

**FOOD NEOPHOBIA: AN EXAMINATION OF FOOD REJECTIONS
WITH SPECIAL REFERENCE TO DISGUST**

By

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A thesis submitted in conformity with the requirements
for the degree of Ph. D.

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with special reference to disgust
Yolanda Martins, Doctor of Philosophy, 2001
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ABSTRACT

Rozin and Fallon (1987) have identified three motivational dimensions underlying acceptance/rejection of foods, each of which is relevant to our understanding of food neophobic (i.e., fear of unfamiliar foods) reactions. They are: (1) anticipated consequences of eating foods, (2) beliefs about the sensory-affective properties of foods, and (3) ideational reasons for acceptance/rejection, including both disgust and belief about the appropriateness of the items as food. Within this framework, three studies were conducted to identify and understand what underlies rejection of novel foods, particularly novel animal foods. Previous research suggests that neophobic reactions towards novel animal foods are mediated by disgust (a specific type of ideational rejection) (Martins et al., 1997). In Study 1 participants rated their beliefs about the properties of, their emotional reactions towards, and their willingness to try the 12 foods. For novel foods, both nonanimal and animal, it was found that participants' beliefs about the disgusting attributes, and interest experienced at the thought of eating the foods were the best predictors of willingness to try them. Study 2 exposed participants to scenarios depicting potentially disgusting foods in an effort to determine what makes foods disgusting. It was found that negative sensory/textural properties and reminders of livingness/animalness accounted for most of the variability in ratings of perceived disgustingness of the foods depicted in the scenarios. Study 3 examined the effect

of a distraction/rumination manipulation on participants' experience of the disgust attributes of novel animal foods and willingness to try them. This manipulation had no effect on ratings of the foods' disgust attributes or willingness to try them. It was concluded that novel nonanimal foods can also elicit disgust reactions, although these disgust reactions may be weaker than the disgust reactions exhibited towards novel animal foods. Additionally, it is proposed that positive transvaluation (i.e., acceptance of foods based on their nature, origin, or social history - an ideational motive for acceptance) may be a fruitful technique for reducing the experience of the disgust attributes and neophobic reactions towards novel animal foods.

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INTRODUCTION

Empirical evidence suggests that food acceptances and rejections develop because of, and are maintained by, a myriad of affective, personal, cultural, and situational factors (Booth, 1990; Krondl & Coleman, 1986; Krondl & Lau, 1982; Lau, Hanada, Kaminskyj, & Krondl, 1979; Logue, 1986). In the present series of studies we are interested mainly in food rejections; we have focused on identifying and understanding what underlies rejection of novel foods, particularly novel animal foods.

We begin by reviewing the literature related to food rejections. First, the basic motivations underlying food rejections will be presented, followed by a discussion of the techniques for weakening the food rejection response. Attention then turns to the special nature of unfamiliar animal foods and the motivational dimension thought to underlie rejection of these foods.

Motives Underlying Food Acceptance or Rejection

Humans, along with other omnivores, show both an interest in and an unwillingness to try unfamiliar foods (Rozin, 1976). This rejection of unfamiliar foods is termed food neophobia, and it occurs despite the nutritional benefits that are derived from obtaining food from a wide variety of sources. Historically, the number of toxins humans were likely to encounter in foods was quite high, and in this context food neophobia may have served a protective function; fear of unfamiliar foods decreased the likelihood of ingestion of harmful substances. In present times, however, it is unlikely that we will encounter dangerous foods; thus, food neophobic

behavior may restrict the number and types of foods we consume. For that reason, it would be useful to identify the mechanisms underlying food neophobic reactions and to develop techniques aimed at overcoming these rejections. Fallon and Rozin (1983) have identified three basic motivational dimensions that provide a useful framework for understanding human food acceptance and rejection. They are: (1) reactions to foods based on anticipated consequences, (2) sensory-affective reactions to foods, and (3) ideational reactions to foods. Each of these motivational dimensions is bipolar; foods near the negative pole are typically rejected, while those near the positive pole are accepted. A brief description of each of these motivational dimensions follows.

Motivational Dimensions

Reactions to Foods Based On Anticipated Consequences

The first dimension in the Fallon and Rozin (1983) taxonomy of reactions to foods is based on the anticipated consequences of eating the food (commonly referred to as reactions based on “danger” in the literature). Foods that are thought to be harmful, in the short or long term, are usually rejected, while those believed to be beneficial, in the short or long term, are accepted. For example, individuals may reject eggs because they believe them to contain high levels of cholesterol, or they may accept broccoli because it is high in vitamins. Individuals may also reject items that are dangerous in the short term, such as poisonous mushrooms or allergens specific to themselves, or they may reject an item that has gone past its due date, such as milk, for fear that the item will cause gastrointestinal upset.

Sensory-Affective Reactions to Foods

The second dimension, sensory-affective reactions to foods, involves accepting or rejecting a food because of its sensory characteristics (i.e., taste, smell, texture, or appearance). Sensory-affective rejections, often referred to as rejections based on 'distaste', are based on the belief or knowledge that the potential food has an unpleasant taste, smell, texture, or appearance. These rejected foods are rarely considered to be dangerous and are usually not objectionable if present in other liked foods in small, undetectable quantities. For example, someone may dislike the texture of onions but would not reject dishes that contained small quantities of them as a flavoring agent. Conversely, foods that are believed or known to have a pleasant taste, smell, texture, or appearance (e.g., chocolate) are accepted. Many, if not most, of the individual differences in food preferences are based on reactions along this dimension.

Ideational Reactions to Foods

The final motivational dimension in the Rozin and Fallon (1987) taxonomy is based on knowledge of the nature or origin of the substance. There are two types of ideational reasons for acceptance/rejections of foods, named in terms of the negative poles of these dimensions, they are inappropriateness and disgust.

Rejections based on inappropriateness occur for items typically not classified as foods within a given culture. These items include most things in the world such as cloth, rocks, paper, etc. These items are often inorganic matter or plant or plant products, tend to have minimal nutrition value, do not evoke strong affective responses when considered as foods, and are not presumed to taste bad.

The second category of ideational acceptances/rejections occurs either because of what a food is or where it comes from or its social history (e.g., who touched or prepared it). The negative pole of this dimension is known as disgust. Unlike inappropriate items, foods that are rejected on the basis of disgust have offensive properties; they are presumed to taste bad and they have the capacity to contaminate other objects. The prototypical (and universal) disgust item is feces. The positive pole of this dimension involves food acceptances based on positive transvaluation; acceptance of foods is motivated by their nature or origin and the belief that the positive properties of the food substances will somehow be magically transmitted to the eater. This idea of positive transvaluation is particularly evident in Hindu religious practice. In South Indian temples, specific foods are offered to the gods of each temple; once the foods have been "eaten" by the deities, the leftovers are redistributed to the worshipers. To be allowed to consume these divine leftovers is seen as an honor amongst worshipers; it brings them spiritually closer to the deities and reifies the cooperative nature of the relationship between men and gods (Appadurai, 1981). Essentially, the foods have been transvalued; their social history has rendered them extremely positive. In comparison to danger and distaste, little empirical research has focused on food rejections and acceptances based on the disgust dimension, although a significant body of theoretical work does exist.

Relevance of Motivational Dimensions to Food Neophobia

Each of these motivational dimensions is relevant to our understanding of food acceptance and rejection. Originally, these dimensions were applied to

acceptance and rejection of familiar foods, but they also provide a useful vantage point from which to characterize reactions to unfamiliar foods.

In a study examining danger and distaste, Pliner, Pelchat, and Grabski (1993) gave college students visual exposure to five novel and five familiar foods. Participants rated how much they disliked or expected to dislike each food, how dangerous ingestion of each food could be, how familiar they were with each food, and how willing they would be to taste a small portion of each food later in the experimental session. For familiar foods, expected disliking was an important predictor of individuals' willingness to try, while perceived dangerousness of the foods was not. Participants both expected to dislike novel (as compared to familiar) foods and considered them dangerous. Moreover, both of these beliefs about novel foods predicted willingness to taste them. Pliner and Pelchat (1991) found that disgust is an important motivation for the rejection of novel foods, at least those of animal origin. In their study, participants were more likely to reject unfamiliar foods of animal origin than those of nonanimal origin. In addition, reactions to these novel animal foods resembled reactions to prototypical disgusting foods to a much greater extent than did reactions to novel nonanimal foods, suggesting that rejection of unfamiliar animal foods may be mediated by disgust. Combined, these studies demonstrate that the negative poles of each of the three motivational dimensions described earlier play a role in the rejection of novel foods. Given this, it is possible that induction of the positive poles of these dimensions may encourage acceptance of novel foods.

Research on Reduction of Food Neophobia

Rozin (1988) has postulated that foods that are accepted are those which are thought to provide positive benefits and those which taste (or are expected to taste) good. In essence, the positive poles of the first two dimensions are thought to play a role in food acceptance; highlighting the positive poles of these dimensions may reduce neophobic behavior toward novel foods, rejection of which is based on anticipated negative consequences or expected dislike.

Anticipated Beneficial Consequences

Research examining the efficacy of inducing anticipated benefits as a method of increasing food acceptance has produced mixed results. Investigators in this area have operationalized anticipated benefits in terms of information about specific nutrient content (e.g., low in fat, high in iron, etc.) which will promote health, with many studies focusing specifically on the willingness to eat foods "low in fat." Among familiar foods, there is evidence which suggests that positive nutrition information produces either no effect or a positive effect on subsequent hedonic and sensory ratings (Eiser, Eiser, Patterson & Harding, 1984; Kähkönen & Tuorila, 1998; Kähkönen, Tuorila, & Rita, 1996; 1998 Light, Heyman & Holt, 1992; Solheim, 1992).

Similar investigations utilizing novel foods have found that positive nutrition information either has no effect on or actually decreases willingness to try and/or consumption of novel foods. For example, Pelchat and Pliner (1995) demonstrated, in two separate experiments, that positive nutrition information did not significantly increase individuals' willingness to sample a novel dip, chip, or fruit in comparison to

a no-information control condition. Koster, Beckers, and Houben (1987) found lower levels of consumption of a novel vegetable roll when it was introduced as "low in fat and salt" compared to when it was presented with no accompanying information.

A closer examination of the literature on positive nutrition information and food acceptance may shed some light on these inconsistent results. It is likely that individual differences in the emphasis placed on good health and nutrition may play a role in determining the relative effectiveness of inducing anticipated beneficial consequences on food acceptance. That is, it may be that highlighting the nutritional benefits associated with unfamiliar foods is only effective at increasing acceptance among individuals for whom good health and nutrition are important food choice motivations. Consistent with this possibility, McFarlane and Pliner (1997) found that general nutrition information ("good for you") was effective at increasing willingness to try novel foods but only among individuals who reported nutrition as an important factor in their everyday eating habits; individuals for whom nutrition was not important actually showed a decrease in willingness to try the foods after receiving the nutrition information.

Recently, Martins, Pelchat, and Pliner (1997) reasoned that another factor that may play a role in determining the efficacy of inducing anticipation of beneficial consequences in increasing acceptance of novel foods may be the availability and accessibility of the foods outside of the experimental situation. Presumably, the nutritional benefits associated with consuming a food are relevant only if the food is consumed over a long period of time; foods do not typically confer nutritional benefits in just one instance of consumption. Thus, encountering positive nutritional

information in relation to unfamiliar foods is not likely to have any effect on subsequent willingness to try the foods if these foods are not readily available for further consumption. To test this hypothesis Martins et al. (1997) included nutrition and nutrition-plus-availability conditions in their experiment. Participants in these conditions were told that the foods they were testing were high in vitamins (nutrition information), or they were told that the foods were high in vitamins and would soon be available in the college cafeteria (nutrition-plus-availability information). Their results demonstrated that willingness to taste novel nonanimal foods was increased by information that the food was high in vitamins and would soon be available in the school cafeteria, whereas the nutrition information alone did not have any effect on willingness to try these foods. In summary, these results suggest that various individual difference and situational factors may moderate the relationship between anticipated beneficial consequences of novel foods and acceptance of these foods.

Positive Sensory Information

Much of the research aimed at reducing rejections of novel foods involves accentuating the positive sensory properties of these foods, consistent with Rozin and Fallon's (1987) notion that foods which are known or believed to have positive sensory characteristics are accepted. Research has demonstrated that directly or indirectly providing positive information about the sensory aspects of foods increases acceptance. Techniques used to convey positive sensory information include exposure to food neophilic models, verbal taste information, and taste exposure.

Numerous researchers have shown that individuals' food choices can be influenced by the eating behavior of others (Birch, 1980; Birch, McPhee, Shoba, Pirok, & Steinberg, 1987; Hobden & Pliner, 1995). Presumably, seeing others ingest foods provides some indirect information about the positive sensory aspects of the foods. After all, if others are consuming them, the minimal implication is that the taste and smell of the foods are acceptable. Hobden and Pliner (1995, Study 2) exposed participants to a videotape of a neophilic model, a neophobic model or to no model (control condition). In the two modeling conditions, participants viewed a confederate who chose one food to taste from each of 10 food pairs, consisting of one novel and one familiar food. In the neophilic condition, the confederate chose nine novel foods, while in the neophobic condition the model chose nine familiar foods. Confederates then tasted the chosen foods (although the foods were not actually seen on the videotape) while maintaining a neutral facial expression. Participants were then presented with 15 pairs of foods, consisting of one novel and one familiar food, and asked to select one member of each pair for subsequent tasting; ten of these pairs were the same pairs that had been presented to the confederate in the modeling conditions, while the other five had not been modeled. For modeled food pairs, exposure to a neophilic model (vs. a no model control) resulted in an increase in the number of novel foods chosen, while exposure to a neophobic model decreased the number of unfamiliar foods chosen. Additionally, the number of novel foods chosen for subsequent tasting differed significantly between the two modeling groups, demonstrating that neophobic responses can be

both increased and decreased. The modeling manipulation, however, had no effect on the likelihood of choosing unfamiliar foods from the five non-modeled pairs.

Other investigations have demonstrated an increase in willingness to try novel foods following the verbal information that they “taste good” (Martins et al., 1997; Pelchat & Pliner, 1995). This type of manipulation allows researchers to accentuate the positive sensory properties of the food items in a more direct fashion; participants are clearly told that the food items “taste good” and are not left to infer this.

Researchers have also examined the effects of actual taste exposure to particular unfamiliar foods on subsequent preferences for these foods. Providing taste exposure to unfamiliar foods highlights the positive poles of both the danger and distaste dimensions. First, if the food is reasonably palatable (as has been the case with the foods used in these studies), participants receive direct, firsthand positive taste information about the food. Second, ingestion of the food item enables individuals to learn that consumption of the food is not followed by negative postingestional consequences (at least in the short term). In two similar investigations designed to examine the effects of taste exposure on subsequent willingness to eat foods, Birch and Marlin (1982) provided children with exposure to five previously unfamiliar cheeses (Experiment 1) or five novel fruits (Experiment 2). In Experiment 1, unfamiliar foods were presented 2, 5, 10, 15 or 20 times in the exposure phase, while in Experiment 2, exposure to foods occurred either 0, 5, 10, 15 or 20 times. During the exposure phase, participants tasted two foods each day. During the testing phase, participants were presented with ten pairs of foods,

comprising all possible pairs of the five foods previously exposed. Children tasted both foods and chose one food to “eat more of.” The results of both studies indicated that participants’ willingness to “eat more of” a particular food was significantly positively related to the number of times it had been tasted in the exposure phase. These results provide evidence that preference is an increasing function of exposure. Similar research by Pliner (1982), using adults, supported Birch and Marlin’s results. Although these studies do not speak to the issue of how to induce an individual to try a novel food the first time, they illustrate that preference for a previously unfamiliar food increases after a few taste exposures to that food.

In a slightly different taste exposure study, Pliner et al. (1983) examined the effects of “forced” taste exposure to one set of good-tasting novel foods on subsequent willingness to try other, previously untasted, novel foods. In this study participants received taste exposure to either seven good-tasting novel foods or seven good-tasting familiar foods. They were then presented with 11 pairs of different foods, each consisting of a novel and a familiar food, and chose one from each pair for later consumption. Participants who had received prior exposure to good-tasting novel foods chose significantly more novel foods in the choice task than did those who had received exposure to familiar foods. These results suggest that exposure to good-tasting novel foods produces a reduction in neophobic behavior that generalizes to other unfamiliar foods, presumably because individuals learn that novel foods can taste good.

Taken together, the results of these studies demonstrate that, at least among novel nonanimal foods, rejections based on anticipated distaste can be reduced if an expectation of liking can be induced.

Overcoming Ideational Rejections Based on Disgust

First and foremost, foods rejected on the basis of disgust are likely to be of animal origin; Rozin and Fallon (1980) found that college students usually named animals or their products when asked to identify a disgusting food. Pliner and Pelchat (1991) presented participants with novel and familiar foods, of both nonanimal and animal origin, and asked them to rate their willingness to try the foods later in the experimental session. Their results demonstrated that participants were less willing to try novel animal foods in comparison to the novel nonanimal foods and that reactions to unfamiliar animal foods more closely resembled reactions to prototypical disgusting foods than to the nonanimal foods.

