

## **Role of Sensory and Cognitive Information in the Enhancement of Certainty and Liking for Novel and Familiar Foods**

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Expected and actual liking for novel and familiar foods were examined under various conditions of sensory and verbal information with 121 subjects who differed in food neophobia. The possible mediating roles of uncertainty about product identity and resemblance to familiar foods were also investigated. Subjects were divided into three verbal information groups (no information; product name; ingredient and use information) balanced for neophobia, age and gender. All groups rated test samples under three sensory conditions: (1) appearance only, (2) appearance and smell and (3) appearance, smell and taste. Neophilics rated novel foods more favorably than did neophobics. Accumulating sensory experience (appearance, smell, taste) decreased liking for novel foods but increased liking for familiar foods. Verbal information generally increased liking for all samples. Liking and certainty of product identity were curvilinearly related for novel foods, but linearly related for familiar foods. Liking for products judged to closely resemble the test product predicted up to 64% of the variability in expected and actual liking. Eight weeks later, subjects rated one of the two novel foods higher than in the first exposure, but no other exposure effects were observed. Our data suggest that information (possibly via reduced uncertainty), resemblance to more familiar foods, and exposure contribute to reducing initially negative responses to novel foods; furthermore, neophobia decreases liking for novel foods similarly at all levels of sensory input (visual, smell and taste).

### INTRODUCTION

Numerous factors play a role in the behavioral response to novel foods. Of particular importance are (1) their sensory quality, (2) available information (or lack of it) concerning the product and (3) attitudinal or personality variables of potential consumers. Understanding the contribution of these factors can lead to the development of strategies for incorporating novel foods into the diets of individuals or specific target consumer groups.

Several mechanisms by which liking for novel foods may develop have been proposed. One of them is mere exposure, an experimentally established tendency for

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enhanced hedonic responses based solely on exposure (Pliner, 1982; Birch & Marlin, 1982; Birch *et al.*, 1987). However, the effects of mere exposure may result from various conditioning mechanisms, including social, postingestional or pharmacological (for a review see Zellner, 1991). Moreover, the acceptance of a sensory characteristic, e.g. a flavor, can be enhanced by associating it with a familiar and well-liked characteristic (Zellner *et al.*, 1983). Also, negative postingestional consequences can lead to dislike for the food (Pelchat & Rozin, 1982).

Neophobia, the reluctance to eat and/or the avoidance of new foods, can be regarded as a biologically meaningful mechanism protecting an individual from consuming potentially toxic foods (Rozin & Vollmecke, 1986; Zellner, 1991). A behavioral tendency in response to food is linked with a corresponding affective response; in the case of neophobia, this response is an expression of dislike for a food (Pliner & Pelchat, 1991). Pliner *et al.* (1993) showed that novel foods may be perceived as slightly dangerous, in comparison to familiar foods. However, as pointed out by these authors, present Western societies test all food products and ingredients in the market for safety. Under these circumstances, neophobia loses its survival value and takes on detrimental aspects, by preventing potential consumers from utilizing novel or foreign nutritious food sources and by establishing itself as a barrier to the introduction of new foods into the marketplace.

In the literature, neophobia has mainly been considered as an intrinsic biological mechanism (e.g. Rozin & Vollmecke, 1986). The possible impact of cognitive input on a neophobic response has not received attention, although in many choice situations cognitive factors, such as are elicited by the name of a product, may play a role. For example, Pliner and Hobden (1992) and Pliner *et al.* (1993) labeled novel foods with unfamiliar names, producing stimuli that were combinations of food samples and their names. According to earlier studies, a label can greatly enhance the acceptance of novel foods (Seaton & Gardner, 1959; Wolfson & Oshinsky, 1966). Moreover, a descriptive, specific label may elicit higher acceptance ratings than a general, non-specific label (Cardello *et al.*, 1985). It is important to note that a label is not only a "name" for a product, but depending on a person's earlier experiences and knowledge, it may evoke a rich range of associations and expectations. Therefore, a label may provide as much information as a description of ingredients or use contexts (the situation or event in which a product is normally consumed), and it may also contribute to affective responses.

One plausible mechanism by which information concerning a novel food may enhance acceptance of that food is through a reduction in uncertainty about the product. The reasoning is that uncertainty about the identity of a product is reduced by available information, and the resultant change caused in cognitive structures can mediate changes in affective responses (Heyduk & Bahrck, 1977). Naturally, the reduction in uncertainty could trigger a negative response when the information is negative. Eckblad (1963), whose stimuli consisted of guessing games, and Heyduk and Bahrck (1977), who studied Chinese characters, concluded that maximal affect occurred in response to moderate levels of uncertainty. However, the degree to which uncertainty mediates affect may differ according to personality traits, e.g. neophobia. The uncertainty associated with a novel food may be part of the enjoyment of trying new things for neophilics, but may be an undesirable aspect for neophobics. Or, alternatively, neophobics may accept only a slight degree of uncertainty compared to neophilics.

Pliner and Hobden (1992), considering neophobia as a personality trait, developed and validated a ten-item verbal instrument to measure the degree of food neophobia in humans. They report having used the instrument to study the effect of neophobia on model behavior with the outcome that, unlike neophilics, neophobic subjects were unaffected by the modeling manipulation. This suggests that neophobia not only affects the initial response to a novel food, but also the mechanisms by which the novelty may gain acceptance.

The aims of the present study were (1) to determine if relevant verbal information about novel foods (a label or description of the food), would differentially affect neophilic and neophobic individuals; (2) to determine if neophobic subjects respond differently to accumulating sensory cues (appearance, smell and taste) of a novel product; (3) to determine the degree to which the uncertainty of the product's identity and the liking for foods or beverages that resemble (or are, otherwise, associated with the novel food) affected hedonic ratings and (4) to determine the effect of prior exposure on subsequent liking and likelihood of consumption.

