



Is food desirability affected by social interaction?



Matteo Rizzato^{a,*}, Cinzia Di Dio^{b,c,d}, Fabrizio Fasano^{c,d}, Gabriella Gilli^b, Antonella Marchetti^b, Alessandro Sensidoni^a

^a Department of Food Science, University of Udine, via Sondrio 2/A, 33100 Udine, Italy

^b Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy

^c Department of Neuroscience, University of Parma, Via Volturno 39/E, 43100 Parma, Italy

^d NeuroComm s.r.l., Parma, Via Leonardo Da Vinci 24, 43123 Parma, Italy

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ABSTRACT

The experience of food can be affected by visual perception and the context in which food is presented. In this study, we investigated the effect of specific emotional contexts on food desirability. To this purpose, we selected a highly familiar Italian food, Pizza Margherita, whose sauce color was digitally manipulated to create different desirability levels. The participants rated the pizza desirability on the basis of its visual features alone (no-context condition) and, most critically, after viewing images representing facial expressions of happiness, anger and neutrality. Anger was selected, as opposed to disgust, as a food-unrelated emotion to assess whether influential effects on food desirability evoked by the observed individual's emotion state needs to be necessarily related to the eating context. Confirming previous results, we found an effect of the social context (facial expressions) on food desirability. Similarly to the no-context condition, happiness evoked the highest desirability ratings for all items compared to neutral and angry expressions, whereas the neutral and angry faces negatively affected food desirability relative to no-context and happy face conditions. These findings show that happiness is commensurate with a situation in which food is presented alone, suggesting that approach to food in healthy individuals is intrinsically related to positive emotions. Additionally, we show that food perception can be also affected by emotions, which are not necessarily related to food, but which nevertheless frame food delivery. We argue that this emotion-related effect may be grounded on resonance 'mirror' mechanisms allowing people to spontaneously tune to others' emotions.

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1. Introduction

The way we experience food is influenced by all five senses (Brody, 2012). However, eating behavior is not characterized only by the perceptual qualities of a given food, but also by cognitive and emotional factors. Flavor, for example, is shown to be the result of the multisensory integration of olfactory, tactile and taste impressions, which will vary from individual to individual based on past experiences as well as on the emotional state of the eater (Smith, 2012). Various studies have shown that the relationship between eating and emotion varies according to the particular characteristics of the individual and to his/her emotional state like, for example, anxiety, anger, joy, depression, sadness and other emotions (e.g., Canetti, Bachar, & Berry, 2002). Similarly, Macht (2008) maintains that the amount of food intake is largely influenced by change of emotions.

Emotional eating is typically defined as eating in response to negative emotions (e.g., Arnow, Kenardy, & Agras, 1995; Van Strien, Rookus, Bergers, Frijters, & Defares, 1986) and this is due to factors, such as one's intent to alleviate negative emotional states (Macht & Simons, 2011). High food consumption was reported during boredom, depression and fatigue and low food intake was reported during fear, tension and pain (Mehrabian, 1980). However, Evers, Adriaanse, de Ridder, and de Witt Huberts (2013) showed that also positive emotions can elicit food intake. Their study revealed that positive emotions evoked by the vision of a brief film caused a higher snack intake during a taste test. Positive emotions are often associated with high appetite levels (Mehrabian & Riccioni, 1986) and with a greater tendency to consume healthy foods, as opposed to junk food during negative emotions (Lyman, 1982). Additionally, it was shown that people tend to eat larger amounts of a less hedonic product (like raisins) when they are in a happy state than when they are in a sad state (Garg, Wansink, & Inman, 2007). Our perception of the sensory world is therefore constantly modulated by our psychological and emotional state as well as by the environment surround-

* Corresponding author.

E-mail address: rizzato.sas@libero.it (M. Rizzato).

ing us (Fontanini & Katz, 2009). Health related contextual factors can also impact eating behavior. For example, the desire to eat decreased when an obese person was observed, independently of the observer's facial expression. In contrast, the desire to eat increased when a subject of normal weight was observed by a person exhibiting a facial expression of pleasure (Barthomeuf, Rousset, & Droit-Volet, 2010).

The effect of external factors, such as the environment or other persons present, seems to be crucial for how we experience food (Jang, King, & Prinyawiwatkul, 2014). It was shown, for example, that socializing can influence the volume of food consumption (Wansink, 2004). Barthomeuf and colleagues (2009) carried out a study to test if pleasure, neutrality and disgust expressed by other individuals on a photograph could affect the desire to eat liked or disliked foods. In this study they tested 44 subjects viewing photographs of people while eating different types of food and showed that the effect of the presence of an eater, and of emotions expressed by this eater, depended on the food category. The desire to eat was higher when foods were presented alone than with an eater expressing neutral emotions. When the eater expressed pleasure, the desire to eat liked foods did not significantly increase while it increased for disliked foods. In contrast, when the eater expressed disgust, the desire to eat liked foods significantly decreased while had no effect on the desire for disliked foods. These results suggest that attending to others' emotions may affect food desirability.

