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A comparison of self-reported emotional and implicit responses to aromas in beer

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ABSTRACT

Sensory scientists are increasingly measuring consumer emotions to aid discrimination between similarly liked products. Some investigations have solely focused on explicit measures of emotional response, asking consumers to self-report their emotions. Others have focused on understanding whether implicit measures such as changes in physiological and facial expression which they believe may capture unconscious responses to stimuli. In this study physiological response and facial expression along with self-reported emotional response and conventional hedonic liking measures towards a range of pleasant, unpleasant and neutral aromas within beer were evaluated. Physiological measures included heart rate and skin temperature, whilst facial expression was assessed by measuring corrugator supercilli and zygomatic major muscle activity using facial electromyography recorded via a MP150WSW (MP150) physiological data acquisition system (Biopac, Goleta, CA, USA). Self-reported emotional response was recorded using a beer specific emotional lexicon. No differences in heart rate and skin temperature were observed in response to presentation of any of the aromas. Facial expression measures found that corrugator supercilli and zygomatic major activity changed in response to unpleasant and pleasant or unpleasant and neutral samples respectively. Liking scores were found to distinguish between more aromas than facial expression measures, allowing distinction between pleasant and neutral samples. Self-reported emotional response was found to be more discriminating than both liking and facial expression measures, allowing discrimination between pleasant and neutral samples as well as between the pleasant samples themselves. The ability for self-reported emotional response to distinguish between pleasant aromas is of particular interest to industry where commercial products may be poorly discriminated on the basis of liking alone. However further work to understand the contribution of implicit measures to understanding emotional response, in particular their association with explicit measures and their representation of unconscious response is required.

1. Introduction

Research on food and beverage products within Sensory Science has recently shifted focus from conventional hedonic tests, to include the impact sensory attributes exert on consumer emotions (King & Meiselman, 2010; Meiselman, 2013). This followed the realisation that although many products receive similar liking scores, between 72 and 88% of all new food and beverage products fail during their first year within the market place (Rudolph, 1995; Stewart-Knox & Mitchell, 2003). Emotion research within Sensory Science has generally proceeded in one of two directions: researchers gaining an explicit measure of emotion, asking consumers to self-report their own conscious emotions and feelings (King & Meiselman, 2010); but other researchers believe implicit measures such as changes in the Autonomic Nervous System (ANS) and/or changes in behaviour such as facial expression could also provide insights as an unconscious measure of consumer response (Danner, Haindl, Joechl, & Duerrschmid, 2014; de Wijk, He, Mensink, Verhoeven, & de Graaf, 2014; de Wijk, Kooijman, Verhoeven, Holthuysen, & de Graaf, 2012).

The majority of emotion research has utilised self-reported measures which require consumers to rank or rate their conscious feelings towards a discrete set of emotions such as disgust, anger, excitement and so on (Gutjar et al., 2014; King, Meiselman, & Carr, 2010; Poels & Dewitte, 2006; Richins, 1997). Several approaches have been adopted with researchers choosing to use pre-defined or product specific lexicons. The EsSense profile (King &

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Meiselman, 2010) and The Geneva Emotion and Odour Scale (GEOS) (Chrea et al., 2009) questionnaires are examples of a predetermined lexicon and have been used to assess consumer emotional response towards a range of products (Chaya, Pacoud, Ng, Fenton, & Hort, 2015; Dorado, Pérez-Hugalde, Picard, & Chaya, 2016; Ferdenzi et al., 2013; Piqueras-Fiszman & Jaeger, 2014; Porcherot et al., 2010). Product specific lexicons have been developed to capture the emotions towards a specific product category such as beer (Chaya et al., 2015), coffee (Bhumiratana, Adhikari, & Chambers, 2014), blackcurrant squash (Ng, Chaya, & Hort, 2013), wine (Ferrarini et al., 2010), dark chocolate (Thomson, Crocker, & Marketo, 2010), salad fruits (Manzocco, Rumignani, & Lagazio, 2013) and hazelnut spreads (Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014). Indeed product specific lexicons have proven to be superior in their discrimination ability compared to predefined lexicons when applied to target product categories (Ng et al., 2013; Spinelli et al., 2014). However, although emotion lexicons are efficient and easy to apply within a traditional sensory test environment, they are prone to a number of limitations. In particular, rating multiple emotions on a scale can increase consumer boredom and fatigue (King, Meiselman, & Carr, 2013). In addition, due to factors such as social desirability bias, consumers may feel social pressure to over or under express certain emotions towards particular product categories (e.g. organic foods) in order to conform to social norms or society expectations (Zander & Hamm, 2010). Furthermore rating items on a scale involves a significant amount of cognitive processing, making subjects aware of their own feelings, preventing a true unconscious measure of emotion (Podsakoff, Mackenzie, Lee, & Podsakoff, 2003; Poels & Dewitte, 2006).

