



Research report

Emotion and food. Do the emotions expressed on other people's faces affect the desire to eat liked and disliked food products?

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ABSTRACT

The aim of the present study was to test if pleasure, neutrality and disgust expressed by other individuals on a photograph could affect the desire to eat liked or disliked food products. Forty-four men and women were presented with two series of photographs. The first series of photographs was composed of six food photographs: three liked and three disliked food products. The second series consisted of the same photographs presented with eaters expressing three different emotions: disgust, pleasure or neutrality. Results showed that the effect of the presence of an eater, and of emotions expressed by this eater, depended on the food category. For the liked foods, the desire to eat was higher when these foods were presented alone than with an eater expressing neutral emotion. When the eater expressed pleasure, the desire to eat these liked foods did not significantly increase. In contrast, when the eater expressed disgust, the desire to eat them significantly decreased. When the foods were disliked, the influence of the pleasant social context was stronger than for the liked foods. The desire to eat the disliked foods actually increased in the presence of an eater expressing pleasure. On the contrary, the disgust and neutral context had no effect on the desire for disliked foods.

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Introduction

Academic and industrial research on food choices assumes that sensory aspects of food products (taste, odour) are the determining factors in food choice and preference (Mela, 2006). In other words, there is an implicit assumption that food choices directly depend on sensory liking responsiveness (Eertmans, Baeyens, & Van den Bergh, 2001). For example, it has been suggested that hedonic value, as assessed by valence ratings of gustatory stimuli, is a good predictor of both the amount of food consumed and food preferences (McCrary, Saltzman, Rolls, & Roberts, 2006). According to Birch (1999), food preferences are established early in infancy and result from primary sensory reactions, probably related to the survival of the species. Indeed, babies prefer some tastes such as sweet and salty and reject others such as sour and bitter. Thus, foods produce sensory reactions of pleasure or disgust that lead to either intake or rejection (Rozin, 1990). However, it is likely that the cultural and social context in which children live influences their taste preferences later in life. For instance, the taste

preferences expressed by the mother or the father may influence the development of a child's preferences. The aim of the present study was to show how facial expressions of pleasure or disgust influence our desire to eat liked and disliked foods.

An effect of social facilitation has been found according to which food intake increases when people eat in groups as compared to when they eat alone (Zajonc, 1965). Indeed, positive correlations between the presence of other people and food consumption have been found both for the different meals of the day and for meals at home or outside of the home (De Castro, Brewer, Elmore, & Orozco, 1990). Moreover, some studies showed that food consumption increased in the presence of other people, irrespective of whether the meal was eaten with friends, family, or strangers (Clendennen, Herman, & Polivy, 1994; De Castro, 1994; De Castro & Brewer, 1991). Other studies, using an experimental paradigm in which naïve participants are simply told how much allegedly prior individuals ate, revealed that the more the allegedly prior individuals ate, the more the naïve participants eat (Pliner & Mann, 2004; Roth, Herman, Polivy, & Pliner, 2001). Thus, the perceived presence of other people influenced food consumption. However, Pliner, Bell, Hirsch, and Kinchla (2006) have recently demonstrated that the social facilitation effect is mediated by the increased length of meals when people eat in groups. They showed that participants ate more during a long rather than a short meal,

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and this regardless of the group size: alone, or with two or four people in the group.

Interestingly, the consumption of food by people who eat in a group is never explained by the change in people's emotions toward the food. Nevertheless, in a group, everybody does not share the same preferences, and an individual may be faced with someone else who expresses more pleasure or disgust toward a particular food. The question is: Given that the context (food quantity eaten by other eaters, meal duration) influences food intake under neutral emotional conditions, does the emotion expressed by other eaters also modulate food intake? Recent studies have suggested that the facial expression perceived in another person automatically affects our own emotional state and perhaps our desire to eat. In an fMRI study, Wicker et al. (2003) reported that observing faces expressing disgust activated the same site in the anterior insula as inhaled odours that produced a strong feeling of disgust. According to the theories of embodied emotion (Barsalou, Winkielman, Krauth-Gruber, & Ric, 2003; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005), the perception of emotions expressed on other people's faces leads to the same emotional state in the observer via an automatic imitation of the facial expressions (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000; Décety & Chaminade, 2003;

