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Impact of olfactory and auditory priming on the attraction to foods with high energy density

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ABSTRACT

Recent research suggests that non-attentively perceived stimuli may significantly influence consumers' food choices. The main objective of the present study was to determine whether an olfactory prime (a sweet-fatty odour) and a semantic auditory prime (a nutritional prevention message), both presented incidentally, either alone or in combination can influence subsequent food choices.

The experiment included 147 participants who were assigned to four different conditions: a control condition, a scented condition, an auditory condition or an auditory-scented condition. All participants remained in the waiting room during15 min while they performed a 'lure' task. For the scented condition, the participants were unobtrusively exposed to a 'pain au chocolat' odour. Those in the auditory condition were exposed to an audiotape including radio podcasts and a nutritional message. A third group of participants was exposed to both olfactory and auditory stimuli simultaneously. In the control condition, no stimulation was given. Following this waiting period, all participants moved into a non-odorised test room where they were asked to choose, from dishes served buffet-style, the starter, main course and dessert that they would actually eat for lunch.

The results showed that the participants primed with the odour of 'pain au chocolat' tended to choose more desserts with high energy density (i.e., a waffle) than the participants in the control condition ($p = 0.06$). Unexpectedly, the participants primed with the nutritional auditory message chose to consume more desserts with high energy density than the participants in the control condition ($p = 0.03$). In the last condition (odour and nutritional message), they chose to consume more desserts with high energy density than the participants in the control condition ($p = 0.01$), and the data reveal an additive effect of the two primes.

1. Introduction

Current research in social and cognitive psychology suggests that people are not as rational as they imagine in the motivations driving their behaviours and choices (Friese, Hofmann, & Wänke, 2008, 2006; Kahneman & Tversky, 2000; Smeets & Dijksterhuis, 2014), and eating behaviour is no exception to this rule. According to Wansink and Sobal (2007), adults typically make more than 200 food-related decisions per day, but they are consciously aware of only 14.4 of these choices. Many cues (e.g., odours, images, messages) are present in the daily environment (Chandon & Ordabayeva, 2009; Coelho, Polivy, Herman, & Pliner, 2009; Fedoroff, Polivy, & Herman, 2003; Ferriday & Brunstrom, 2008; Harris, Bargh, & Brownell, 2009) and may affect eating behaviour and, more precisely, food choice behaviour, but people are not necessarily conscious of the impact of these cues (see Wansink, 2004 for a review). Understanding the impact of non-attentively perceived cues involved in eating behaviour requires the contribution of psychology and cognitive sciences, domains in which several paradigms have been developed to explore non-conscious influences. One of these paradigms is called 'priming'.

From a methodological perspective, the priming paradigm initially developed in cognitive psychology (Schacter, 1987; Tulving & Schacter, 1990) consists of two phases. In the first phase,

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participants are exposed incidentally or not to a stimulus called a prime, which can belong to any sensory modality (e.g., visual, auditory, olfactory). During the exposure, mental representations related to the prime are activated (Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). In a second phase, the non-conscious effects of the activation are evaluated using 'indirect' memory tasks (Richardson-Klavehn & Bjork, 1988) in which no reference is made to the prior experience. Cues or primes can automatically activate associated representations in memory, leading them to become more accessible. This accessibility then spreads to related constructs via an associative network (Anderson, 1983; Collins & Loftus, 1975). According to this spreading activation account, priming a given construct in memory leads to the spontaneous activation of related constructs in memory. Consequently, we can suppose that exposure to a food-related stimulus (e.g., odour, message) may have important effects on subsequent eating behaviour.

The priming paradigm has been used in several fields of investigation and has been especially well described in the visual and semantic domains (Aarts & Dijksterhuis, 2003; Bargh, Chen, & Burrows, 1996; Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trötschel, 2001; Chartrand & Bargh, 1996; Custers & Aarts, 2005, 2007; Kawakami, Dovidio, & Dijksterhuis, 2003). Recently, the priming paradigm has been applied in the eating behaviour domain. Various studies have shown that food choices in adults are influenced by a non-attentively perceived odour (Coelho et al., 2009; Fedoroff et al., 2003; Forwood, Ahern, Hollands, Ng, & Marteau, 2015; Gaillet, Sulmont-Rossé, Issanchou, Chabanet, & Chambaron, 2013; 2014).

