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Sounds sweet, sounds bitter: How the presence of certain sounds in a brand name can alter expectations about the product’s taste

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Abstract

This paper examines how certain speech sounds within a brand name can alter expectations about the product’s taste. Across two studies we demonstrate that the presence of voiced (b, d, g, z & v) vs. voiceless (p, t, k, s & f) obstruents (speech sounds produced when airflow is obstructed in the oral cavity) in a chocolate’s brand name can alter its expected taste as bitter vs. sweet. We propose this is because voiced obstruents are typically of low frequency (frequency code hypothesis), contain harsh acoustic qualities and evoke negativity (due to aerodynamic difficulties in their pronunciation). In a third study, we extended these findings to show, using the Brand Personality Scale (BPS), that the presence of voiced (vs. voiceless) obstruents makes brand names sound more masculine, rugged and tough and less honest, charming, glamorous, wholesome, cheerful and sentimental. Research linking consonant sound symbolism (specifically voiced obstruents) and product attributes is sparse. Most research in this field links vowels with product attributes, sounds with shapes and music (or musical notes) with taste attributes. We contribute by extending these findings to voicing (and associated harshness) and the sweet-bitter continuum of the expected taste.

Keywords: Sound symbolism; voiced obstruents; voicing; brand names; brand personality traits; taste attributes
Highlights

- When asked to make a choice, respondents rate food products having voiced obstruents (b, d, g, z & v) in their brand names as bitter (compared to ones with voiceless obstruents).
- When asked to make a choice, respondents rate food products having voiceless obstruents (p, t, k, s & f) in their brand names as sweet (compared to ones with voiced obstruents).
- Hypothetical brand names with voiced obstruents are perceived as more rugged and less sophisticated than the brand names with voiceless obstruents.
VOICING AND TASTE ATTRIBUTES

Sounds sweet, sounds bitter: How the presence of certain sounds in a brand name can alter expectations about the product’s taste

1 Introduction

A brand’s name typically represents the first touchpoint between a brand and its consumers, making its selection a vital component of a brand’s marketing strategy (Charmasson, 1988; Klink & Athaide, 2012). Indeed, there is evidence to suggest that up to 40% of a brand’s success can be attributed to a well-chosen name (Alashban, Hayes, Zinkhan, & Balazs, 2002; Zaltman & Wallendorf, 1979). Research has shown that during the process of selecting a product consumers are more influenced by the brand name to a greater extent than other important determinants (e.g., price and physical appearance) (Dawar & Parker, 1994). There is now a considerable body of research demonstrating the relationship between brand name sounds and perceived product attributes (e.g., slowness vs. fastness, heaviness vs. lightness, basic vs. luxury, feminine vs. masculine). This suggests that consumers often expect some congruency between the sound of a brand name and its associated product features. Furthermore, when these brand evoked expectations are consistent with the actual product experience, consumers typically appreciate them more (Friese, Wänke, & Plessner, 2006). In fact, the relationship between brand names and product expectancy has been shown to be more salient when the brands (or brand names) are unfamiliar (Fenko, Lotterman, & Galetzka, 2016).

All languages contain sounds which are perceived as harsh or soft (Aryani, Conrad, Schmidtke, & Jacobs, 2018). In this paper, we provide evidence for a sound symbolic link between harsh sounds and expectations of how a product will taste. More specifically, we show that brand names containing harsh sounds lead to expectations that the associated product will
taste bitter whereas those with soft sounds generate taste expectations of a sweet tasting product. We used voiced (vs. voiceless) obstruents, the speech sounds produced when airflow is obstructed in the oral cavity, in hypothetical brand names to imbue them with a sense of harshness. This paper builds on previous research in that here (i) we use voicing in consonants to induce perceptual harshness [previous research has used ‘hard’ vs ‘soft’ consonants (e.g., /k/ vs /l/)] with taste attributes, and (ii) other research has shown voicing (vs. non-voicing) to be associated with roundness (vs. spikiness) and roundedness with sweetness (vs. spikiness with bitterness). These findings suggest an association of voicing (vs. non-voicing) with sweetness (vs. bitterness). We on the contrary show an opposite association of voicing (vs. non-voicing) with bitterness (vs. sweetness).