Gallese, 2003). Recently, Rousset, Schlich, Chatonnier, Barthomeuf, and Droit-Volet (2008) tested if the presence of an eater on a photograph, expressing pleasure, disgust, and neutrality, influences the desire to eat familiar and non-familiar food products. They revealed that the presence of an eater increased the participant's desire to eat food products in comparison to his/her absence. Moreover, this increase varied more or less as a function of the emotional facial expressions of the eaters. Indeed, the increase in the desire to eat was observed with both neutral and happy faces, although more so in the latter case, but not with disgusted faces. Furthermore, with happy faces, the desire to eat increased more for unfamiliar than for familiar foods. In the case of unfamiliar foods, facial expressions provide information about the food's taste. Because non-familiar food products had not previously been tasted, the emotion expressed by other people would indicate if this food was good or not. The question here is: Do facial expressions of emotions influence the desire to eat food to the same extent when emotions toward foods are well established, that is to say, when foods are liked or disliked? Indeed, we can wonder if food habits and preferences can be transmitted or modified by the social environment (family, friends), i.e., by the emotion spontaneously expressed on other people's faces.

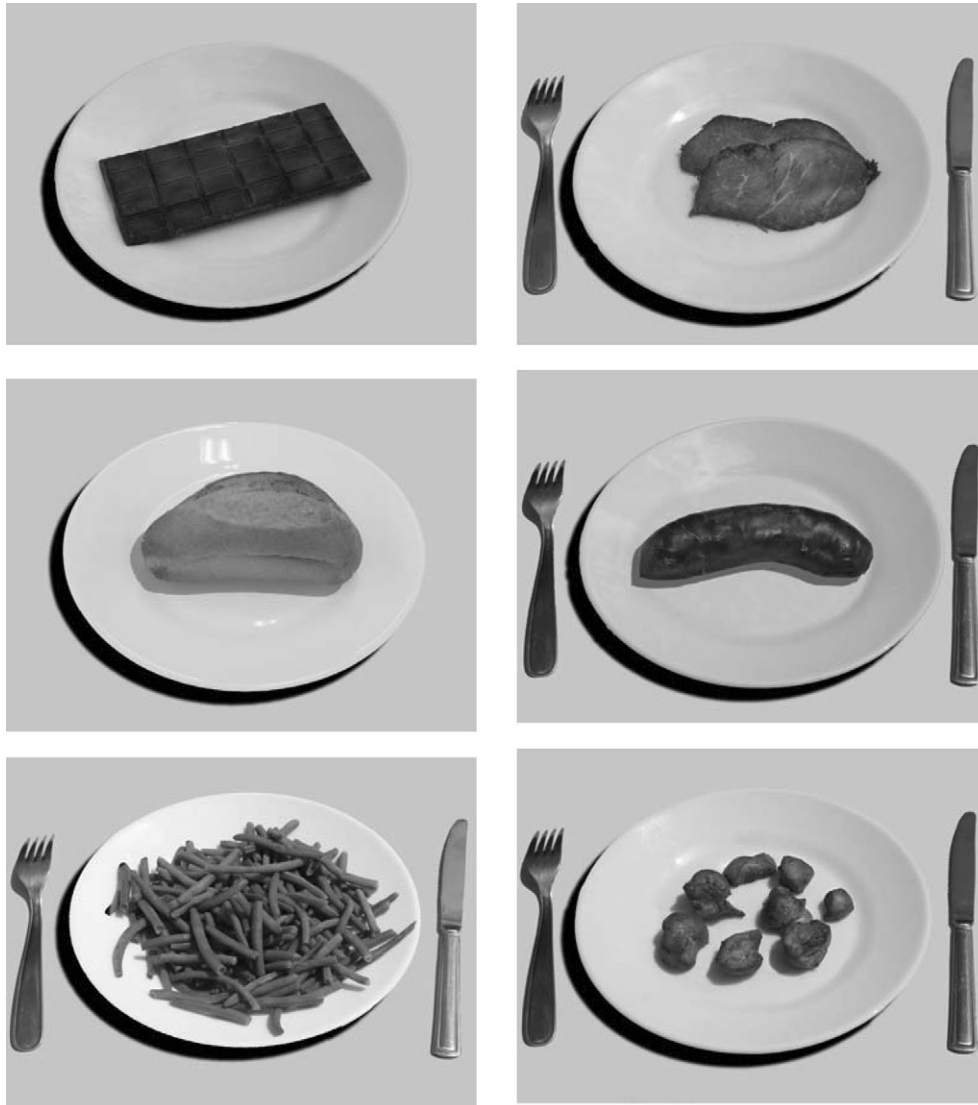


Fig. 1. Pictures of the six food products.