Few studies aimed at identifying techniques to overcome neophobia have actually used unfamiliar animal foods, and most of those have not distinguished between animal and nonanimal foods in their analyses. Unlike danger and distaste, no research to date has attempted to highlight the positive pole of this dimension (positive transvaluation, described earlier) in an attempt to reduce rejections based on disgust. In fact, the one study that has focused on overcoming neophobic responses to both novel animal and nonanimal foods accentuated the positive poles of the danger and distaste dimensions as a method of overcoming rejection of both types of foods (Martins et al., 1997) but did not use any manipulation specifically related to disgust. In this study, we exposed participants to a set of seven novel and

seven familiar foods, with one novel and one familiar food from each of the following nonanimal categories: vegetables, fruits, grains, and two novel and two familiar foods from the following animal categories: dairy/egg and meat/poultry. This set of fourteen foods was accompanied by one of four kinds of information: no information (control), information that the foods had been previously tasted by other students and were rated as tasting good (taste information), information that the foods were known to be high in vitamins (nutrition information), or information that the foods were known to be high in vitamins and would soon be available in the college cafeteria (nutrition plus availability information). The main dependent measure was participants' rated willingness to taste each food later in the experimental session. Analyses revealed that taste information and nutrition plus availability information were effective at increasing willingness to try novel nonanimal foods in comparison to the no information control condition. In contrast, neither of these manipulations was effective at increasing willingness to try novel animal foods. Based on these results and the results of the Pliner and Pelchat (1991) study, Martins and her colleagues suggested that, since rejections of novel animal foods are mediated by disgust, in order to reduce these rejections, manipulations must be aimed at reducing disgust reactions. Because disgust seems to be important in relation to novel animal foods and because there is little empirical work examining this rejection category, it is important to examine what we do know about food-related disgust. What follows is such an examination.

Overview of Food-Related Disgust

Disgust has been considered to be a basic emotion since Darwin (Darwin, 1965, cited in Rozin, Haidt, & McCauley, 1993). It is currently recognized by emotion theorists as one of the six or seven “core” emotions (Izard, 1991; Rozin et al., 1993; Tomkins, 1963). Like other basic emotions, disgust has a characteristic facial expression, a specific physiological state (nausea), a behavioral component (distancing of oneself from the offensive object), and a characteristic feeling state (revulsion) (Rozin & Fallon, 1987; Rozin et al., 1993). The physiological concomitant of disgust, nausea, occurs in the absence of ingestion, thereby serving to inhibit consumption of the disgusting item.

The facial expression that accompanies disgust centers around the mouth, the part of the body most involved in food acceptance and rejection. It involves the closing of the nostrils, the opening of the mouth, and sometimes gaping (this causes items already in the mouth to dribble out). It has been argued that this facial response is another element of the disgust response that serves to prevent ingestion of disgusting substances (Izard, 1991; Rozin & Fallon, 1987). In modern society, the disgust reaction is often elicited by objects other than those that could serve as potential foods. The word “disgusting” and experience of the emotion are often applied to various sociomoral violations (e.g., a man having sex with his son), suggesting that this emotion has expanded beyond its original function of protecting against ingestion of revolting substances. However, since the focus of this paper is on food rejections and acceptances, the discussion of disgust that follows will limit itself to the original meaning and function of disgust.

Rozin and Fallon (1987) have conceptualized core disgust (meaning disgust as it originally functioned) as a food-related emotion, defining it as: "...that form of food rejection which is characterized by revulsion at the prospect of oral incorporation of an offensive and contaminating object." (pg. 24) As noted earlier, items rejected on the basis of disgust are rejected primarily because of their nature, origin, or social history, are considered to be offensive, and have the capacity to contaminate other objects, rendering them objectionable. They are also presumed to taste bad. Although disgust shares with distaste the negative sensory-affective property of bad taste, a critical distinction between these two dimensions is the contaminating properties of the former; i.e., substances rejected on the basis of disgust are objectionable if present, even in small, undetectable quantities in a dish, whereas items rejected on the basis of distaste are not objectionable if they are not detectable. Feces seem to be a universal disgust object, at least among most adults (Angyal, 1941; Rozin & Fallon, 1987). Within this definition of core disgust, there exist three components that are integral to the occurrence of the emotion: (1) revulsion at the prospect of oral incorporation (providing a link to food and eating), (2) a sense of offensiveness, and (3) contaminant properties (Rozin & Fallon, 1987; Rozin et al., 1993). What follows is a brief examination of each of these elements.

Oral Incorporation

Rozin and Fallon (1987) have observed that the mouth is the primary locus of entry into the gastrointestinal system, making it "...the gateway to the body" (Rozin et al., 1993, pg. 581). The mouth functions as a border between the bodily self (i.e., the inside of the body) and the outside world; it is the critical point of

transition between the bodily self and non-self. While in the mouth, an item can still be returned to the outside world; once swallowed, it becomes a part of the bodily self unless vomiting is induced.

Offensive Entities

Angyal (1941), as well as Rozin and his colleagues (Rozin & Fallon, 1987; Rozin et al., 1993), have suggested that animals, along with their products (including waste products and mucous), are the primary offensive entities and, hence, the core elicitors of the disgust response. All animals and animal products are thought to have the potential to elicit the disgust response; in fact, Rozin and Fallon (1987) claim that at some point in the evolutionary history of humans, "...animalness was a necessary and sufficient condition for disgust" (pg. 28). This view is consistent with Soler's (1973/1979) observation that (according to the Bible) prior to the great flood all animals were prohibited as food items; Hebrews were vegetarian. It was only after the flood that some animals were allowed as food items; these animals were the exception, rather than the rule.

Thus, despite the fact that in most cultures some animals and their products are consumed, North Americans, along with members of almost all other cultures, eat only a very small subset of potential animal foods (Rozin & Fallon, 1987; Rozin et al., 1993). In Western cultures, most insects, amphibians, reptiles, and mammals that are not already considered acceptable food sources elicit a disgust reaction when considered as food.

Contaminant Properties

Items that are disgusting have the capacity to contaminate other acceptable foods, causing rejection of these foods if the disgusting item comes into contact with the acceptable food. This occurs even if there is no physical residue of the disgusting substance on or in the acceptable food, indicating that the contaminant properties of disgusting substances are largely psychological in nature (Rozin & Fallon, 1987; Rozin et al., 1993).

Research Goals

Research providing empirical support for the theoretical definition of the disgust reaction and the mechanisms underlying it is almost nonexistent. In addition, no investigation has assessed the predictive utility of all three motivational dimensions in relation to willingness to try novel foods. Given this, the overarching goal of the current series of studies is threefold: (1) to understand what underlies rejection of novel foods – especially novel animal foods (with the expectation that some aspect(s) of disgust is important) (2) to explore in more detail the disgust reaction, and (3) to develop a technique to reduce food rejections based on disgust, which targets the disgust reaction. Study 1 addresses the first of these goals.

STUDY 1

The first study in this series was designed to identify the specific factors that contribute to acceptance and rejection of familiar and novel animal and nonanimal foods. In particular, we tested directly the assumption made by Martins and her

colleagues (Martins et al., 1997; Pliner & Pelchat, 1991, Rozin & Fallon, 1980) that rejection of novel animal foods is mediated by disgust. More specifically, we wanted to identify the specific beliefs about properties of foods (i.e., cognitions) and the specific feelings evoked by the thought of consuming foods (i.e., emotions) that contribute to willingness to try them.¹ Although we use the terms “cognitions” and “emotions”, it should be noted that at least in relation to foods, many of these factors are not purely “cognitive” or “emotional”. For example, for the purposes of this study, participants are asked to indicate the extent to which they agree or disagree with the statement “This food has (or would have) an unpleasant taste, smell or texture.” This item assesses an individual’s belief about the sensory properties of the food, a type of judgement typically deemed “cognitive” (Breckler, 1984; Breckler & Wiggins, 1989; Edwards, 1990; Edwards & von Hippel, 1995; Millar & Millar, 1990; Ostrom, 1969). However, it is doubtful that beliefs about the sensory properties of a food are exclusively cognitive. In reality, it is likely that they also include feelings of displeasure at the thought of ingesting a food with negative sensory properties or conversely, pleasure at the thought of consuming a food with positive sensory properties. Similarly, indicating that the thought of consuming this food makes one feel “glad” is considered to be an emotional reaction toward an

¹ Conceptually speaking, reactions towards foods can be thought of as attitudes. Researchers in the attitude domain have long recognized that attitudes consist of three components: (1) an affective component (i.e., emotional) consisting of our emotional reactions to the attitude object, (2) a cognitive component consisting of our thoughts and beliefs about an attitude object, and (3) a behavioral component consisting of our observable actions toward the attitude object (Breckler, 1984; Breckler & Wiggins, 1989; Eagly & Chaiken, 1998; Ostrom, 1969). Since the present study assesses beliefs about properties of foods and feelings evoked by the thought of consuming foods, we have adopted the terms “cognitive” and “emotions” to refer to these two categories of beliefs, respectively.

object, but when the objects being rated are foods, it is conceivable that such an emotional reaction is influenced by beliefs about the characteristics of the foods. For example, the positive emotions evoked by the thought of ingesting a food may be influenced by the knowledge that it contains vitamins important for the maintenance of good health. We believe that judgements about foods are a complex combination of cognitions and emotions; although they may be primarily cognitive or emotional in nature, we do not believe that they are purely cognitive or emotional. However, for the purposes of this study, judgements about the properties of the foods will be referred to as “cognitions” and feelings produced by the thought of eating the foods will be considered “emotions”.

As stated earlier, the purpose of this study is to identify the beliefs about the properties of foods and the emotional reactions evoked by the thought of eating foods that contribute to willingness to eat them. Since the dimensions of familiarity and “animalness” appear to be important in food acceptance, we examined, separately, foods in four categories: novel animal, novel nonanimal, familiar animal, familiar nonanimal. In addition, we examined individual difference variables which have been shown in previous research to be related to food acceptance and rejection. First, we considered the trait of food neophobia since prior research has demonstrated that it is related to willingness to try novel foods (Martins et al., 1997; Pliner & Hobden, 1992). We also examined disgust sensitivity and the motivations underlying everyday food choices since these variables appear to play roles in food selection (Haidt, McCauley, & Rozin, 1994; McFarlane & Pliner, 1997).

Predictions

Familiar Foods. Among familiar foods, of both animal and nonanimal origin, prior research has demonstrated that sensory factors, especially taste, predict willingness to eat them (Pliner et al., 1993). In addition, research examining self-reported motives underlying familiar food choices (it should be noted that this research typically has not distinguished between animal and nonanimal foods) has found that sensory factors, perceived healthfulness, experience of pleasure and experience of a calm and relaxing state have all been reported as important motives underlying food choices (Kronl & Coleman, 1986; Kronl & Lau, 1982; Lau, Kronl, & Coleman, 1984; Logue, 1986; Rappaport, Peters, Huff-Corzine, & Downey, 1992). Overwhelmingly, sensory factors (particularly taste) are the motives most often reported when individuals are asked to indicate why they choose the foods they do. Further support for the importance of sensory factors in everyday food choices comes from the development of two measures, the Food Choices Questionnaire (FCQ) (Steptoe, Pollard, & Wardle, 1995) and the Food Motivation Scale (FMS) (Martins & Pliner, 1998). Both scales assess a variety of motivations underlying individuals' everyday food choices, including sensory factors, emotional factors, health, convenience, and price. Research carried out during the development of these scales has indicated that sensory factors are rated as the most important motivation underlying individuals' everyday food choices. Additionally, sensory factors often underlie food likes and dislikes. In a study by Letarte, Dubé, and Troche, (1997) participants named the food item they liked and disliked the most and were then asked to specify their reasons for their attitudes

towards these foods. Sensory factors were the most prominent reasons cited for both like and dislike of foods, with over 60% of reasons for liking or disliking particular foods falling into the sensory category. Together, the results of these studies leads us to expect that, at the very least, sensory factors will predict willingness to try both familiar animal and nonanimal foods.

Novel Foods. For novel nonanimal foods, it was expected that sensory factors, anticipated consequences, and feelings of interest at the thought of consuming the foods would predict willingness to try these foods. Prior research has demonstrated that humans are reluctant to eat novel foods and that anticipated dislike of the sensory properties and perceived harmfulness predict willingness to try these foods (Pliner et al., 1993). Paradoxically, along with a reluctance to consume unfamiliar foods humans often display an interest in these foods (Rozin, 1977). Although interest has not been examined specifically in relation to willingness to try novel foods, the relationship between sensation seeking and willingness to try unfamiliar foods has been explored . Trait levels of food neophobia are negatively related to trait levels of sensation seeking, and there are positive correlations between sensation seeking and willingness to try unusual foods, (Pliner & Hobden, 1992; Raudenbush, Van Der Klaauw, & Frank, 1995; Terasaki & Imada, 1988). Although sensation seeking and interest are not equivalent, the latter is the emotion that maps most closely onto sensation seeking. Thus, it seems likely that the experience of interest may play a role in willingness to predict novel nonanimal foods.

Finally, for novel animal foods, we anticipate that disgust and perceptions related to their offensive properties will predict willingness to try, since previous research has suggested that reactions to animal foods are similar to reactions to prototypical disgusting foods (Pliner & Pelchat, 1991).

Method

Participants

Participants were 37 male and 41 female University of Toronto students, between the ages of 18 and 37. All participants reported eating foods from all food groups and indicated that they did not have any dietary restrictions or food allergies. They received either course credit for their introductory psychology course or \$7.50/hour as payment for their participation.

Food Stimuli

Six novel and six familiar foods were used as stimuli, one of each from each of the vegetable, fruit, grain product, and dairy/egg categories, and two of each from the meat/poultry category (thus, half were of animal origin and the remainder, nonanimal). Novel foods were foods rarely found or eaten in North America and familiar foods were foods typically found or eaten in North America (these a priori categorizations were verified in the course of the study by means of familiarity ratings). Small amounts of the foods were presented in clear plastic cups covered with plastic lids so that they could be seen but not smelled. Each food was accompanied by a label identifying it as “novel” or “familiar” and indicating the food category to which it belonged, as well as a card that provided its name and a brief description. In an effort to ensure that unfamiliar foods were really perceived as

novel and to reduce the possibility that participants would mistake them for familiar foods, these foods were given fictitious names and fictitious descriptions. However, in order to minimize extraneous differences between the novel and familiar foods, the descriptions of the novel and familiar foods within each food category were equated as much as possible. For example, beef meatballs (a familiar animal food) were described as “[m]eatballs made from the meat of cows, domestic animals indigenous to North America” and Bresner (a novel animal food which was really Chinese meatballs made from processed beef) was described as “[s]picy meatballs made from the meat of any of several small animals found in the Middle East” . A complete list of the names and descriptions of the novel and familiar foods can be found in Table 1. In addition, the novel and familiar foods within each category were chosen to be visually similar to each other (as judged by the experimenter and another researcher involved in this study) in order to minimize extraneous variables (such as appearance) that may play a role in food acceptance. For example, green grapes were chosen as the familiar fruit and palm seeds (named “Nokotop” for the purposes of this study), a fruit indigenous to Asia, were chosen as the novel fruit because of their overall similarity in texture, size, and appearance.

Measures

Manipulation Checks and Dependent Variable. Participants rated, on 7-point Likert scales, the extent to which they had eaten the food before, the extent to which the food was familiar to them, and their willingness to taste the food in a subsequent food tasting session. The first two questions were used to verify the

Table 1

Names and Descriptions of Novel and Familiar versions of Food Category

Category/Name of Food	Description
<u>Nonanimal</u>	
Rice	Grain from an erect grass, usually boiled and served as a side dish.
Brynza	Grain from the husk of Brynza, often boiled or steamed, usually found in the Mediterranean.
Green Grapes	Light green fleshy fruit of a vine often grown in Italy and California.
Nokotop	The translucent fruit of a shrub tree found in the remote regions of Russia.
Celery	Stalk from a green flowering vegetable, easily found in Canada.
Bliknot	Stalk from a yellowy-green flowering vegetable grown by many Central Americans.
<u>Animal</u>	
Bacon	Thin, pan fried meat from a pig, an animal frequently raised in North America.
Trupuk Chips	Thin, dehydrated pieces of meat from the Marsupial, a wild animal found in the Australian outback.
Chicken Egg	The egg of a ground nesting bird indigenous to North America, usually boiled in water for a few minutes prior to being served.

(table continues)

Category/Name of Food	Description
Walla Egg	The egg of a tree nesting bird indigenous to Central Europe, which is usually boiled in brine for several hours.
Beef Meatballs	Meatballs made from the meat of cows, domestic animals indigenous to North America.
Bresner	Spicy meatballs made from the meat of any of several small animals found in the Middle East.

categorization of foods as novel or familiar and the last question constituted the major dependent variable of the present study.

Cognitions about Foods. Eight items, previously developed by Rozin and Fallon (1980) were utilized in order to assess cognitions about various properties of the foods. The items were assigned to subscales based on the three motivational dimensions underlying food rejections: sensory-affective reactions to foods, reactions to foods based on anticipated consequences, and ideational reactions to foods. The sensory-affective subscale assesses individuals' beliefs about the sensory properties of the foods and included items such as "This food has [or would have] an unpleasant taste, smell, or texture". The anticipated consequences subscale measures individuals' beliefs about the consequences of consuming the foods and was assessed by the item "This food might contain something that even in modest amounts could physically endanger my body". The ideational motivational dimension was represented by two subscales; the 'ideational' subscale was designed to assess ideational rejections on a general level (i.e., rejections of foods because of knowledge of their nature or origin) while the disgust attributes subscale was used to assess beliefs related to offensiveness, oral incorporation and contamination, thought to be exclusive to food-related disgust rejections. For example, the item "The thought of this food in my stomach is unpleasant" was part of the disgust attributes subscale. Each item was answered on a 7-point bipolar rating scale, with endpoints labeled "1" disagree strongly and "7" agree strongly. The items, divided into their appropriate subscales, can be found in Appendix A.

Emotion Items. Subscales from the Differential Emotions Scale IV (DES-IV) (Izard, Libero, Putnam, & Haynes, 1993) were used to assess emotional reactions to eating the foods: interest, anger, joy, disgust, inner-directed hostility, surprise, sadness, fear, guilt, shyness, and shame. The DES-IV and its predecessors have been consistently shown to have valid, reliable, and internally consistent structures (Izard et al., 1993). In addition, we included five items to assess calmness since the experience of calmness (also conceptualized as alleviation of stress, promotion of relaxation etc.) has been reported as a motivation underlying everyday food choices (Macht & Simons, 2000; Martins and Pliner, 1998; Steptoe et al., 1995). These five items were generated based on their face validity and subsequent analyses demonstrated that they loaded on the same underlying factor and that they were internally consistent ($\alpha = .93$).