Previous studies (Gaillet et al., 2013; 2014) have demonstrated that non-attentively perceived fruity odours affect food choices, guiding participants towards more fruit and/or vegetable choices. Following these findings highlighting the non-conscious influence of olfactory cues on subsequent food choices, the main objective of the present study was to determine whether an olfactory prime (a sweet-fatty odour) and a semantic auditory prime (a nutritional prevention message), both presented incidentally either alone or in combination, can influence subsequent food choices. We can suppose that a sweet-fatty odour will guide choices towards sweet-fatty products.

In 2007 the French National Nutrition Programme was launched, requiring health promotion messages to be included on all advertisements for food products. These messages have a positive tone and present solutions for avoiding weight gain, such as: 'Eat five fruit and vegetables per day' or 'For your health, avoid eating too fatty, too sweet or too salty'. These messages appear at the bottom of all print advertisements for food products, as well as within radio and television advertisements. The health promotion message is explicitly presented, but it is embedded within the advertisement; for example during TV advertisements for food, a banner with the message appears at the bottom of the screen. This embedded presentation of the health promotion message can be non-attentively perceived by people and can have a priming effect. Little is known about the real impact of these embedded promotion messages and results appear contradictory when used for other products. Health labels on cigarette packs are effective (Hammond, Fong, McDonald, Brown, & Cameron, 2004; Sabanne, Lowrey, & Chebat, 2009) but those on food packets are not. An evaluation of the French National Nutrition Programme labels reveals high levels of recall and positive attitudes (INPES). But prevention campaigns can have counterproductive effects (Cuny, 2013; Werle & Cuny, 2012). There is therefore interest in assessing the impact of these health promotion messages on food choice behaviour.

Finally, to obtain a more ecological situation, this study focused on the combined presentation of these two types of primes (olfactory and semantic auditory) and on its impact on food choices. We aimed to answer the question 'If a sweet-fatty odour is diffused at the same time that a healthy nutritional message is delivered, what will be the impact of this double priming?' The experiment was conducted in a real situation of food choices at lunchtime with adults who had to choose a starter, a main course and a dessert from a buffet.

2. Material and methods

2.1. Participants

One hundred and forty-seven participants (see Table 1 below) took part in the experiment. They were recruited from a population registered in the *Chemosens Platform's PanelSens* database. This database has been declared to the relevant authority (Commission Nationale Informatique et Libertés – CNIL – n° d'autorisation 1148039). Participants were tested in groups of 6–9 and were assigned to a scented condition, an auditory condition, a scented and auditory condition, or a control condition with no stimulation. On the basis of a recruitment questionnaire, participants who declared having food allergies or being on a diet and participants who explicitly reported having some trouble in odour perception (chronic sinusitis or anosmia), audition or vision were excluded. To ensure that the participants were unaware of the real purpose of the experiment (i.e., the study of olfactory and auditory priming), they were told that the experiment was designed to study communication skills and to examine how people interact in the environment where they eat (false pretence). The participants were invited for a 1-h session at lunchtime (i.e., from noon to 1 pm) and were informed that they would have their lunch in the laboratory. They were asked not to wear perfume and not to smoke during the hour preceding the session. The experimental protocol was approved by the *Comité de la Protection des Personnes Est I* (Research Ethics Committee). In accordance with the procedures of this regulatory body, the participants received written and oral information regarding the study before signing a consent form. In return for their participation, they received a €10 voucher.

The choice of the olfactory and semantic auditory primes and the characteristics of the dishes proposed for the *Lunch* were determined after preliminary studies that are detailed in the following two sections. The participants involved in these preliminary experiments were different from those involved in the priming experiment, but they shared similar characteristics.

2.2. Olfactory priming

A sweet-fatty odour of 'pain of chocolat' was used as the olfactory prime. This odour was obtained by baking real small 'pains au chocolat' (Thiriet ©) in an oven. The odorisation procedure was designed to (1) ensure a homogeneous distribution of the odorant in the waiting room, (2) ensure an intensity of the odour that would

Table 1
Number of men and women, their mean age and their age range assigned to the different experimental conditions (scented, auditory, scented + auditory, and control).

Condition	Men	Women	Total	Mean age	Age range
Scented	9	29	38	36.24	18–50
Auditory	8	29	37	33.41	18–50
Scented + Auditory	8	27	35	33,31	18–50
Control	7	30	37	32.32	18–50
All conditions	32	115	147	33.82	18–50