1.1 Sound symbolism and taste

A vast body of research has now shown a systematic relationship between sounds and their perceived meanings (e.g., Hinton, Nichols, & Ohala, 1994; Ramachandran & Hubbard, 2001; Sapir, 1929). This relationship has been shown in the context of names (e.g., Sidhu & Pexman, 2015; Slepian & Galinsky, 2016), psycholinguistic elements (e.g., Nuckolls, 1999), shapes (e.g., Ramachandran & Hubbard, 2001), product attributes (e.g., Klink, 2000), personality traits (e.g., Klink & Attaide, 2012) and more specifically, related to the current paper, with taste perceptions (see Spence, 2012 for a review), to name but a few.

Fónagy (1963) was the first to suggest a relationship between taste (on a sweet-bitter continuum) and the sound of articulated front vs. back vowels. For example, amongst Hungarian respondents, /i/ was found to be sweeter, and /u:/ as bitter. A similar relationship was shown by Yorkston and Menon (2004) albeit in the context of the creaminess of ice-creams. Similarly, Simner, Cuskley, and Kirby (2010) have linked vowel height and back-ness with tastes. In their
VOICING AND TASTE ATTRIBUTES

studies, higher vowels tended to signify sweetness while lower vowels connoted bitterness and sourness. Similarly, back vowels were linked to sweetness while front ones indicated bitterness and sourness. More recently, sharper speech sounds (e.g., takete, kiki) have been linked with sharp objects (e.g., spiky shapes) and bitter tastes (vs. softer sounds, e.g. maluma, lula, with rounded objects and sweet tastes) (Gallace, Boschin, & Spence, 2011). A similar cross-modal relationship has been reported by Ngo, Misra, and Spence (2011). These researchers showed that chocolates containing only 30% cocoa (i.e. sweeter chocolates) were more easily matched with rounded speech sounds (e.g., maluma) whereas chocolates containing 70% cocoa (i.e. bitter chocolates) were more closely matched with sharper speech sounds (e.g., takete). The association between sounds (e.g., musical notes) and tastes has also been explored in depth (e.g., Bronner, Frieler, Bruhn, Hirt, & Piper, 2012; Crisinel & Spence, 2009; Knoferle, Woods, Käppler, & Spence, 2015; Knöferle & Spence, 2012), but the relationship between speech sounds and tastes has not been as extensively researched as those between speech sounds and other product attributes (e.g., fastness, heaviness, lightness) (e.g., Abel & Glinert, 2008; Klink, 2000; see Spence, 2012 for a review). The current paper is an attempt to bridge this gap.

So why should voiced obstruents signify bitterness while voiceless ones connote sweetness? We propose two mechanisms that may explain this phenomenon. The first is the frequency code hypothesis (FCH) and the second is the aerodynamic difficulties associated with the pronunciation of voiced obstruents. Voiced (vs voiceless) obstruents have been shown to have lower (vs. higher) frequencies (Kingston & Diehl, 1995; Kingston, Diehl, Kirk & Castleman, 2008) and low frequency sounds have been shown to be more closely associated with warnings, threat and hostility (vs. pleasure, appeasement and friendliness for higher frequency sounds) (Morton, 1977; Ohala, 1994). Similarly, low (vs. high) frequencies have been indirectly
VOICING AND TASTE ATTRIBUTES

(e.g., music) shown to be associated with bitter (vs. sweet) tastes (Simner et al., 2010; Knöferle & Spence, 2012; Spence, 2012).