In order to direct their attention to the emotions produced by eating a particular food, participants were asked to answer the emotion questions after imagining that they had consumed a small amount of it. Items were answered on a 5-point Likert scale with endpoints ranging from "1" not at all to "5" extremely. Items for the various subscales can be found in Appendix B.

Food Neophobia Scale. The Food Neophobia Scale (FNS, see Appendix C) (Pliner & Hobden, 1992) is a 10-item scale assessing trait levels of food neophobia. Items are answered on a 7-point bipolar scale with endpoints labeled "1" Disagree Strongly and "7" Agree Strongly. The FNS is an internally consistent, reliable, and valid measure of food neophobia (Pliner & Hobden, 1992).

Disgust Sensitivity Scale. The Disgust Sensitivity Scale (DSS, see Appendix D) (Haidt et al., 1994) is a 32-item scale assessing disgust sensitivity for the following eight domains of disgust elicitors: food, animals, body products, sex, body envelope violations, death, magic, and hygiene. Sixteen of the items on the DSS are answered in true-false format and the remaining sixteen items are answered on a 3-point Likert scale with endpoints labeled “0” not disgusting at all and “2” very disgusting. Each of the eight subscales is comprised of two true-false and two Likert scale items. In addition, the DSS yields an overall disgust sensitivity score. The DSS is a valid, reliable, and internally consistent measure of disgust sensitivity across its eight domains (Haidt et al., 1994).

Procedure

Participants were under the impression that they were pretest subjects and would be tasting and rating some foods being considered for use in a future experiment. They were told that they would see a set of twelve foods and would be asked to answer some questions about each food and to rate their willingness to taste each food later in the session. They were further informed that their willingness ratings would be used to determine which foods they actually tasted later in the session and that they would complete sensory ratings of the foods they actually tasted.

The foods were arrayed on a long table; each food and its novel/familiar label was covered and the card containing the name and description of the food was placed face-down in front of the appropriate container. The order of presentation of the foods was counterbalanced across participants.

Half of the participants received exposure to the sight of the food first, followed by exposure to information about the food while the other half of the participants received exposure to the information about the food first, followed by exposure to the food. Before beginning, participants were told that the food samples would be presented in clear plastic containers but that the foods they would actually be tasting would be fresh, and not these “tired, old samples”. They were then given a questionnaire package containing the cognition and emotion questionnaires; both questionnaires were completed for each food. The order of presentation of the questionnaires was counterbalanced so that half of the participants completed the cognition questions then the emotion questions for each food, while the reverse was true for the other half. Ratings were completed for each food before participants went to the next food. To keep the situation as similar as possible among participants, all subsequent instructions were presented by tape. These instructions informed participants when to uncover the food, when to turn over the cards containing the information about the food, when to begin and end their ratings and when to re-cover the food and replace the card. After starting the tape, the experimenter remained in the room while the participants completed the ratings for the first food in case they encountered difficulties with any of the items in the questionnaire and to ensure they were following instructions. The experimenter then left the room and returned at the end of the rating session, collected the completed questionnaire packages and asked participants to fill out some additional questionnaires while their food samples were being prepared. These questionnaires included the Food Neophobia Scale and the Disgust Sensitivity Scale. When this

task was completed, participants were informed that the experiment was over and were thoroughly debriefed.

Results

Overview

The main goal of the analyses was to identify the best regression model for predicting willingness to eat foods from each of the four categories (familiar nonanimal, familiar animal, novel nonanimal and novel animal), using the cognition and emotion items as predictors. A secondary purpose was to examine the individual difference variables as predictors of willingness to eat foods, both alone and in interaction with the other predictors.

Data Preparation Procedures

Before the main analyses were conducted, several preparation and aggregation procedures took place, within each of the four food categories. First, the emotion items were transformed from scores on a 5-point Likert scale to scores on a 7-point Likert scale to ensure that all items in the regression analyses were on the same scale. This was done because regression procedures are sensitive to differences in scaling between predictor and criterion variables; these differences in scaling may affect the results of an analysis if not properly controlled for (Pedhazur, 1997).² The individual emotion items were then aggregated into their appropriate a priori scales, as described earlier. Next, the standard deviations of these scales were examined. Since items need variability in order to be correlated with other

² Although we could have administered the questionnaire using a 7-point scale, we did not do this because we wanted to administer the scale in the format that it was originally validated in.

variables, it is highly unlikely that items with a standard deviation of ≤ 1 will significantly contribute to the obtained results. For that reason, a decision was made a priori to exclude all emotion scales with standard deviations of ≤ 1 for all twelve foods. Based on this criterion, scores for the following emotion scales were eliminated: Inner Directed Hostility, Sadness, Fear, Shyness, and Anger. The remaining emotion scales were averaged (over the three foods of each category) into emotion scores, for each of the four food categories. For example, in order to create a participant's score for the emotion "Interest" for novel nonanimal foods, the average of the "Interest" scores for the novel vegetable, novel fruit, and novel grain was calculated.

The cognition items were aggregated to create, for each of the 12 foods, the following four scales: sensory-affective, anticipated consequences, ideational, and disgust attributes. These subscale scores were subjected to the same procedures as the emotion scores; however, none were eliminated as a result of the standard deviation criterion. These scales were then averaged over the three foods within each of the four food categories, following the procedure described for the emotion scores.

Finally, scores on the dependent variable, willingness to taste the food, were averaged over foods within each of the four food categories.

Manipulation Checks

Ratings of familiarity were averaged across food type, creating familiarity ratings for the following four categories: novel animal foods, novel nonanimal foods, familiar animal foods and familiar nonanimal foods. A 2 X 2 (origin of food X

familiarity) within subjects analysis of variance was performed on these ratings to compare the familiarity ratings of novel and familiar animal and nonanimal foods. The only significant effect was a main effect for familiarity, $F(1, 77) = 1697.72$, $p < 0.001$, demonstrating that the novel foods were rated as much less familiar than the familiar foods ($M_{\text{novel foods}} = 1.42$; $M_{\text{familiar foods}} = 6.80$). Familiarity ratings of the foods did not differ as a function of whether they were of animal or nonanimal origin.

Ratings of the extent to which participants' had eaten the foods before were also averaged across food type, and a 2 X 2 (origin of food X familiarity) within subjects ANOVA (as described above) was carried out on these ratings. The most important effect was the main effect for familiarity, $F(1, 77) = 1567.35$, $p < 0.001$, demonstrating that familiar foods had been previously eaten to a much greater extent than novel foods ($M_{\text{familiar foods}} = 6.41$; $M_{\text{novel foods}} = 1.30$). The analysis also revealed a significant effect for origin of food, $F(1, 77) = 4.28$, $p < 0.05$, indicating that nonanimal foods had been previously eaten to a greater extent than animal foods. However, a significant interaction was obtained between origin of food and familiarity, $F(1, 77) = 5.55$, $p < 0.05$, which qualifies the main effect of origin of food. It indicates that nonanimal foods were rated as slightly, but consistently, eaten to a greater extent than animal foods when the foods were familiar ($M_s = 6.57$ vs. 6.25 , respectively), but not when the foods were novel ($M_s = 1.31$ vs. 1.28 , respectively).

Main Dependent Variables

Overview

In order to identify the best regression models for predicting willingness to eat foods in each of the four food categories, a preliminary series of regression analyses for each of the categories (using the aggregated predictor and criterion scores) was carried out. First, willingness to taste the food was regressed, using a stepwise selection procedure, on the following emotion subscales: interest, joy, disgust, guilt, shame, calmness and surprise. Similar analyses were then carried out using the following cognitive subscales as predictor variables: sensory-affective, anticipated consequences, ideational and disgust attributes. Given that numerous regression analyses were being carried out, we selected an entry criterion of $p \leq .01$ and a removal criterion of $p \geq .05$, in order to decrease the probability of Type I error.

The two preliminary regressions for each food category yielded the following set of predictors: (1) familiar nonanimal: sensory-affective and joy subscales; (2) familiar animal: sensory-affective, anticipated consequences, joy and guilt subscales; (3) novel nonanimal: disgust attributes (cognitive), interest, and disgust (emotion), and (4) novel animal: disgust attributes (cognitive), interest, and disgust (emotion). After examining these results we carried out a third set of analyses in which willingness to taste the food (in each of the four categories) was regressed on those emotion and cognitive subscales previously identified as significant predictors in the two preliminary analyses. Again, a stepwise selection procedure

using the entry and removal criteria described above was used. The final model for each food category is presented below.³

Familiar Foods

Nonanimal. Results of the regression analysis carried out on willingness to try familiar nonanimal foods indicated that the best predictors of this variable were the sensory-affective and joy subscales, the former from the cognitive scales and the latter from the emotion scales. As seen in Table 2⁴, sensory-affective beliefs about the foods and willingness to taste the foods are negatively related; as beliefs about the negative sensory properties of the foods decrease, willingness to eat the foods increases. Joy and willingness to taste the foods are positively related; as feelings of joy at the thought of eating the foods increases, willingness to try the foods increases.

Animal. This analysis demonstrated that the sensory-affective and anticipated consequences subscales were the best predictors of willingness to taste familiar animal foods. Scores on the sensory-affective subscale and willingness to

³ After identifying the final models for each category, each of the four models was subjected to two individual difference regression analyses using individuals' trait levels of food neophobia and disgust sensitivity as individual difference scores, along with their interaction with the terms identified as predictors in the models presented above. Since none of these analyses demonstrated a significant effect of an individual difference variable they will not be presented.

⁴ All tables presented for the final models contain all of the separate cognition and emotion items found to predict willingness in the preliminary analyses in each food category. These items went into the combined cognition/emotion analyses from which the final models were generated. In some cases predictors which were found to be significant predictors in the separate cognition and emotion analyses (i.e., the preliminary analyses) were not significant predictors in the final models. These variables are listed under "Excluded Variables" in the tables; regression weights are not calculated for excluded variables in a stepwise regression and as such, no corresponding beta values are presented for these variables. These variables have been included in the table to allow readers to examine all of the items that went into the combined cognition/emotion analyses.

Table 2

Summary of Final Regression Analysis for Variables Predicting Willingness to try Familiar Nonanimal Foods (N = 77)

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
Sensory-Affective	-1.202	0.269	-0.459**
Step 2			
Sensory-Affective	-0.967	0.273	-0.369**
Joy	0.404	0.151	0.278**

Note. $R^2 = .21$ for Step 1; $\Delta R^2 = .07$ for Step 2 ($ps < .01$).

** $p < .01$

taste familiar animal foods are negatively related; as the negative beliefs about the sensory properties of the foods decrease, willingness to try the foods increases (see Table 3). Similarly, a negative relationship was found between scores on the anticipated consequences subscale and willingness to try the foods, indicating that as beliefs that the foods could be potentially harmful increase, willingness to try the foods decreases.

Novel Foods

Nonanimal. A model containing the subscale of disgust attributes, along with the subscale of interest, was the best model for predicting willingness to try novel nonanimal foods. As seen in Table 4, scores on the disgust attribute subscale and willingness to try novel animal foods are negatively related, so that as beliefs about the disgusting aspects of the foods decrease, willingness to try the foods increases. Scores on the interest subscale were positively related to willingness to try novel nonanimal foods, so that as feelings of interest at the thought of ingesting the food increase, willingness to try the foods increases.

Animal. The results of the regression analysis yielded a model containing the disgust attribute subscale and the interest subscale as the best predictors of willingness to try novel animal foods (see Table 5). Scores on the disgust attribute subscale were negatively related to willingness to try novel animal foods; as beliefs about the disgusting aspects of the foods increase, willingness to try these foods decreases. Scores on the interest subscale were positively related to willingness to try novel animal foods; as feelings of interest at the thought of eating the food increase, willingness to taste the food also increases.

Table 3

Summary of Final Regression Analysis for Variables Predicting Willingness to try Familiar Animal Foods (N = 77)

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
Sensory-Affective	-0.992	0.138	-0.639**
Step 2			
Sensory-Affective	-0.939	0.132	-0.605**
Anticipated Consequences	-0.300	0.101	-0.253**
Excluded Variables			
Joy	—	—	—
Guilt	—	—	—

Note. $R^2 = .41$ for Step 1; $\Delta R^2 = .06$ for Step 2 ($ps < .01$).

** $p < .01$

Table 4

Summary of Final Regression Analysis for Variables Predicting Willingness to try Novel Nonanimal Foods (N = 77)

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
Disgust Attributes	-1.155	0.118	-0.749**
Step 2			
Disgust Attributes	-1.005	0.112	-0.651**
Interest	0.563	0.130	0.313**
Excluded Variables			
Disgust	—	—	—

Note. $R^2 = .56$ for Step 1; $\Delta R^2 = .09$ for Step 2 ($ps < .01$).

** $p < .01$

Table 5

Summary of Final Regression Analysis for Variables Predicting Willingness to try Novel Animal Foods (N = 76)

Variable	<u>B</u>	<u>SE B</u>	β
Step 1			
Disgust Attributes	-0.942	0.098	-0.744**
Step 2			
Disgust Attributes	-0.826	0.093	-0.652**
Interest	0.556	0.130	0.312**
Excluded Variables			
Disgust	—	—	—

Note. $R^2 = .55$ for Step 1; $\Delta R^2 = .09$ for Step 2 ($ps < .01$).

** $p < .01$

Discussion

Previous research has not systematically sought to delineate which factors are most important in predicting willingness to eat familiar and novel, animal and nonanimal foods. For familiar foods of both nonanimal and animal origin, the hypothesis that beliefs about the sensory properties of foods would predict willingness to try them was supported. For nonanimal foods, it was found that beliefs about the sensory-affective properties and joy elicited at the thought of consuming the foods predicted willingness to try them, while beliefs about the anticipated consequences of ingesting the foods and beliefs about the sensory-affective properties of the foods predicted willingness to try animal foods. Previous research in food choice has found that taste, healthfulness and pleasure are all important dimensions which affect choice of familiar foods (although they are not the only dimensions reported to affect food choice) (Lau, Krondl, & Coleman, 1984; Rappaport, Peters, Huff-Corzine, & Downey, 1992).⁵ Although the sensory-affective, anticipated consequences and joy subscales are not entirely identical to those used in previous food choice investigations, they do map on to the taste, healthfulness and pleasure factors previously examined. These results are consistent with prior research which has demonstrated that taste, health and pleasure are important motivations underlying individuals' everyday food choices.

⁵ It should be noted that previous research examining food choice for familiar foods has not distinguished between animal and nonanimal foods, making it difficult to determine if motives underlying familiar food choices differs as a function of origin of the foods.

For novel foods, disgust attributes and interest were the best predictors of willingness to eat both animal and nonanimal foods. The latter finding (i.e., interest predicts willingness to eat these foods) was expected only for nonanimal foods; however, these results provide empirical evidence for the approach component of the approach-avoidance behavior manifested in the “omnivore’s dilemma”. As Rozin (1977) points out, as omnivores, humans need foods from a wide variety of sources in order to satisfy nutritional requirements. Although ingesting unfamiliar edibles may be nutritionally advantageous, it is also risky given that these foods may be harmful or toxic. Humans often exhibit both an interest in and a reluctance to eat novel foods (i.e., approach and avoidance) (Rozin & Rozin, 1981). Previous research has provided evidence to support the “avoidance” end of this pattern, demonstrating that willingness to eat novel foods decreases as beliefs that the food could be potentially harmful increase (Pliner et al., 1993). However, until now, no evidence existed to support the “approach” component of this behavioral dilemma. The results of the present study offer support for this component of the omnivore’s dilemma, indicating that to the extent that interest is generated at the thought of eating novel foods, willingness to try these foods increases.

The finding that perception of the disgust attributes of novel animal foods predicts willingness to try them was expected, given that earlier research in this area has demonstrated that reactions to novel animal foods resemble reactions to prototypical disgusting foods. However, for novel nonanimal foods, it was hypothesized that beliefs about their sensory properties and anticipated consequences of eating them, along with feelings of interest at the thought of

consuming the foods, would predict willingness to try them. Instead, the results indicated that perceptions of the disgust attributes of novel nonanimal foods predicts willingness to try them, a finding unexpected since previous research has demonstrated that rejection of novel nonanimal foods is mediated by distaste and danger, but not disgust (Pliner & Pelchat, 1991; Rozin & Fallon, 1980). These results should be replicated.

When considering novel animal foods, prior research has illustrated that manipulations highlighting the positive poles of the sensory-affective and anticipated consequences motivational dimensions are not effective at reducing neophobic responses. Since the results of this study indicate that perceptions of the disgust attributes of novel animal foods predicts willingness to taste them, techniques targeted directly at the disgust attributes should be developed, in order to determine their utility for reducing neophobic responses towards these types of foods.

In summary, the present research clearly identifies those factors which are important in predicting willingness to eat familiar and novel foods, of both nonanimal and animal origin. These results are particularly important with respect to novel foods since we know that humans tend to reject them (Martins et al., 1997; Pliner & Pelchat, 1991; Pliner et al., 1993). Identifying variables which predict willingness to try unfamiliar foods brings us one step closer to reducing food neophobic behavior, by identifying factors which could be targeted when constructing techniques designed to overcome neophobic responses. These data provide evidence that two variables underlie willingness to eat novel animal and nonanimal foods: beliefs

about the disgust attributes associated with the foods and interest in consuming the foods. Given that the core properties of disgust reactions were assessed by the disgust attribute subscale (i.e., nausea, contamination, offensiveness, oral incorporation), these data suggest that one method through which disgust reactions may be overcome is to decrease individuals' perceptions of these properties. The definition of food-related disgust (revulsion at the prospect of oral incorporation of an offensive and contaminating substance) suggests that if we can decrease the offensive nature and contaminant properties of these foods, we may be able to decrease neophobic responses towards unfamiliar animal foods. However, before techniques can be designed to target individuals' beliefs about the disgusting properties of these foods, we need to identify what it is about foods that makes them disgusting. Identifying the factors underlying beliefs about the disgusting properties of foods is the focus of Study 2.

