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Looks like chicken: Exploring the law of similarity in evaluation of foods of animal origin and their vegan substitutes

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ABSTRACT

Eighty omnivorous college students (four groups of 20) given chocolate milk, macaroni and cheese, chicken tenders and meatballs, or vegan substitutes for those four foods, were told either that they were eating the animal products or vegan substitutes. We expected the subjects who were told that they were eating vegan foods to rate those foods as less familiar and therefore expected them to be less willing to try them. We also thought that the subjects would expect those foods to taste worse and be more dangerous and disgusting, particularly the “flesh foods” and their vegan substitutes (chicken tenders and meatballs). Prior to eating the products, no difference was found in ratings of familiarity, willingness to try, anticipated distaste, danger, or disgust between those subjects shown the products of animal origin and those shown the vegan substitutes for those products nor between subjects told they were viewing animal or vegan products. However, there were differences between the meatball and the other foods on these measures regardless of what they were told about them (animal or vegan). All meatballs were rated as less familiar and more disgusting than the other foods and more dangerous than the chicken tender. Subjects expected the meatballs to taste worse than the other foods and were less willing to try them. Once they tasted the products, they rated the taste of the foods they were told were vegan better than those they were told were of animal origin. Vegan products that resemble animal products are responded to similarly to their animal counterparts as predicted by the law of similarity, one of the laws of sympathetic magic.

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Introduction

Humans are omnivores and eat many different foods including both animal and plant products. Although many foods of both types are widely accepted, rejection of both types of food items is common. Rozin and Fallon (1980) proposed three categories of reasons for food rejections: sensory-affective reasons (distaste), anticipation of bodily harm (danger), and ideational factors (inappropriate and disgust).

The rejection of a food based on sensory-affective reasons occurs when the subject expects the food to possess negative sensory qualities such as a bad taste, texture or odor. This is called “distaste.” Distaste is a common reason for rejection of plant-based foods (Glasson, Chapman, & James, 2010; Lucan, Barg, & Long, 2010) possibly in part because of the presence of bitter components in

many plants (Drewnowski, Henderson, & Barratt-Fornell, 2001). However, distaste has not been found to be a primary reason for rejection of animal-based foods (Kubberod, Ueland, Tronstad, & Risvik, 2002; Mooney & Walbourn, 2001).

If a subject anticipates some unpleasant consequence following consumption of the food, the rejection is categorized as dangerous (Rozin & Fallon, 1980). In the case of “danger”, subjects expect that some bodily harm, either short term (e.g., gastrointestinal distress) or long-term (e.g., heart disease) will result if they consume the food. Foods rejected for this reason are not necessarily expected to taste bad (Fallon & Rozin, 1983). Rejection due to danger often comes from food allergies (Rozin & Fallon, 1980). Although many danger-based food rejections occur to plant-based food because of food allergies (e.g., peanuts, gluten), rejection of animal-based foods due to danger is also common (Martins & Pliner, 2005). Gastrointestinal distress due to consumption of dairy products occurs in many people due to lactose intolerance. In addition, eating of animal-based foods has been associated with an increase in heart disease and weight gain and these foods are often rejected for these reasons (Lea & Worsley, 2002; Mooney & Walbourn, 2001).

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Ideational factors can result in two kinds of rejections (Fallon & Rozin, 1983; Rozin & Fallon, 1980). Foods can be considered as “inappropriate” if the culture does not consider those items to be food (Rozin & Fallon, 1980). These are items that elicit little affect and are not thought to be particularly bad-tasting (Rozin & Fallon, 1980). So, for example, tree bark would be classified as inappropriate in most cultures. On the other hand, ideational factors can cause foods to be rejected because they are considered “disgusting” (Rozin & Fallon, 1980). In this case, knowledge of its source results in the food being rejected (Fallon & Rozin, 1983). Unlike inappropriate foods, disgusting foods result in negative affect and are expected to be bad-tasting (Fallon & Rozin, 1983). In fact, the literal meaning of disgust means “bad taste.” Disgusting items have the ability to contaminate other items and are usually animal or animal products (Angyal, 1941; Rozin & Fallon, 1987).

Disgust for animal-based foods is influenced by their degree of “animalness” and the degree to which they remind us that their source was a living animal (Angyal, 1941; Martins & Pliner, 2006; Rozin & Fallon, 1987). Disgust responses to meat are greater if the meat is presented in such a manner as to increase the association of a meat with the animal source (e.g., showing cuts of raw chicken such as legs and wings versus pieces of cut-up chicken cooked in a dish containing other foods, Kubberod, Dingstad, Ueland, & Risvik, 2006).