The aim of our study was to investigate if the presence of other people in a photograph, expressing different facial emotions would affect the participants' desire to eat liked and disliked products. More precisely, we tested how emotional facial expressions of pleasure, neutrality and disgust influence the desire to eat three liked food products (chocolate, bread, French beans) and three disliked food products (rare red meat, kidney, black pudding) (Fig. 1). We expected that eaters' faces expressing pleasure and neutrality would increase the desire to eat foods, compared to those expressing disgust. However, the expression of pleasure associated with foods should normally have a larger impact on disliked than on liked food because liked food is already liked whereas disliked food starts from a lower baseline and has more likelihood of improving. We also assumed that the faces expressing disgust would decrease the desire to eat foods, compared to those expressing pleasure and neutrality. The decreased desire to eat should be more pronounced for the liked than for the disliked

foods. Furthermore, in our study, the disliked foods were meat-based foods and some studies have shown major differences in men's and women's liking of meat products such as offal and rare red meat (Audebert, Deiss, & Rousset, 2006; Rousset, Deiss, Juillard, Schlich, & Droit-Volet, 2005). Indeed, some women experienced more discomfort and disgust than men toward meat products (Kubberød, Ueland, Rodbotten, Westad, & Risvik, 2002). Therefore, we could expect that the desire to eat the disliked foods was lower in women than in men.

Method

Participants

Eighty-eight young people, 44 men and 44 women, with a mean age of 27.7 (S.D. = 3.0) for women and 27.0 (S.D. = 3.3) for men, were recruited in Clermont-Ferrand (France) through advertising