STUDY 2

As noted earlier, Rozin and Fallon (1987) have defined core disgust as "...revulsion at the prospect of oral incorporation of an offensive and contaminating object." (pg. 24). What follows is a detailed exploration of each of these concepts

Oral Incorporation

Oral incorporation (in this context) involves assimilating an object into the body. In order to assess the degree of "unpleasantness" associated with incorporation of a disgusting food, Rozin and his colleagues (Rozin, Nemeroff,

Wane, & Sherrod, 1995) asked participants to imagine a variety of situations involving different degrees of contact with a disgusting food (ranging from 10 inches away from a closed mouth to inside the stomach) and to rate the unpleasantness of each. Results demonstrated that contact with the inside of the mouth, particularly the tongue, and behavioral precursors of entry into the stomach (i.e., the acts of chewing and swallowing) all contributed to a sense of 'oral incorporation' and were rated as being much more unpleasant than when the disgusting food was near the mouth or inside the stomach.⁶

This fear of oral incorporation may stem in part from the belief that "you are what you eat". That is, people are thought to take on the physical, moral, and intellectual properties of the food they eat (Rozin & Fallon, 1987; Rozin et al., 1993). Nemeroff and Rozin (1989) demonstrated the existence of this belief in North American college students. Subjects read a description of a culture described as hunting marine turtle for food and hunting wild boar for its tusks or a culture hunting wild boar for food and hunting marine turtle for its shell. They were then asked to rate the personality characteristics of members of the culture. Results revealed that subjects attributed more turtle-like characteristics (e.g., good swimmers) to members of the turtle-eating culture and more boar-like

⁶ The fact that contact with a disgusting food inside the stomach was rated as less unpleasant than contact with a disgusting food inside the mouth (or contact with the tongue, etc.) seems counterintuitive given that the ultimate 'oral incorporation' is the presence of the disgusting food inside the stomach. Readers should be reminded, however, that the mouth functions as a border between the bodily self (i.e., the inside of the body) and the outside world. Increases in ratings of unpleasantness when the disgusting food is "in" the mouth, as compared to pre- or post- mouth contact exaggerates the border between the bodily self and the outside world. This corresponds to a Mach Band, a sensory phenomenon in which perceptual contrasts are exaggerated, making borders more salient (Rozin et al., 1995). From a functional perspective this makes sense since once a food has passed through the mouth options for rejecting the food become almost nonexistent (unless vomiting is induced).

characteristics (e.g., fast runners) to members of the boar-eating culture. Thus, this “primitive” notion - you are what you eat - is present even in educated North Americans.

Rozin and Fallon’s (1987) definition of disgust implies that the mechanism underlying the experience of revulsion at the thought of eating “disgusting” foods stems from the belief that the object being ingested is offensive and has contaminant properties. This suggests that if the offensive and contaminant properties of these foods can be reduced, the experience of revulsion may be reduced. However, before the offensiveness and contaminant properties of these foods can be decreased, it is necessary to understand what makes these foods offensive and contaminating (and hence, disgusting).

Offensiveness

Animalness. As stated earlier, researchers describing food-related disgust responses have suggested that the core elicitors of this response are animals, along with their products (Angyal, 1941; Rozin & Fallon, 1987; Rozin et al., 1993). Thus, it makes some sense to assume that (all) animals are potentially offensive. In most cultures people eat only a small subset of available animals, and even among those animals that are accepted, the head and viscera are generally avoided, suggesting that only certain parts of these animals are actually acceptable as food. One could argue that the head and viscera of an animal serve as more prominent reminders of the origin of the food than are body parts typically consumed, making the latter more acceptable than the former as food sources. Further evidence of the importance of the reduction of animalness for increasing the acceptability (at least

among Western cultures) of animal foods comes from Angyal (1941) who pointed out that, at least in the English language, some (but not all) meats have names that are markedly different from their animal names (e.g., beef vs. cow) and are often prepared and served in a manner intended to disguise their animal origin (i.e., slicing or chopping into small unrecognizable pieces).

In attempting to understand why animals and their products are offensive it is necessary to step into the world of theoretical suppositions. Rozin and Fallon (1987) have identified three theories that explain, at least partially, why animals are offensive and are the core elicitors of the disgust response. What follows is an account of each of these theories.

Distance from Humans. One explanation for why animals are offensive and the primary elicitors of disgust implicates the human-animal distinction. This view posits that in an effort to maintain their beliefs that they are distinct from, and superior to, other animals, humans wish to emphasize the distinction between themselves and animals. Leach (1964) and Tambiah (1969) have asserted that in order to do this, humans eat animals at “intermediate distances” from the self. According to this view, animals that are biologically close to humans (e.g., other primates) or are in close social relationships with humans (e.g., pets) are highly offensive and elicit disgust when considered as food, primarily because their “closeness” to humans fails to accentuate the human-animal distinction. Animals that are tame but not very close to humans (i.e., farm animals) or animals under human protection but are not tame (i.e., field or game animals) are edible, serving to strengthen the perceptions of humans as superior to these animal categories.

Remote wild animals (i.e., animals not subject to human control) and vermin (i.e., pests – e.g., insects) are rejected as food items primarily because humans' lack of control over these animals fails to reinforce the belief that humans are superior to them. It should be noted however, that animals can move from one category to another. For example, this view would argue that pigeons are pests (and therefore inedible) when they attack crops, but become edible if classified as game or kept under restraint as farm animals. Although this theory offers some insight into why some animals are offensive, it does not explain the entire category of disgust objects. The view it offers is, admittedly, a Western world view – for example, it does not explain why Asian cultures accept monkey, insects, or dog as food items. Additionally, it fails to account for acceptance (as food items) of some animals that are quite distant from the self (i.e., shellfish & other invertebrates).

Spoilage & Decay. Given that spoiled or decayed items are often offensive and elicit core disgust, it seems reasonable to suggest that animals in contact with spoiled and/or decaying items would also be considered offensive and produce a disgust reaction. According to this view, the primary avoidance is to spoiled or decaying matter. Thus, animals are offensive and elicit disgust because: (1) all animals (when considered as food) are potentially decayed, (2) animals are often exposed to and/or eat spoiled or decaying animal matter (e.g., animals may encounter and have contact with the carcasses of other animals), and (3) many animals produce putrid feces (Rozin & Fallon, 1987). Although this view is unable to account for the entire class of disgust objects, it does suggest that contact with

decomposing or spoiled matter increases the likelihood that an object will be considered offensive and engender the disgust reaction.

Anomaly. The final theory that accounts for why some (though not all) animals are offensive, comes from Douglas (1966), who asserts that humans have a need to create explicit categories for the objects in their world. Anomalous items, such as those that do not fit into any category or those that manifest properties of two or more categories simultaneously, are seen as offensive and become taboo. Examples of such animals include crabs, which live in water, but do not have fins and which possess the ability to walk on land, and penguins, which are birds but do not fly. Both Soler (1973/1979) and Douglas (1966) have noted that many of the dietary restrictions placed on Jews involve animals that are anomalous. Although interesting, this theory was originally intended to account for the laws of Kasruth – not disgustingness of animals. Moreover, this theory is limited by the fact that it cannot explain the almost exclusive focus on animals and their products as objects of disgust. According to this theory, anomalous plant items should also evoke disgust, but research (prior to Study 1 in this dissertation) has indicated that disgust is seldom a basis for rejection where nonanimal items are concerned (Fallon & Rozin, 1983; Rozin & Fallon, 1980). In addition, this theory cannot account for the offensive properties and disgust reactions associated with non-anomalous animals (e.g., ants). At best, this theory provides a historical account of why anomalous items were considered offensive, but it does not explain the full range of modern day disgust elicitors.

Contaminant Properties

Items that are offensive have the capacity to contaminate other acceptable foods, causing rejection of these foods if the offensive item even brushes against the acceptable food. This phenomenon has been explained by Rozin and his colleagues (Rozin, Millman, & Nemeroff, 1986; Rozin, Nemeroff, Wane, & Sherrod, 1989; Nemeroff & Rozin, 1992) in terms of the laws of sympathetic magic and, more specifically, in terms of the law of contagion. The laws of sympathetic magic are beliefs and/or assumptions about the physical world; they are thought to underlie the diverse magical practices and rituals in traditional cultures and are believed to operate even in modern Western cultures. The law of contagion holds that things that have once been in contact may continue to influence each other, through the transfer of some or all of their properties, via an "essence". As applied to food, it may be that if a disgusting food item touches an acceptable food, the acceptable food will be rejected because it is believed to have acquired at least some of the properties associated with the disgusting food. Contamination can also take an associational form in which an acceptable food is rejected because it is associated with a contaminating substance, even in the absence of any physical trace (Fallon, Rozin, & Pliner, 1984). For example, Rozin and his colleagues (Rozin & Fallon, 1980; Rozin et al., 1986) have found that subjects refuse to eat a favorite soup if it has been stirred with a brand new flyswatter or a brand new comb.

The second law of sympathetic magic, the law of similarity, asserts that objects that are superficially similar are also fundamentally similar; e.g., if something looks like dog feces then it is like dog feces. This law accounts for

rejections of items that look like disgusting items, but in reality, are not disgusting. Because of their appearance, these items are treated as disgusting objects. Rozin and his colleagues (Rozin & Fallon, 1980; Rozin et al., 1986) have demonstrated that American college students are unwilling to consume chocolate fudge shaped like dog feces or ingest a favorite beverage that has been in contact with a plastic replica of an insect. Essentially, items that look like disgusting items or have had contact with things that resemble disgusting items are rendered “disgusting” by virtue of association.

Examination of the three elements of the disgust response (oral incorporation, offensiveness, contamination) strongly suggests that animals and animal products are the quintessential disgust items (Angyal, 1941; Rozin & Fallon, 1987; Rozin et al., 1993). Rejection of animals and animal products contains all of the elements necessary to attribute the rejection to disgust. First, humans reject animals because of the belief that they might, if they orally incorporate them, acquire the characteristics of the animal being consumed (at the very least, humans would become more “animal-like”). Additionally, rejected animals are offensive because of their distance from humans, because they are decayed and/or because they are anomalous.

This review of oral incorporation, offensiveness and contamination strongly implicates “animalness” as a factor in disgust. However, we still do not know exactly what it is about animalness that makes it potentially offensive and contaminating. After examining the literature on disgust we generated the following 12 categories of disgust elicitors: the extent to which foods reminded people of living animals,

bloodiness, viscera, organs other than viscera, body parts, fat, spoilage/decay, moldiness, mushiness/squishiness, sliminess, intimations of killing, and insects. These categories are thought to represent more specific aspects of the general theories that have been offered to explain offensiveness of animal foods. Although some of these factors are related to only one general theory (i.e., moldiness may be the factor that leads to foods being perceived as 'spoiled/decayed'), some of them may be related to more than one general theory (i.e., viscera may remind people of 'animalness' and may also remind them of the distance between humans and the animal being consumed). Moreover, although these categories were generated for the general theories used by Rozin and Fallon (1980) to explain offensiveness of animal foods, some of them can be used to understand disgust reactions toward nonanimal foods. For example, it may be that disgust reactions can be elicited by nonanimal foods covered in mold.

Since a variety of explanations (unsupported by empirical evidence) have been offered as factors underlying disgust reactions to animal foods, and no explanations have been offered in relation to nonanimal foods, the purpose of the present investigation is to identify, specifically, the characteristics of animal and nonanimal foods that makes them disgusting.

Method

Overview

The present study uses multidimensional scaling (MDS), a statistical technique designed to identify the dimensions that best account for the similarity/dissimilarity among ratings of stimuli on a particular question. These

dimensions are representative of latent variables that influence the object ratings. In order to interpret these latent variables, the stimuli are also rated on a variety of attributes, and scores representing locations on the identified dimensions are regressed over the means (collapsed over individuals) of each attribute for each stimulus. The results of the regressions enable one to ascertain how well the identified dimensions predict each attribute, permitting interpretation of the dimensions. In the present study, ratings for the question used to compute the MDS and ratings for questions assessing the attributes of the stimuli required very specific (and different) instructions in order to ensure that participants' ratings reflected the variables we wanted to assess. Because the necessary instructions differed, two samples were utilized; ratings of the dependent variable used for the MDS were obtained from participants in Sample One, while ratings of the attributes of the stimuli were made by participants in Sample Two.

Sample One

Participants

Participants were 35 male and 45 female University of Toronto students between the ages of 18 and 44. All participants reported eating foods from all food groups and indicated that they did not have any dietary restrictions or food allergies. Students received either course credit or \$10.00/hour as payment for their participation.

Stimulus Materials

Food Stimuli. Twenty-four scenarios were constructed to depict potentially disgusting familiar animal and nonanimal foods, for the following 12 categories of potential disgust elicitors: reminders of a living animal, blood, viscera, slime, fat, other organs, spoilage/decay, moldiness, mushiness/squishiness, body parts, intimations of killing, insects. It should be noted that these scenarios were constructed using familiar foods. This was done because it was thought that using the potential disgust elicitors in conjunction with novel foods in the scenarios would lead to ceiling effects in the ratings of our dependent measures, given that disgust attributes predict willingness to eat novel foods even when they are not blatantly presented in conjunction with potential disgust elicitors (as shown in Study 1). This would result in low variability across the scenarios, making it impossible to identify the mechanisms underlying disgust reactions. In order to eliminate this potential problem, only familiar foods were used in this study to ensure that any reported disgust reactions were due to the potential disgust elicitors and not just novelty of the depicted foods.

With the exception of the mold category, one paragraph in each category was constructed to represent a situation where the food stimulus itself was “disgusting”, while the other paragraph was constructed to depict a situation where the food stimulus was in contact with a potential disgust elicitor (i.e., disgust as a result of contamination). For example, in the blood category, the disgusting scenario involving the food stimulus itself was:

“In some European and West Indian cultures a specialty dish known as Blood Pudding is commonly eaten. This dish is made by mixing

~~rice with various herbs and spices and then mixing the blood of a cow~~ into the rice mixture. The entire mixture is then stuffed into sausage casing. Once it's cooked, how would you feel about eating this dish?"

Thus, participants were asked to rate how they would feel about eating (a dish that contained) blood. The scenario involving disgust as a result of contamination in the blood category read as follows:

"You and your father travel to a cattle farm to buy some fresh beef. Once you have selected the large piece of beef you would like to purchase, the butcher cuts it into smaller pieces. During the cutting process a vein that still contains blood is cut open and the blood spurts out. The butcher removes the vein. Later that day your father cooks two pieces of beef that were purchased earlier in the day. How would you feel about eating this piece of beef?"

Here, participants were asked to rate how they would feel about eating a piece of beef that had once been in contact with blood. Within the mold category both paragraphs were constructed to assess disgust via contamination. The scenarios that were used can be found in Table 6.

Measures

As measures of their beliefs about the disgustingness of each of the 24 foods, participants responded to the following four questions, after reading each of the scenarios:

1. The thought of eating this food makes me nauseous.
2. I dislike the idea of having this food in my stomach.
3. I dislike the idea of this food because of what it is or where it comes from.
4. The thought of eating this food is disgusting to me.

Questions 1 and 2 are from the disgust attributes subscale used in Study 1; the contamination questions from this subscale were not used in this study since

Table 6

Descriptions of Disgusting Foods as a Function of Disgust-Eliciting Category

Category	Label	Description
Animal	A1 [†]	You are eating beef steak in a small town restaurant and when you look outside the window you see a herd of cows grazing in the adjacent field. How would you feel about continuing to eat this beef steak?
	A2	Your parents go to a turkey farm to select the live turkey that you will eat for Thanksgiving dinner. Later that day the turkey is cooked and served for dinner. How would you feel about eating this turkey?
Blood	B1 [†]	You and your father travel to an cattle farm to buy some fresh beef. Once you have selected the large piece of beef you would like to purchase, the butcher cuts it into smaller pieces. During the cutting process a vein that still contains blood is cut open and the blood spurts out. The butcher removes the vein. Later that day your father cooks two of the pieces of beef that were purchased earlier in the day. How would feel about eating the piece of beef?
	B2	In some European and West Indian cultures a specialty dish known as blood pudding is commonly eaten. This dish is made by mixing rice with various herbs and spices and then mixing the blood of a cow into the rice mixture. The entire mixture is then stuffed into sausage casing. Once it's cooked, how would you feel about eating this dish?
Viscera	V1	You are visiting some friends in the Southern United States and one evening you all go out to dinner. One of your friends orders chitterlings, a specialty dish in the South which is really the intestines of a hog. Your friend offers you a bite of his chitterlings. How would you feel about eating the chitterlings?

(table continues)

Category	Label	Description
	V2 [†]	You are in a butcher's chop awaiting your turn at the counter when you notice a large pile of intestines piled on the corner of the chopping block, just barely touching the slab of beef that is currently being cut. When you are at the counter you request a piece of steak and the butcher cuts it from the slab of beef touching the pile of intestines. Later that day the steak is cooked. How would you feel about eating the steak?
Slime	S1	You've just ordered a veggie stir-fry for lunch and you watch as the cook takes the vegetables out of the refrigerator. You notice the part of the zucchini is slimy and watch as the Cook cuts off this part of the zucchini and proceeds to use the rest of it in your stir-fry. How would you feel about eating the rest of the zucchini?
	S2 [†]	Your father has just returned from the turkey farm and you notice that the pieces of turkey he purchased are completely covered in a thin layer of a slimy substance that you need to wash off of the turkey. After cooking the turkey, how would you feel about eating it?
Fat	FT1 [†]	Your brother buys a pork roast for dinner. Even after it's finished cooking, there is a thick layer of fat covering the meat. How would you feel about eating a piece of this meat?
	FT2	You go to your mother's house for Sunday dinner and you notice that she is defrosting a container of beef gravy left over from last week's dinner. You look into the container and realize that there is a glob of creamy fat covering the liquid underneath. Once heated, how would you feel about eating this gravy?
Other Organs	OO1	You have dinner at a friend's house. The main course consists of stuffed beef heart. How would you feel about eating the stuffed beef heart?
	OO2 [†]	The gravy served with your Thanksgiving turkey is described as "giblet" gravy. This consists of gravy made using the gizzard and liver of the turkey. The gizzard and liver are then strained out of the liquid. How would you feel about eating this gravy?

