Food Quality and Preference 50 (2016) 129–134

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Haptic exploration of plateware alters the perceived texture and taste of food

Lulie Biggs [a], Georgiana Juravle [b,*], Charles Spence [c]

[a] Flavour SenseNation, London, UK
[b] Department of Systems Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[c] Crossmodal Research Laboratory, Department of Experimental Psychology, Oxford University, UK

ARTICLE INFO

Article history:
Received 19 August 2015
Received in revised form 5 February 2016
Accepted 7 February 2016
Available online 8 February 2016

Keywords:
Haptics
Texture
Oral-somatosensory
Taste
Flavour
Sensation transference

ABSTRACT

We report two naturalistic citizen science experiments designed to highlight the influence of the texture of plateware on people's rating of the mouthfeel and taste of food (specifically, biscuits) sampled from that plateware. In the first experiment, participants tasted a biscuit from a pair of plates, one having a rough and the other a smooth finish. In the second experiment, participants tasted biscuits and jelly babies; participants rated the mouthfeel and taste of the two foodstuffs. The results both confirm and extend previous findings suggesting that haptically and visually perceived texture can influence both oral-somatosensory judgments of texture as well as, in this case, the reported taste or flavour of the food itself. The crossmodal effects reported here are explained in terms of the notion of *sensation transference*. These results have potentially important implications for everything from the design of the tactile aspects of packaging through to the design of serviceware in the setting of the restaurant.

1. Introduction

There is now growing evidence that the oral-somatosensory attributes of what we eat and drink can influence our perception of flavour (e.g., Bult, de Wijk, & Hummel, 2007), and even satiety (e.g., Hogenkamp, Stafleu, Mars, Brunstrom, & de Graaf, 2011). However, an equally important topic that has received far less attention, at least thus far, is whether haptically-perceived (i.e., as experienced by the hand) texture, be it the texture of the food (Barnett-Cowan, 2010), or the packaging in which the food or beverage is presented (Krishna & Morrin, 2008; Piqueras-Fiszman & Spence, 2012), or even the feel of the plateware or cutlery used to eat a meal (see Spence, Hobkinson, Gallace, & Piqueras-Fiszman, 2013; Spence & Piqueras-Fiszman, 2014), can also impact our experience of food and drink.

Especially relevant in this regard is a study conducted by Barnett-Cowan (2010). He had blindfolded participants rate the freshness/staleness and the crispness/softness of a series of pretzels while biting into either the fresh or stale end of a pretzel. The congruency between the tactile information provided to the participants' hand and that provided to their mouth was manipulated. In half of the trials, the participants were given a half-fresh/half-stale pretzel, whereas in the remainder of the trials, they were given either a whole fresh or whole stale pretzel. The most interesting results were in the incongruent condition where the stale part of the pretzel was rated as being significantly fresher and crispier in-mouth because the hand held what felt like a fresh pretzel, and vice versa when holding the stale end. Such results therefore clearly suggest that the perceived in-mouth texture of a dry food product can be altered simply by changing the haptic information provided to the consumer's hands. While intriguing, these results are perhaps not so surprising given that the participants were feeling what they presumably took to be the food in their mouth. What is more surprising, therefore, are those studies suggesting that the feel of the non-food items can also influence our perception of food while eating.

Suggestive evidence in this regard comes from a study by Piqueras-Fiszman and Spence (2012b).[1] These researchers demonstrated that people ($N = 58$) rated pieces of stale or fresh digestive biscuit served from a small plastic yoghurt pot as tasting both significantly crunchier and significantly harder when the packaging had been given a rough sandpaper finish, as compared to when exactly

* Corresponding author at: Department of Systems Neuroscience, University Medical Center Hamburg-Eppendorf, W34, Martinistr. 52, 20251 Hamburg, Germany.
E-mail address: g.juravle@uke.de (G. Juravle).

[1] We have also heard anecdotally that if you were to hold a handful of gravel in one hand then you would end up rating a sample of ice-cream as tasting grittier than if you were to grasp a handful of cotton wool instead (see Spence & Piqueras-Fiszman, 2014, p. 124).

http://dx.doi.org/10.1016/j.foodqual.2016.02.007
0950-3293/

the same food was served from a container with the usual smooth plastic feel of a yoghurt pot. That said, although the feel of the container influenced people's perception of a dry food product, it had no effect on their ratings of the yoghurt. As such, Piqueras-Fiszman and Spence argued that further research was needed in order to understand the limiting conditions on this particular effect (i.e., the effect of what people hold, specifically the texture, on what they taste or experience).

Elsewhere, Krishna and Morrin (2008) conducted an intriguing between-participants study in which they investigated the impact of the feel of the container (a plastic cup) on people's perception of water mixed with Sprite. Their study was conducted in a university cafeteria where 180 people evaluated the drink after having tasted it using a straw. Half of the participants touched the flimsy cup in which the drink was contained with their hand before evaluating it, whereas the rest did not. Those participants who exhibited less of a need for touch[2] were affected in their evaluation of the drink by the feel (i.e., the firmness vs. flimsiness) of the cup, whereas those participants who scored lower in terms of their need for touch were not. The participants rated the drink as being lower in quality when they felt the cup's flimsiness. These results clearly suggest that changes in the haptic qualities of the receptacle in which a drink is served might have different effects on different people depending on their general liking for haptic input.