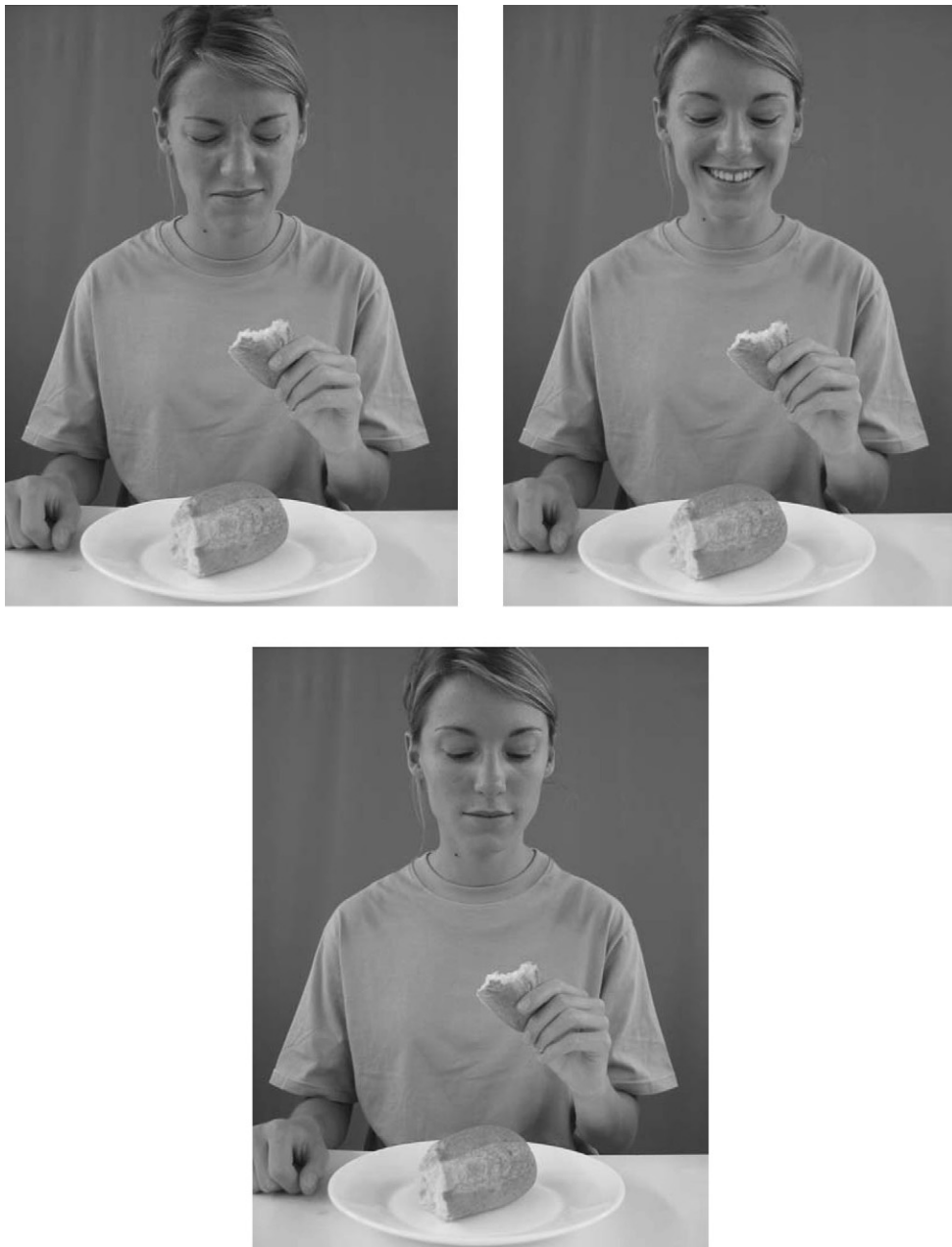


Fig. 2. Examples of an eater with expressions of disgust, pleasure and neutrality towards bread.

in the local newspapers. The body mass index (BMI) for women and men was 19.7 (S.D. = 4.0) and 22.5 (S.D. = 2.9), respectively. Participants were not receiving medical treatment for any progressive illness. They received a payment of €20 as compensation for their participation in the study.

Materials

The participants were tested individually. They were seated in front of a computer in a laboratory setting. The experimenter gave the instructions to the participant and then left him/her alone. The stimuli consisted of six different photographs of food products: three liked foods (chocolate, bread, French bean) and three disliked food products (rare red meat, kidney, black pudding). The foods judged as liked and disliked were validated in Rousset et al.'s study (2005). In this study, each participant assessed the intensity of the emotion "to like", that was aroused by 30 food pictures, on the 5-point liking scale, from 0, "I do not feel this emotion", to 4, "I feel it very strongly". The three liked foods received the highest mean ratings and the three disliked foods received the weakest mean ratings on this liking scale (Table 1). There was no neutral food because food, regardless of what it is, is not associated with neutrality but always with some emotional intensity.

There were also photographs of six eaters seated at a table: three young men and three young women. Each eater expressed three different emotions: pleasure, neutrality and disgust. Each facial expression was presented with each of the six food products (Fig. 2). A pre-test showed that participants attributed the emotional expression to the food when eaters on the photograph were looking at the food. From an early age, individuals are able to link an emotional expression to the stimulus to which it is intended through eye gaze-direction (Engell & Haxby, 2007). The emotional faces expressed by the six eaters were validated by Rousset et al. (2008). These six photographs were selected for the quality and the intensity of the expressed emotions, using a 7-point scale, from 0, "the face does not express this emotion", to 6, "the face strongly expresses this emotion" (Table 2).

Procedure

The subjects participated in one session, either between 10:00 a.m. and 12:00 a.m. or between 6:00 p.m. and 8:00 p.m., and were instructed not to eat during the 2 h before the testing session. They were told that they would have to look at colour photographs of food and to assess their desire to eat the product shown on each photograph. Each participant was presented with two series of photographs on the computer. The first series was composed of the six different photographs, one for each food product (three liked and three disliked). The second series was composed of 36 different photographs ($2 \times 3 \times 6$), i.e., two eaters (one man and one woman) for the three emotional expressions (disgust, neutrality and pleasure), for the six food products. The order of presentation of

