. Therefore, for the following three scenarios, please indicate whether the rejection was based on “Disgust” or “Something Else”.

- 1.) Vanessa rejects a food because she doesn't like the way it smells. Is this rejection likely based on Disgust or Something else?

Disgust: No, there is no mention that the idea of the food is the reason Vanessa rejects it. As a result, the rejection likely is based on another reason (smell).

Something Else: Yes, there is no mention that the idea of this food causes Vanessa to reject it.

- 2.) Jess rejects a food because the idea of eating it makes her nauseated. Is this rejection likely based on Disgust or Something else?

Disgust: Yes, this rejection is likely based on disgust. Jess rejects the food because the idea of it grosses her out.

Something else: No, this rejection is based on Disgust because the idea of the food grosses Jess out.

- 3.) Kate rejects a food because she fears that it might make her physically sick. Is this rejection based on Disgust or Something else?

Disgust: No, this reaction doesn't so much have to do with the idea of the food per se, but instead that the food might be dangerous.

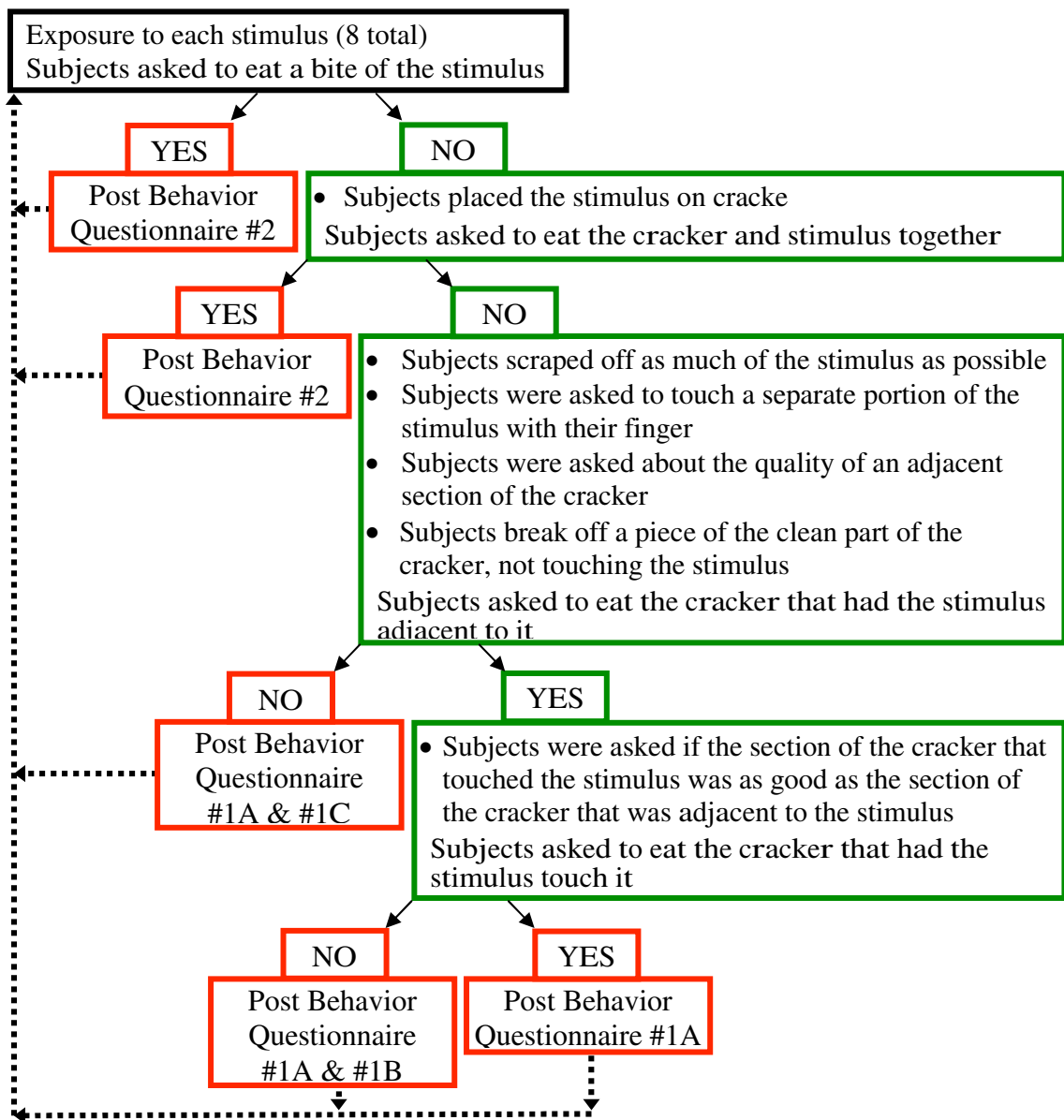
Something else: Yes, this rejection has more to do with the food being dangerous instead of the idea of the food grossing Kate out.