This social effect on one's emotions can be explained in terms of the commonly accepted existence of a mirror mechanism. Humans possess six basic emotions, namely happiness, surprise, fear, sadness, anger, and disgust combined with contempt, although the list has been expanded later (Ekman, 1999). As in the theories of embodied emotions (Barsalou, Niedenthal, Barbey, & Ruppert, 2003; Niedenthal, 2007; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Wicker et al., 2003), the perception of emotions expressed by other people's faces leads to a comprehension of the emotional state in the observer via an automatic imitation of the facial expressions (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000; see also Dimberg, 1982, 1990). This 'resonance' between individuals (empathy) may be grounded on the existence of mirror mechanisms (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996; Rizzolatti et al., 1988; Rizzolatti & Craighero, 2004; Rizzolatti, Fadiga, Fogassi, & Gallese, 1999; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996) that are considered the neural basis of intersubjectivity (Gallese, 2001, 2003). Through the mirror systems, perception of actions and emotions in others overlaps with the same neural mechanisms in the beholder when actively executing the same actions or feeling the same emotions (e.g., Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992; Fadiga, Fogassi, Pavese, & Rizzolatti, 1995; Gallese, 2006; Iacoboni et al., 2005; Sato & Yoshikawa, 2006).

In this study, we aimed at exploring how a perceived emotion can influence food experience. In particular, a behavioral experiment was carried out to assess whether the mere sight of other people's emotions, shown by their facial expressions, exerts a significant influence in the level of predisposition to food consumption (desirability) independently of the initial emotional state of the observing subject. For this purpose, we manipulated food desirability by changing the visual features of the presented stimulus and, more specifically, its color. As a stimulus, we selected a typical and well-known Italian food, Pizza Margherita, commonly recognized as desirable. We assessed its desirability when presented alone (no-context condition) and observed changes in its desirability level when embedded in a social emotional context. The social context condition was created by introducing, prior to the food target presentation, a male or female face expressing happiness, anger and neutrality. Differently from previous studies (e.g., Barthomeuf, Rousset, & Droit-Volet, 2009) that used images of peo-

ple in the act of eating, we presented the emotional stimulus prior to food observation to evaluate if observation of others' emotions alone (and not emotion in association with eating) exerts effects on food perception. Additionally, we used facial expressions, whose emotions are not necessarily linked to eating as in the case, for example, of disgust. This was done to assess whether, generally, food perception is affected by the receiver's current emotion state. Nevertheless, we chose some emotions (happiness and anger) that, at a probabilistic level (because more frequent), could ease the emotional response of the viewers for food, as opposed to emotions such as sadness and fear (Macht, 1999) that are less frequent in food related contexts (Scherer, Wallbott, & Summerfield, 1986). For example, in a restaurant it is more likely to see a stressed waiter displaying an emotion of anger rather than sadness. Additionally, since the present findings could have implications for food behavior and education, we selected anger rather than emotions like sadness because it has been shown to be the most common response to negative and stressful events in young children (Tiberi & Pedrabissi, 1988; see also, Gilli, Marchetti, & Rosini, 2001; Gilli, Siegal, Marchetti, & Peterson, 2001).

2. Materials and methods

2.1. Participants

Thirty-three (33) volunteers, aged between 20 and 31 years, 18 male and 15 female, participated to this study. None of the participants had celiac disease nor intolerance to the components of the presented food stimuli. This study was approved by the University of Udine Ethics Committee.

2.2. Stimuli

A typical Italian food, Pizza Margherita, was selected as food model to our purpose. Pizza Margherita has a widespread approval rating in the Italian population and is considered a 'familiar' food. Images of Pizza Margherita were supplied by Roncadin S.p.A. (Meduno, Pn, Italy). Different degrees of desirability were created by digitally manipulating the sauce color. More specifically, we varied the red color coordinate (light red -30 , standard red 00 , bright red $+30$) using the Photoshop software function (Image, adjustments, selective color, reds, and varying magenta levels -30 and $+30$; see Fig. 1). Using the same stimulus in different visual variances allowed us to control for homogeneity of responses due to differences in the visual composition of food.

The emotional stimulus (facial expression) represented a male or female face expressing either a neutral, happy, or angry emotion. Happy and angry face expressions were selected among six possible emotions according to Ekman's categorization: sadness, anger, surprise, fear, disgust and contempt, happiness (1999). In total, 6 emotional stimuli were used (2 gender \times 3 emotions; Fig. 2). To increase the ecological power of the observed effects, all participants (males and females) were equally presented with both face genders. To support that the effect of the social stimuli on food desirability was independent of whether a female or male participant observed a female or male face, a supplementary analysis including the participants gender as a between-subjects factor showed no significant interaction effect between participants' gender and the gender of the presented face (see Section 3 below).

2.3. Stimulus validation

To validate the stimuli used, after the experimental session, in which we required participants to express a desirability judgment on the food images, the subjects had to evaluate which emotion

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