## METHODS

### *The Main Study*

#### *Subjects*

Subjects were drawn from a pool of 201 Natick employees who completed a questionnaire on food neophobia (FNS) and general neophobia (GNS) (Pliner & Hobden, 1992). Their FNS scores ranged from 10 to 54 (theoretical range 10 to 70). Subjects' GNS scores varied from 8 to 51 (theoretical range 8-56) and were correlated with the FNS scores 0.36 ( $p < 0.001$ , Pearson's  $r$ ). Reliability (Cronbach's alpha) of the FNS and GNS scales was 0.89 in both cases. Subjects scoring from 10 to 22 on FNS were classified as "neophilics" and those scoring from 30 to 54 "neophobics"; the remaining respondents ( $n = 66$ ) scored from 23 to 29, and were excluded from the study. Three treatment groups of 45 subjects each were balanced for number of "neophilic" and "neophobic" individuals, age and gender. Of these 135 subjects, 14 were unavailable at the time of the final sensory tests which were carried out 2 months after the neophobia ratings were obtained. The final population ( $n = 121$ ) is described in Table 1.

#### *Samples*

Two Finnish and two American products were used as stimuli. The Finnish foods, novel for Americans, were Easter pudding (Mämmi, Fazer Oululainen, Lahti, Finland) and non-alcoholic beer (Tuoppi Kotikalja, Raisio Tehtaat, Raisio, Finland). The pudding was delivered frozen from the factory and was thawed in a refrigerator (5°C) overnight, then brought to room temperature (22°C) before testing. The beer was made according to package directions by mixing the malt extract, sugar and yeast, and letting the mixture ferment at room temperature for 24 h. It was then bottled in tightly closed glass bottles and refrigerated for 3-7 days before testing. The American products, apple butter (Musselman's, Knouse Foods, Biglerville, PA, U.S.A.) and root beer (A&W Beverages, White Plains, NY, U.S.A.) were chosen because their color and texture (or carbonation, in the case of the beverages) resembled those of the novel Finnish foods. Thus, their initial visual impression was similar to that for the novel products. The serving temperatures

TABLE 1  
Subjects assigned to verbal information conditions

Characteristic <sup>a</sup>	Type of information		
	No information	Label only	Descriptive information
Number of subjects	42	40	39
Number of neophilics	22	18	20
FNS score ( <i>SD</i> )	16.9 (3.0)	16.9 (3.8)	16.7 (4.0)
GNS score ( <i>SD</i> )	19.3 (6.5)	18.8 (6.4)	23.2 (8.1)
Age ( <i>SD</i> )	41.0 (13.0)	41.1 (11.2)	41.4 (8.8)
Percentage men	73	78	70
Number of neophobics	20	22	19
FNS score ( <i>SD</i> )	38.6 (7.7)	37.3 (5.7)	37.9 (6.3)
GNS score ( <i>SD</i> )	26.4 (9.0)	28.9 (8.5)	23.6 (10.0)
Age ( <i>SD</i> )	38.4 (12.0)	39.8 (10.8)	41.0 (13.5)
Percentage men	60	68	74

<sup>a</sup> FNS=food neophobia score, GNS=general neophobia score (not used in grouping).

were, likewise, matched to the novel foods, so that apple butter was served at room temperature and root beer at 5°C. Easter pudding and apple butter were each presented on a white saucer (sample size=15 g). Non-alcoholic beer and root beer were presented in transparent 140 ml glasses (sample size=40 ml).

#### Procedures

Verbal information was used as a between-groups variable and sensory information as a within-groups variable. One of the three test groups was given no verbal information about the samples (condition 1). The second group was informed of the names of the products ("Finnish pudding", "Finnish non-alcoholic beer", "apple butter", "root beer") (condition 2). The third group (condition 3) received descriptions of ingredients and use contexts but no informative names, as follows:

1) This is a Finnish rye-based product, sweetened with syrup and flavored with orange peel jam and spices. It is made by baking in an oven at a moderate temperature for several hours. It is typically eaten at Easter and is served with milk or cream and sugar. (*Finnish pudding*)

2) This is a Finnish nonalcoholic, barley-based product, made of malt extract, water, yeast and sugar, and fermented for several days. The product is served with lunch or dinner or drunk alone. (*Finnish nonalcoholic beer*)

3) This is an American product made of apples, sugar, apple cider concentrate, and spices. It is used as a spread. It can also be used as an ingredient in baked goods or served warm on vanilla ice cream. (*apple butter*)

4) This is an American nonalcoholic product made of carbonated water, sugar, caramel color and flavoring. The flavoring is traditionally birch, anise and clove. The product is served with lunch or dinner, with snacks, or drunk alone. (*root beer*)

All subjects rated the samples sequentially in three phases: (1) based on appearance only, (2) based on appearance and smell and (3) based on appearance, smell and

taste. Thus, after reading the general instructions, subjects received the four samples sequentially, in a randomized order, for visual examination. Each sample vessel was covered with transparent cellophane. At the next phase, subjects received the samples in a different random order and were asked to open the cellophane to smell the sample. At the third phase, samples were presented uncovered, in a new randomized order, for tasting. Spoons and a glass of bottled spring water for rinsing were also provided.

Each sample and condition was accompanied by a test form. The verbal information (label or description of the sample) was printed at the top of each form. In verbal information conditions 1 (no information) and 3 (descriptive information), the subjects rated expected liking (dislike extremely-like extremely) during visual and smell trials and actual liking during taste trials. Subsequently, subjects rated their certainty of the product's identity (extremely uncertain-extremely certain). They then responded to an open-ended question on what food or beverage most closely resembled the test sample, how much the test sample resembled that product (vaguely-extremely) and how much they liked/disliked the product that it resembled (dislike extremely-like extremely). In the taste condition, subjects also rated the likelihood of consuming the product in the future if there were an opportunity (extremely unlikely-extremely likely). All ratings were made on a nine-point scale with only the end-points verbally anchored.