In this study we are interested in gathering information about DISGUST!

APPENDIX H

PROCEDURE FLOW CHART

50 Subjects (31 F, 19 M)	Informed Consent and Demographic Form
Pre-Behavior Assessment for each stimulus	Subjects asked to eat a bite of the cracker (All complied)



APPENDIX I

BEHAVIORAL OBSERVATIONS

1. "I've noticed that all gross textures in this study are soft, aren't there any gross textures that are crunchy?"
2. After poking at the banana, "Oh my, that is gross!"
3. "I don't like any white foods. I am Mexican, and I associate white with bland, at least the peanut butter is bland so it is the color of spices." When she wouldn't eat the adjacent cracker subject stated, "All these foods are contaminated!"
4. For Cottage Cheese: "Oh, why not, I guess I'll do it."
5. For Banana: "I'm only going to eat a really small bite of this, I think the cracker will mask it."
6. For Banana: "For the purposes of science, I am going to eat this."
7. After eating okra: "It didn't really have a flavor and it was not as bad as my expectations" For the tomato: "Can I scrape the seeds off?"
8. "As a child I used to like eating jelly fish, even though they are very slimy" "I don't think the banana is very fresh" (referencing the instructions).
9. Subject was very excited to participate in experiment. He writes a local food blog and self identifies as someone who will eat anything no matter how disgusting.
10. Subject would not eat the tomato when it was halved; however, when experimenter went to put the tomato on the cracker it spilled. Went to grab another tomato and when she sliced the new tomato in half she stated that now she would (and did) eat the tomato.
11. Swallowed the banana after a lot of deliberation about whether or not to do it.
12. Quote From Participant: "I pride myself on not being a picky eater."
13. Quote from the participant in regards to agreeing to eat part of the cracker that the banana had touched "I surprised myself!"
14. In regards to the spoon full of graham cracker I scooped out: "Eww. Looks a lot worse than before" "People don't actually eat this stuff do they?" "Have you ever had people eat all of them?"
15. Subject wanted to rate the Banana a -10 in his willingness to eat, chew, and swallow the banana, because he felt 0 wasn't a low enough rating. Behavioral: As to whether or not the part of the cracker that touched the Okra was as good as a regular cracker, he said "No, the taste is already there."