(table continues)

Category	Label	Description
Spoilage/ Decay	RD1 [†]	You and your friend are making a salad for lunch. You open your refrigerator only to be confronted with the sight of a tomato that is covered with dark spots and is rapidly rotting. Part of the tomato can still be saved and your friend decides to use that part of the tomato in the salad. How would you feel about eating this remaining portion of the tomato?
	RD2	You are eating dinner in a restaurant with a friend and have just finished ordering the premier steak on the menu. The menu claims that the “premier” steak it has to offer has been “aged to perfection for 35 days”. Your friend points out that the phrase “aged to perfection” is simply a polite, marketable way of indicating that the meat you just ordered has been sitting around decaying for 35 days. How would you feel about eating the steak now?
Mold	M1 [†]	You and your housemate are making grilled cheese sandwiches. When you take the cheese out of the refrigerator, you notice a greyish-blue mold covering most of the cheese. Your housemate scrapes the mold off of the cheese and proceeds to make your sandwiches. How would you feel about eating this sandwich?
	M2 [†]	Your dad has decided to make you breakfast and unwraps a previously opened package of bacon. You notice that a soft white fuzz has begun to grow on the right half of the bacon and you watch as your father cuts it off and cooks the rest of the bacon. How would you feel about eating the rest of the bacon?
Mushy/ Squishy	MS1 [†]	You’re having a picnic with a friend and the bananas she’s packed are extremely mushy. How would you feel about eating one of these bananas?

(table continues)

Category	Label	Description
	MS2	Your Mom has been soaking dried navy beans for several days. While you are helping her prepare dinner you pick a few beans out of the bowl and they are so soft and squishy that they collapse between your fingers and turn into mush. Your Mom cooks the rest of the beans and serves them with dinner. How would you feel about eating these beans?
Body Parts	BP1 [†]	You've been invited to a potluck dinner and the hostess has cooked a rump roast as the main dish. All of a sudden one of the guests has an epiphany and shouts out "You mean that's the butt of the cow?!". How would you feel about eating the rump roast?
	BP2	You're having dinner at a friend's house and soup is the first item that is served. You notice a bone in your soup. You ask your friend what it is and she replies that it's the neck of a turkey; in her culture it is common to eat the meat on necks and then suck the marrow from the neck. How would you feel about eating the neck?
Intimations of Killing/Death	KD1	You are driving along a country road and the driver in front of you hits a large wild turkey and pulls over on the side of the road. You pull over and offer your assistance to the driver. The turkey is obviously dead and the other driver suggests that you find a way to share the turkey so that you can each take home some fresh turkey meat. How would you feel about eating a piece of this cooked turkey?
	KD2 [†]	You are eating dinner with your family when all of a sudden your 5-year old sister realizes that the chicken you're all eating once used to be alive and says: "You mean we're eating a dead bird?" How would you feel about eating this chicken now?

(table continues)

Category	Label	Description
Insects	I1 [†]	Your parents are having people over for a backyard barbeque. Your Mom leaves the salad on the patio table and when you and she return, you both notice a black bug moving amongst the leaves. Your Mom promptly picks up the piece of lettuce the bug is on and continues serving the salad. How would you feel about eating the rest of the salad?
	I2	You are visiting Louisiana and one of the most popular stores you run across is a candied-insects store. This store sells lollipops with worms in them, chocolate covered grasshoppers and ants and even caramel coated cockroaches. As you are walking by, an employee is offering free samples of chocolate covered ants. How would you feel about eating chocolate covered ants?

Note. Labels are presented since Figure 1 uses these labels to identify the scenarios.

[†] Denotes scenarios in which the food stimulus was in contact with a potential disgust elicitor (i.e., disgust as a result contamination).

disgust via contamination was represented in half of the scenarios created. The third question assesses the ideational dimension of food acceptance/rejection and it was used because rejections based on disgust are thought to be a sub-category of this dimension (Rozin & Fallon, 1980). Since the instructions in this study included a definition of food-related disgust (see Procedure section below), participants were also asked to rate the extent to which the thought of eating the food was disgusting to them. Questions were answered on a 7-point Likert scale, with "1" not at all and "7" = extremely. Participants also rated their familiarity with each food item.

Procedure

Participants were tested individually in a one hour session. Upon arrival at the laboratory, they were informed that we were interested in why people reject foods and were told that food rejections typically fall into one of three categories: sensory-affective, danger, or disgust. In order to facilitate participants' understanding of the three types of food rejections, the experimenter then verbally delivered the following lecture:

"Foods rejected for sensory-affective reasons are rejected primarily because of their taste, smell, texture, or appearance. In essence, it is a rejection based on the sensory properties of the food. If you're rejecting a food on this basis you wouldn't object to the presence of a small, unpalatable amount of this food in an otherwise liked food. For example, I dislike onions because of their texture, but if they're chopped up finely and mixed into an omelette, I would still eat the omelette. Foods that are rejected for sensory-affective reasons are rarely considered dangerous and tend to be a matter of individual taste. For example, you may dislike coffee because of the strong flavour whereas your friend may like coffee because of the strong flavour.

The second major category of food rejections is danger. Foods rejected on the basis of danger are rejected primarily because of the

anticipated negative consequences of eating the food. In some instances, otherwise liked foods wouldn't even be accepted if it contained the tiniest amount of this substance. Despite the expectation or knowledge that these rejected foods are harmful, there is not usually a negative response to the sensory properties of the food. For example, I wouldn't eat a poisonous mushroom because I expect that it will cause harm to me, not because I dislike the sensory properties of the mushroom.

The final category of food rejections is rejections based on disgust. These are strong negative reactions to a food based on the idea of what it is or where it comes from. There are strong objections to any association of the person with such foods (so, you wouldn't want it on your person, on your hands, or in your stomach, etc.). Nausea is usually associated with the thought of eating these foods and, if these rejected foods even touch an otherwise liked food, the otherwise liked food becomes inedible. Feces are the prototypical disgust item in American culture.

Do you understand the differences between the three categories? Do you have any questions?

After hearing the lecture on the three categories of food rejections, participants were informed that we were particularly interested in determining why people consider certain foods disgusting. They were told that their task involved reading several brief scenarios describing situations involving foods. They were then asked to imagine these situations as vividly as possible and to rate their feelings about eating the food in question after the occurrence of the situation described in the scenario. In addition, they were asked to keep in mind the differences between rejections based on sensory-affective reasons, danger, and disgust and to indicate that they were rejecting a food based on disgust only if their reaction to the food contained the characteristics associated with a disgust reaction, as described to them earlier. Participants were then given a package containing the scenarios (order of presentation was counterbalanced across participants) and responded to the main dependent variable items, along with the question assessing familiarity,

after reading each. Once the package had been completed, participants were thoroughly debriefed.

Sample 2

Participants

Participants were 23 male and 46 female (1 participant did not report her/his gender) University of Toronto students between the ages of 18 and 40. All participants reported eating foods from all food groups and indicated that they did not have any dietary restrictions or food allergies. Students received either course credit for their Introductory Psychology course or \$10.00/hour as payment for their participation.

Stimulus Materials

Food Stimuli. The twenty-four scenarios, used in Sample 1, served as the stimuli for this sample of participants as well. They can be found in Table 6.

Measures

To indicate their beliefs about the specific characteristics of the foods depicted in the 24 scenarios, participants rated them on 14, 7-point bipolar scales.

The endpoints for these scales were:

1. not at all slimy....extremely slimy
2. reminds me of animalness/makes me think of animalness....does not remind me of animalness/make me think of animalness
3. not at all bloody....extremely bloody
4. extremely gooey....not at all gooey
5. internal to an entity....external to an entity
6. not at all in close contact with internal bodily fluids other than blood....in extremely close contact with internal bodily fluids other than blood
7. reminds me of humans/makes me think of humans....does not remind me of humans/make me think of humans
8. not at all mushy....extremely mushy
9. smells extremely bad....does not smell bad at all

10. reminds me of the living entity this was or was part of....does not remind me of the living entity this was or was part of
11. extremely rotten/decayed....not at all rotten/decayed
12. not at all in close contact with blood....in extremely close contact with blood
13. not at all like humans (with humans being defined as a whole, complete physical specimen)....extremely like humans (with humans being defined as a whole, complete, physical specimen)
14. not at all gory....extremely gory

Procedure

Participants were tested in groups in a one hour laboratory session.

Partitions were placed between participants in order to ensure that they did not interact with each other during the experimental session. Upon arrival at the laboratory, participants were informed that we were interested in individuals' reactions towards foods. The following instructions were then verbally delivered:

There are certain facts that we know about stimuli or objects we encounter in the world which may not necessarily be in sync with the feelings we have towards these stimuli or objects. For example, many people know for a fact that snakes are not slimy, but they feel as though snakes are slimy. Do you understand what we're trying to get at? Now, we are particularly interested in people's feelings about foods. What we know about these foods may not necessarily be in sync with what we feel to be true about these foods, just like in the previous snake example. So, we would like you to read the following scenarios about foods and answer the questions that follow by circling a number between 1 and 7. Please answer the questions based on what you feel to be true, not necessarily what you know to be true, about each food as described.

After receiving this information, participants were given a questionnaire package containing the stimulus paragraphs (order of presentation of the paragraphs was counterbalanced across participants) and dependent measures; the cover page of this package reiterated the instructions that had been verbally delivered. They were

asked to read each of the scenarios, imagining them as vividly as possible, and then to respond to the questions following each. After completing the questionnaire package participants were then thoroughly debriefed.

Results

Overview

Multidimensional scaling (MDS) was used to identify the optimal number of dimensions that account for the similarity/dissimilarity among the disgustingness ratings (obtained in Sample 1) of the 24 food scenarios. In this type of analysis, the number of dimensions to be identified is specified prior to the analysis. In order to determine the optimal number of dimensions, researchers generate solutions comparing one-unit increases in the number of dimensions specified. A solution is considered optimal when the stress value⁷ does not decrease considerably and/or when the proportion of variance accounted for by the dimensions does not increase appreciably from one solution to the next. Essentially, the stress and R^2 values function as goodness-of-fit indices. Since these criteria are left open to interpretation by researchers, an a priori decision was made to identify an optimal solution as follows: (1) the stress value decreases $\leq .10$ from one solution to the next and (2) the R^2 value increases $\leq .05$ from one solution to the next.

Once the optimal solution has been identified, the task then becomes one of interpretation of the identified dimensions. To this end, means (over subjects) for each of the 14 attributes, separately for each scenario, were generated from the

⁷ The stress value is a single number which shows how well (or how poorly) the identified dimensions fit the data. Stress values are always greater than 0; if the stress value is 0 there is exact equality between the identified dimensions and the data (Kruskal & Wish, 1978). The idea then, is to minimize this value as much as possible (Kruskal & Wish, 1978).

data collected in Sample Two. A new data file was then created in which the unit of analysis was the scenario; each row represented a scenario and the columns represented the dimension coordinates from the MDS analysis (Sample 1) and the mean ratings of the 14 attributes (Sample 2). Interpretation of these latent dimensions was determined by regressing the dimension coordinates over the ratings of each attribute. In other words, this analysis determined how well each of the MDS dimensions predicted each of the attributes. In order for a particular attribute to provide a satisfactory interpretation of a given dimension, the R^2 value for the regression must be at least moderately high and should be significant at the .01 level or better (indicating that the attribute is well fitted by the coordinates of the dimensions), and the given dimension must have a high regression weight on the attribute in question (t-values should be significant at $p < .01$) while the other dimension(s) in the analysis should have relatively low regression weights on the attribute (Kruskal & Wish, 1978).

Checks on Characteristics of the Stimuli

Familiarity. Familiarity ratings of the animal and nonanimal foods were calculated, collapsing across actual foods and participants. The animal foods received a mean familiarity rating of 4.84 and nonanimal foods received a mean familiarity rating of 4.92. These ratings of familiarity are a little lower than the ratings that familiar animal and nonanimal foods received in Study 1 ($M_{\text{animal}} = 6.76$, $M_{\text{nonanimal}} = 6.83$), but are much higher than the familiarity ratings of novel foods in Study 1 ($M_{\text{animal}} = 1.44$, $M_{\text{nonanimal}} = 1.39$), indicating that on the whole, the foods used in Study 2 were perceived as reasonably familiar. It should be noted that the

foods used in Study 1 were not depicted in scenarios designed to elicit disgust and this may account for the differences between familiarity ratings of Study 1 and Study 2.

Disgustingness. Mean scores (i.e., over subjects) on the ratings of disgust, nausea, and the thought of the food in the stomach were calculated for each scenario. Mean ratings on the disgust question were then correlated with means for the other two questions across scenarios. The correlation between mean ratings of disgust and nausea was $r = .98$, $p < .01$, $n = 24$, while the correlation between mean disgust ratings and the thought of the food in the stomach was $r = .99$, $p < .01$, $n = 24$. Since these two questions are part of the disgust attributes scale previously used in Study 1, these correlations suggest that our measure of disgust was indeed assessing disgust.

Multidimensional Scaling Analysis

Identification of the Optimal Solution. Using Euclidian distances derived from the data, multidimensional scaling (MDS) was carried out on Sample One participants' disgustingness ratings (question 4). Table 7 shows stress and R^2 values for solutions using one, two and three dimensions. The results indicate clearly that the addition of the second dimension improves the fit of the data and the amount of variance accounted for appreciably, while the addition of a third dimension does not add substantial improvement to either of these dimension fit

Table 7

Stress and R² Values in Multidimensional Scaling by Dimensionality

Number of Dimensions	Stress Value	R ²
1	.29	.78
2	.16	.87
3	.12	.91

indices. The 2-dimensional solution, which accounts for 87% of the variance in disgustingness ratings, is therefore considered to be the optimal solution for this data set. Table 8 presents the scaling coordinates of the 24 scenarios for the two-dimensional solution and Figure 1 offers a plot of this solution.

Interpretation of the Optimal Solution. Prior to interpretation of the MDS analyses, ratings on attributes 2, 4, 5, 7, 9, 10, and 11 (obtained from Sample 2) were reverse scored so that higher numbers represented “more of” the attribute in question. Means for each attribute were then generated for each scenario.

Interpretation of the dimensions was derived by regressing the scaling coordinates of the dimensions over each of the 14 attribute ratings, using enter method entry procedures. As seen in Table 9, Dimension 1 has significant negative relationships with ratings of perceived sliminess, gooey-ness, mushiness, smelling bad, rottenness/decay, and goriness. This indicates that as the spatial location of scenarios moves from left to right on Dimension 1 (see Figure 1), participants' perceptions of these scenarios as slimy, gooey, mushy, smelly, rotting/decaying, and gory decreases. That is, scenarios located on the left of Dimension 1 are perceived as being more slimy, gooey, mushy, smelly, rotting/decaying, and gory than scenarios located on the right. Moreover, Dimension 1 accounts for the greatest proportion of variance and has the highest standardized regression weight for participants' ratings of perceived sliminess. Taken together, these results suggest that this dimension appears to reflect negative sensory/texture properties, with items such as consumption of chocolate covered ants, blood pudding and chitterlings at one of the scale and consumption of a turkey that was selected while

Table 8

Multidimensional Scaling Coordinates of 24 Disgust Eliciting Scenarios in Two Dimensions

Category	Brief Description	Label	Dimension	
			1	2
Animal	eat steak, see cow	A1 [†]	2.16	.11
	turkey from farm	A2	1.80	.27
Blood	vein in beef	B1 [†]	.89	.52
	blood pudding	B2	-2.02	.21
Viscera	chitterlings	V1	-1.45	.67
	intestines touch beef	V2 [†]	1.06	.35
Slime	slime on zucchini	S1	.30	-.37
	slimy layer on turkey	S2 [†]	.53	.30
Fat	layer of fat on pork roast	FT1 [†]	.04	.76
	fat in gravy	FT2	.41	-1.02
Other Organs	beef heart	OO1	-.92	.84
	giblet gravy	OO2 [†]	-.69	.84
Spoilage/Decay	rotting tomato	RD1 [†]	-.70	-.87
	premier steak	RD2	-.18	-.65
Mold	moldy cheese	M1 [†]	-.93	-1.33
	fuzzy bacon	M2 [†]	-.69	-.21
Mushy/Squishy	mushy bananas	MS1 [†]	-.01	-.37
	mushy navy beans	MS2	1.30	.42
Body Parts	rump roast	BP1 [†]	1.10	-.62
	turkey neck	BP2	.28	1.00
Intimations of Killing/Death	dead wild turkey	KD1	-.92	.05
	chicken (dead) = chicken (live)	KD2 [†]	2.50	-.22
Insects	bug on lettuce	I1 [†]	-.80	-.64
	chocolate covered ants	I2	-2.58	-.05

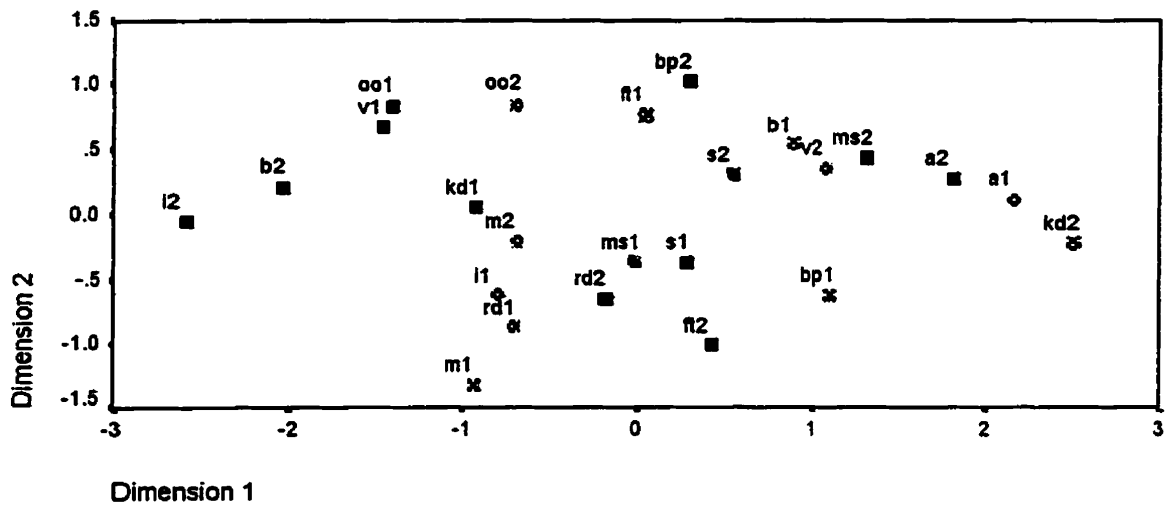


Figure 1. Results of multidimensional scaling – Dimension 1 - negative sensory/textural properties; Dimension 2 - reminder of livingness/animalness. Plotted by labels used in Tables 6 and 8.