A second approach to evaluating consumer response is to measure the unconscious responses of consumers through implicit measures such as changes in the ANS (such as heart rate and skin temperature) and facial expression (measured via facial recognition tools and facial electromyography). As an automatic system the ANS functions below the consciousness of an individual and has attracted considerable attention from researches interested in emotional response (Mauss & Robinson, 2009). However as these are non-articulated measures, they are frequently recorded alongside simple measures of emotion such as valence (pleasantness/unpleasantness) and activation (high energy/low energy), the core dimensions of emotional response (Larsen & Diener, 1992; Russell, 2003). For example in response to basic taste solutions; heart rate and skin temperature responses increased and were longer in duration in response to unpleasant bitter in comparison to pleasant sweet tastes and neutral water samples (Rousmans & Robin, 2000). Similarly, studies on olfactory stimuli have noted that heart rate increases with ratings of aroma unpleasantness (Alaoui-Ismaïli, Vernet-Maury, Dittmar, Delhomme, & Chanel, 1997; Bensafi et al., 2002b; Brauchli, Ruegg, Etzweiler, & Zeier, 1995; Delplanque et al., 2009; He, Boesveldt, de Graaf, & de Wijk, 2014) and decreased with aroma pleasantness (Brauchli et al., 1995). This suggests that increases in heart rate in response to aroma stimuli is an indication of displeasure. Results from skin temperature are less conclusive, with some research indicating that skin temperature increases with unpleasant stimuli (Rousmans & Robin, 2000) whilst others report a greater increase in skin temperature for liked samples (de Wijk et al., 2012, 2014) or find no difference in skin temperature between stimuli (He et al., 2014; Heuberger, Hongratanaworakit, Böhm, Weber, & Buchbauer, 2001) (Glass, Lingg, & Heuberger, 2014) but see (de Wijk et al., 2012). Facial electromyography has also been an effective tool for inferring affective states, revealing that frowning and smiling responses are detected towards pleasant and unpleasant stimuli respectively (Larsen & Norris, 2009; Ritz, Dahme, & Claussen, 1999; Tan et al., 2011). However the extent to which physiological measures are evaluating these underlying dimensions of emotional response and how they could be interpreted is still not clear.

One of the ultimate goals of emotion research within Sensory Science is to find a measure that can provide deeper insights into consumer response and discrimination between products other than liking scores alone (Meiselman, 2015). Evidence from one survey suggests that along with perceptions of quality and learnt associations with food, it is the sensory properties that elicit the largest number of emotions of consumers towards food and beverage products (Desmet & Schifferstein, 2008). Enhanced discrimination has particular relevance to commercial products, many of which are comparable in terms of both quality and price (Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013) making differences based on liking scores hard to notice. In recent years a number of studies have compared changes in ANS and facial expression activity with liking scores towards commercial products. For example de Wijk et al. (2014) found that although liking scores did not vary between 5 breakfast drinks, heart rate and skin temperature could discriminate between samples, with both responses showing a trend to increase with liking scores. In a separate study, the same group also found that whilst heart rate did not vary with liking scores, skin temperature responses decreased or increased respectively between personalised liked and disliked foods in adults and children (de Wijk et al., 2012). Danner, Haindl, et al. (2014) found that five fruit juice samples which were well discriminated on the basis of liking could be further discriminated by skin conductance responses, with less well liked samples inducing larger responses. Furthermore when facial expressions were measured using FaceReader technology, these studies also found a negative association between liking scores and anger, surprise and disgust reactions (Danner, Haindl, et al., 2014; de Wijk et al., 2012, 2014).

There are two recent studies which are known to make a direct comparison between explicit measures of emotion and implicit measures. In the first of two papers (He, Boesveldt, de Graaf, & Wijk, 2016) compared self-reported emotional response and changes in facial expression measured using FaceReader technology towards pleasant orange and unpleasant fish aromas. Both implicit and explicit measurements were found to vary with a function of valence, with neutral and surprise facial expression and pleasant emotional terms in response to orange odours whilst fish odours led to disgust, anger and sad expressions as well as self-reported emotions such as dissatisfaction and fear. In a second paper, the same group compared physiological, facial expression, self-reported emotional response as well as pleasantness and activation towards a set of six odorants (He, de Wijk, de Graaf, & Boesveldt, 2016). However these studies were interested in the emotional response to pure odorants and did not look at consumer response to commercial products.

Within the study reported here, the aim was to investigate what insights selected implicit physiological and facial expression measures could give regarding consumer response to different aromas compared to explicit self-reported emotional response and liking responses. Unlike previous studies here the aromas were against the background of a real product rather than specific aromas on their own. This was achieved by: a) measuring the physiological and facial expression response to beer with added aromas and a water control; b) exploring self-reported emotional response, liking and familiarity across different aromas in beer; and c) evaluating the results from the different explicit and implicit approaches.

2. Materials and methods

Ethical approval was received from The University of Nottingham's Biosciences Ethical Committee prior to starting this study