16. About cottage cheese: "My mom always said I was really weird about texture, which was why I signed up for this study."
17. When asked for her willingness to eat the cracker that had touched the banana, she asked if she could smell it. After smelling it, she rated her willingness as 0 no way. For the Okra, the subject indicated that she was willing to chew and swallow a bite, but then spit it out.
18. "I've never eaten cottage cheese before. It's just so gross!"
19. Subject indicated that smell is very important to how disgusting she finds a food: When poking at Okra, she remarked "ew": When asked if she would chew and swallow the okra she said, "I'll try but spit it out if it is gross" When eating the piece of cracker the banana had touched, she took the smallest piece.
20. Subject stated "I used to be a picky eater as a child, but enjoy trying new foods now".
21. For the Graham Cracker, when she broke a piece off that had touched to eat, it a very tiny piece.
22. Swirled all foods together before she ate them.
23. "I'm really just not a fan of bananas."
24. "If the Okra was last, I bet more people would eat it. They're used to eating all sorts of gross things by then."
25. "I am going to try everything, because I'm a picky eater and I want to be a trooper."
26. For the Rice Pudding, when asked if he would chew it, he replied "Yes, reluctantly". For the Mayo and the Banana, when asked if he would chew it he said "I don't have to right?" And was assured he didn't. Stated that the banana just tasted like banana bread.
27. Cottage Cheese "This is so gross, people don't actually eat this ever do they? No way."
28. After eating Okra: "That feels so weird-- really weird texture". When eating Rice Pudding and Graham cracker, subject made it look almost painful. He was told however he did not have to eat them if he didn't want to.
29. Only ate a tiny bit of the Mayo
30. For Behavioral Test, all items with Dairy were skipped (because of lactose intolerance). For the banana; subject really thought about it; then said "sure, I'm not eating any of your dairy ones."
31. "I've never tried okra before, so sure!"
32. Described that she had to eat a lot of bananas in the Peace Corps, and that they now disgusted her.
33. Didn't want to take the top cracker; dug down to a lower one.

REFERENCES

- Agresti, A., & Coull, B. (1998). Approximate is better than “exact” for interval estimation of binomial proportions. *The American Statistician*, 52, 119-126.
- Angyal, A. (1941). Disgust and related aversions. *Journal of Abnormal and Social Psychology*, 36, 393-412.
- Appadurai, A. (1981). Gastro-politics in Hindu South Asia. *American Ethnologist*, 8, 494-511.
- Brommer, S. J. (1981). The paradox of pride and loathing, and other problems. *Western Folklore*, 40, 115-124.
- Chapman, H.A., Kim, D.A., Susskind, J.M., and Anderson, A.K (2009). In bad taste: Evidence for the oral origins of moral disgust. *Science*, 323, 1222-1226.
- Crawley, E. (1902). *The Mystic Rose. A study of primitive marriage*. London: Macmillian.
- Curtis, V., & Brian, A. (2001). Dirt, disgust and disease: Is hygiene in our genes? *Perspectives in Biology and Medicine*, 44, 17-31.
- Darwin, C.R. (1965). *The expression of the emotions in man and animals*. Chicago: University of Chicago Press. (Original work published in 1872).
- Davey, G. C. L., Forster, L., & Mayhew, G. (1993). Familial resemblance in disgust sensitivity and animal phobias. *Behaviour Research and Therapy*, 31, 41-50.
- Davey, G. C. L. (1993). Factors influencing self-rated fear to a novel animal. *Cognition and Emotion*, 7, 461-471.
- Doctoroff, G., & McCauley, C. (1996, March). Demographic differences in sensitivity to disgust. Poster presented at the annual meeting of the Eastern Psychological Association, Philadelphia.
- Douglas, M. (1966). *Purity and danger: An analysis of concept of pollution and taboo*. London: Routledge.
- Dunlop, F. (2008). *Shark’s Fin and Sichuan Pepper: A Sweet-Sour Memoir of Eating in China*. New York: W. W. Norton & Company.