In condition 2 (label information), the question on product certainty and the questions related to food resemblances were eliminated, since the label indicated the identity of the sample.

#### *Post-test*

Eighty subjects participated in a follow-up study approximately 8 weeks after participating in the main study. Subjects were given the same verbal information they received 8 weeks earlier, but the only sensory condition was tasting. They rated their liking of each sample and the likelihood of consuming it in the future. As their final task, subjects rated their familiarity with the four samples "before sampling them in this laboratory" from 1 (not at all familiar) to 9 (very familiar).

#### *Data Analysis*

Responses to the novel products were, in the majority of cases, not significantly different from one another and were therefore analysed within the same four-way analyses of variance (repeated measures): the effects of (1) food item (pudding vs. beer), (2) FNS group (neophilic vs. neophobic), (3) information condition (none, name, descriptive information) and (4) sensory condition (appearance, smell, taste) on expected or actual liking were analysed. The data on apple butter and root beer were analysed separately, hence three-way analysis of variance (repeated measures) was applied on each of them. The same sources of variance were used in the analyses of judged certainty of the identity of products, but the data were available from two subgroups only (no information, descriptive information).

Only significant main effects and interactions are reported below. Any statements of differences between the ratings are based on *post-hoc* range tests at  $p < 0.05$  (Tukey HSD).

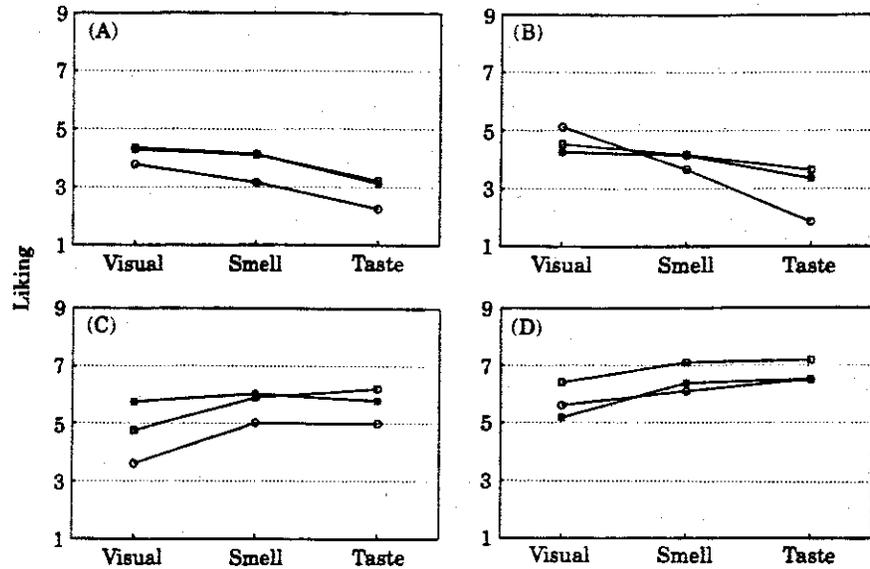


FIGURE 1. Mean expected (visual and smell conditions) and actual liking (taste condition) for experimental samples in the three verbal information conditions (no information, O,  $n=42$ ; label information, □,  $n=40$ ; descriptive information, \*,  $n=39$ ). (A) Finnish pudding; (B) Finnish non-alcoholic beer; (C) apple butter; (D) root beer.

Multiple regression analysis was used to characterize the effects of certainty and associations on the hedonic ratings, and ratings in post-test were compared with earlier ratings using analysis of variance (repeated measures).

## RESULTS

### *Familiarity of the Samples*

The mean familiarity ratings collected in the post-test condition from the then-available 80 subjects indicated that novel foods were unfamiliar to subjects. Finnish pudding received 1.4 ( $SD=1.1$ ) from neophilics and 1.2 (0.6) from neophobics; and the Finnish non-alcoholic beer was rated 1.5 (1.3) by neophilics and 1.4 (1.2) by neophobics. Apple butter was only somewhat familiar to subjects: 5.9 (2.7) for neophilics and 4.6 (2.9) for neophobics. Root beer received high familiarity ratings: 8.4 (0.8) from neophilics and 8.6 (0.7) from neophobics.

### *Expected and Actual Liking*

The sensory condition significantly affected the (expected or actual) liking for novel foods; main effect,  $F(2,230)=77.71$ ,  $p<0.001$  [Fig. 1(A) and (B)]. Ratings significantly decreased from the visual to the smell, and from the smell to the taste condition (Tukey). There was also a main effect of information condition,  $F(2,115)=4.69$ ,  $p=0.011$ : the "no information" condition resulted in lower ratings than the "label information" condition, while the "descriptive information" condition

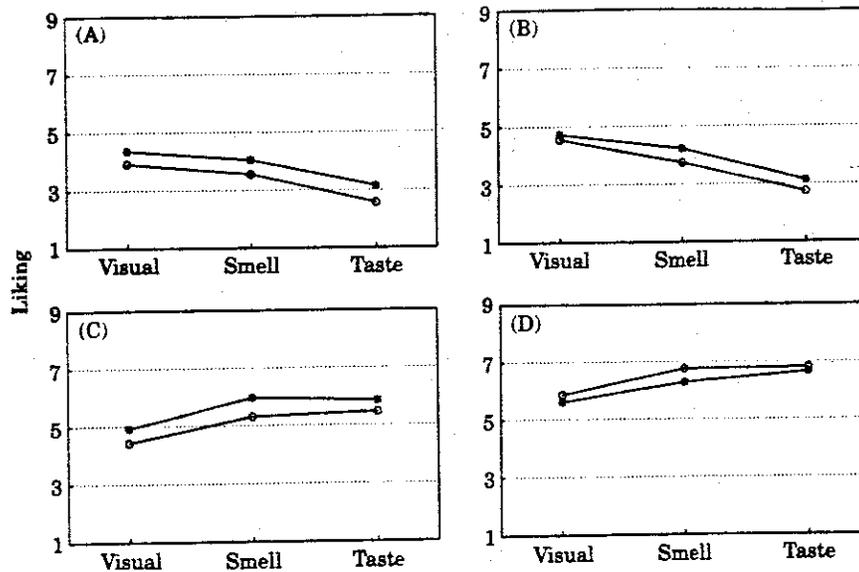


FIGURE 2. Mean expected (visual and smell conditions) and actual liking (taste condition) for experimental samples by neophilic (\*) ( $n=60$ ) and neophobic (O) ( $n=61$ ) subjects. (A) Finnish pudding; (B) Finnish non-alcoholic beer; (C) apple butter; (D) root beer.