- Denotes items where the food stimulus itself was “disgusting”.
- ◻ Denotes items where the food stimulus was in contact with a potential disgust elicitor (i.e., disgust as a result of contamination).

Table 9

Summary of Regression Analyses for Interpretation of MDS Dimensions

Attribute	Standardized Beta		R ²
	Dim1	Dim2	
Slimy	-0.82*	0.25	0.72*
Animalness	-0.16	0.60*	0.39*
Bloody	-0.25	0.61*	0.43*
Goey	-0.76*	0.23	0.62*
External/internal	-0.29	0.76*	0.65*
Bodily fluids	-0.36	0.63*	0.52*
Humans	-0.07	0.63*	0.40*
Mushy	-0.59*	0.13	0.36*
Smells	-0.76*	-0.12	0.60*
Living entity	-0.12	0.59*	0.36*
Rotten/decay	-0.58*	-0.43*	0.51*
Contact w/ blood	-0.22	0.61*	0.41*
Like humans	0.04	0.59*	0.35*
Gory	-0.66*	0.48*	0.65*

Note. In these analyses scaling coordinates on the dimensions were regressed over each attribute.

* $p < .01$

it was alive from a turkey farm, eating a steak while seeing cow and realizing that chicken that is eaten actually comes from the bird called “chicken” at the opposite end. It should also be noted that foods depicted as eliciting disgust via contamination were evenly distributed along this dimension, although none of these items were at the extreme high end of this dimension.

Referring again to Table 9, it can be seen that Dimension 2 has significant positive relationships with animalness, bloodiness, internality to an entity, in contact with bodily fluids, reminder of humans, reminder of living entities, rottenness/decay, contact with blood, like humans, and goriness. This illustrates that as the spatial location of scenarios moves from the bottom to the top of Dimension 2 (see Figure 1), participants' perceptions of the presence of these attributes in the scenarios increases. That is, scenarios located near the top of Dimension 2 are perceived as being more of a reminder of animalness, humanness, living entities, and as being more like humans, bloody, internal to an entity, in contact with other bodily fluids, rotting/decaying and gory. In addition, Dimension 2 accounts for the greatest proportion of variance and has the highest standardized regression weight for participants' ratings of perceived externality/internality of foods to an entity. Taken together, this suggests that this dimension is one of livingness/animalness, with consumption of foods such as a turkey neck and stuffed beef heart at one end of this dimension and consumption of cheese after removing mold from it and eating a tomato after discarding the rotting portion of it at the other end. Again, it should be noted that foods depicted as eliciting disgust via contamination were evenly distributed along this dimension.

Except for rotten/decay and goriness (the attributes predicted by both dimensions), the attributes significantly predicted by each dimension appear to reflect distinct themes. To further explore this finding, a principle components analysis (PCA) using varimax rotation was carried out on the mean attribute ratings. Examination of Table 10 reveals that this analysis yielded two factors. The first factor can be conceptualized as a livingness/animalness factor while the second factor can be thought of as a negative sensory/texture factor. Factor scores were computed for both factors by generating the mean ratings of attributes with factor loadings $>.80$ on a factor (see Table 10). Ratings for rotten/decay and goriness were not included in these calculations since these items were complex (i.e., they loaded fairly highly on both factors) (Tabachnick & Fidell, 1989). Scaling coordinates of the dimensions were then regressed over each of the factor scores, using enter method as the entry procedure. Examination of Table 11 reveals that Dimension 1 has a significant negative relationship with Factor 2, and Dimension 2 has a significant positive relationship with Factor 1. These results are not particularly surprising given that all of the attributes found to load most highly on Factor 2 in the principle components analysis significantly predicted only Dimension 1 in these regressions, while all of the attributes found to load most highly on Factor 1 significantly predicted only Dimension 2. It should be noted that

Table 10

Factor Loadings Derived from the Principle Components Analysis On Mean Ratings for Each Attribute

Attribute	Factor 1	Factor 2
Animalness	.97	-.13
Contact w/ blood	.97	2.09E-02
Reminder of life	.96	-.12
Bloodiness	.95	.11
Contact w/ other bodily fluids	.95	7.72E-02
Internal to entity	.95	.13
Like humans	.93	-.23
Reminder of humans	.91	-5.5E-02
Gory	.82	.53
Goey	.12	.94
Slimy	.13	.93
Mushy	-.14	.89
Smell	.12	.85
Rotten/decayed	-.38	.81

Note. Ratings on each attribute were collapsed across individuals and scenarios in order to derive means.

Factor 1 is thought to represent the extent to which foods remind individuals of livingness/animalness and Factor 2 is thought to represent negative sensory/textural properties of foods.

Table 11

Summary of Regression Analyses using Mean Scores on Each Factor as the Criterion**Variables**

Factor Number & Description	<u>Standardized Beta</u>		R²
1: Reminders of Livingness/ Animalness	-0.26	0.65*	0.478*
2: Negative Sensory/Textural Properties	-0.78*	-0.00	0.615*

ratings of rotten/decay and goriness were the only attributes that did not have simple structure in the PCA and that these two attributes were the only attributes that were significantly predicted by both dimensions.

In order to rule out the possibility that one of the identified dimensions was actually representative of perceived familiarity of the foods, scaling coordinates of the dimensions was regressed over mean familiarity ratings (from Study 1). This analysis revealed that coordinates of Dimension 1 are positively related to familiarity ratings, $R^2 = .67$, $p < .01$, $\beta = .68$, $p < .01$, and coordinates of Dimension 2 are negatively related to familiarity ratings, $R^2 = .67$, $p < .01$, $\beta = -.47$, $p < .01$. Recall however, that the criteria for interpretation of a given dimension states that the given dimension must have a high regression weight on the attribute in question, while the other dimension must have a low regression weight on this attribute (Kruskal & Wish, 1978). This is because in MDS, the identified dimensions are orthogonal to each other, indicating that co-ordinates of different dimensions should predict scores on different attributes – when dimensions are found to predict the same attribute it can only be argued that the dimensions are related to this attribute, but they cannot be interpreted as reflecting this attribute since it violates the orthogonality of the dimensions. Thus, although the dimensions identified in the present study are related to familiarity ratings, neither one can be interpreted as a dimension of “familiarity”.

Taken together, these analyses provide further support for the conclusion that Dimension 1 is a negative sensory/textural dimension, while Dimension 2 is reflective of participants' perceptions of livingness/animalness.

Discussion

The purpose of the present investigation was to identify the factors underlying disgust reactions to animal and nonanimal foods. After reviewing the disgust literature, 12 categories of potential disgust elicitors were identified; participants in Sample 1 rated the foods in these scenarios on their disgustingness and other disgust attributes (e.g., oral incorporation, nausea) while participants in Sample 2 rated the foods in these scenarios on a variety of attributes that had the potential to be factors underlying disgust reactions.

The results of this study clearly indicate that disgust reactions towards foods are based on two latent variables: (1) the negative sensory/textural properties of the foods and (2) the extent to which the foods are reminders of livingness/animalness. More importantly, these findings appear to be robust. The MDS analysis was based on participants' ratings of the disgustingness of each food (Sample 1) and a two-dimensional solution, interpreted to be representative of the two latent variables identified above, proved to be optimal for these data. Participants in Sample 2 rated each food on a variety of attributes and a principle components analysis of these items indicated that ratings of these attributes represented two latent factors which were also correlated with the two latent variables described above. This illustrates that regardless of whether individuals are asked to respond to a single question assessing perceived disgustingness or are asked to rate a variety of attributes thought to underlie perceived disgustingness, two latent variables, namely negative sensory/textural properties of the foods and reminders of livingness/animalness, account for most of the variability in these ratings.

Until now, researchers have assumed that food-related disgust reactions are elicited primarily by animals, and a variety of general theories (reviewed in the introduction to this study) have been put forth to explain why this is so (Angyal, 1941; Rozin & Fallon, 1980). However, none of these theoretical explanations accounts for the entire range of disgusting foods and no empirical evidence was offered in support of these explanations. Moreover, these explanations did not identify any specific factors thought to underlie disgust reactions, but instead focused only on general explanations and actually failed to consider a variety of other potential factors that may account for these types of reactions. Finally, these explanations have been offered only for animal foods, despite the fact that they may also be relevant for disgust reactions towards nonanimal foods (e.g., spoilage and decay). Essentially, research prior to this thesis has failed to consider that nonanimal foods can also elicit disgust reactions. In the present study, origin of the food (animal vs. nonanimal) did not affect mean ratings of disgustingness, ($M_{\text{animal}} = 3.80$, $M_{\text{nonanimal}} = 4.09$, ns), nausea ($M_{\text{animal}} = 3.67$, $M_{\text{nonanimal}} = 3.86$, ns), or dislike of the idea of having the food in one's stomach ($M_{\text{animal}} = 3.87$, $M_{\text{nonanimal}} = 4.18$, ns), illustrating that animal and nonanimal foods are perceived as equally disgusting. In addition, although the second dimension identified in the MDS analysis is related to livingness/animalness, the first dimension (accounting for more variance; see Table 7) is related to negative sensory/textural properties of the foods, which has little, if anything to do with whether a food is animal or nonanimal.

The present study is the first to provide empirical evidence of the specific mechanisms underlying disgust reactions to both animal and nonanimal foods and

suggests that nonanimal foods can also be perceived as disgusting. Our attention now turns to examining the effectiveness of techniques that might be used to (1) decrease individuals' beliefs about the disgust attributes of foods and (2) increase their willingness to try these foods.

STUDY 3

The findings of Study 1 provide evidence that disgust attributes are an important predictor of willingness to eat novel foods. Study 2 explored the factors underlying disgust rejections and found that perceived negative sensory/textural properties and the extent to which foods reminded individuals of livingness/animalness accounted for a significant proportion of the variance in how disgusting foods were perceived. Study 3 was conducted to ascertain if it is possible to increase individuals' willingness to try novel animal foods. Novel animal foods were chosen as the focus of the present study since prior research has demonstrated that informational manipulations are effective at reducing neophobic responses to novel nonanimal foods but have no effect on individuals' willingness to eat novel animal foods or familiar foods (Martins et al., 1997). Moreover, previous research has indicated that individuals' are more neophobic with respect to novel animal foods and that reactions to these foods resemble reactions to prototypical disgusting foods (Pliner & Pelchat, 1991). Further support for the importance of disgust in relation to novel animal foods comes from Study 1 which found that individuals' perceptions of the disgust attributes of novel animal foods is an

important predictor of willingness to try these foods. Together, these results suggest that reducing individuals' perceptions of the disgust attributes of these foods may increase their willingness to try them. Specifically, if individuals' perceptions of the negative sensory/textural properties and the extent to which these foods remind them of livingness/animalness could be decreased, willingness to try them could be increased. Attempting to reduce these perceptions may be an arduous task; for example, if individuals are presented with a piece of "langua" steak and it reminds them of the animalness of this piece of meat, changing this perception of animalness may not be possible; after all, this piece of meat does come from an animal. It may, however, be possible to make the disgusting attributes of the foods less salient or to focus individuals' attention away from them. With that in mind, the present study employed a distraction manipulation and assessed its ability to focus attention away from the disgust attributes of the foods, which, at least in theory, should (1) reduce the experience of disgust, and (2) increase willingness to try the foods.

Previous research on the self-regulation of other negative emotions such as anger and depression has illustrated that distraction reduces the experience of these emotions (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Nolen-Hoeksema & Morrow, 1993; Rusting & Nolen-Hoeksema, 1998). Distraction is thought to work by focusing individuals' attention away from the negative mood and its causes onto neutral or pleasant stimuli that are engaging enough to prevent their minds from wandering back to the source of the negative mood. In a study examining the effects of distraction and rumination on the experience of anger,

Rusting and Nolen-Hoeksema (1998), induced angry moods in participants by having them write about a time when they felt "...so angry that [they] wanted to explode" (pg. 797). After completing anger mood scales, participants were asked to focus on ideas and thoughts that were related to nonemotional stimuli (e.g., the layout of a double-decker bus) (distraction condition), emotion-focused (e.g., "why people treat you the way they do") (rumination condition), or were given no instructions pertaining to attentional focus (control condition). Following this, another measure of angry mood was completed. Results demonstrated that participants in the distraction condition exhibited the weakest amount of anger, while participants in the rumination condition displayed the most intense anger, despite the fact that no differences in anger were noted between the three conditions prior to the focus manipulation.

In a similar series of investigations Nolen-Hoeksema and her colleagues (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Nolen-Hoeksema & Morrow, 1993) have provided evidence that distraction (vs. rumination) from a depressed mood reduces the experience of depressed mood (compared to baseline measures) in mild to moderately depressed or dysphoric individuals and that these individuals recall fewer negative autobiographical memories and rate positive events as having occurred more frequently in their lives and negative events as having occurred less frequently.

The important findings of these studies, in relation to the objective of the present research, are that (1) distraction can decrease the experience of negative emotions, and (2) rumination can increase the experience of negative emotions.

Given its ability to reduce the experience of anger and depression, it may be that distraction would also be effective at reducing the experience of the emotion of food-related disgust.

The purpose of the present study is to determine if distraction manipulations are effective at decreasing individuals' experience of disgust and increase their willingness to try novel animal foods. To accomplish this, participants were provided with written information about novel foods accompanied by either no pictorial information (control condition), irrelevant distraction pictorial information (i.e., pictorial information that focused attention away from the 'disgust' eliciting food and on to something else), relevant distraction (i.e., pictorial information that focused on aspects of the disgust eliciting food other than the disgusting ones) , or disgust salience pictorial information (i.e., information that highlighted the disgusting aspects of the food, essentially equivalent to the rumination conditions in the studies reviewed above).⁸ In addition, individuals' trait levels of food neophobia were assessed since prior research has indicated that this variable plays a role in willingness to try novel foods (although the results of Study 1 did not differ as a function of individuals' trait levels of food neophobia) (Martins et al., 1997; Pliner & Hobden, 1992).

It was expected that the distraction manipulations would decrease the experience of disgust associated with novel animal foods and increase individuals'

⁸ Participants in this study were presented with small samples of actual foods (target stimuli). Since a visual mode of presentation was used for the target stimuli we chose to use a visual mode of presentation (i.e., pictures) for the stimuli used in the distraction/rumination manipulation in order to maintain as much consistency as possible between the presentation of the target stimuli and the presentation of the distraction/rumination information.

willingness to try them, in comparison to reactions to and willingness to eat foods in the control condition. It was hypothesized that the disgust salience manipulation would increase disgust reactions since this manipulation focused individuals' attention on to the disgusting properties of the foods and would result in a decreased willingness to try these foods.

Method

Overview

Male and female participants rated the disgust attributes of, and their willingness to taste (later in the session) a set of novel animal and nonanimal foods. Foods were presented in groups of three, to represent a 'meal' typically consumed in other cultures. The first food presented was always an animal food and it was the target food in this study. Each 'meal' was accompanied by written information about each food in the meal and included a brief description of the eating habits and cultural rituals surrounding the meal. Each meal was accompanied by no visual information or one of three kinds of visual information: irrelevant distraction, relevant distraction, or disgust salience. The dependent variables were participants' ratings of the disgust attributes of the target food and their willingness to taste the target food later in the experimental session.

Participants

Participants were 32 female and male students, ranging in age from 18 - 23, enrolled in Introductory Psychology at the University of Toronto at Mississauga. Participants received course credit for taking part in the study.

Stimulus Materials

Food Stimuli. Twelve novel foods were used in this study; eight from the meat/poultry category and four from the vegetable category. Foods were presented in four “meals”, each consisting of two foods from the meat/poultry category and one food from the vegetable category in each meal. The first food presented was in the meat/poultry category and was assigned to be the target food; reactions to this food constituted the main dependent variable. The foods were presented in clear plastic cups covered with plastic lids so that they could be seen but not smelled. Each group of foods (meal) was accompanied by a brief paragraph providing the names of the foods and their origin, along with a description of the rituals and beliefs surrounding consumption of these foods in a particular culture. To ensure that all foods were perceived as novel, they were accompanied by fictitious names and descriptions. Table 12 contains the names and descriptions of the foods used in this study.

Distraction/Rumination Manipulation. Nine photographs were selected for use in this study with three photos in each of the three visual information conditions. Order of presentation of the photographs was counterbalanced across presentation of the meals. In the “irrelevant distraction condition” photographs were selected to focus attention away from the disgust eliciting attributes of the target food and on to something else. In this condition, the distracting photographs (three in total) depicted the vegetable that was part of the meal presented (see Appendix E).

In the relevant distraction condition, the distracting photographs (again, three in total) depicted the target food itself. However, they were chosen to distract

attention from its disgust attributes. They highlighted the cooking techniques and utensils used in the preparation and consumption of the food (see Appendix F).

