Food Quality and Preference 46 (2015) 142–150

Contents lists available at ScienceDirect

Food Quality and Preference

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

Perception of chemesthetic stimuli in groups who differ by food involvement and culinary experience

Nadia K. Byrnes[a,b,1], Christopher R. Loss[c], John E. Hayes[a,b,*]

[a] Sensory Evaluation Center, College of Agricultural Sciences, The Pennsylvania State University, University Park, PA, USA
[b] Department of Food Science, College of Agricultural Sciences, The Pennsylvania State University, University Park, PA, USA
[c] Department of Culinary Science, The Culinary Institute of America, Hyde Park, NY, USA

ARTICLE INFO

Article history:
Received 28 May 2014
Received in revised form 23 July 2015
Accepted 24 July 2015
Available online 27 July 2015

Keywords:
Perceptual mapping
Chemesthetic
Expert
Culinary
Spicy

ABSTRACT

In the English language, there is generally a limited lexicon when referring to the sensations elicited by chemesthetic stimuli like capsaicin, allyl isothiocyanate, and eugenol, the orally irritating compounds found in chiles, wasabi, and cloves, respectively. Elsewhere, experts and novices have been shown to use language differently, with experts using more precise language. Here, we compare perceptual maps and word usage across three cohorts: experts with formal culinary education, naïve individuals with high Food Involvement Scale (FIS) scores, and naïve individuals with low FIS scores. We hypothesized that increased experience with foods, whether through informal experiential learning or formal culinary education, would have a significant influence on the perceptual maps generated from a sorting task conducted with chemesthetic stimuli, as well as on language use in a descriptive follow-up task to this sorting task. The low- and highFIS non-expert cohorts generated significantly similar maps, though in other respects the highFIS cohort was intermediate between the lowFIS and expert cohorts. The highFIS and expert cohorts generated more attributes but used language more idiosyncratically than the lowFIS group. Overall, the results from the expert group with formal culinary education differed from the two naïve cohorts both in the perceptual map generated using MDS as well as the mean number of attributes generated. Present data suggest that both formal education and informal experiential learning result in lexical development, but the level and type of learning can have a significant influence on language use and the approach to a sorting task.

1. Introduction

Sorting is one approach within a family of methods commonly used to generate perceptual maps. Perceptual mapping techniques provide information about basic attributes and common characteristics that are relevant to the assessors, regardless of whether those assessors are experts or naïve participants. In a sorting task, assessors evaluate a group of stimuli and create groupings of the stimuli based on perceived similarities and dissimilarities. A related technique is napping, which takes its name from 'nappe' (tablecloth in French). In napping (also known as projective mapping), the participants place samples on a large sheet of paper so that similar samples are closer together and dissimilar samples are farther apart. Prior work suggests napping may provide better product differentiation when compared to sorting (DeNeve & Cooper, 1998; Nestrud & Lawless, 2011) but there are significant drawbacks to the napping method. Specifically, the *ad libitum* retasting that is common in napping limits its utility with highly fatiguing samples, such as chemesthetic stimuli like capsaicin, zingerone, and menthol. Recently, we demonstrated that it is possible to conduct sorting with chemesthetic stimuli if the necessary precautions are taken (Byrnes, Nestrud, & Hayes, 2015).

Generally, there can be substantial semantic confusion surrounding the sensations elicited by chemesthetic compounds (e.g., Bennett & Hayes, 2012). It is not uncommon to hear sensations that are easily distinguishable, such as those caused by chili peppers and horseradish, all colloquially referred to as being "spicy" or "hot" in spite of clear differences between them. Historically, one major advantage of using similarity-based judgments is that they avoid what Schiffman and colleagues termed "linguistic contamination" (Schiffman, Reynolds, Young, & Carroll, 1981). Here, we wished to explore the role of formal culinary education on the ability of assessors to differentiate between and describe the sensations elicited by a broad set of chemesthetic

* Corresponding author at: 220 Erickson Food Science Building, College of Agricultural Sciences, The Pennsylvania State University, University Park, PA, USA.
E-mail address: jeh40@psu.edu (J.E. Hayes).
[1] Current address: Viticulture & Enology, University of California Davis, Davis, CA, USA.

http://dx.doi.org/10.1016/j.foodqual.2015.07.017
0950-3293/

agents. We compared individuals with formal culinary education to naïve assessors as we reasoned that formal culinary education would enhance an individual's personal lexicon regarding sensations from these various chemesthetic stimuli.

Previous work conflicts as to whether consumers are able to generate perceptual maps comparable to those generated by assessors trained via descriptive analysis techniques (here specifically called "trained panelists") or individuals with specific expertise, both of which have been referred to as "experts" in the literature (Barcenas, Elortondo, & Albisu, 2004; Cartier et al., 2006; Chollet & Valentin, 2001; Faye et al., 2004, 2006; Gains & Thomson, 1990; Giacalone, Ribeiro, & Frøst, 2013; Guerrero, Gou, & Arnau, 1997; Kennedy & Heymann, 2009; Lawless & Glatter, 1990; Nestrud & Lawless, 2010; Pagès, 2005; Perrin et al., 2008; Risvik, McEwan, & Rødbotten, 1997; Roberts & Vickers, 1994). Prior reports test the consensus of these configurations using a number of different methods, including sorting (Cartier et al., 2006; Lawless & Glatter, 1990), napping (Kennedy & Heymann, 2009; Nestrud & Lawless, 2010), and free-choice profiling (Gains & Thomson, 1990; Guerrero et al., 1997), with a variety of stimuli including odorants (Lawless & Glatter, 1990), leather (Faye et al., 2006), beers (Giacalone et al., 2013), and cheddar cheeses (Roberts & Vickers, 1994). Critically, these reports also use a variety of different, and sometimes contradictory, definitions of the term "expert" (cf. Chollet, Lelièvre, Abdi, & Valentin, 2011; Chollet & Valentin, 2001; Guerrero et al., 1997; Lawless & Glatter, 1990; Nestrud & Lawless, 2008; Pagès, 2005; Roberts & Vickers, 1994), perhaps accounting for the discrepancy in reported results.