produced intermediate ratings (Tukey). When the sensory information advanced from visual to smell to taste, ratings of liking decreased more in the "no information" condition than in the other two conditions; interaction between sensory and information condition,  $F(4,230)=7.59$ ,  $p<0.001$ ; Tukey. This effect was more pronounced for the non-alcoholic beer than for the pudding; interaction between food item and information,  $F(4,230)=5.22$ ,  $p<0.001$ . Neophilic subjects rated the novel foods significantly more favorably than did neophobics; main effect,  $F(1,115)=4.87$ ,  $p=0.029$  [Fig. 2(A) and (B)].

There was also a main effect of information condition on liking for apple butter,  $F(2,115)=8.94$ ,  $p<0.001$  [Fig. 1(C)]. Ratings were lower in the "no information" condition than in the other two information conditions (Tukey). The sensory condition also affected ratings; main effect,  $F(2,230)=24.02$ ,  $p<0.001$ . Ratings increased when progressing from visual to smell to taste in the "no information" and "label" conditions, but remained unchanged in the "descriptive information" condition; interaction between sensory and information conditions,  $F(4,230)=4.53$ ,  $p<0.001$ . Neophilics tended to rate apple butter higher than did neophobics; main effect,  $F(1,115)=3.85$ ,  $p=0.052$  [Fig. 2(C)].

Ratings of root beer were significantly affected by information condition; main effect,  $F(2,115)=6.72$ ,  $p=0.002$ . They were most favorable in the "label" condition (Tukey). Ratings increased when moving from the visual condition to smell and taste; main effect of sensory condition,  $F(2,230)=30.21$ ,  $p<0.001$ . The expected or actual liking of root beer was not significantly affected by subjects' levels of neophobia [Fig. 2(D)].

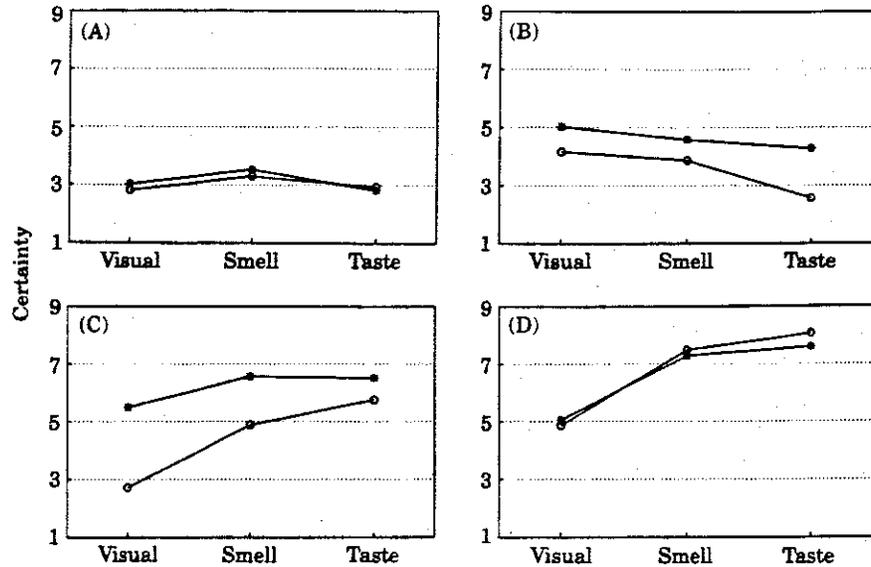


FIGURE 3. Mean certainty of the identity of experimental samples in two verbal information conditions (no information, ○,  $n=42$ ; descriptive information, ●,  $n=39$ ). (A) Finnish pudding; (B) Finnish non-alcoholic beer; (C) apple butter; (D) root beer.

#### Certainty

Regarding the novel foods, subjects felt more certain of the identity of non-alcoholic beer than of Finnish pudding; main effect of food item on certainty ratings,  $F(1,77)=20.81$ ,  $p<0.001$ . The "descriptive information" increased judged certainty about beer, but not about pudding; main effect of information,  $F(1,77)=5.04$ ,  $p=0.028$ . The main effect of sensory condition,  $F(2,154)=7.33$ ,  $p=0.001$ , and the interaction between sensory condition and food item,  $F(1,154)=5.88$ ,  $p=0.003$ , indicate a constant uncertainty over the sensory conditions of the identity of the pudding, as opposed to decreasing certainty of the identity of the beer [Fig. 3(A) and (B)].

Neophilic subjects felt more certain about the identity of apple butter than did neophobic subjects; main effect,  $F(1,77)=4.94$ ,  $p=0.029$ , and the "descriptive information" increased judged certainty when compared to the "no information" condition; main effect,  $F(1,77)=17.46$ ,  $p<0.001$ . There was a main effect of sensory information as well,  $F(2,154)=44.49$ ,  $p<0.001$ . Smelling and tasting, as opposed to visual information, helped to identify apple butter (Tukey). Sensory and verbal information conditions interacted,  $F(2,154)=9.64$ ,  $p<0.001$ : smell and taste information were more helpful in the absence of information than in the presence of "descriptive information" (Tukey) [Fig. 3(C)].

