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Food-pics-PT: Portuguese validation of food images in 10 subjective evaluative dimensions☆

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ABSTRACT

This work presents subjective ratings for a sub-set of 210 food images selected from food-pics (Blechert, Meule, Busch, & Ohla, 2014). Our main goals were to provide further validation to this database, using a sample from a different nationality (N = 307 Portuguese volunteers, M = 34.67 years old, SD = 13.49) and to extend the number of subjective dimensions used to evaluate each image. In an online survey, each stimulus was evaluated by a minimum of 30 participants regarding arousal, familiarity, valence, liking, frequency of consumption, caloric content, healthiness, tastiness, desire to eat and perceived level of transformation. Ratings in these dimensions were compared according to caloric density (low vs. high caloric density), degree of processing (whole vs. processed food), and gustatory quality (sweet vs. savory), as well as food category (beverages, cereals, fruits, proteins, sweets, vegetables and meals). Overall, our results were consistent with those reported in the original database, although some cross-cultural differences were observed. Descriptive data for each stimulus across evaluative dimensions (means, standard deviations, and confidence intervals) is available as Supplementary material at https://osf.io/av6he/. The validation of standardized food images is useful for several research domains (e.g., food perception; eating behavior) and interventions with normative and clinical populations.

1. Introduction

Images of food are pervasive in people's daily lives. For example, advertisements displaying appetizing food images are everywhere (e.g., magazines, billboards, television), influencing dietary preferences and food intake (for reviews, see Giese et al., 2015; Sadeghirad, Duhaney, Motaghipisheh, Campbell, & Johnston, 2016). Presenting pictures alongside food names is also a common practice in the restaurant industry. Such practice has been associated with higher brand or product recall, more favorable attitudes toward products, and stronger purchase intentions (for a review, see Hou, Yang, & Sun, 2017). Including pictures in the menu is especially helpful if the verbal information is presented in a foreign language or when the consumer is not familiar with the style of food offered (e.g., Jang & Kim, 2015). In recent years, food pictures became particularly popular on social media (e.g., Abbar, Mejova, & Weber, 2015; Mejova, Haddadi, Noulas, & Weber, 2015; Petit, Cheok, & Oullier, 2016). For instance, searching #food on Instagram retrieves more than 216 million posts (https://www.instagram.com/explore/tags/food/, April 2017), and this number is likely to increase. The consequences of this overexposure to food (e.g., increased desire to eat) are still under examination (for a review, see Spence, Okajima, Cheok, Petit, & Michel, 2016). Interestingly, pictures taken by users can be useful in health related contexts, in connection with food recognition engines that help individuals monitor their food intake (e.g., Farinella, Allegra, Moltisanti, Stanco, & Battiato, 2016; Merler, Wu, Uceda-Sosa, Nguyen, & Smith, 2016).

This paper presents subjective norms for 210 food images selected from a comprehensive food images database (food-pics, Blechert, Meule, Busch, & Ohla, 2014). Our main goal is to extend the original work by validating the stimuli using a sample from a different nationality and by including new subjective evaluative dimensions. These normative ratings allowed to explore how different food types (e.g., whole vs. processed) and food categories (e.g., fruits; meals) are evaluated and how cultural, individual (e.g., gender) and state (e.g.,

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hunger) variables impact food perception.

The cognitive processing of food-related information is influenced by food-intrinsic proprieties (e.g., healthiness; caloric density), by the perceiver's current internal states (e.g., level of satiety, blood sugar concentration) or by relatively stable characteristics such as their Body Mass Index (BMI; for reviews, see Higgs, 2016; Rumiati & Foroni, 2016; see also, Rumiati, Foroni, Pergola, Rossi, & Silveri, 2016). Food perception is routed in multiple sensory modalities (for a review, see Rolls, 2005). Still, many studies have focused on the visual processing of food. The ability to visually distinguish between food and non-food is key to survival and the processing of this distinction is quite rapid (85 ms post-stimulus onset; Tsourides et al., 2016). The mere sight of food can result in changes at the physiological level, such as salivation, insulin release and heart rate (for a review, see Spence et al., 2016). Research has also shown that visual food cues attract our attention, even when irrelevant for the task at hand (Foroni, Rumiati, Coricelli, & Ambron, 2016; Husted, Banks, & Seiss, 2016), and that people are able to extract information about food sensory proprieties just by perceiving it visually (Rumiati & Foroni, 2016). For instance, even the experience of flavor can be largely influenced by the visual presentation of food (for a review, see Spence, 2015). Other visual cues, such as the color content of food images, influence the ratings of perceived caloric content and arousal (Foroni, Pergola, & Rumiati, 2016). Additionally, affective reactions can be triggered unconsciously by the sight of food and such responses may be related to eating behaviors (Sato, Sawada, Kubota, Toichi, & Fushiki, 2016). Neuroimaging studies have further shown similar patterns of brain activation during exposure to images of food and during actual tasting or smelling of food samples (for reviews, see Chen, Papies, & Barsalou, 2016; Foroni, Pergola, Argiris, & Rumiati, 2013). A recent meta-analysis assessing the predictive effects of food cue reactivity and craving on eating suggested that visual food cues produced effect sizes similar to real food exposure, and stronger than olfactory cues (Boswell & Kober, 2016).