Not only the presentation of animal foods (e.g., small pieces versus whole body parts), but also the type of animal foods affects the elicitation of disgust. For example, Kubberod et al. (2006) found that raw red meat elicits more disgust than does chicken (see also Kubberod et al., 2002). Rozin and Fallon (1980) found that although milk is clearly of animal origin, it fell into the distaste rather than disgust category (except for human milk). Thus, it appears that not all foods of animal origins elicit the same level of disgust. Red meat is more likely than chicken or non-meat animal products such as milk or cheese to elicit disgust. The more meat reminds people of animals the more likely it is to elicit disgust.

Recently, vegan substitutes for animal-based foods have become available (McIlveen, Abraham, & Armstrong, 1999). There are various vegan substitutes for cows’ milk, including soy, almond and rice milks. There are also yogurt, cheese, chicken, and red meat vegan substitutes made of soy and/or other vegetable-based ingredients. Many of these products are made to resemble specific animal-based foods. For example, there are vegan “meatballs”, “beef tips”, and “chicken tenders”.

Rozin, Millman, and Nemeroff (1986) have shown that objects made to resemble disgusting objects elicit disgust through the law of similarity, one of the laws of sympathetic magic (Frazer, 1959; Mauss, 1972; Rozin & Nemeroff, 1990). Rozin et al.’s subjects rated their desire to eat some fudge in the shape of a muffin higher than the same fudge in the shape of dog feces. According to the law of similarity, things that look alike have the same properties or essence. Therefore, it is possible that non-animal foods that resemble animal foods cause the same reactions as seen with animal foods, including disgust. This might be particularly true for meat substitutes that are processed such as “balls”, “burgers”, “sausages”, and “coated” items since the animal and non-animal versions of these foods are considered to be from the same food category (Hoek, van Boekel, Voordouw, & Luning, 2011) and therefore similar.

In addition to affecting ratings of disgust, the law of similarity should affect other aspects of a food such as willingness to try it, distaste, danger and liking. Rozin et al. (1986) found that subjects were less willing to taste sugar from a jar they had labeled “poison” than from another jar possibly because they considered it to be dangerous to eat. Tuorila, Meiselman, Bell, Cardello, and Johnson (1994) found that similarity of a novel food to a familiar, already liked food can also increase liking for the novel food once tasted.

The novelty of vegan substitutes relative to their animal counterparts among individuals who are not vegan, might also influence evaluation of these foods. If vegan substitutes are considered to be novel it might be expected that, as with other novel foods, people would expect them to taste unpleasant and be dangerous (Pliner, Pelchat, & Grabski, 1993). People would thus be less willing to try these foods than they would be to try their more familiar animal-based counterparts. Hoek, Luning, Weijzen, Engels, Kok, and de Graaf (2011) did find unfamiliarity to be the most important reason for not eating meat substitutes. In addition, as with other novel foods, once people taste them they might rate them as more unpleasant than the more familiar foods (Birch & Marlin, 1982; Pliner, 1982).

The effect of neophobia on disgust, danger, and distaste reactions and unwillingness to try vegan foods that resemble more familiar animal products might actually be less than if these products did not resemble familiar animal foods. That is, similarity of a vegan substitute to a familiar animal food might reduce neophobia and therefore increase willingness to try and liking for the food. The more a vegan food shares sensory properties with a more familiar animal food the more it might be found acceptable (Hoek et al., 2011). For example, an imitation chicken tender might be more accepted than the same ingredients not shaped like a chicken tender. This similarity might make people more willing to taste it because it looks like a real chicken tender and also make them like it more.

Just thinking that a food is either of plant or animal origin might affect liking for the food. If neophobia increases disgust, danger, and distaste reactions and decreases willingness to try and liking for the food, telling subjects that a food is the more familiar animal product might affect the evaluation of the food in a positive way. On the other hand, telling subjects that a product is a less familiar vegan substitute might have a negative impact. Labeling has been shown to affect liking ratings of foods (Guinard, Uotani, & Schlich, 2001; Pliner & Pelchat, 1991; Torres-Moreno, Tarrega, Torrescasana, & Blanch, 2011) and food odors (De Araujo, Rolls, Velazco, Margot, & Cayeux, 2005; Herz & von Clef, 2001; Zellner, Hoer, & Feldman, 2014). If foods are labeled in such a way as to indicate a superior product they are more positively evaluated.

Visual similarity of a vegan food to a familiar animal product and labeling it as such should only increase liking for the vegan food if the food is good enough to be accepted as the animal product. If the taste, texture, or other sensory quality of the food is not what the subjects expects, a decrease in liking might occur (Zellner, Strickhouser, & Tornow, 2004).

The present study investigated people’s willingness to try, and their ratings of disgust, danger, and distaste for animal and non-animal (vegan) versions of foods that they were told were either vegan substitutes for animal products or the actual animal products. Four types of foods were presented to each subject. The foods were either a vegan or animal version of chocolate milk, macaroni and cheese, chicken tender, or meatball. After eating the foods the subjects also rated their liking for the foods.