The only significant effect obtained for root beer was the increase in judged certainty with increasing sensory cues; main effect,  $F(2,154)=86.29$ ,  $p<0.001$ , so that smelling and tasting were more helpful than the visual information only (Tukey) [Fig. 3(D)].

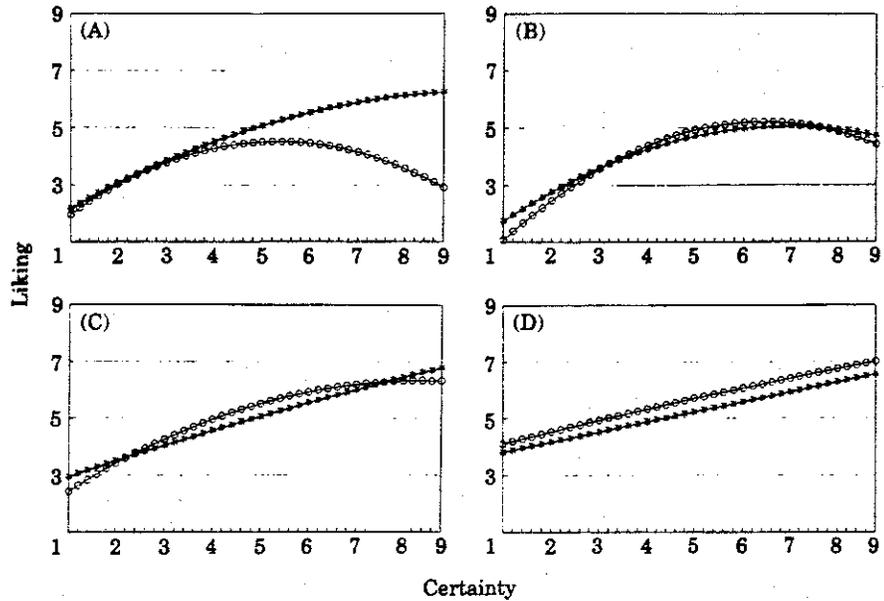


FIGURE 4. Relationships between certainty and liking among neophilics and neophobics. Each equation is based on 126 (neophilics) (\*) or 117 (neophobics) (O) responses (two verbal information groups, three sensory conditions). (A) Finnish pudding; (B) Finnish non-alcoholic beer; (C) apple butter; (D) root beer.

Predictive equations (\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ ):

(A) $L_{phil}$	=	$1.16 + 1.05^{***}C$	$-0.05C^2$ ,	$R^2 = 0.40$
$L_{phob}$	=	$0.65 + 1.45^{***}C$	$-0.13^{***}C^2$ ,	$R^2 = 0.34$
(B) $L_{phil}$	=	$0.52 + 1.31^{***}C$	$-0.09^{**}C^2$ ,	$R^2 = 0.34$
$L_{phob}$	=	$-0.58 + 1.80^{***}C$	$-0.14^{***}C^2$ ,	$R^2 = 0.43$
(C) $L_{phil}$	=	$2.36 + 0.59^*C$	$-0.1C^2$ ,	$R^2 = 0.37$
$L_{phob}$	=	$1.30 + 1.20^{***}C$	$-0.07^{**}C^2$ ,	$R^2 = 0.43$
(D) $L_{phil}$	=	$3.46 + 0.35C$	$-0.00C^2$ ,	$R^2 = 0.22$
$L_{phob}$	=	$3.67 + 0.44C$	$-0.00C^2$ ,	$R^2 = 0.28$

Certainty of product identity was entered into a regression model as a predictor of liking (expected and actual) (Fig. 4). The way in which certainty predicted liking varied with the product and with the degree of neophobia. Among neophobics, the relationship between certainty and liking was curvilinear for novel foods and apple butter, but not for root beer. Among neophilics, the relationship was significantly curvilinear only for the Finnish beer. Generally, the judged certainty predicted up to 43% of the variability in expected or actual liking. Judged certainty was least predictive in the case of the most familiar product, root beer.

To examine the effect of modality on certainty ratings among neophilics and neophobics, the regression equations were computed for visual, smell and taste conditions separately. There was some variation among the equations over modalities but in general, the regression coefficients and the predictive power were fairly stable over modalities.

#### *Resemblance to Other Foods*

Food associations (based on sensory resemblance) to the novel foods varied greatly in response to visual, smell and taste cues, and confirmed that the novel

TABLE 2

Standardized regression coefficients and squared multiple correlations for the prediction of expected/actual liking from liking for an associated product, the degree of resemblance between that product and sample, and their interaction. Each equation is based on 210–243 responses (two verbal information groups, three sensory conditions)

Food product	Regression coefficient			$R^2$
	Like	Resemblance	Like × Resemblance	
Finnish pudding	0.11	-0.15	0.72***	0.54
Finnish beer	0.05	-0.18	0.72***	0.53
Apple butter	0.21*	0.05	0.58**	0.64
Root beer	-0.08	-0.19	0.94***	0.58

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

foods used in this study were unrecognizable to the subjects. In contrast, apple butter was correctly associated with apple products or recognized as apple butter by the majority of subjects, and almost all subjects recognized root beer when they smelled and tasted it.

Resemblance of the test sample to a familiar product, liking for that product, and the interaction between the two variables were entered into a regression model as possible predictors of liking (expected or actual) for novel and familiar foods (Table 2). The regression model explained up to 64% of the variability in the ratings of liking. The interaction was the major predictor, thus indicating that liking for a product that resembles the novel food enhances liking for the test product, provided that there is a close resemblance between the two.

The regression analyses were also carried out for visual, smell and taste conditions separately. There was some tendency for the expected liking in the visual modality to be the least predictable (lower  $r^2$  compared to smell and taste conditions) but splitting observations into subgroups led, in several cases, into non-significant regression coefficients.