From an applied standpoint, presenting images of food is easier than manipulating food products (or food aromas). For example, a researcher interested in examining if exposure to food cues can trigger food craving, may simply present pictorial food stimuli on a computer screen and record psychophysiological data or subjective ratings (Rodríguez-Martín & Meule, 2015). Also, as argued by Woodward, Cameron, and Treat (2016), using images of food (vs. words) increases the ecological validity and generalizability of research in the eating domain because we are used to interact with food visually (e.g., advertising, restaurant menus); visual cues are more compelling than verbal descriptions; and decisions towards food in our daily life are often informed by visual cues (e.g., choosing a snack at a bakery).

Images depicting food have been extensively used in a variety of domains. For example, in neurophysiological studies – with fMRI (e.g., van Meer et al., 2016; for a review, see Pursey et al., 2014) or EEG (e.g., Fearnbach et al., 2016; Hume, Howells, Rauch, Kroff, & Lambert, 2015; Schacht, Łuczak, Pinkpank, Vilgis, & Sommer, 2016) – food images are used as visual food cues to investigate brain activation patterns. A recent systematic review of electrophysiological studies examining attentional processing of food stimuli (Wolz, Fagundo, Treasure, & Fernández-Aranda, 2015) suggested an attentional bias towards food pictures (compared with neutral pictures) for both patient (e.g., anorexia, bulimia, binge eating, obesity) and control groups. Other studies have used only normative samples. For example, in a recent study by Blechert, Klackl, Miedl, and Wilhelm (2016) participants underwent fMRI while viewing images of food. Results suggested that immediately available foods (i.e., foods that could be eaten during and after the experiment), particularly when high in caloric density, elicited higher palatability ratings as well as stronger neural activation of brain structures implicated in reward and appetitive motivation. Another fMRI study using food images showed that group norms (i.e., peer preferences) can shift neural patterns and food preferences to healthy/unhealthy foods (Nook & Zaki, 2015).

There is also extensive research examining the influence of exposure to visual food cues on cognitive and affective processing. For example, it has been shown that food images (particularly those depicting disliked foods), distract attention away from the processing of time (Gil, Rousset, & Droit-Volet, 2009), and that images depicting appetitive foods (e.g., desserts, fruit) decrease the attentional breadth as indicated by increased RTs to global targets in a Navon task (Domachowska et al., 2016). Likewise, Van Dillen, Papies, and Hofmann (2013) showed that people allocate more attention to pictures of attractive food (e.g., brownies) – presenting slower RT in a spatial categorization task – compared to neutral food (e.g., radishes). Using a primed lexical decision task, the authors have also shown that when hedonic words (e.g., delicious) are preceded by images of attractive (vs. neutral) foods, performance is facilitated. In a recent series of six experiments, Chen, Veling, Dijksterhuis, and Holland (2016) showed that when participants were instructed not to respond to appetitive foods (e.g., desserts) they devaluated those stimuli. Also, responses toward this type of stimuli can be influenced by the presence of environmental cues associated with inhibition (no-go cues, see Veling, Aarts, & Papies, 2001; Veling, Aarts, & Stroebe, 2011, 2013).

Food images have also been used to investigate differences in food perception, or behaviors towards food, between normative and clinical populations. For example, it has been shown that healthy participants display an approach bias towards food, but patients with anorexia nervosa do not (Paslakis et al., 2016). Other studies including a normative sample, have shown evidence for a specific approach bias (i.e., a particularly craved food – chocolate; Kemps, Tiggemann, Martin, & Elliott, 2013). Differences in the evaluation of food stimuli have also been reported between overweight participants with binge eating disorder who display a stronger food bias (e.g., liking, wanting) than overweight participants without this disorder (Leehr et al., 2016). Also at a behavioral level, there is evidence that exposure to food cues may enhance impulsive and risky decision making, at least for women susceptible to overeating (Yeomans & Brace, 2015).

1.1. Food images databases

The development and validation of stimuli databases is highly relevant for the scientific community. Standardization promotes experimental reproducibility and the comparison of results across studies (e.g., Leng et al., 2016). These standardized materials can be used in different experimental paradigms, and allow for the manipulation (or control) of specific stimuli characteristics (e.g., Rodríguez-Martín & Meule, 2015). Normative ratings are available for a variety of visual stimulus, from simple line-drawings sets (e.g., Snodgrass & Vanderwart, 1980) to complex real life pictures (e.g., Lang, Bradley, & Cuthbert, 2008). Other stimuli databases are content-specific, including symbols (e.g., McDougall, Curry, & de Bruijn, 1999; Prada, Rodrigues, Silva, & Garrido, 2016), emoji and emoticons (Rodrigues, Prada, Gaspar, Garrido, & Lopes, 2017) or human faces (e.g., Ebner, Riediger, & Lindenberger, 2010; Garrido et al., 2016; Langner et al., 2010). Recently, several databases comprising images of beverages (e.g., Billieux et al., 2011; Pronk, van Deursen, Beraha, Larsen, & Wiers, 2015; Pulido, Brown, Cummins, Paulus, & Tapert, 2010; Stauffer, Dobberteen, & Woolley, 2016) or food have been developed and validated. In the following section, we will describe the main food images databases available.

Food-pics (Blechert et al., 2014) comprises 568 color images of food and 315 non-food images (e.g., flowers, household items). The food products depicted are diverse and classified according to their (a) degree of processing: whole (e.g., apple; carrots; raw chicken) versus processed foods (e.g., waffle; cheese; hamburger); (b) caloric density (median split of caloric density – Kcal/100gr): low (e.g., sushi rolls; salad plate; shrimp) versus high calorie foods (e.g., chocolate cookie; hot dog; avocado); and (c) gustatory quality: sweet (e.g., figs, sundae, muesli bar) versus savory foods (e.g., onion; fish sticks; quiche). The