If the vegan versions of the foods are more unfamiliar than the animal versions, we expect less willingness to try the foods subjects think are vegan, lower ratings of liking for the taste and higher ratings of danger (Pliner et al., 1993) and distaste (Martins & Pliner, 2005) for those foods. We expect to see more disgust for the flesh foods (chicken tender and meatball) than either the milk or cheese (Pliner & Pelchat, 1991). This should be true of both the vegan and animal-based foods and the foods that people are told are animal-based and those they are told are vegan due to the similarity in the look and name of the foods due to sympathetic magic. The disgust ratings might be higher for both the vegan and animal-based meatball than for the other foods since it is a red meat or red meat substitute. Vegan foods also might

Table 1
Main hypotheses.

1. If the vegan foods or those that subjects are told are vegan are rated as less familiar people should be less willing to try them, and should rate them higher on distaste, danger, and disgust than those that are animal-based or those they are told are animal-based. They should also like them less than those that are animal-based or that they are told are animal-based
2. Because the vegan foods used look like the animal versions they might be rated similarly on familiarity. Differences between the foods that are vegan and animal or that subjects are told are vegan and animal might therefore not occur. The sympathetic magic law of similarity might cause the vegan versions (or ones they are told are vegan) to be rated like the animal-based versions or those they think are animal-based versions
3. If the law of similarity has an effect on vegan products made to look like those of animal origin, then the “flesh foods” (both vegan and animal and those subjects were told were vegan or animal) should be rated higher on distaste, danger, and disgust than the “dairy” foods. This should be particularly true for the meatballs as an example of “red meat”

be liked less than the animal products if they taste different from the animal versions and people’s flavor expectations are violated (Zellner et al., 2004). See Table 1 for main hypotheses.

Methods

Participants

Subjects were 80 Montclair State University students, 52 females and 28 males with a mean age of 21 years. The composition of the Montclair State University student body is approximately 49% White, 22% Hispanic, 9% Black, and 5% Asian (the rest are mixed race or not reported). Most of the students come from the state of New Jersey (95%); the majority from the urban and exurban areas of northern New Jersey. Most of the subjects were recruited from the psychology department subject pool which is one way to fulfill a requirement for some psychology courses. The rest of the subjects were volunteers from the university campus. No subjects received monetary compensation for participating. The subjects were randomly divided into four groups: 20 tasted the vegan foods and were told that they were vegan, 20 tasted the vegan foods and were told that they were of animal origin, 20 tasted the animal-based foods and were told that they were vegan, and 20 tasted the animal-based foods and were told they were of animal origin. Prospective subjects who indicated, on a screening questionnaire, that they had food allergies or dietary restrictions (including not eating meat) were excluded. Three additional subjects were excluded from data analysis due to incomplete responses (parts of the questionnaires were left blank).

Materials

Foods (macaroni and cheese, meatball, chocolate milk, and chicken tender) were chosen which had a vegan and animal-based version that looked similar and, as much as possible, tasted similar. The vegan versions of the foods were sold as substitutes for the animal-based version so they were made to resemble the animal versions. In order to choose foods where the vegan and animal-based versions tasted similar we chose to use chocolate milk rather than plain milk because the chocolate masked the difference in taste to some degree and meatballs and chicken tenders rather than cuts of “meat” because the vegan versions more closely resembled the animal versions. In addition, we chose to present macaroni and cheese rather than cheese slices because we thought that the vegan version was more similar to the animal-based version. Because the chicken was breaded and the meatball was a “ball” we also expected the vegan and animal versions to be thought of as similar since Hoek et al. (2011) found that the vegan and animal versions of such foods were put into the same category.

The foods were vegan and animal versions of two “flesh foods” (chicken tender and meat ball) and vegan and animal versions of two “dairy foods” (chocolate milk and macaroni and cheese). Both flesh and dairy foods were chosen because prior research has found

that they are rated differently (e.g., disgust, see Pliner & Pelchat, 1991; Rozin & Fallon, 1980). While flesh foods elicit more disgust than do dairy foods, red meat seems to elicit more disgust than does chicken (Kubberod et al., 2006).

Food Samples: Half of the subjects ($n = 40$) were given the following items: 2-tablespoons of Amy’s Macaroni and Cheese, one half of a Mama Lucia Fully Cooked Homestyle Cocktail-Size Frozen Meatball (from Quaker Maid), 2-oz of Lehigh Valley Dairy Farms Chocolate Milk, and half of a Health is Wealth All Natural Chicken Tender. The other half of the subjects ($n = 40$) received vegan food equivalents of those four foods. They received 2-tablespoons of Amy’s Dairy-Free Rice Macaroni and Cheese, one half of a Nate’s Meatless Meatball, 2-oz of 365 Chocolate Soy Milk, and half of a Gardein’s Crispy Tender.