Table 1

Means and standard deviations of the evaluation of "to like" emotion toward the food pictures on the 5-point liking scale, from 0 "I do not feel this emotion" to 4 "I feel it very strongly"

Food picture	Mean	S.D.
Chocolate	2.9	1.1
Bread	2.7	0.9
French beans	2.5	0.8
Red meat	1.5	1.3
Black pudding	1.0	1.2
Kidney	0.6	1.1

Table 2

Means and standard deviations of intensity of emotions perceived from the six eaters that best expressed disgust, neutrality and pleasure on a 7-point scale, from 0 "the face does not express this emotion", to 6 "the face strongly expresses this emotion"

	Pleasure ^a		Neutrality ^a		Disgust ^a	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Selected eater						
Men ^b						
M1	5.1	1.6	3.7	1.7	4.7	1.1
M2	4.1	1.7	3.0	1.9	5.4	1.0
M4	4.3	1.6	3.6	2.0	5.2	1.0
Women ^b						
W1	4.9	1.5	3.8	2.1	5.1	1.4
W2	5.3	1.3	3.8	2.2	5.3	0.8
W3	5.3	1.0	3.7	2.1	4.9	1.1

^a Emotional expressions.

^b The first two characters indicate the sex (M for men and W for women) and the code (no. 1, 2, 3 or 4) of the selected eater.

the two series of photographs was counterbalanced across subjects. Half of the subjects began to look at the first series while the other half began to look at the second series of photographs. For each food and emotional expression, the man's and the woman's face was randomly chosen from among the three eaters. Within each series, photographs were presented in random order. For each photograph, the participants assessed the intensity of their eating desire on a vertical and non-structured scale (from the bottom, "I have no desire to eat", to the top, "I have a great desire to eat"). When the foods were presented alone, the eating desire score corresponded to the food liking score, leading us to assume that the more we desire to eat the food, the more we like it. Scores varied between 0 and 10. Both the photographs and the eating desire scale were presented on the same screen. After participants scored their evaluation, they pressed a button to bring up the next photograph.

Data analysis

We used three models of analysis of variance with the food photographs as repeated measurements. The first one (2×2 ANOVA) was run on the eating desire scale value for the first series of photographs (food products in a non-social context), with participants' gender as a between-subject factor, and food categories (liked vs. disliked) as a within-subject factor. The following two analyses ($2 \times 2 \times 2$ ANOVAs) were carried out on the data with the same factors (participant's gender, food category), and an additional context within-subject factor: non-social vs. social, i.e., food presented without an eater and food presented with an eater. This was done for each of the three emotions expressed by the eaters in order to test the effect of facial expressions under each emotional condition. When significant interactions were found, we used other ANOVA models. For example, we performed an ANOVA with context as the within-subject factor for each type of product (liked vs. disliked). Moreover, for each food category, we carried out an ANOVA to determine the effect of the participant's gender. The purpose of the last ANOVA ($3 \times 2 \times 2 \times 2$) was to compare the three emotional facial expressions, the two food categories and the impact of eater and participant's gender on food eating desire. When overall significant effects were found, Student's *t*-tests were run. A Bonferroni correction was used for *t*-tests in the case of the comparison of the three expressions.

The eater's gender effect was not significant, so it was not pursued further.

Results

Influence of participant's gender and food category on the desire to eat food products in a non-social context

The results showed a main effect of food category, $F(1, 86) = 104.67, p < 0.001$, indicating that the liked products elicited more desire to eat than the disliked products (6.49 vs. 3.36). There was no main effect of the participant's gender, $F(1, 86) = 0.30, p > 0.05$, but a significant food category \times gender interaction, $F(1, 86) = 6.79, p < 0.05$. This interaction indicated that for the liked foods, the desire to eat food products was similar between men (6.20) and women (6.79), $F(1, 86) = 1.74, p > 0.05$. In contrast, for the disliked foods, the desire to eat food tended to be higher in men (3.86) than in women (2.85), $F(1, 86) = 3.48, p = 0.06$. Thus, men desired to eat food products more than women did, regardless of the disliked foods, $p > 0.05$.

Comparison of the non-social and social context on the desire to eat food products.