- Ekman, P. & Friesen W. V. (1975). *Unmasking the face*. Englewood Cliffs, NJ: Prentice Hall.
- Ekman, P. (1992) An argument for basic emotions. *Cognition and Emotion*, 6, 169-200.
- Fallon, A.E., & Rozin, P. (1983). The psychological basis of food rejections by humans. *Ecology of food and nutrition*, 13, 15-26.
- Fessler, D.M.T., & Navarrete, C.D. (2003). Meat is good to taboo: Dietary proscriptions as a product of the interaction of psychological mechanisms and social processes. *Journal of Cognition and Culture*, 3, 1-40.
- Foa, B.E., Kozak, M.J., Salkovskis, P.M., Coles, M.E. and Amir, N. (1998). The validation of a New Obsessive-Compulsive Disorder Scale: The Obsessive-Compulsive Inventory. *Psychological Assessment*, 10:3, 206-214.
- Frazer, J. G. (1959). *The golden bough: A study in magic and religion*. New York: Macmillian. (Reprint of 1922 abridged edition, edited by T. H. Gaster; original work published in 1890).
- Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences*, 16, 701-713.
- Harris, L. (1985). *Holy days: The world of a Hasidic family*. New York: Summit Books.
- Hutchings, J.B., & Lilliford P.J. 1988. The perception of food texture- the philosophy of the breakdown path. *Journal of Texture Studies*, 19, 103-115.
- ISO. 1981. *Sensory analysis vocabulary, part 4*. International Organization for Standardization. Geneva, Switzerland.
- Izard, C. E. (1977). *The face of emotion*. New York: Appleton-Century Crofts.
- Jones, M. A. (2000). What's disgusting, why and what does it matter? *Journal of Folklore Research*, 37, 53-71.
- Kessler, D.A. (2009). *The end of overeating: Taking control of the insatiable American appetite*. New York: Rodale.
- Kauer, J. (2002). *The range and variation of human food selection: Adult picky eating*. Retrieved from dissertation and theses database. (AAT 3054960).
- Lawless, H. T., & Heymann, H. (1998). *Sensory evaluation of food: Principles and practices*. Food science texts series. New York: Chapman & Hall.

- Martins, Y. & Pliner P. (2005). Human food choices: An examination of the factor underlying acceptance/rejection of novel and familiar animal and non-animal foods. *Appetite*, 45, 214-224.
- Martins, Y. & Pliner P. (2006). "Ugh! That's disgusting!" Identification of the characteristics of foods underlying rejections based on disgust. *Appetite*, 46, 75-85.
- Mauss, M. (1972). *A general theory of magic* (R. Brian, Trans). New York: W. W. Norton. (Original work published 1902; *Esquisse d'une theorie generale de la magie*. *L'Annee Sociologique*, 1902-1903.)
- 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.
- Miller, W. I. (1997). *The Anatomy of disgust*. Cambridge: Harvard University Press.
- Mitte, K. (2009). Trait-disgust vs. fear of contamination and judgmental bias of contamination concerns. *Journal of Behavioral Therapy and Experimental Psychology*, 39, 577-586.
- Morales, C. A. & Fitzsimons, G. J. (2007). Product contagion: Changing consumer evaluations through physical contact with "disgusting" products. *Journal of Marketing Research*, 44, 272-283.
- Nabi, R. L. (2002). The theoretical versus the law meaning of disgust: implications for emotion research. *Cognition and Emotion*, 16, 695-703.
- Oaten, M., Stevenson, R.J., & Case, T.I. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin*, 135, 303-321.
- Olatunji, B.O., & Armstrong, T. (2009). Contamination fear and effects of disgust on distress in a public restroom. *Emotion*, 9, 592-597.
- Olatunji, B.O., Haidt, J., McKay D., & David, B. (2008). Core, animal reminder, and contamination disgust: Three kinds of disgust with distinct personality, behavioral, physiological, and clinical correlated. *Journal of Research in Personality*, 42, 1243-1259.
- Olatunji, B.O., Williams, N.L., Tolin D.F., Abramowitz, J.S., Sawchuk, C.N., & Lohr J.M. (2007). The disgust scale: Item analysis, factor structure, and suggestions for refinement. *Psychological Assessment*, 19, 281-297.
- Parker, L.A., & Limebeer, C.L. (2006). Conditioned gaping in rats: A selective measure of nausea. *Autonomic Neuroscience*, 129, 36-41.