#### *Likelihood of Consumption in the Future*

In general, neophilic subjects rated the likelihood of consuming novel foods in the future higher than did neophobics; main effect,  $F(1,115) = 8.59$ ,  $p = 0.004$  (Fig. 5). Likelihood of consuming was also affected by the information condition; main effect,  $F(2,115) = 6.10$ ,  $p = 0.003$ . Neophilic subjects in the "label" condition were significantly more positive than neophobics in the "label" condition or any subjects in the "no information" condition; interaction between neophobia and information,  $F(2,115) = 3.85$ ,  $p = 0.024$ .

Rated likelihood of consuming apple butter was greater among neophiles than neophobics; main effect,  $F(1,114) = 5.55$ ,  $p = 0.02$ . Likelihood of consuming root beer in the future did not depend on any of the variables included in the analysis of variance model.

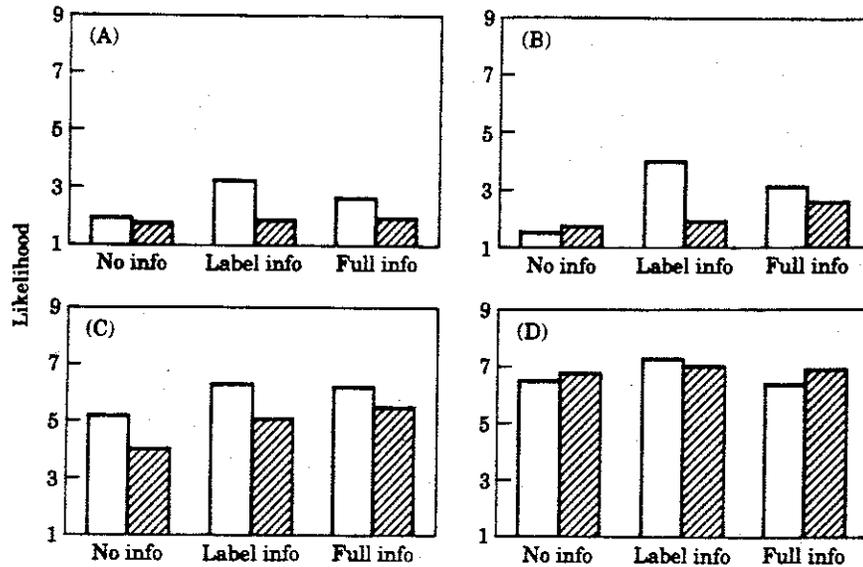


FIGURE 5. Mean likelihood of consumption in the future for the experimental samples in three verbal information conditions (no information,  $n=42$ ; label information,  $n=40$ ; descriptive information,  $n=39$ ). (A) Finnish pudding; (B) Finnish non-alcoholic beer; (C) apple butter; (D) root beer. □, neophilic; ▨, neophobic.

Liking for an item in the taste condition and likelihood of consuming it in the future were highly correlated: 0.82 (Finnish pudding), 0.81 (Finnish non-alcoholic beer), 0.84 (apple butter) and 0.75 (root beer) (all  $p < 0.001$ , Pearson's  $r$ ).

#### Post-test

The mean difference (the second minus first exposure) varied from  $-0.5$  to  $+0.9$  for liking and from  $-0.8$  to  $+1.1$  for the likelihood of consumption in the future, both on a nine-point scale (Table 3). The second exposure significantly increased the ratings of liking in the case of the Finnish non-alcoholic beer, interaction between exposure and food item,  $F(1,74) = 5.06$ ,  $p = 0.027$ , but no other significant main effects or interactions related to the first vs. second exposure were observed. Thus, although neophobics tended to increase their liking for novel foods at the second exposure, when compared to neophilics, this was not statistically significant; main effect,  $F(1,74) = 2.98$ ,  $p = 0.088$ .

## DISCUSSION

### Experimental Samples

The two novel foods used in this study are necessarily a very narrow sample of all possible new foods, and so are the familiar foods that were selected mainly based on their visual resemblance to the two novel foods. Therefore the results cannot be generalized to all novel or familiar foods. Also, it should be noted that the mechanisms leading to greater acceptance were in several cases similar in novel and familiar

TABLE 3

Mean differences (second exposure minus first exposure) in ratings of liking and in the likelihood of consumption in the future among neophilic (Phil) and neophobic (Phob) subjects who participated in the post-test ( $n=80$ )

Verbal condition	Liking		Future use	
	Phil	Phob	Phil	Phob
No information ( $n=29$ )				
Finnish pudding	-0.1	+0.2	-0.1	+0.5
Finnish non-alcoholic beer	+0.1	+0.6	0.0	+0.3
Apple butter	-0.3	-0.3	-0.8	+0.2
Root beer	+0.3	+0.5	+0.6	+0.4
Label information ( $n=27$ )				
Finnish pudding	-0.5	+0.2	-0.6	-0.1
Finnish non-alcoholic beer	+0.3	+0.7	+0.4	+0.6
Apple butter	-0.5	-0.1	+0.3	-0.1
Root beer	-0.3	0.0	-0.4	+0.2
Descriptive information ( $n=24$ )				
Finnish pudding	-0.1	+0.3	+0.2	+0.3
Finnish non-alcoholic beer	+0.3	+0.9	+0.2	+0.7
Apple butter	+0.7	+0.5	0.0	+0.1
Root beer	-0.2	+0.4	+0.3	+0.5

foods: cognitive information was helpful both for novel and familiar foods, and the resemblance to a familiar product seemed to play a similar role in the case of all four food samples.

One might argue that the novel products were not palatable enough to be acceptable to a new consumer population. However, both are popular products in the Finnish food market, and it would be extremely difficult to find a novel food sample that would have chances to please consumers at the first sampling.