In the “disgust rumination” condition, photographs showing the preparation of the animals (constituting the target foods) for human consumption were used, in order to remind participants that these foods came from unfamiliar animals which were once alive. More importantly, the 3 photographs used in this condition possessed the ‘negative sensory/texture’ and ‘livingness/animalness’ attributes, discovered in Study 2 to be the primary factors underlying ratings of disgust (see Appendix G).

Since this manipulation was counterbalanced across presentation of the meals, photographs in the “relevant distraction” and “disgust rumination” conditions were chosen for their ability to be perceived as representative of each of the four possible target foods (all animal foods) while photographs in the “irrelevant distraction” condition were chosen for their ability to be perceived as representative of each of the four possible vegetables that were presented.

Measures

For each food, participants were asked to rate, on 7-point bipolar scales, with endpoints labeled “1” disagree strongly and “7” agree strongly the following items:

1. I would be willing to taste a small amount of this food later in the experimental session.
2. This food has (or would have) an unpleasant taste, smell, or texture.
3. Eating this food makes (or would make) me nauseous.
4. The thought of this food in my stomach is unpleasant.
5. This food has an unattractive appearance.

Table 12

Names and Descriptions of the Foods Presented in Each Meal

Names of Foods	Descriptions
Bresner, Nokotop, Schlaten	These three foods are typically prepared by the Naguwoo people of Australia during their annual Festival of Kyos. Bresner are spicy meatballs made from the meat of the Quolt, a wild animal found in the Outback and Nokotop is a root vegetable, commonly grown in Australia, usually served boiled. Schlaten is meat which comes from a small Australian game animal. The Festival of Kyos celebrates the beginning of the harvest season by the Naguwoo people of Australia. Some of the rituals surrounding the Festival of Kyos involve the hunting and skinning of the Quolt and the cooking of the Quolt by the male members of this group.
Trupuk Chips, Bliknot, Walla	These foods are prepared by the people of Pingelap, a small island in the South Pacific, to welcome visitors to the island. Trupuk Chips are thin, smoked pieces of meat, sometimes served with a sauce from the Trupuk, a medium-sized grazing animal indigenous to Pingelap. Bliknot is a stalk vegetable, often marinated in a spicy mixture before serving and Walla is a mixture of meat from several small marsupials found on the island. On Pingelap, the preparation of food is seen as a community endeavor and all members of the community are taught how to slaughter animals to be eaten and how to prepare Trupuk at an early age.

(table continues)

Cassowary, Chayote, Gurdan These three foods are consumed by the people of Tasmania, during their Independence day celebrations. Cassowary is a fleshy animal, native to Tasmania, Australia and New Zealand, typically slow-cooked outdoors. Chayote is a commonly grown, starchy plant, often mashed with a variety of spices to give it its characteristic color. Gurdan is the meat from a small nesting bird common in Tasmania. Cassowary is a highly revered animal in Tasmania and during Independence Day celebrations, the Cassowary is often displayed in the morning, raw, in its entirety, prior to commencement of the outdoor cooking.

Langua, Pendula, Brynza These foods are usually prepared by the people of Onurka, a small Pan-Asian Island, to celebrate their new year. Langua is the meat from the Langua, an undomesticated animal that is often killed for its meat; the meat from this animal is typically fried or boiled. Pendula is a plant that grows freely on the Island and is consumed approximately once a week by the Island's inhabitants. Brynza is the meat from a small, tree-dwelling mammal, indigenous to Onurka. New Year's day celebrations are taken quite seriously by the people of Onurka and many days are spent in cooking and preparation by the entire community, before the celebrations begin. Once the preparation work is over, the community fasts for 24 hours before sitting down together to partake of the foods they've prepared.

Note. Target animal foods are presented in boldface type.

6. Getting this food on my hands would be undesirable.
7. Any dish that contained even the tiniest amount of this food would be unappealing, even if I could not taste, smell, feel, or see it.
8. The idea of what this food is or where it comes from makes it unappealing.
9. This food might contain something that even in modest amounts might physically endanger my body.

Questions 2 through 9 are the questions previously developed by Rozin and Fallon (1980) and were combined as in Study 1 to form scores on the following subscales: sensory-affective, anticipated consequences, ideational, and disgust attributes (refer to Appendix A to view the division of these items in their appropriate subscales). In addition, participants were also asked to rate the familiarity of each food, and to complete the Food Neophobia Scale (FNS; see Appendix C).

Procedure

Participants were run in pairs, in a one-hour laboratory session. They were seated on opposite sides of a table and were separated by wooden partitions to prevent interaction. Upon arrival at the laboratory, participants were told that we were pre-testing a memory task being considered for use in a future experiment. It was further explained that, while memory studies typically involve examining memory for nonsense syllables or other meaningless information, the current study would assess individuals' memories for real, meaningful information – the rituals and beliefs surrounding food and eating behavior in other cultures. They were then informed that we were particularly interested in two aspects of memory: (1) whether memory for such information in written form would differ as a function of whether or not visual information highlighting some aspect of the written information accompanied it, and (2) whether memory would differ as a function of whether or

not they had personal experience with the stimuli described in the written paragraphs.

Participants were then informed that they would see a small subset of a larger number of foods being considered for use in the “real” experiment and that the foods would be presented in groups of three, accompanied by a paragraph containing some information about the foods and the rituals and beliefs surrounding the foods in a particular culture. They were then told that slides (projected on a white wall) highlighting some aspect of the written information would or would not accompany the written information and that the content of the slides ranged from animals being prepared for human consumption to raw vegetables. Participants were then informed that they would answer a variety of questions pertaining to each food, which, according to memory research, would aid in their processing of the information. Participants were reminded that we were also interested in whether memory for the information presented to them differed as a function of immediate personal experience with the foods, and they were informed that a subsequent tasting session would constitute the personal experience portion of the experiment. That is, they would also rate their willingness to taste each food later in the experiment, during a tasting session in which they would taste about half of the foods, and that their willingness ratings would be used to determine which foods they actually tasted during this session. Next, participants were told they would complete some questionnaires relevant to their eating habits while the foods for the tasting session were being prepared, in order to assess extraneous variables that may affect their memory for foods. Participants were then informed that their last

task, after the tasting session, would be a memory recall task, in which slides would be projected on the screen and they would indicate whether or not they had previously seen that slide and to recall as much of the information as possible about the culture depicted.

Participants were then shown 12 novel foods of both animal and nonanimal origin. Foods were presented in groups of three (two novel meats and one novel vegetable) in separate containers on a cafeteria-style lunch tray. All foods were identified by small labels containing their names. Additionally, a brief written description of the foods and the rituals surrounding the use of foods in a particular (fictitious) culture accompanied each group of three foods. Foods were arrayed on the tray and described in the accompanying paragraphs in a meat-vegetable-meat order, with the first meat constituting the target food. Trays were arrayed on a long table, and each tray was covered with a piece of opaque material, with the accompanying description lying face down in front of each tray.⁹ Each tray contained one group of foods, and the order of presentation of these trays was counterbalanced across pairs of participants. Participants were informed that they would uncover the trays and read the accompanying description one tray at a time, working from left to right, and that the experimenter would tell them when to move from one tray to the next. At this point, participants were asked to begin the experiment by removing the cover for the first tray and reading the accompanying description. For some participants this tray contained a meat labeled "Bresner", a

⁹ Since two participants were run in a single session, with dividers between them, each participant was presented with her/his own foods.

vegetable labeled “Nokotop”, and a meat labeled “Schlaten” , which was accompanied by the following written description:

These three foods are typically prepared by the Naguwoo people of Australia during their annual Festival of Kyos. Bresner comes from the Quolt, a wild animal found in the South Pacific, Schlaten is meat which comes from a small Australian game animal and Nokotop are the translucent seeds of a stalk vegetable, commonly grown in Australia. The Festival of Kyos celebrates the transition of seasons by the Naguwoo people of Australia. Some of the rituals surrounding the Festival of Kyos involve the hunting and skinning of the Quolt, and the display of the animal before it is cooked. In addition, males often help to cook the meat typically consumed at this festive time.

After seeing the foods and receiving this information, participants were then randomly assigned to receive one of the distraction/rumination manipulations, each consisting of three pictures, all of which were consistent with information presented in the written description, or no information. In total, participants received one food in each of the four conditions. Photographs were projected on to a white wall at the front of the experimental room at a distance of 4.5 meters; pictures were presented for seven seconds each, for a total of 21 seconds of pictorial information in each of the distraction/rumination conditions. In the control condition, participants did not receive any visual information. Photographs used in the distraction/rumination conditions were introduced verbally with one sentence that indicated what the pictures were of, but which offered no additional information about the food or the culture which they were from. Each condition was accompanied by its own distinct, standard sentence. In the “irrelevant distraction” condition, participants saw pictures of the raw vegetable that was a part of the same meal (see Appendix E for these pictures); these pictures were introduced with the following sentence: “These are

pictures of the (insert name of novel vegetable in meal here) in its raw form and being purified.” In the “relevant distraction” condition, participants saw pictures of the cooking techniques and utensils used to prepare the target meat (see Appendix F for these pictures). These photographs were accompanied by the following information: “These are pictures of the typical cooking and eating utensils used in the preparation of the (insert Animal name of target food).” In the “disgust” condition, participants saw pictures of the target novel animal highlighting it being prepared for human consumption (see Appendix G for pictures), and which was accompanied by the following sentence: “These are pictures of the (insert Animal name of target food).” In the “control” condition, participants were asked to “Please complete your ratings now.” Pictures presented in the relevant distraction and disgust conditions were chosen for their ability to represent any of the four target meats and pictures in the irrelevant distraction condition were chosen for their ability to match any of the four vegetables presented. The order of presentation of each group of each set of pictures was counterbalanced across presentation of the meals and presentation of the meals was counterbalanced across pairs of participants.

After receiving the visual information or no information, participants were asked to rate their willingness to taste and familiarity with each food in the meal (i.e., the target food and the other two foods), and completed the items developed by Rozin and Fallon (1980), including the disgust attributes subscale. Participants were under the impression that their willingness ratings would determine which foods they actually tasted later in the session. It should be noted however, that

participants did not actually taste any of the foods. Rated beliefs about the disgust attributes of the foods and willingness to taste the target animal foods constituted the main dependent variables. While the foods were “being prepared for the tasting session” participants were asked to complete a questionnaire package containing the Food Neophobia Scale. When this task was completed, participants were informed that the experiment was over and were thoroughly debriefed.

Results

Overview

Unless otherwise specified, all analyses were 1-way repeated measures analyses of variance with distraction/rumination condition (control, irrelevant distraction [vegetable focus], relevant distraction [cooking focus], or disgust salience [animal focus]) as the within subject variable.¹⁰ Although participants made ratings for all 12 foods (i.e., 3 foods/meal), the present analyses pertain only to ratings made of the target animal food. Analyses were carried out first on the disgust attributes subscale to assess if the distraction/rumination manipulation had any effects on participants’ rated beliefs about the disgust attributes of the target foods. Then, the analysis was carried out on participants’ ratings of willingness to try the target animal foods.

¹⁰ Scores on the FNS were subjected to a median split and were entered (in separate analyses) as between subjects variables in order to examine the effects of these variables, the distraction/rumination manipulation, and their interaction on the two dependent variables. Since these analyses did not yield any significant effects they will not be presented.

Manipulation Checks

Familiarity ratings of the target foods were calculated, collapsing across actual foods (since order of presentation of meals was counterbalanced across conditions). The target foods received a mean familiarity rating of 1.09. Although ratings of familiar foods are not available in this study with which to compare these means, these ratings are consistent with the mean of novel animal foods in Study 1, ($M_{\text{novel animal foods}} = 1.44$ vs. $M_{\text{familiar animal foods}} = 6.80$) indicating that our target novel animal foods were, in fact, perceived as novel.

Disgust Attributes

Individuals' ratings of the disgust attribute items were averaged to form an overall score on the disgust attributes subscale (as we did in Study 1; refer to Appendix A to view the items in this subscale). A one-way repeated measures analysis of variance was then performed on these scores, revealing that the distraction/rumination manipulation did not have any effects on participants' rated beliefs about the disgust attribute properties of these foods, $F(3,93) = .57$, *ns*.

Willingness to Taste

The one-way repeated measures analysis of variance carried out on willingness-to-eat ratings for the target animal foods yielded no significant effects, $F(3, 93) = .23$, *ns*, indicating that the distraction/rumination manipulation did not affect participants' willingness to try the target foods.

Discussion

The purpose of the present study was to ascertain whether individuals' experience of disgust for novel animal foods could be decreased and whether

willingness to taste novel animal foods could be increased. It was hypothesized that the irrelevant and relevant distraction manipulations would decrease the experience of disgust associated with novel animal foods and increase willingness to try novel animal foods, in comparison to reactions to and willingness to sample foods in the control and disgust rumination condition.

The distraction/rumination manipulation had no effect whatsoever on participants' ratings of the disgust attributes of the novel animal foods or on rated willingness to try these foods. Moreover, this absence of significant results was not due to either ceiling (for increasing disgust with the rumination manipulation) or floor (for decreasing disgust with the distraction manipulation) effects. In fact, a comparison of the mean ratings of novel animal foods between Study 1 and Study 3 (note that Study 3 used the same novel animal foods used in Study 1, along with two other novel animal foods) indicates that participants in Study 3 had significantly decreased perceptions of the disgust attributes of novel animal foods ($M_{\text{Study 1}} = 3.54$, $M_{\text{Study 3}} = 2.81$; $t(108) = 2.46$, $p < .05$) and were more willing to try these foods ($M_{\text{Study 1}} = 3.33$, $M_{\text{Study 3}} = 4.16$; $t(108) = -2.144$, $p < .05$). This occurred despite the fact that participants in Study 3 were significantly more neophobic than participants in Study 1 ($M_{\text{Study 1}} = 32.5$, $M_{\text{Study 3}} = 38.09$; $t(108) = -1.959$; $p < .05$) and rated the foods as less familiar than participants in Study 1 ($M_{\text{Study 1}} = 1.44$, $M_{\text{Study 3}} = 1.09$; $t(108) = 2.12$, $p < .05$).

At the very least, it was expected that the rumination condition would increase disgust reactions towards these foods and decrease willingness to try them. It may be that the rumination condition may have been ineffective at

increasing individuals' experience of disgust towards novel animal foods because participants were forewarned as to the content of the pictorial stimuli used in this condition. Previous research in attitude change has demonstrated that forewarning individuals about the content of a communication leads to less attitude change in these individuals compared to those who are not forewarned (McGuire, 1969; McGuire & Papageorgis, 1962; Petty & Cacioppo, 1977). The pictures used in the rumination condition were graphic in nature and consisted of an animal being skinned and prepared for human consumption and a display of innards spilling forth from the gut of an animal. Because of the graphic nature of these pictures, we felt that it was unethical not to inform participants about their content prior to participation. To circumvent this ethical dilemma all participants were told prior to participation that the pictures they would be seeing would range from "...the preparation of meat in various stages after the animal has been caught to pictures of vegetables in their raw, unprocessed form." In addition, the consent form used in this study reminded participants of the graphic content of the pictures by including the following statement: "These [pictures] may include pictures of raw meat, innards and animal carcasses." Although we tried to minimize the warnings used in this experiment, it is still possible that these statements served as enough of a warning to decrease the effectiveness of these pictures in the rumination condition.

Although this explanation offers some insight into why the rumination manipulation may have been ineffectual, it does not explain why the distraction conditions failed to produce any results. It is possible that the distraction manipulations were simply too weak – participants may not have been distracted

enough. Closer examination of the content of the photographs used in the distraction conditions suggests that these pictures may not have been distracting at all. That is, these photographs may not have had the capacity to focus participants away from their experience of disgust. Consider first the irrelevant distraction condition. In this condition the photographs used were of a novel vegetable in its raw, unprocessed form. The results of Study 1 indicate that individuals' beliefs about the disgust attributes of novel nonanimal foods predicts willingness to try these foods. Thus, it is possible that the irrelevant distraction manipulation, designed to focus participants' attention away from the disgusting properties of the novel animal foods by focusing them on a completely different food (i.e., a novel vegetable) simply maintained their experience of disgust even though the target of the disgust reaction had changed (from a novel animal to a novel nonanimal food). It should be noted however, that the photographs used in this condition did not exhibit the characteristics found to underlie disgust reactions in Study 2 (i.e., negative sensory/textural properties and reminders of livingness/animalness), suggesting that a more likely possibility is simply that this manipulation was not strong enough to reduce individuals' experience of disgust.

The photographs used in the relevant distraction condition were directly related to the target animal foods and attempted to distract participants away from the disgust attributes of these foods by making salient the cooking techniques used to prepare these foods. However, since these photographs focused on the preparation and cooking of the foods, they may have inadvertently reminded participants of the negative sensory/textural properties of the foods and the fact that

the foods came from animals that were once alive, thereby diminishing their capacity to reduce individuals' experience of disgust.

GENERAL DISCUSSION

The research described in this dissertation had three goals: (1) to understand the cognitive and emotional factors which underlie rejection of novel foods, particularly novel animal foods, (2) to identify the factors underlying disgust reactions, and (3) to develop a technique to reduce rejections of novel foods based on disgust. Together, the results of these studies contribute to our knowledge of food-related disgust and have implications for future directions of research in this area.

Review of the Findings

Study 1 was designed to identify the specific cognitions and emotions that contribute to willingness to try familiar and novel nonanimal and animal foods. Willingness to try familiar nonanimal foods was predicted by beliefs about the negative sensory properties of the foods and joy elicited by the thought of eating them. Willingness to try familiar animal foods was predicted by beliefs about the negative sensory properties of the foods and beliefs about the anticipated negative consequences of eating them. Willingness to try novel foods of both nonanimal and animal origin was predicted by cognitions about their disgust attributes and feelings of interest evoked by the thought of consuming these foods.