- Perry C. (1993, December 30). Hey We'll Just Call it Sewsage. *Los Angeles Times*.
- Pliner, P., & Pelchat, M. L. (1991). Neophobia in humans and the special status of foods of animal origin. *Appetite*, 16, 205-218.
- Quigley, J.F., Sherman M.F., & Sherman N.C. (1997). Personality disorder symptoms, gender, and age as predictors of disgust sensitivity. *Personality and Individual Differences*, 22, 661-667.
- Raudenbush, B., & Frank, R.A. (1999). Assessing food neophobia: The role of stimulus familiarity. *Appetite*, 32, 261-271.
- Rozin, P. (1990). Social and moral aspects of food and eating. In I. Rock (Ed.) *The legacy of Solomon Asch: Essays in cognition and social psychology* (pp. 97-110). Hillsdale NJ: Erlbaum.
- Rozin, P., & Fallon, A. (1980). The psychological categorization of foods and non-foods: A preliminary taxonomy of food rejections. *Appetite*, 1, 193-201.
- Rozin, P., & Fallon, A. E. (1987). A perspective on disgust. *Psychological Review*, 94(1), 23-41.
- Rozin, P., Fallon, A., & Mandell, L. (1984). Family resemblance in attitudes to foods. *Developmental Psychology*, 20, 309-314.
- Rozin, P., Haidt., & McCauley, C.R. (2008). Disgust. In M. Lewis, J. M. Haviland-Jones & L. F. Barrett (Eds.), *Handbook of emotions*, 3rd Edition (pp. 757-776). New York: Guilford Press.
- Rozin, P., Haidt, J., McCauley, C.R., Dunlop L., & Ashmore, M. (1999). Individual differences in disgust sensitivity: Comparisons and evaluations of paper-and-pencil versus behavioral measures. *Journal of Research in Personality*, 33, 330-351.
- Rozin, P., Haidt, J., McCauley, C. R., & Imada, S. (1997). The cultural evolution of disgust. In H.M. Macbeth (Ed.), *Food preferences and taste: Continuity and change* (pp. 65-82). Oxford: Berghahn.
- 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.W. Stilger., R.A. Shweder., & G. Herdt (Eds.) *Cultural psychology: Essays on comparative human development* (pp. 205-232). New York: Cambridge University Press.

- Rozin, P., Nemeroff, C., Horowitz, M., Gordon, B., & Voet, W. (1995). The borders of the self: Contamination sensitivity and potency of the mouth, other apertures and body parts. *Journal of Research in Personality*, 29, 318-340.
- Rozin, P., Nemeroff, C., Wane, M., & Sherrod A. (1989). Operation of the sympathetic magical law of contagion in interpersonal attitude among Americans. *Bulletin of the Psychonomic Society*, 27, (4), 367-370.
- Schyver, T., & Smith, C. (2005). Reported attitudes and beliefs toward soy food consumption of soy consumers versus nonconsumers in natural foods or mainstream grocery stores. *Journal of Nutrition Education and Behavior*, 37, 292-299.
- Tomkins, S. S. (1963). *Affect, imagery, consciousness: Vol. 2. The negative affects*. New York: Springer.
- Tylor, E. B. (1974). *Primitive culture: Researches into the development of mythology, philosophy, religion, art and custom*. New York: Gordon Press. (Original work published 1871).
- Vickers, Z. M. (1987). Sensory, acoustical and force-deformation measurements of potato chip crispness. *Journal of Food Science*, 52, 138-140.
- Yenket, R., Chambers, E. and Gatewood, B. M. (2007), Color has little effect on perception of fabric handfeel: Tactile properties in cotton fabrics. *Journal of Sensory Studies*, 22: 336–352.
- Yoshikawa, S., Nishimaru, S., Tashiro, T., and Yoshida, M. (1970). Collection and classification of words for description of food texture. I: Collection of words. *Journal of Texture Studies*, 1, 437-442.