All food samples were prepared according to the directions on the package. Each of the four items was served in a 2-oz Dart Portion Souffle Cup (No. 200PC). Water was served in a 7-oz America’s Choice plastic cup, which was used to wash the taste of the food out of the mouth before consuming the next sample. Subjects were also given a napkin and a plastic fork.

Procedure

Subjects entered the room and were seated at a table where they could not view the other participants. After reading and signing a consent form, they filled out a questionnaire about their food allergies and dietary restrictions. Subjects who did not consume meat or dairy products or who had any dietary restrictions or food allergies were thanked for coming and dismissed.

Subjects were led to believe that they were participating in a food rating study for a company trying to market new products. They were informed that they would taste and rate food samples and were also told what type of food samples they would rate (vegan or animal-based). Half of the subjects who got the vegan samples and half who got the animal-based samples were informed that they were sampling meat and dairy products while the other half were told that they were sampling vegan products. Subjects who were told that they were sampling vegan foods were provided a clear explanation of what “vegan” meant. They were told “these samples contain nothing that comes from an animal, meaning they do not contain any dairy, eggs, or meat or meat by-products”. All food samples were presented to the subjects one at a time in the same order. Macaroni and cheese was presented first, followed by meatballs, chocolate milk and finally, chicken tenders. Subjects were told what food they were being given (e.g., chocolate milk, vegan chocolate milk).

Before consuming each food sample, subjects looked at the food and answered a series of questions. They first rated familiarity with the food and willingness to try it using 201-point bipolar willingness-to-try and familiarity scales. The 201-bipolar scales ranged from -100 (extremely unwilling to try/unfamiliar) to $+100$ (extremely willing to try/familiar), 0 was labeled “neither willing nor unwilling/neither unfamiliar nor familiar”. The other seven

questions included five strictly about disgust (nausea, dislike having the food in their stomach, dislike of its appearance, contagion, and dislike of sample's origin), one question about food distaste (this question was also included as one of the six in the disgust score), and one question about food danger. These questions were adapted from Pliner and Pelchat's (1991) disgust scale. Each question was rated using a scale from 0 to 100, where 0 was labeled "not at all" and +100 was labeled "extremely."

Subjects were then told to try the food sample. They were asked to rate the food on a 201-bipolar hedonic scale that ranged from –100 (dislike extremely) to +100 (like extremely) with 0 labeled "neither like nor dislike". Subjects received a verbal explanation of the rating scales before rating the food samples.

Once all the samples were consumed, two groups of subjects who had been misled as to what sort of foods they had eaten (animal or vegan) were told the truth. These two groups were asked to re-taste the samples and rate how much they liked the foods a second time using the 201-point bipolar hedonic scale. Subjects were asked if they would like another sample to taste but were allowed to consume what remained of their original sample. In most cases, new samples were provided because subjects had entirely consumed the original sample. Upon completion of the study, all subjects read and signed a debriefing form disclosing the purpose of the study.

Statistical analysis

For each of the six variables measured (familiarity, willingness to try, disgust, distaste, danger, and liking) a 3-way mixed ANOVA was performed. The two between-subjects variables were food type (vegan or animal) and information (told vegan or told animal). Food product (macaroni and cheese, meatball, chocolate milk, and chicken tender) was the within-subjects variable. Bonferroni-corrected *t*-tests were performed on the four food products comparing ratings before and after subjects were told the truth about what they were actually eating for two groups (the group that was given the vegan products and told they were of animal origin and the group that was given the animal-based products and told they were vegan).

Results

Familiarity

There were no main effects of food type, or information. There were also no significant interactions. However, there was a main effect of food product [$F(3,228) = 29.2, p < .001$]. Bonferroni corrected *t*-tests comparing the familiarity ratings of the different foods found that subjects were less familiar with the meatballs than any of the other three foods (p 's $< .001$). In addition, the macaroni and cheese was rated as more familiar than any of the other three foods (p 's $< .001$). See Table 2.

Table 2

Means and standard deviations of ratings for the four food products independent of information or food type ($n = 80$).

	Macaroni & cheese	Meatball	Chocolate milk	Chicken tender
Familiarity	96.8 (11.2) ^a	34.4 (68.8) ^b	71.0 (49.6) ^c	78.5 (41.8) ^c
Willingness to try	78.6 (33.6) ^a	36.8 (54.5) ^b	62.4 (51.2) ^c	73.2 (40.8) ^{ac}
Disgust	8.2 (15.5) ^a	22.7 (21.8) ^b	9.4 (15.3) ^a	9.5 (15.9) ^a
Distaste	14.8 (24.9) ^a	36.4 (31.2) ^b	18.4 (26.0) ^a	17.8 (26.2) ^a
Danger	3.9 (15.2) ^{ab}	7.3 (18.4) ^b	3.4 (12.1) ^{ab}	2.8 (11.8) ^a

Note. Different superscripts within each dependent variable indicate differences of $p < .008$.