Non-social vs. social context: neutral faces

The ANOVA showed a main effect of food category, $F(1, 86) = 107.98, p < 0.001$, but neither a significant main effect of participant's gender, $F(1, 86) = 0.89$, nor of context, $F(1, 86) = 0.08$, all $p > 0.05$. However, the participant's gender \times food category interaction was significant, $F(1, 86) = 10.14, p < 0.01$. For the liked foods, there was no significant difference between men (6.05) and women (6.57), $F(1, 86) = 1.31, p > 0.05$ (Fig. 3). On the other hand, for the disliked foods, the desire to eat was stronger in men (4.25) than in women (2.73), $F(1, 86) = 9.12, p < 0.01$. In addition, there was a significant interaction between the context and the food category $F(1, 86) = 4.58, p < 0.05$. For the liked products, we observed a marginally significant effect of context, $F(1, 86) = 3.37, p = 0.07$, suggesting that the desire to eat these foods tended to be higher when they were presented alone rather than with an eater expressing a neutral emotion (6.49 vs. 6.31). In contrast, for the disliked foods, the desire to eat them did not change with the context, $F(1, 86) = 0.94, p > 0.05$.

Non-social vs. social context: faces expressing pleasure

The analysis of variance showed two main effects: food category, $F(1, 86) = 115.92, p < 0.001$, and context, $F(1, 86) = 6.25, p < 0.05$, while interactions between these two factors were not significant, $F(1, 86) = 1.96, p > 0.05$. Moreover, there was no effect of participant's gender, $F(1, 86) = 0.75, p > 0.05$, but a significant participant's gender \times food category interaction, $F(1, 86) = 10.60, p < 0.01$. We then ran an ANOVA with context as the within-subject factor and gender as the between-subject factor, for each food category taken separately. For the liked products, there was no effect of context, $F(1, 86) = 2.85$, nor participant's gender effect, $F(1, 86) = 1.87$, nor context \times participant's gender interaction, $F(1, 86) = 0.004$, all $p > 0.05$ (Fig. 3). Thus, when the products were already liked, the perception of an eater expressing pleasure no longer increased the desire to eat these products. For the disliked products, the pleasant faces increased the desire to eat compared to the non-social context, $F(1, 86) = 5.87, p < 0.05$, although the desire to eat remained low (less than 5 on a 10-point scale). Furthermore, there was a gender effect, $F(1, 86) = 6.11, p < 0.05$, but no interaction between context and participant's gender, $F(1, 86) = 2.37, p > 0.05$. This indicated that the desire to eat the disliked foods was greater in men than in women, irrespective of the context.

Non-social vs. social context: faces expressing disgust

There was a main effect of food category, $F(1, 86) = 105.31, p < 0.001$, and of context, $F(1, 86) = 10.14, p < 0.01$, as well as a

significant interaction between these two factors, $F(1, 86) = 5.80, p < 0.05$. However, there was no gender effect, $F(1, 86) = 0.85, p > 0.05$. Thus, for the liked foods, the desire to eat was greater in the non-social context than in the presence of an eater expressing disgust (6.49 vs. 5.93), $F(1, 86) = 14.51, p < 0.001$ (Fig. 3). However, for the disliked foods, the desire to eat was similar when food was shown with and without a disgusted eater, $F(1, 86) = 1.50, p > 0.05$.

Comparison of the three emotional facial expressions on desire to eat food in the social context

The main effect of emotional facial expressions (neutrality, pleasure and disgust) was highly significant, $F(2, 172) = 22.12, p < 0.001$, and there was a marginally significant context \times food category interaction, $F(2, 172) = 2.67, p = 0.07$. Thus, for the liked foods, the disgusted faces produced lower eating desire scores than those expressing pleasure (5.93 vs. 6.66), $t(87) = 4.95, p < 0.001$, or neutrality (5.93 vs. 6.31), $t(87) = 4.06, p < 0.001$. In contrast, the faces expressing pleasure increased the level of eating desire compared to neutral facial expressions (6.66 vs. 6.31), $t(87) = 4.33, p < 0.001$. In the same way, for the disliked foods, the desire to eat was higher for the happy faces than for the disgusted faces (3.73 vs. 3.20), $t(87) = 4.32, p < 0.001$, or neutral faces (3.73 vs. 3.49), $t(87) = 3, p < 0.01$, and it was lower for the faces expressing disgust than neutrality (3.20 vs. 3.49), $t(87) = 3.69, p < 0.001$.

