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Mouth-watering words: Articulatory inductions of eating-like mouth movements increase perceived food palatability

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ABSTRACT

We explored the impact of consonantal articulation direction of names for foods on expected palatability for these foods (total $N = 256$). Dishes (Experiments 1–2) and food items (Experiment 3) were labeled with names whose consonants either wandered from the front to the back of the mouth (inward, e.g., PASOKI) or from the back to the front of the mouth (outward; e.g., KASOPI). Because inward (outward) wandering consonant sequences trigger eating-like (expectoration-like) mouth movements, dishes and foods were rated higher in palatability when they bore an inward compared to an outward wandering name. This effect occurred already under silent reading and for hungry and satiated participants alike. As a boundary condition, this articulation effect did occur when also additional visual information on the product was given (Experiment 3), but vanished when this visual information was too vivid and rich in competing palatability cues (Experiment 2). Future marketing can exploit this effect by increasing the appeal of food products by using inward wandering brand names, that is, names that start with the lips and end in the throat.

The preference for food is determined by various psychological factors. Already before consumption, exteroceptive cues such as color, variety, shape and surface area influence how likeable and palatable we expect a food to be (for a recent comprehensive review, see Wadhera & Capaldi-Phillips, 2014). The visual appearance of a meal influences our expectations about its taste quality, flavor, and palatability (Hurling & Shepherd, 2003). Its color influences food choice and taste expectations (Koch & Koch, 2003; Walsh, Toma, Tuveson, & Sondhi, 1990), as well as its shape does (Olsen, Ritz, Kramer, & Møller, 2012). But also exteroceptive cues that do not directly stem from the food itself influence preference, such as contextual lighting (Cho et al., 2015; Hasenbeck et al., 2014), the color of the plate the food is served on (Piqueras-Fiszman, Alcaide, Roura, & Spence, 2012), or the packaging (Deng & Kahn, 2009; Gmuer, Siegrist, & Dohle, 2015; Madzharov & Block, 2010; Siegrist, Leins-Hess, & Keller, 2015). Furthermore, also an appealing presentation of food increases preference and consumption (Jansen, Mulkens, & Jansen, 2010; Zampollo, Kniffin, Wansink, & Shimizu, 2012; Zellner, Lankford, Ambrose, & Locher, 2010; Zellner, Loss, Zearfoss, & Remolina, 2014; Zellner et al., 2011). These exteroceptive cues can also influency taste ratings (Piqueras-Fiszman & Spence, 2015; Spence, Levitan, Shankar, & Zampini, 2010; see Siegrist & Cousin, 2009; for the difference between taste ratings and the taste experience itself) and can increase the desire to eat it (Marcelino, Adam, Couronne, Koster, & Seiffermann, 2001). Moreover, there were demonstrations that the verbal label a food is given can influence the attitudes towards this food (e.g., Gmuer et al., 2015; Gmuer, Siegrist et al., 2015; Miller & Kahn, 2005). For instance, in their classic study Wolfson and Oshinsky (1966) labeled a drink as either 'Space food' or as 'Unknown', with the former increasing preference compared to the latter label. Also, matching of the sounds in the brand name with certain product features increases preference (Spence, 2012).

Besides these exteroceptive cues, of course interoceptive cues such as taste, odor, and mouthfeel most heavily influence our attitudes towards food, with taste being the key determinant (Birch, McPhee, Shoba, Pirok, & Steinberg, 1987; Bobroff & Kissileff, 1986; Duffy, 2007; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998). Finally, higher psychological factors influence food palatability, such as familiarity of the food (Birch & Marlin, 1982; Pliner, 1982) or the nutritional status of the consumer (Drobes et al., 2001). In this vein, it was shown that food deprived individuals evaluate food stimuli more positively than satiated individuals (Brendl, Markman, & Messner, 2003; Seibt, Häfner, & Deutsch, 2007), consume more of

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it (Bellisle, Lucas, Amrani, & Le Magnen, 1984; Hill, 1974) and show lower disgust responses towards unpalatable food (Hoefling et al., 2009).

We demonstrate a route to increase food palatability not yet considered, namely an articulatory induction of eating movements that increase the expected palatability of food. The basic logic behind this approach is that triggering bodily movements that are related to a certain need increases the need-related attractiveness of that object. Regarding food and eating, the simplest (and surely trivial) instantiation of such an induction would be to confront individuals with food and to let them imagine or pantomime eating it. Such a simulation of eating behavior would likely increase the perceived palatability of that food (cf., for an eating imagery task, see Morewedge, Huh, & Vosgerau, 2010). In this vein, although without a presentation of an actual object, Topolinski and Türk Pereira (2012) found that food-deprived participants reported higher hunger when they had chewed a tasteless and calory-free chewing gum (eating-related movements) than when they had kneaded a ball (non-eating related control behavior) for a few minutes.

The present approach introduces a way to induce such eating-like movements without participants' awareness via articulatory means, as is developed in the following.