Willingness to Try

There were no main effects of food type, or information. There were also no significant interactions. However, there was a main effect of food product [$F(3,228) = 20.2, p < .001$]. Bonferroni corrected *t*-tests comparing the willingness to taste the different foods found that subjects were less willing to try the meatballs than any of the other three foods (p 's $< .001$). They were also less willing to try the chocolate milk than the macaroni and cheese ($p = .002$). See Table 2.

Disgust

Disgust scores were based on the mean of six ratings from the food questionnaire derived from Pliner and Pelchat (1991) and were calculated for each food sample. There were no main effects of food type, or information. There were also no significant interactions. However, there was a main effect of food product [$F(3,228) = 23.1, p < .001$]. Bonferroni corrected *t*-tests comparing disgust score for the different foods found that subjects rated the meatballs as more disgusting than any of the other three foods (p 's $< .001$). See Table 2.

Distaste

There were no significant main effects of food type, or information. There were also no significant interactions. However, there was a main effect of food product [$F(3,228) = 14.2, p < .001$]. Bonferroni corrected *t*-tests comparing distaste scores for the different foods found that subjects expected the meatballs to taste worse than any of the other three foods (p 's $< .001$). See Table 2.

Danger

There were no significant main effects of food type, or information. There were also no significant interactions. However, there was a main effect of food product [$F(3,228) = 4.4, p = .005$]. Bonferroni corrected *t*-tests comparing danger scores for the different foods found that subjects found the meatballs to be more dangerous to consume than the chicken tenders, $t(79) = 3.0, p = .004$. Although the meatballs were perceived to be somewhat more dangerous than both the macaroni and cheese ($p = .035$) and the chocolate milk ($p = .025$), these comparisons were not significant when the significance criteria were Bonferroni corrected. See Table 2.

Liking

There was no significant main effect of food type, although it approached significance [$F(1,76) = 3.1, p = .08$]. There was a significant main effect of information [$F(1,76) = 6.0, p = .02$]. Subjects who were told that the foods were vegan liked the foods significantly more than did subjects who were told that the foods were of animal origin (see Fig. 1). There was also a significant main effect of food product [$F(3,228) = 4.5, p = .04$]. Bonferroni corrected *t*-tests showed that subjects liked chocolate milk more than chicken tenders, $t(79) = 2.8, p = .006$. However, there was also a significant food product by food type interaction [$F(3,228) = 13.2, p < .001$]. Bonferroni corrected *t*-tests comparing liking for the animal versus vegan versions of the four foods found that subjects liked the vegan chocolate milk ($M = 20.4, SD = 66.1$) significantly less than the chocolate milk of animal origin ($M = 83.4, SD = 25.5$), $t(78) = 5.6, p < .001$. A similar but non-significant effect was seen with subjects liking the vegan macaroni and cheese ($M = 28.75, SD = 58.9$) less than the animal version ($M = 52.1, SD = 48.2$), $t(78) = 1.94, p = .056$. However, the opposite effect (again, non-significant) was found with the chicken tender. The vegan chicken tender