There was also a significant food category effect, $F(1, 86) = 103.66, p < 0.001$, and a food category \times participant's gender interaction, $F(1, 86) = 12.54, p < 0.01$. The main effect of the participant's gender was not significant, $F(1, 86) = 1.57, p > 0.05$. No other interaction was significant. Thus, in agreement with our previous results, the liked food products produced a greater desire to eat than the disliked food products (6.30 vs. 3.47). In addition, as previously reported, the participant's gender difference in the desire to eat food products tended to be significant for the disliked food products, $F(1, 86) = 8.89, p < 0.05$, but not for the liked food products $F(1, 86) = 1.26, p > 0.05$, suggesting that the desire to eat the disliked foods was stronger in men than in women (4.20 vs. 2.74) (Fig. 3).

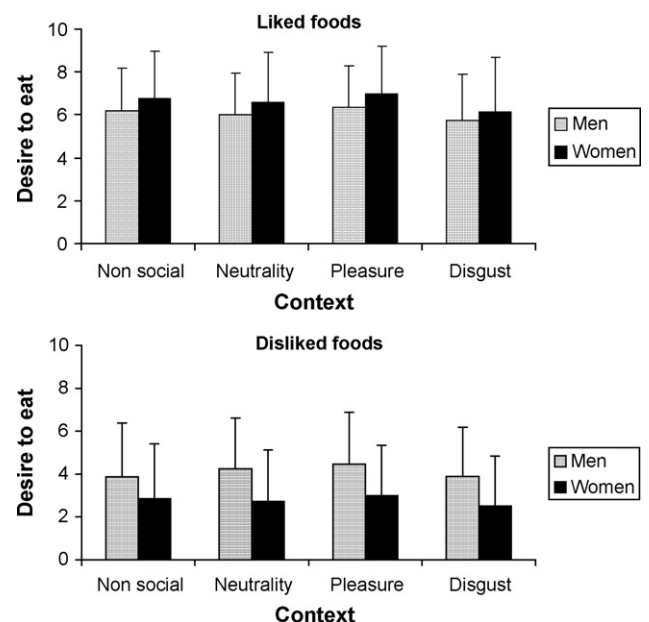


Fig. 3. Means and standard deviations of the neutral, pleasant and disgust social contexts compared to the non-social context on the desire to eat liked foods and disliked foods in men and women participants.

Discussion

The present study showed that, in the non-social context, the desire to eat was greater for the liked than for the disliked food products. This provided additional support for the hypothesis that liking food activated the reward system, thereby affecting the desire to eat and ingestive behaviour (Pelchat, 2002). However, in our study, the evaluation of desire to eat the food products presented alone on a photograph revealed that the desire to eat disliked food products was greater in men than in women, whereas there was no gender difference for the liked food products. This result could be explained by the fact that the disliked food products used in the present study were rare red meat and offal. Our results were thus entirely consistent with the results of other studies suggesting that women felt more disgust toward meat than men (Kubberød et al., 2002; Lea & Worsley, 2002). Indeed, some women reported disliking meat for its red colour, blood and flesh that reminded them of the death of animals (Kubberød, Dingstad, Ueland, & Risvik, 2006; Mooney & Walbourn, 2001). In contrast, when the photographs showed chocolate, bread and French beans, i.e., liked foods, the desire to eat this type of food did not differ between men and women.