#### *The Effect of Information*

The results demonstrate that verbal information—either a name or a description of ingredients and product use—enhances the acceptance of novel (but also familiar) foods. Although a large number of studies have examined the effects of brand name and image on product acceptance (e.g. Makens, 1965; Moskowitz, 1983; Gacula *et al.*, 1986; Render & O'Connor, 1976; Sheen & Drayton, 1988), relatively fewer studies have examined the roles of product name on acceptance (Pettit, 1957; Seaton & Gardner, 1959; Wolfson & Oshinsky, 1966; Cardello *et al.*, 1985; Levin & Gaeth, 1988; Meiselman & Bell, 1991/92). In the studies on brand labels, the label has produced a large number of cognitive associations related to the image and reputation of the brand. However, when only product name or product information is manipulated, these associations should be fewer. Under these conditions, label or information may mediate their effects through a reduction in the uncertainty associated with what the product *is* or *is like*. This identification of a product via a label does not always result in an increase in hedonic response. Meiselman and Bell

(1991/92) found that, in some instances, providing an ethnic name for a food lowered hedonic response. They suggest that naming a product may confirm its identity, "bringing into play the consumers' expectation of what the product should be". If the expectation for the product is low, hedonic response may decline compared with ratings for the same product in an unnamed condition, as has been shown by Cardello and Sawyer (1992) and Tuorila *et al.* (1994).

#### *Certainty and Liking*

One assumption underlying this study was that there is a likely association between the perceived degree of certainty (or uncertainty) of the product identity and subjects' affective response to the item. Pliner *et al.* (1993) showed that there is some risk or danger associated with novel foods. In situations that involve risk or danger, both animals and humans prefer low levels of uncertainty (see Slovic *et al.* 1987; Seligman *et al.*, 1971). The data support the hypothesis in that for the familiar foods, liking increased linearly as a function of judged certainty of the product identity; however, for novel foods, acceptance increased monotonically as a function of judged certainty, then reached a peak and declined at the highest levels of certainty. This tendency was more typical of neophobics, as a group, than of neophilics. Furthermore, the tendency was against our second hypothesis that the association between liking and product certainty would be curvilinear in neophilics, but linear in neophobics; the neophilics would get enjoyment out of the uncertainty related to novelty, and get bored by a high degree of certainty (c.f. Stang, 1975), whereas neophobics would appreciate a high degree of certainty.

The curvilinearity may reflect the fact that certainty was accompanied by the realization that the food was not one that the subject would probably like. Information reduced the uncertainty and increased expected liking for an unidentifiable food but, as certainty increased further and as the subject's expectation became more specific, liking was determined by the actual stimulus, rather than by certainty alone. With this interpretation, neophobics demonstrated a ceiling effect, a constraint that would not permit higher ratings of novel foods, while neophilics tended to enjoy the novel food when they knew more about it.

#### *Resemblance to Familiar Foods*

Close resemblance of a food to an already familiar food was a good predictor of liking. Such a resemblance—not only in terms of sensory, but perhaps also in terms of functional properties, image, social context, etc.—can serve as a useful tool when novel foods are introduced to potential consumers. However, it should be noted that our results are correlational and do not prove a causal relationship. Thus, it is possible that, based on their initial favorable or unfavorable impression of a test product, subjects generated corresponding favorable or unfavorable associations, and not the reverse.

#### *The Role of Neophobia*

Both neophilics and neophobics tended to rate liking higher when verbal information was available. This supports the notion that both groups similarly processed the information provided about the samples. Furthermore, there were no interactions

between neophobia and sensory information. Thus, neophobics also processed the sensory information similarly to neophilics. This suggests that sensory cues do not function differently in neophilics and neophobics.

In addition, ratings of expected and actual liking of novel foods were higher in neophilics than in neophobics. Pliner and Hobden (1992) noted that subjects high and low in neophobia did not differ in acceptance ratings, but did differ in expected liking ratings. Thus, the present study does not support their conclusion that neophobia manifests itself at the level of expectation but not of actual liking.

Novel foods with labels were rated highest in terms of likelihood of consumption among neophilic subjects, while in the no information condition, both neophilics and neophobics rated the future likelihood of consumption as low. It should be noted that several items of the Neophobia Scale are related to the acceptance of ethnic foods. Therefore, a correlation between neophobia, when measured on this scale, and liking for another ethnic food ("Finnish") is not surprising. Future studies should use non-ethnic novel foods as well.

Expected and actual liking of novel foods were significantly higher in neophilics than in neophobics, and neophilics were more willing to consume these foods in the future than were neophobics. These findings support the general validity of the Neophobia Scale (Pliner & Hobden, 1992). However, any verbal instrument, such as the neophobia scale, needs to be examined and interpreted in light of the actual content of statements. The content is often culture-specific and reflects the prevailing ideas in the culture. Thus, this scale draws on the neophobia of Canadian college students, but it may need adjustments to be reliable in other groups and cultures, and it may not be an appropriate measure of neophobia in non-urban groups, in children, etc. Further, as an instrument the Neophobia Scale resembles typical attitude scales; whether the feature measured should be called a personality trait (Pliner & Hobden, 1992) or an attitude may be a question of preference, but it may affect the way we think the feature could be altered or manipulated.

Another methodological point is that our dependent variable was expected or actual liking, not the willingness to eat. Although liking and the likelihood of consuming in the future were highly correlated in the taste condition, the likelihood of consuming seemed to depend on the interaction of information and neophobia, whereas neophobia only had a main effect on ratings of liking.

One caveat should be made concerning the subject population. None of our subjects were extreme neophobics. Subjects who were herein classified as neophobics scored slightly above the mean on the scale of Pliner and Hobden (1992). Extreme neophobics may have had different response patterns. Future research with the Neophobia Scale should characterize different populations by their range and average score. Consumer panelists, due to their willingness to participate in these types of activities, may demonstrate a restricted range or a skewed distribution, as found here.