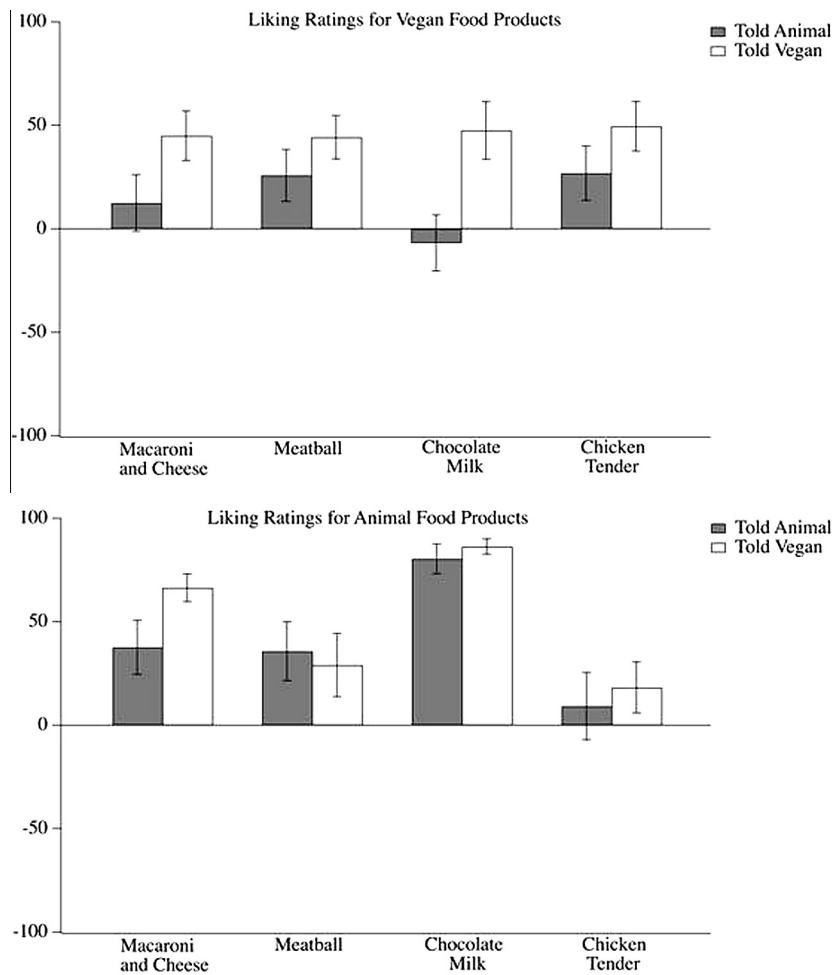


Fig. 1. Mean (\pm SEM) liking ratings for the two groups (both $n = 20$) tasting the vegan foods (top) and the two groups (both $n = 20$) tasting the animal foods (bottom). The ratings by the groups who were told that the foods were vegan are white bars and ratings by the groups who were told that the foods were animal products are black bars.

($M = 38.25$, $SD = 56.7$) was liked somewhat more than the animal version ($M = 13.8$, $SD = 64.0$), $t(78) = 1.81$, $p = .074$. See Fig. 1.

Post-debriefing liking ratings

Participants who received vegan versions of the four foods and were told that they were of animal origin ($n = 20$) and those who received animal versions of the four foods and were told that they were vegan ($n = 20$) were asked to rate the food a second time, once they were told the truth about the origin of the food samples.

Vegan-told animal

t -tests on the four foods comparing ratings before and after being told that what they were eating was vegan revealed that the liking rating of the vegan macaroni and cheese was more positive after subjects were told that it was vegan ($M = 29.50$, $SD = 57.92$) than before, when they thought it was of animal origin ($M = 12.45$, $SD = 61.08$), $t(19) = 2.17$, $p = 0.04$. However, liking ratings did not change for any of the other food samples (meatball, chocolate milk, or chicken tenders), all p 's > 0.05 .

Meat-told vegan

t -tests on the four foods comparing ratings before and after being told that what they were eating was of animal origin found no significant differences in the liking ratings for any of the food samples, all p 's > 0.05 .

Discussion

Vegan products were not rated as less familiar than the animal-based equivalents. Even when people were told that they were eating vegan substitutes, their familiarity ratings were no different from those of subjects who were told they were eating foods of animal origin. Not surprisingly, since willingness to try a food is related to its novelty (Birch & Marlin, 1982; Pliner, 1982; Raudenbush & Frank, 1999), subjects did not indicate that they were less willing to try vegan products or foods they thought were vegan than the foods of animal origin or those they thought were of animal origin.

Consistent with the familiarity and willingness to try results, subjects also did not find the foods that were vegan or that they were told were vegan as more dangerous or disgusting than the foods that were of animal origin or that they were told were of animal origin. Therefore, they were treating the vegan products that resembled animal products the same as they were treating the animal products.

In addition, there was no difference in expected liking for the taste of the foods (distaste measure) between the vegan and animal-based versions of the foods nor was there a difference in expected liking between subjects who were told they were rating vegan foods and those told they were rating animal-based foods. Since increased expected distaste, danger and disgust all seem to decrease willingness to try foods (Pliner & Salvy, 2006), one would expect to see no differences on these three variables.

The lack of a difference in all of these ratings suggest that either the similarity of the vegan versions to the animal-based versions resulted in the subjects treating them as similar (i.e., sympathetic magic was at work) or the vegan products were indeed familiar to our subjects, or both. Our subjects were college students drawn from the mostly urban and exurban areas of New Jersey outside of New York City where access to such vegan substitutes for animal foods is available. Aramark, one of the largest providers of food on college campuses in the USA reported (Warner, 2005) that in a survey they conducted of 100,000 college students, almost one-quarter said that finding vegan meals on campus was important to them. In fact, the positive view of vegan foods might be becoming more widespread. In a National Restaurant Association survey (2013), more than half of the chefs surveyed indicated that vegan entrees was one of the hot trends in the USA (ranked 50). Vegan options such as veggie burgers and veggie chili were also found to be highly purchased food items in elementary school and middle-school cafeterias (Eckart, Strong, Moppert, & Barnard, 2010). Therefore, it is possible that both the vegan and animal versions of the foods were familiar and acceptable to our subjects, although, since they are less common than the animal products, they should not be as familiar. The results might have been different if the subjects were drawn from a different population who were less familiar with vegan foods. If people who were known to be unfamiliar with the vegan versions of products showed the same pattern as seen in the present study it would provide stronger evidence of a role of sympathetic magic.