Given the importance of beliefs about the disgusting properties of the foods in predicting willingness to eat both novel animal and nonanimal foods, the goal of Study 2 was to determine what characteristics of foods makes them disgusting. In this study, participants read a set of scenarios designed to depict potentially disgusting foods; participants in Sample 1 rated the perceived disgustingness of the foods while participants in Sample 2 rated the foods on a variety of attributes relevant to theoretical conceptions of disgust. Multidimensional scaling revealed two dimensions, negative sensory/textural properties of the foods and reminders of livingness/animalness, that accounted for most of the variability in ratings of perceived disgustingness of the foods depicted in the scenarios. This study was the first of its kind to actually identify the characteristics of foods which elicit disgust reactions.

In Study 3 our attention turned to discovering a technique that could be used to decrease the experience of the disgust attributes of novel animal foods and increase willingness to try them. Participants in this study were exposed to pictorial information designed to either distract their attention away from the disgusting attributes of a set of novel animal target foods or cause them to ruminate about their disgusting attributes. The distraction/rumination manipulation had no effect whatsoever on participants' ratings of the foods' disgust attributes or their willingness to try them.

Implications for Food-Related Disgust Research

The results of Study 1 suggest that individuals' perceptions of disgust attributes influence willingness to try not only novel animal foods, as predicted, but

also novel nonanimal foods. This latter result is discrepant with findings from previous research which has demonstrated that individuals' beliefs about the negative sensory-affective properties of foods and the anticipated consequences of ingesting them underlie rejections of novel nonanimal foods (Pliner & Pelchat, 1991; Rozin & Fallon, 1980), and is discrepant with Rozin and Fallon's (1987) supposition that disgust reactions are exhibited primarily in relation to animal foods. It should be noted, however, that the first dimension (accounting for over 75% of the variance in ratings of disgustingness) found to underlie disgust reactions in Study 2 was not solely applicable to animal foods. That is, nonanimal foods also have the capacity to be perceived as having negative sensory/textural properties, providing some support (albeit indirectly) for the results of Study 1 and for the notion that animal foods may not be the only stimuli capable of evoking disgust responses.

If the findings pertaining to novel nonanimal foods prove to be robust, this leads to the question of whether disgust reactions to animal foods are stronger than disgust reactions to nonanimal foods. A paired t-test, carried out on mean ratings of perceptions of the disgusting attributes of novel animal and nonanimal foods in Study 1 suggests that participants do have stronger disgust responses to animal foods ($M_{\text{animal}} = 3.54$, $M_{\text{nonanimal}} = 2.67$; $t(77) = 5.41$, $p < .01$). If disgust reactions to nonanimal foods are weaker than disgust reactions to animal foods, it is possible that these reactions may be more easily overcome, even by relatively mild manipulations such as telling participants that these foods "taste good" or are "good for you" (as in previous studies). Recall that prior research has demonstrated that highlighting the positive poles of the sensory-affective and anticipated

consequences dimensions increases willingness to try novel nonanimal foods; however, it is not known if these manipulations decrease perceptions of the disgusting attributes of these foods (Martins et al., 1997; McFarlane, 1997; Pelchat & Pliner, 1995). Although this is a viable avenue of research to pursue, we did not carry out such an investigation because we were particularly interested in understanding and identifying techniques to decrease disgust reactions towards novel animal foods since little empirical work has focused on them. However, if the finding that perceptions of disgust attributes as one of the primary predictors of willingness to try novel nonanimal foods is replicated, future research should ascertain if highlighting the positive poles of the sensory-affective and anticipated consequences dimensions reduces individuals' disgust reactions towards these foods.

Since animal foods elicit a stronger disgust reaction than nonanimal foods, it is likely that stronger manipulations, targeting directly the factors underlying disgust reactions, may be required to reduce perceptions of the disgusting properties of the former. In Study 3, a distraction manipulation was ineffective at reducing perceptions of the disgust properties of the foods and had no effect on willingness to try these foods. Given that the results of Study 2 illustrate that two dimensions underlie disgust reactions towards foods, it is possible that the manipulations used previously (i.e., in Study 3; Martins et al., 1997) were ineffective at increasing willingness to try novel animal foods because they did not attempt to directly improve individuals' perceptions of novel animal foods on the two dimensions thought to underlie disgust reactions. For example, these manipulations were not

designed to direct individuals' attention to why these foods should not be perceived as having negative sensory/textural properties (which, theoretically, should decrease individuals' experience of disgust towards these foods); instead the manipulations used tried to reduce disgust indirectly, by focusing individuals' attention onto something else. Since Study 1 indicates that perceived disgust attributes of novel animal foods predicts willingness to taste these foods, reducing individuals' disgust reactions towards these foods should increase willingness to taste them. Since the results of Study 3 inform us that using a technique (i.e., distraction) that attempts to reduce disgust reactions indirectly has no effect on these reactions, a stronger technique, targeted directly at the two dimensions underlying disgust reactions should be developed and examined for its utility.

For example, investigations examining the link between spider phobias and disgust have demonstrated (both directly and indirectly) that individuals with subclinical and clinical spider fears show higher levels of disgust sensitivity than non-phobic controls (Matchett & Davey, 1991; Davey, 1994; Merckelbach, de Jong, Arntz, & Schouten, 1993; Mulkens, de Jong, & Merckelbach, 1996), leading Davey and his colleagues to assert that spiders are more likely to acquire a disgust-evoking status in individuals with high levels of disgust sensitivity (Davey, Forster, & Mayhew, 1993). If the disgust-evoking status of spiders is a critical feature of spider phobias, then treatments designed to reduce spider phobias should reduce their disgust-evoking capabilities. In a study designed to assess this, de Jong, Andrea and Muris (1997) assessed spider fear, general disgust sensitivity, and the disgust-evoking status of spiders in a group of spider-phobic girls, both before and after a

treatment consisting of desensitization and in vivo exposure. Scores were then compared to those of controls. As expected, the spider phobic group exhibited more spider fear, general disgust sensitivity and considered spiders more disgusting than the control group, both before and after treatment. More importantly, among spider phobics, both fear and the disgust-evoking status of spiders decreased after treatment, suggesting that treatments targeting directly the disgust-evoking properties of disgust-eliciting objects diminish their ability to produce disgust reactions. If the disgust evoking properties of spiders (a live animal) can be reduced via a combination of desensitization and exposure, it may be that such techniques would have the capacity to diminish disgust reactions towards novel animal foods.

Alternatively, it may be that positively transvaluing novel animal foods may lead to increased willingness to try them. As stated in the Introduction, rejection of foods based on disgust occur because of what a food is, where it comes from or its social history (e.g., who touched it). The opposing pole of the disgust reaction involves acceptance of food because of its nature, origin, or social history, and is described as positive transvaluation. While the nature, origin, or social history of foods rejected on the basis of disgust have rendered them extremely negative and offensive, foods accepted on the basis of positive transvaluation are those which have been deemed extremely positive and favorable because of their nature, origin, or social history. Additionally, acceptance of positively transvalued foods is accompanied by the belief that the positive properties of the foods will somehow be magically transmitted to the eater. No research to date has definitively examined whether positive transvaluation reduces disgust reactions towards novel animal

foods or increases willingness to try them. Although Study 3 did not directly assess the utility of positive transvaluation, comparison of the results of this study with those of Study 1 suggest that this may be a worthwhile area for future research. Closer examination of the descriptive paragraphs that accompanied the foods in Study 3 (see Table 12), indicates that these foods were described as having a positive social status – they were all described as being part of important rituals or celebrations. Even though this was a relatively mild (and unintentional) positive transvaluation of these foods (i.e., positive social history), an examination of the mean ratings of novel animal foods on the disgust attributes subscale and rated willingness to try these foods in Studies 1 and 3 indicated that participants in the latter rated the disgust attributes of novel animal foods significantly less negatively and were significantly more willing to try these foods (refer to Study 3's Discussion for these means). Moreover, these results do not appear to stem from differences in trait levels of food neophobia (FNS) or perceived familiarity of the foods between participants in the two studies. This comparison suggests that an experiment properly designed to assess the impact of positive transvaluation on disgust reactions to novel animal foods and willingness to try them may be a fruitful avenue of research.

Conclusions

In summary, the present series of studies provides us with a better understanding of what factors contribute to acceptance/rejection of foods and, more specifically, contributes to our knowledge of food-related disgust reactions. We have learned that, contrary to results of previous investigations, disgust reactions

can be exhibited towards novel nonanimal foods and we have identified the characteristics of foods that make them disgusting. In addition, we have suggested that treatments involving a combination of desensitization and exposure or highlighting the opposing pole of disgust rejections may reduce these types of rejections.

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Appendix A

The following questions, previously developed by Rozin and Fallon (1980) comprised the cognition subscales used in Study 1. These questions were answered on a 7-point bipolar scale, ranging from "1" disagree strongly to "7" disagree strongly.

<u>Subscale Name</u>	<u>Items Used</u>
Sensory-Affective	<ol style="list-style-type: none"> 1. This food has (or would have) an unpleasant taste, smell, or texture. 2. This food has an unattractive appearance.
Anticipated Consequences	<ol style="list-style-type: none"> 1. This food might contain something that even in modest amounts could physically endanger my body.
Ideational (General)	<ol style="list-style-type: none"> 1. The idea of what this food is or where it comes from makes it unappealing.
Disgust Attributes	<ol style="list-style-type: none"> 1. Eating this food makes (or would make) me nauseous. 2. The thought of this food in my stomach is unpleasant. 3. Getting this food on my hands would be undesirable. 4. Any dish that contained the tiniest amount of this food would be unappealing, even if I could not taste, smell, feel, or see it.

Appendix B

Name of Food: _____

Imagine that you have just eaten a small amount of this food. Please rate the extent to which eating this food would make you.....

	Not at All				Extremely
1. Feel regret, sorry that you ate the food	1	2	3	4	5
2. Feel sheepish, like you do not want to be seen eating this food	1	2	3	4	5
3. Feel glad	1	2	3	4	5
4. Feel like something stinks, puts a bad taste in your mouth	1	2	3	4	5
5. Feel like you can't stand yourself	1	2	3	4	5
6. Feel embarrassed if somebody sees you	1	2	3	4	5
7. Feel unhappy, blue, downhearted	1	2	3	4	5
8. Feel surprised, like when something suddenly happens you had no idea would happen	1	2	3	4	5
9. Feel shy, like you want to hide	1	2	3	4	5
10. Feel like what you're doing is interesting	1	2	3	4	5
11. Feel scared, uneasy, like something might harm you	1	2	3	4	5
12. Feel mad at yourself	1	2	3	4	5
13. Feel happy	1	2	3	4	5
14. Feel so interested in what you're doing that you're caught up in it	1	2	3	4	5
15. Feel amazed, like you can't believe what you're eating, it's so unusual	1	2	3	4	5

16.	Feel fearful, like you're in danger, very tense	1	2	3	4	5
17.	Feel sad and gloomy, almost like crying	1	2	3	4	5
18.	Feel like you did something wrong	1	2	3	4	5
19.	Feel bashful, embarrassed	1	2	3	4	5
20.	Feel disgusted, like something is sickening	1	2	3	4	5
21.	Feel joyful, everything is rosy	1	2	3	4	5
22.	Feel like people will laugh at you	1	2	3	4	5
23.	Feel like things are so rotten it could make you sick	1	2	3	4	5
24.	Feel sick about yourself	1	2	3	4	5
25.	Feel like you ought to be blamed for something	1	2	3	4	5
26.	Feel the way you do when something unexpected happens	1	2	3	4	5
27.	Feel alert, curious, kind of excited about something unusual	1	2	3	4	5
28.	Feel angry, irritated	1	2	3	4	5
29.	Feel discouraged	1	2	3	4	5
30.	Feel afraid	1	2	3	4	5
31.	Feel refreshed	1	2	3	4	5
32.	Feel relaxed	1	2	3	4	5
33.	Feel content	1	2	3	4	5
34.	Feel cheerful	1	2	3	4	5
35.	Feel less stressed	1	2	3	4	5

Appendix C
Food Neophobia Scale

Please answer the questions by using the numbers from the rating scale below.
Place your answers in the spaces to the left of the questions.

- 1 = DISAGREE STRONGLY
- 2 = DISAGREE MODERATELY
- 3 = DISAGREE SLIGHTLY
- 4 = NEITHER AGREE NOR DISAGREE
- 5 = AGREE SLIGHTLY
- 6 = AGREE MODERATELY
- 7 = AGREE STRONGLY

- _____ I am constantly sampling new and different foods.
- _____ I don't trust new foods.
- _____ If I don't know what is in a food, I won't try it.
- _____ I like foods from different countries.
- _____ Ethnic food looks too weird to eat.
- _____ At dinner parties I will try a new food.
- _____ I am afraid to eat things I have never had before.
- _____ I am very particular about the foods I will eat.
- _____ I will eat almost anything.
- _____ I like to try new ethnic restaurants.

Appendix D

Disgust Sensitivity Scale

Please circle T (true) or F (false):

- T F 1. It bothers me to see someone in a restaurant eating messy food with his fingers.
 T F 2. Seeing a cockroach in someone else's house doesn't bother me.
 T F 3. It bothers me to hear someone clear a throat full of mucous.
 T F 4. I think it is immoral for people to seek sexual pleasure from animals.
 T F 5. It would bother me to be in science class, and to see a human hand preserved in a jar.
 T F 6. I would go out of my way to avoid walking through a graveyard.
 T F 7. I never let any part of my body touch the toilet seat in public restrooms.
 T F 8. 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 fly swatter.
 T F 9. I might be willing to try eating monkey meat, under some circumstances.
 T F 10. It would bother me to see a rat run across my path in a park.
 T F 11. If I see someone vomit, it makes me sick to my stomach.
 T F 12. I think homosexual activities are immoral.
 T F 13. It would not upset me at all to watch a person with a glass eye take the eye out of the socket.
 T F 14. It would bother me tremendously to touch a dead body.
 T F 15. I probably would not go to my favorite restaurant if I found out that the cook had a cold.
 T F 16. 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.

Please rate (0, 1, or 2) how disgusting you would find the following experiences.

0 = not at all disgusting

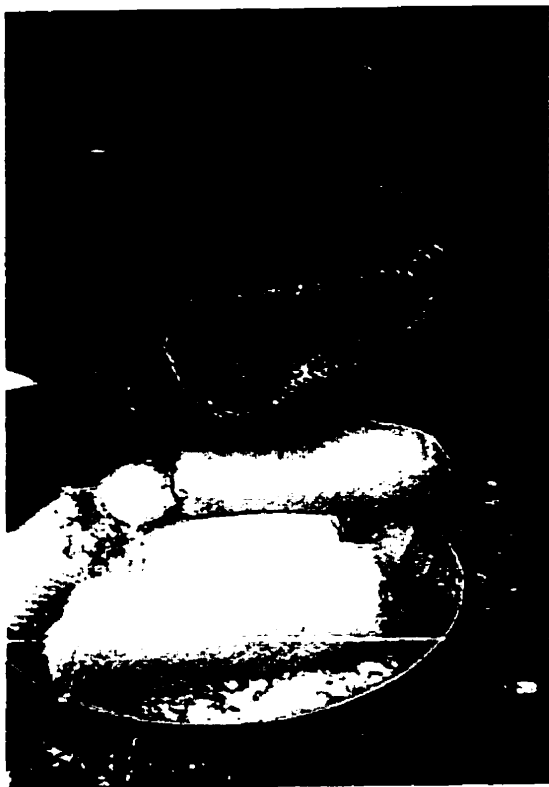
1 = slightly disgusting

2 = very disgusting

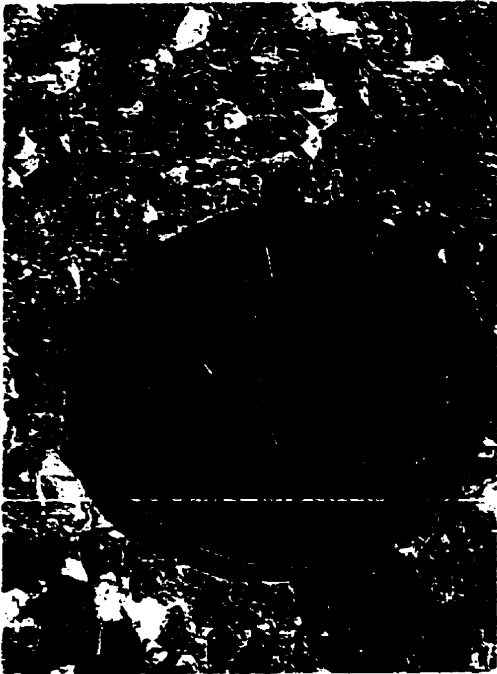
If you think something is bad or unpleasant, but not disgusting, you should write "0".

- _____ 17. You see someone putting ketchup on vanilla ice cream, and eat it.
 _____ 18. You see maggots on a piece of meat in an outdoor garbage pail.
 _____ 19. While you are walking through a tunnel under a railroad track, you smell urine.
 _____ 20. You hear about a 30 year old man who seeks sexual relationships with 80 year old women.
 _____ 21. You see someone accidentally stick a fishing hook through his finger.
 _____ 22. Your friend's pet cat dies, and you have to pick up the dead body with your bare hands.
 _____ 23. You take a sip of soda, and then realize that you drank from the glass than an acquaintance of yours had been drinking from.
 _____ 24. A friend offers you a piece of chocolate shaped like dog-doo.
 _____ 25. You are about to drink a glass of milk when you smell that it is spoiled.
 _____ 26. You are walking barefoot on concrete, and you step on an earthworm.
 _____ 27. You see a bowel movement left unfleshed in a public toilet.
 _____ 28. You hear about an adult woman who has sex with her father.
 _____ 29. You see a man with his intestines exposed after an accident.
 _____ 30. You accidentally touch the ashes of a person who has been cremated.
 _____ 31. You discover that a friend of yours changes underwear only once a week.
 _____ 32. As part of sex education class, you are required to inflate a new unlubricated condom, using your mouth.

Appendix E



Appendix F



Appendix G