More interestingly here, our study revealed that the simple presentation of a photograph of an eater may modify the desire to eat a food product, but that this depended on both the food category (liked vs. disliked) and on the facial expression of the eater. More precisely, when the foods were liked, the desire to eat these foods was lower with a photograph of an eater expressing disgust and neutrality than when these foods were presented on a photograph alone. In contrast, probably related to a ceiling effect, when the foods were already liked, a photograph of an eater expressing pleasure did not significantly increase the desire to eat these foods compared to the same foods presented alone. On the other hand, when the foods were disliked, the desire to eat these foods was higher with the photograph of an eater expressing pleasure than without a photograph of an eater. The observation of a photograph with an eater expressing disgust and neutrality did not additionally decrease the desire to eat the disliked foods in comparison to when these foods were presented alone. Thus, the influence of a photograph of an eater expressing different emotions on the desire to eat depended on the basic emotion (like, dislike) that the participant felt toward food products. The degree of eating desire did not change in the presence of disgusted faces when the participants already disliked the products. In the same way, the degree of eating desire did not significantly differ in the presence of pleased faces when the subjects already liked the products. It would be interesting to use foods in our study that produced neutral emotion in order to further investigate the effect of pleasure and disgusted facial expressions. However, as reported in an earlier section, the specificity of food is that it always produces an emotion although this emotion may be of different intensity. Thus, we may suggest that when there was congruence between the emotion felt toward foods and the facial expression of another eater, there was no modulation of the desire to eat. On the other hand, when the participants liked the foods and the eater expressed disgust or neutrality, that is to say, when emotions were incongruent, the desire to eat was higher without the photograph of an eater, i.e., when the foods were presented alone. Finally, when the participants did not like the foods but the eater expressed pleasure, the other person's facial expression influenced the desire to eat. In fact, in spite of their negative emotions toward these products, viewing another person eating these foods on a photograph with a happy face increased their desire to eat these disliked foods. An emotional effect also occurred when the participants liked the foods and the eaters expressed disgust. In

the same way, in spite of their positive emotions, the presence of an eater expressing disgust toward these liked foods decreased their desire to eat them. However, our study suggested that the desire to eat increased or decreased but did not completely change. Thus, viewing another person eating with a happy or disgusted face modulates our basic emotions toward food and, consequently, our desire to eat these food products but it does not radically change our emotions probably due to the well-known influence of the sensory characteristics of food (Forde & Delahunty, 2004).

Concerning the social context, that is to say, when eaters were present on photographs, our results showed that the desire to eat was higher when they expressed pleasure than disgust or neutrality, and lower when they expressed disgust than neutrality, and this for liked and disliked food products. The question raised is: What are the mechanisms underlying these effects? It may be suggested that the other person's facial expressions provide information about the foods. A disgusted expression indicates that the food is not good. However, we can think that this is more likely for unfamiliar foods, as shown by Rousset et al. (2008), than for well-known foods such as those used in the present study. Another explanation should come from the broaden-and-build theory (Fredrickson, 2001, 2004), showing that positive emotions tended to motivate participants to accept new ideas. Consequently, in our study, the pleasant faces of the eater toward the disliked foods motivated the participants to accept these food products even more, which resulted in an increased desire to eat them. On the contrary, negative emotions tended to reduce the participants' motivation, which could explain why the emotion of disgust decreased the desire to eat the liked food products.

On the other hand, the theory of social embodiment claims that the other person's emotions (facial expression of disgust) produce the corresponding emotion in the observer (feeling of disgust), although to a lower extent. Within the framework of studies on emotion and facial expression, there is a growing body of evidence supporting this hypothesis (for a recent review, see Niedenthal, 2007). According to the embodiment theory, the observation of emotions expressed by other people's faces induced the physiological reactions associated with this emotion in individuals. As suggested by Dimberg (1982, 1990), the perception of positive and negative facial expressions induces spontaneous mimicry that in turn produces the corresponding emotional state. Therefore, viewing a person expressing pleasure when he/she eats would activate the same emotion in the participants, which would increase their desire to eat. Conversely, to view a person expressing disgust would tend to activate the emotion of disgust, which would lead the participants to decrease their desire to eat the foods. Thus, we may assume that the emotion perceived in other people modulated the emotion elicited by the food products themselves. However, our study deals with the desire to eat and not with food intake. We can suppose that there is a correlation between people's desire to eat food and their actual intake of it. However, there may well be a discrepancy between the judgement (desire to eat) and the behaviour (food intake). Since emotion is a dynamic process, it can evolve during a meal. Consequently, future investigations should seek to determine whether the exposure to emotional expression affects food intake in a real consumption situation as it did with photographs presented on a computer.

In conclusion, our study demonstrated that the emotions expressed toward food by other people on photographs affected our own desire to eat these foods. However, it did not change the basic emotions (like, dislike) that we feel toward foods, from like to dislike or, inversely, from dislike to like. We now intend to see if these results can be generalised to the case of food intake.

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