The only significant effect found on ratings of familiarity, willingness to try, anticipated distaste, danger, and disgust was between individual foods. In particular, the meatball (both animal-based and vegan and independent of information given about it) was rated as the least familiar of the four foods and subjects were less willing to try the meatball than all the other foods. This is not surprising since milk, macaroni and cheese (a current fad food) and breaded chicken tenders (similar to chicken fingers which are also ubiquitous) are more common than meatballs to college students in the USA, and particularly to our student body which is almost ¼ Hispanic, a culture where meatballs are not common. Although we did not measure neophobia, lower willingness to try scores and higher anticipated distaste, danger and disgust scores for the meatballs compared to the other more familiar foods might have been more pronounced for the neophobic subjects.

Because it was less familiar and/or because it was a “red meat” product, subjects expected the meatball to taste worse than the other foods and rated it as more disgusting. While distaste and danger occur with unfamiliar foods and influence willingness to try them (Pliner & Salvy, 2006), disgust is something most commonly seen with animal products (Rozin & Fallon, 1987). In fact, red meat is perceived as more disgusting than other meats (Kubberod et al., 2002) and animal products such as milk (Rozin & Fallon, 1980). Since there was no difference in expected distaste or disgust ratings between the meatballs that subjects thought were vegan and those they thought were ground meat, it appears that simply resembling a red-meat product is enough to elicit a disgust response. This is consistent with the law of similarity in sympathetic magic. In this case, subjects thought imitation red meat to be as disgusting as the real thing. This disgust response to both the vegan and ground meat meatballs might have been enhanced by calling them both *meatballs*. Calling them *meat* might have called to mind the food’s relationship to animals and therefore elicited a stronger disgust response (Angyal, 1941; Martins & Pliner, 2006; Rozin & Fallon, 1987).

The meatball (independent of food type or information given) was also rated as more dangerous to eat than the chicken tender but not than the chocolate milk or macaroni and cheese. That a beef meatball should be rated as more dangerous than chocolate

milk or macaroni and cheese (both containing dairy products) is not unreasonable. Red meat has been tied to heart disease. In addition, the Centers for Disease Control and Prevention (Lynch, Painter, Woodruff, & Braden, 2006) report more food-borne-disease outbreaks, in the United States, attributed to beef than to dairy-products. However, the CDC also reports more disease outbreaks attributed to poultry than to beef. Based on this data, subjects should have rated the chicken tender as more dangerous than the meatball. Therefore, subjects’ judgments of danger are not based on actual food danger.

Given that the vegan imitation animal foods are not animal products but vegetable-products, the foods subjects thought were vegan should have been rated as less dangerous than those they thought were the animal versions. Foods of animal origin are most often implicated in incidents of food poisoning (Todd, 1997). The fact that vegetables are less dangerous than meat is confirmed by the CDC (Lynch et al., 2006) report. However, our subjects thought that the vegan meatball or the meatball they thought was vegan as dangerous as the meatball that was made of meat or that they thought was made of meat. Again, the similarity of the vegan alternative to the animal product seems to have resulted in a similar danger response, supporting the idea that the law of similarity is at play.

The fact that all meatballs, independent of what information subjects were told about the source (vegan or animal) or whether they were, in fact, vegan or animal-based, were rated differently from all the other products on familiarity, willingness to try, distaste, danger, and disgust suggests that because the vegan and animal-based meatballs looked alike, they were treated similarly and differently from the other foods. Likewise, subjects treated all versions of the other foods (chicken tender, chocolate milk, and macaroni and cheese) similar as well. This, too, supports the idea that the law of similarity is at work. This extends the findings of Hoek et al. (2011). Not only are vegan and animal-based foods that look alike categorized together, they are also evaluated similarly.

In addition to the findings supporting the role of sympathetic magic in the evaluation of vegan foods that resemble animal products, we also found some additional, interesting results. First, although people anticipated liking the taste of the meatball less than the other foods, when they actually tasted it, people did not like it less. Raudenbush and Frank (1999) found a similar effect. In their study, subjects, especially those classified as neophobic, thought they would like foods less than they actually did once they tasted the foods. This was particularly true of novel foods.

Second, we surprisingly and unexpectedly found that when subjects tasted the food and rated how much they liked the taste, those who were told the food was vegan liked the food significantly better than did those who were told the food was of animal origin. Thus, thinking a food was vegan actually increased liking for the taste of that food. This was true even though we intentionally eliminated from participation in the study anybody with any dietary restrictions, including those who indicated that they were vegan. Not only were vegan substitutes for both meat and dairy foods rated as familiar and acceptable to our omnivorous subjects, thinking that a food is vegan actually made it taste better. This could be due to a type of halo effect. Vegetarian diets, free of meat, are considered healthy, even by meat-eaters (Povey, Wellens, & Conner, 2001). In addition, not eating meat is seen as ethical and environmentally friendly (Povey et al., 2001; Santos & Booth, 1996). Maybe people view vegan options as being good for them, for animals, and for the environment and therefore these foods are good tasting as well. Thinking that a food is healthy has been shown to increase consumption (Provencher, Polivy, & Herman, 2009) and reduce the estimation of calories in the food (Chandon & Wansink, 2007). It might also increase liking of the taste of the food.