#### *Exposure*

Finnish non-alcoholic beer received higher ratings in the posttest condition, compared to the ratings during the first exposure. Thus, the data provide some support for the positive effect of exposure on the acceptance of novel foods (Pliner, 1982; Birch & Marlin, 1982). This observation should be interpreted cautiously since, apart from the exposure effect, other mechanisms may also play a role. The 8-week

break between the two sessions may have affected subjects' ratings strategies. Also, it should be noted that the procedures were not identical: in the first exposure, three modalities (visual, smell and taste) were involved, while in the second only tasting was required.

#### CONCLUSIONS

Several strategies to overcome an initial dislike for a novel food are inferred from our data. They include (1) providing verbal information about new products, (2) increasing exposure to them and (3) encouraging associations with familiar foods. Another approach, based on higher hedonic responses by neophilics when compared to neophobics, would be (4) to modify the level of neophobia in the target population; it might be worthwhile to investigate if, and by what manipulations, this is possible. Although our study illustrates the potential value of the strategies, their relative importance and possible interactions remain to be determined in future studies.

#### REFERENCES

- Birch, L. L. & Marlin, D. W. (1982) I don't like it; I never tried it: effects of exposure on two-year-old children's food preferences. *Appetite*, 4, 353-60.
- Birch, L. L., McPhee, L., Shoba, B. C., Pirok, E. & Steinberg, L. (1987) What kind of exposure reduces children's food neophobia? Looking vs. tasting. *Appetite*, 9, 171-8.
- Cardello, A. V., Maller, O., Masor, H. B., DuBose, C. & Edelman, B. (1985) Role of consumer expectancies in the acceptance of novel foods. *Journal of Food Science*, 50, 1707-18.
- Cardello, A. V. & Sawyer, F. M. (1992) Effects of disconfirmed consumer expectations on food acceptability. *Journal of Sensory Studies*, 7, 253-77.
- Eckblad, G. (1963) The attractiveness of uncertainty. *Scandinavian Journal of Psychology*, 4, 1-13.
- Gacula, M. C., Jr., Rutenberg, S. K., Campbell, J. F., Giovanni, M. E., Gardze, C. A. & Washam, II, R. W. (1986) Some sources of bias in consumer testing. *Journal of Sensory Studies*, 1, 175-82.
- Heyduk, R. G. & Bahrack, L. E. (1977) Complexity, response competition, and preference. Implications for affective consequences of repeated exposure. *Motivation and Emotion*, 1, 249-59.
- Levin, I. P. & Gaeth, G. J. (1988) How consumers are affected by the framing of attribute information before and after consuming the product. *Journal of Consumer Research*, 15, 374-8.
- Makens, J. C. (1965) Effect of brand preference upon consumers' perceived taste of turkey meat. *Journal of Applied Psychology*, 49, 261-3.
- Meiselman, H. L. & Bell, R. (1991/92) The effects of name and recipe on the perceived ethnicity and acceptability of selected Italian foods by British subjects. *Food Quality and Preference*, 3, 209-14.
- Moskowitz, H. R. (1983) *Product testing and sensory evaluation of foods*. Pp. 458-65. Westport, U.S.A.: Food and Nutrition Press.
- Pelchat, M. L. & Rozin, P. (1982) The special role of nausea in the acquisition of food dislikes by humans. *Appetite*, 3, 341-51.
- Pettit, L. A. (1958) Informational bias in flavor preference testing. *Food Technology*, 12, 12-4.
- Pliner, P. (1982) The effects of mere exposure on liking for edible substances. *Appetite*, 3, 283-90.
- Pliner, P. & Hobden, K. (1992) Development of a scale to measure the trait of food neophobia in humans. *Appetite*, 19, 105-20.
- Pliner, P. & Pelchat, M. L. (1991) Neophobia in humans and the special status of foods of animal origin. *Appetite*, 16, 205-18.

- Pliner, P., Pelchat, M. & Grabski, M. (1993) Reduction of neophobia in humans by exposure to novel foods. *Appetite*, 20, 111-23.
- Render, B. & O'Connor, T. S. (1976) The influence of price, store name, and brand name on perception of product quality. *Journal of the Academy of Marketing Science*, 4, 722-30.
- Rozin, P. & Vollmecke, T. A. (1986) Food likes and dislikes. *Annual Review of Nutrition*, 6, 433-56.
- Seaton, R. W. & Gardner, B. W. (1959) Acceptance measurement of unusual foods. *Food Research*, 24, 271-8.
- Seligman, M., Maier, S. F. & Solomon, R. L. (1971) Unpredictable and uncontrollable aversive events. In F. R. Brush (Ed.), *Aversive conditioning and learning*. Pp. 347-400. New York, U.S.A.: Academic Press.
- Sheen, M. R. & Drayton, J. L. (1988) Influence of brand label on sensory perception. In D. M. H. Thomson (Ed.), *Food acceptability*. Pp. 89-99. London: Elsevier.
- Slovic, P. (1971) Perception of risk. *Science*, 236, 280-5.
- Stang, D. J. (1975) When familiarity breeds contempt, absence makes the heart grow fonder: effects of exposure and delay on taste pleasantness ratings. *Bulletin of the Psychonomic Society*, 6, 273-5.
- Tuorila, H., Cardello, A. V. & Leshner, L. L. (1994) Antecedents and consequences of expectations related to fat-free and regular-fat foods. *Appetite*, 23, 000-000.
- Wolfson, J. & Oshinsky, N. S. (1966) Food names and acceptability. *Advertising Research*, 6, 21-3.
- Zellner, D. A. (1991) How foods get to be liked: some general mechanisms and some special cases. In R. C. Bolles (Ed.), *The hedonics of taste*. Pp. 199-217. Hillsdale: Lawrence Erlbaum.
- Zellner, D. A., Rozin, P., Aron, M. & Kulish, C. (1983) Conditioned enhancement of human's liking for flavor by pairing with sweetness. *Learning and Motivation*, 14, 338-50.

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