1. An articulatory induction of eating-like mouth movements

The intake of food, such as during sucking, drinking, slurping and simply eating, is realized by muscular movements of the mouth, involving the lips, the tongue, and the pharyngeal muscles in the throat (Duffy, 2007; Hejnol & Martindale, 2008; Rosenthal, 1999; Rozin, 1996). The specific muscular pattern to propel food and liquid from the entrance of the mouth through the oral cavity into the pharynx and the esophagus is a sequence of muscle contractions starting in the front of the mouth −the lips−, over the front of the tongue to the rear of the tongue and further on to the pharyngeal muscles, not unlike peristalsis of the esophagus (Goyal & Mashimo, 2006). In contrast, the expectoration of harmful or unwanted substances, such as during spitting or vomiting, is realized by muscular constrictions wandering from the rear of the mouth, the throat, over the tongue to the lips (Rozin, 1999), similar to an outward peristalsis (Goyal & Mashimo, 2006). Thus, food intake requires an inward going peristalsis, and food expectoration requires an outward going muscle peristalsis.

The mouth, however, does not only serve the function of ingestion, but also the evolutionarily more recent function of language, namely via articulation (Rozin, 1999; Steklis & Harnad, 1976). This behavior is a complex muscular activity of the lips and the tongue (Inoue, Ono, Honda, & Kurabayashid, 2007; Ladefoged & Maddieson, 1996). Basically, articulating a phoneme (that is, a speech sound) works by generating a certain well-defined muscle tension on a certain spot of the mouth (e.g., Crystal, 2010; Titze, 2008). For instance, we can only utter the phoneme [p] by pressing our lips against each other, or the phoneme [t] by pressing the tip of the tongue against the soft palate (International Phonetic Association, 1999). Note that these constraints are biomechanical necessities, not subjective ones; and that they are universal across all languages (although of course languages differ in the way which phoneme is assigned to which letter). There is, for instance, no way to articulate [p] without pressing the lips against each other. The generation of vowels (A, E, I, O U) instead does not involve such specific muscle parts.

Naturally, the articulation spots vary on the sagittal lane of the mouth, from the front to the rear. This front-back lane starts with the lips (e.g., labials such as [b] and [p]), wanders along the front part of the tongue (alveolars, such as [d] or [t]), to the rear of the tongue (velars and uvulars such as [k]). Because nonsense words can be construed by arbitrarily arranging letters, we can construe words for which the articulation spots wander from the front of the mouth to rear. Consider, for instance the artificial word BODOK. While the vowels (the Os) in this words are neutral, the consonants clearly wander from the lips (B) over the tip of the tongue (D) to the rear of the mouth (K), which makes this an inward going word. Now consider the reversed sequence, KODOB, featuring consonantal articulation spots that start in the rear of the mouth (K) over the middle (D) to the front (B), which makes this an outward going word.

On a mere muscular level, the mouth activities during the articulation of inward words resemble the inward peristalsis during ingestion, and articulation of outward words resembles the outward peristalsis during expectoration. Thus, merely uttering an inward word such as BODOK simulates food intake in an abstract fashion, and uttering an outward word like KODOB simulates expelling food. This method of articulatory induction of inward and outward mouth movements has recently been applied to the induction of approach and avoidance states (Topolinski, Maschmann, Pecher, & Winkielman, 2014). Approach states are motivational states realizing a decrease in distance, and avoidance states realize an increase in distance toward an attitude object (Higgins, 1997). Approach signals positive attitudes and likeability, whereas avoidance signals negative attitudes and withdrawals.

As a consequence, it was hypothesized that inward (outward) words would induce approach (avoidance) states and accordingly more positive (negative) attitudes. Showing this, it was found in various set-ups that individuals being unaware of the articulation manipulation preferred inward over outward words and also liked persons and products more when those were labeled with inward than with outward names (Godinho & Garrido, 2015; Kronrod, Lowrey, & Ackerman, 2015; Topolinski & Bakhtiari, 2015; Topolinski, Boecker, Erle, Bakhtiari, & Pecher, 2015; Topolinski, Maschmann, et al., 2014; Topolinski, Zürn, & Schneider, 2015). Thus far, this effect was found for English, German, and Portuguese articulation and even occurred when participants read the words silently. While this seems surprising at first, it is well in line with previous research on subvocal vocalizations (Topolinski, 2012; Topolinski et al., 2014; Topolinski & Strack, 2009, 2010). During reading the brain automatically simulates the motor movements required to produce speech, which can even be mapped with electromyography in the laryngeal motor periphery; but these motor simulations are covert, not overt movements, so usually they are much too subtle to be felt by the reader or to overtly observed (Hardyck, Petrinovich, & Ellsworth, 1966). There are also many other demonstrations of the affective consequences of such covert simulations in other muscle systems (e.g., Körner, Topolinski, & Strack, 2015; Leder, Bär, & Topolinski, 2013; Sparenberg, Topolinski, Springer, & Prinz, 2012; Topolinski, 2010). One possible alternative explanation of this effect might the fluency with which inward and outward words are processed (cf., Topolinski, 2013, 2014; Topolinski, Erle, & Bakhtiari, 2016; Topolinski et al., 2015; Topolinski, Likowski, Weyers, & Strack, 2009; Topolinski & Reber, 2010). For instance, it could be the case that inward words are simply read more easily than outward words, which would feel more comfortably and thereby increase positivity (cf., Dohle & Siegrist, 2014; Gmuer et al., 2015). However, in an independent line of research we have shown that, although reading fluency does play a role in the in-out effect, it does not completely mediate this effect (Bakhtiari, Körner, & Topolinski, 2016).

This oral approach-avoidance induction might be highly relevant for the perception of food, because food itself is approach-related (Bradley, Codispoti, Cuthbert, & Lang, 2001; Chen &