Third, liking ratings changed for subjects who were initially told that the vegan macaroni and cheese was made with real cheese and then rated it again after being told it was vegan. They liked it less when they thought it was an animal product than they did when they tasted it a second time, after being told that it was, in fact, vegan. This result probably has to do with the fact that when subjects were told that they were getting real macaroni and cheese they had fairly strong expectation about the taste of the product since macaroni and cheese was rated as very familiar. Although the vegan macaroni and cheese that was used in the present study was made with Daiya cheese substitute which melts like cheese, the taste and consistency of the cheese is not identical to real cheese and was not what they expected.

The increase in liking ratings for the vegan macaroni and cheese among subjects who first rated it thinking it was an animal product and then rated it knowing it was vegan can be explained by what we know about the effect of expectations on hedonic ratings. Violations of expectations can increase liking for the taste of the food if the taste of the food is better than expected and can decrease liking of the food if it is worse than expected (e.g., Zellner et al., 2004). This is called hedonic contrast and might have caused the effect we saw. When subjects thought that the macaroni and cheese was made with real cheese the imitation cheese did not meet expectations and they gave it a more negative rating than when they were later told it was vegan.

While ideas and expectations about the foods seem to have influenced liking ratings, the differences between the ratings of the vegan and animal versions of some foods may have been based on actual differences in the taste of the foods. The largest difference in liking ratings (and only significant one) was between the soy chocolate milk and the animal-based chocolate milk. This is not surprising since soy milk does not taste like cow's milk and soy products have been found to be less liked than animal-based dairy products in blind taste tests (e.g., Wu, Molaison, Pope, & Reagan, 2005). What is interesting is that the other vegan products compared favorably with their animal counterparts once tasted. In fact, the imitation chicken tender was rated as somewhat (although not significantly) better than the real chicken tender. Clearly, at least some of the current vegan products on the market have been successfully produced to be acceptable animal-alternatives for consumers.

Conclusions and suggestions for further research

The findings that the vegan foods and those foods subjects were told were vegan were rated as familiar as the versions of animal origin suggest that the visual similarity of the products might be causing “magical thinking” in our subjects. That is, foods that look alike are alike in many ways including ratings of distaste, danger, and disgust. Like red meat in other studies, our meatballs (independent of whether they were vegan or meat or subjects were informed that they were vegan or meat) were evaluated differently from the other foods. Subjects showed increased distaste, danger and disgust ratings for all the meatballs in all conditions compared to the other foods. If the animal version of a food was rated one way so was the vegan version or the version that subjects thought was vegan.

While these results suggest that vegan foods are treated much like their animal counterparts, the study only used four foods. It would be interesting to replicate this study using different pairs of vegan and animal products. In particular, it would be interesting to use a chicken/chicken substitute and red meat/red meat substitute that was not made into balls, burgers, or sausages or coated (e.g., with bread crumbs) as our samples were. Because Hoek et al. (2011) found that such vegan and animal foods tend to be categorized together we might have found a stronger similarity

effect for our chicken tender and meatball foods than would be seen with foods that are or resemble cuts of meat.

It would also be interesting to study these effects in subjects who were clearly not familiar with vegan products. Pretesting subjects to find out if they eat such products and how often would make it possible to determine if the high familiarity scores seen for our vegan products and those that subjects thought were vegan were due to actual familiarity with the product or were the result of sympathetic magic.

The surprising finding that vegan substitutes were liked by our subjects and foods thought to be vegan were liked more should be further investigated. Is this liking for foods subjects think are vegan related to an increase in awareness of healthy eating? Does the degree of neophobia affect the degree of liking for these foods? Would subjects who never tried vegan substitutes show the same effect? Different results might also be obtained using subjects who were not omnivores, but vegan. In particular, comparing “moral” (those avoiding animal products because they think it is “wrong” to eat them) versus “health” (those avoiding animal products because they think it is better for their health) vegans might well reveal differences in disgust, expected liking and willingness to try vegan foods imitating foods of animal origin (especially meat) because of their similarity to animal products. Because moral vegans have stronger disgust responses to meat (Rozin, Markwith, & Stoess, 1997) than do health vegans, they might more strongly reject foods that resemble meat. Further research is needed on the role of sympathetic magic in the acceptance of vegan foods made to look like animal products.

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