Consistent with these findings, the results of a very recent study by Tu, Yang, and Ma (2015, Experiment 1) demonstrated that participants gave a higher rating of the perceived iciness and coldness of a cup of Chinese tea when presented in a glass container than in a plastic or paper container (of approximately the same size). Such results therefore suggest that changes in the haptic qualities of the glass, cup, or any type of container in/on which a food is served, might have important effects on a consumer's appraisal of the quality of the product within, not to mention on their global experience of the food.

Summarizing what we have seen thus far, it would appear that what people hold in their hand, even if it is the non-eating hand, can influence their estimates of the sensory properties of the foods eaten with the other. But how should such robust, yet surprising, crossmodal effects be explained? One suggestion that has been put forward here is in terms of the phenomenon of *sensation transference* (Cheskin, 1957), or what Spence and Gallace (2011) refer to as *affective ventriloquism*, when the transference concerns specifically our hedonic ratings. The basic idea is that a person's thoughts and feelings about a product extrinsic sensory cue can carry over to influence what they say, or think, about other product intrinsic cues that they have been asked to evaluate. In recent years, a number of examples of such sensation transference effects have been reported in the literature (see Gallace & Spence, 2014; Spence & Piqueras-Fiszman, 2014, for reviews). Sensation transference can also occur as a result of the weight of the package, plate, or cutlery we hold in our hand(s), while eating or drinking (Kampfer, Leischnig, Ivens, & Spence, submitted; Michel, Velasco, & Spence, 2015; Piqueras-Fiszman, Harrar, Roura, & Spence, 2011).

In the present study, data was collected from a number of public science events in order to try and both replicate and extend Piqueras-Fiszman and Spence's (2012) findings using a much larger sample of participants (note that they only tested 58 participants). Here, we thus report the results of tests conducted on a far greater number of participants ($N = 695$ in total, across 2 experiments). Acquiring additional evidence concerning the impact of felt texture on the experience of food is clearly of growing relevance, given the increasing number of chefs, artists, and designers interested in utilizing different materials and/or textures in their plateware, cutlery, even the texture of the restaurant seat itself (see Spence & Piqueras-Fiszman, 2014; Stuckey, 2012).

2. First series of citizen science experiments

2.1. Methods

2.1.1. Participants

184 participants took part in this experiment. An additional group of 470 participants was also tested over several science fairs in the UK (including The Big Bang Science Fair, Bestival, The BBC Bakes and Cakes Events, and The BBC Good Food Show). The participants consisted of people of all ages. The data were collected by Flavour SenseNation, UK. Ethical approval to collect citizen science data of this sort had been obtained.

2.1.2. Materials, procedure, and design

Small groups of up to 4 participants were asked to eat a piece of biscuit (Lotus biscuits, Lotus Bakeries) presented on two plates of the same shape. One plate had a rough and grainy surface texture, whereas the other was smooth and shiny, see Fig. 1. The participants were asked to feel the surface of the plate while they consumed a piece of biscuit from each of the plates. A within-participants experimental design was used: That is, each participant sampled a piece of biscuit from both the smooth and rough plates. The participants were requested not to make any comment until they had performed this task with both plates (to avoid influencing anyone else in the group). The participants were instructed to think about the mouthfeel and the taste of the biscuit while they performed the task. Once they had completed the task, the participants answered the following questions for the biscuit sampled from each of the plate: 'When touching the 'rough'/'smooth' plateware, how did the biscuit *feel* in your mouth?' and 'When touching the 'rough'/'smooth' plateware, how did the biscuit *taste*?' The participants were also asked 'Was there a difference in the mouthfeel/taste of the biscuits, when touching the 'rough' and 'smooth' plateware?' Those who answered in the affirmative were then prompted to describe the difference. For each of the plates (rough vs. smooth), we collected estimations of the biscuit mouthfeel and the biscuit taste. For the experimental study, the answers to the questions were open and logged by the experimenter into categories. The participants in the festival session had several predefined choices for their answers (see Fig. 3 for details).

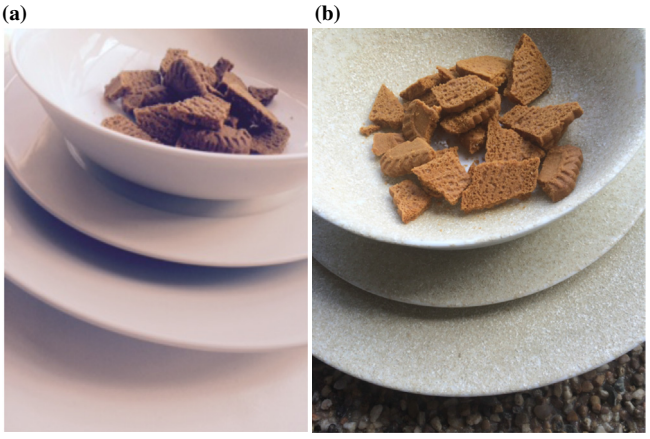

Fig. 1. Examples of the smooth (a) and rough (b) plates used in the first series of experiments.

[2] Peck and Childers (2003a,b) developed 'the need for touch' scale. It consists of a series of questions, and appears to successfully segment populations in terms of how much they like to acquire/use tactile information when making decisions.