In 1984, Lawless identified multiple, different types of "experts" as "(1) trained panelists who use techniques such as the 'Flavor Profile' method, who have undergone a uniform and directed program of training, (2) persons who have such longstanding experience with a product that they are able to serve as 'expert' sensory evaluators, for example, in quality control work, and (3) persons who have made it their profession to develop new products based on sensory attributes, e.g., flavor chemists, perfumers, and the like" (Lawless, 1984). Even though trained panelists and experts are not equivalent (Perrin et al., 2008; Roberts & Vickers, 1994; Torri et al., 2013), the terms "expert" and "trained panelist" have been used imprecisely and somewhat interchangeably in prior literature, perhaps reflecting the varied sources of expertise described by Lawless. While these individuals are trained in different ways, and with different intent, experts and trained panelists do share key characteristics regarding their lexical and memory capacities. Perhaps due to these similarities, experts and trained panelists perform similarly on sorting tasks (Lawless & Glatter, 1990).

While acknowledging that domain specific experts and trained panelists are not identical or interchangeable, several common characteristics of experts, broadly defined, warrant comparison of their perceptual maps to those of untrained assessors. A few of the key differences identified in previous literature include differences in sensory acuity, language use or memory between experts and non-experts, or differential focus as a result of training. It has been proposed that experts may perform tasks differently than untrained assessors due to superior memory abilities, resulting in less of an impairment by a delay between samples and a better ability to cope with the memory load required in tests with repeated tasting of samples (Almeida, Cubero, & O'mahony, 1999; Chollet, Valentin, & Abdi, 2005; Nestrud & Lawless, 2010; Parr, White, & Heatherbell, 2004). Dissimilarities between experts and novices have also been attributed to differential use of language. While untrained assessors tend to use vague, less specific terms, experts and trained panelists tend to use language more precisely and efficiently (Chollet & Valentin, 2001; Clapperton & Piggott, 1979; Faye et al., 2004; Gains & Thomson, 1990; Guerrero et al., 1997; Lawless, 1984; Solomon, 1990). Importantly, assessment of the precision of word usage by experts and trained panelists refers to both the specificity and repeatability of the words. Solomon argues that the precise use of language allows for more subtle discrimination between samples (Solomon, 1990), a view supported by literature showing better discrimination in experts and trained panels compared to untrained assessors (Lawless, 1984; Risvik et al., 1997; Roberts & Vickers, 1994; Tang & Heymann, 2002; Torri et al., 2013), although it is also possible that experts may choose to become experts because of differences in innate ability (e.g., Hayes & Pickering, 2011).

While trained assessors may be better at identifying small differences between samples, training or expertise may also shift the way assessors attend to the task (Delarue & Sieffermann, 2004; Roberts & Vickers, 1994; Torri et al., 2013). For example, Roberts and Vickers (1994) observed that trained dairy judges focus on defects in cheeses, rating primarily negative qualities, as compared to assessors not trained in dairy judging, who rated both positive and negative attributes. Likewise, Torri et al. (2013) showed that wine experts tended to generate napping configurations that were equivalent to quality assessments while consumers tended to sort based on hedonic criteria. Overall, it remains unclear whether data from experts are more reproducible or more idiosyncratic than consumers as past reports conflict (Barcenas et al., 2004; Nestrud & Lawless, 2008; Torri et al., 2013); we wished to explore this further here.

Bell and Marshall (2003) conceived of the Food Involvement Scale (FIS) as a general measure of overall involvement with food, where food involvement is defined as the level of importance of food in someone's life. Their scale measures involvement with food across five different stages: acquiring, preparing, cooking, eating, and disposal. Factor analysis indicates individual scale items load onto two subscales: preparation and eating (FIS-PE) and set up and disposal (FIS-SD). While an individual's moods or cravings may change throughout the day, making them more or less likely to want to prepare a meal versus dine out, food involvement is more similar to a personality trait in that it does not vary from moment to moment (Marshall & Bell, 2004). Marshall and Bell reported individuals with higher FIS scores show finer discrimination between food items, both in intensity and hedonic ratings (Bell & Marshall, 2003), although pilot work from our lab suggests this may not be a robust effect (Byrnes & Hayes, unpublished data). Regardless of differences in sensory acuity that may potentially exist across groups with different expertise (see Hayes & Pickering, 2011), we anticipate that higher interest in and experience with food, as measured with the FIS, will have lead to greater prior learning about food. Thus, we also anticipate that highFIS individuals will fall between the lowFIS and expert cohorts regarding lexical development. To test the effect of formal culinary education, we recruited a group of individuals from a culinary school as a cohort of experts. We hypothesized that the expert cohort would perform a free sorting task with chemesthetic stimuli similarly to the non-expert cohorts in terms of the perceptual maps they created, but that they would outperform the non-experts in the descriptive portion of the task, where they provided verbal labels to describe the groups formed during the free sorting task.

2. Materials and methods

2.1. Overview

This study was performed in three separate cohorts of individuals. All conditions, stimuli, and instructions were the same in each cohort. All data were collected with the approval of the Penn State Institutional Review Board; all participants provided informed consent.