The second mechanism that may explain these obstruent-taste associations is the significant aerodynamic difficulties associated with the pronunciation of voiced obstruents (see Ohala, 1983 for a review). These difficulties have often been cited as the reason why voiced obstruents are associated with negative meanings or perceptions (Kawahara, Shinohara, & Uchimoto, 2008; Kubozono, 1999; Ohala, 1983). Voiced obstruents have also been shown to be associated with perceived heaviness and largeness (e.g., large and dangerous animals) (Kubozono, 1999; Saji, Akita, Imai, Kantartzis, & Kita, 2013). Other research suggests that, when used in the names of fictitious characters, voiced obstruents evoke feelings of a bigger, larger and more threatening character. For example, studies using Pokémon characters in Japanese and English speakers show that a larger and more menacing character’s name is considered more appropriate if it contains voiced obstruents (Kawahara & Moore, 2018; Shih, Ackerman, Hermalin, Inkelas, & Kavitskaya, 2018).

In the current paper, we extend this relationship between negativity and harshness of sounds associated with voiced obstruents to the taste dimension. We aim to show that when used in the context of brand names (BNs) of chocolates, consumers consider names containing harsh speech components as signifying that the chocolate is bitter. Chocolate was chosen as the preferred product category as this has been successfully used in past research on cross-modal associations, specifically on the sweet-bitter continuum (e.g., Ngo et al., 2011; Ngo & Spence, 2011; Spence & Gallace, 2011).
1.2 Speech sounds

Consonants and vowels form the two building blocks for all languages. Vowels are typically smoother, do not involve much movement of the articulatory muscles and are produced by the movement of the air within the oral cavity with little obstruction. The production of consonants, on the other hand, typically involves a higher degree of obstruction, friction and constriction of the vocal tract (Carrol, 2004; Ladefoged, 1993). Speech sounds can be broadly classified into obstruents and resonants. Obstruents are sounds made due to a partial (or full) obstruction of the airflow within the oral cavity, whereas resonants are produced without any obstruction to the airflow. Obstruents can further be divided into, stops (e.g., /p/, /b/), fricatives (e.g., /f/, /v/), and affricates (e.g., /tʃ/ as in Chin, /dʒ/ as in General). Within these, voiced obstruents is a sub-class of sounds where an additional voicing accompanies the phonemic sounds (e.g., /b/, /g/, /z/). Voicing is the vibration of the vocal cords during the pronunciation of some speech sounds. For example, feel the vibration of the vocal cords on Adam’s apple while saying /b/ (voiced) vs /p/ (unvoiced) (Slepian & Galinsky, 2016). The accompanied voicing and modulation of the vibrating vocal cords, is believed to make the voiced obstruents sound even harsher compared to the smoother, unmodulated sound of the voiceless obstruents.

Voicing is a complicated process, involving complex articulatory movements and aerodynamic control. For voicing to occur, two essential conditions have to be met. Firstly, there should be an adequate amount of tension in the vocal cords, and secondly, air must be expelled from the lungs into the vocal cords to vibrate them. While tensing the vocal cords is easy, the process of vibrating them is not so. The entire oral cavity consists of two smaller spaces demarcated by the glottis, the oral cavity (having an intra oral pressure of Po) and subglottal cavity (having sub glottal pressure of Ps). The vocal cord vibration requires a differential of
pressure (approx. 2–3 cm H20 in normal speaking conditions) between the oral cavity and subglottal cavity. To initiate voicing, the speaker has to actively lower the Po so that Po < Ps and the air flows across the vocal cords to vibrate them (Ohala, 1983; Shinohara & Kawahara, 2010). In the case of voiced obstruents, the process is further complicated due to the obstruction of the airways, which makes the condition of making Po < Ps more difficult (as the intra oral pressure tends to rise due to the obstruction) (Hayes & Stivers, 1996). In order to reduce the Po, the speaker resorts to complex manoeuvres such as extending the oral cavity by lowering the larynx, raising the velum or expanding the cheeks (Ohala, 1983; Shinohara & Kawahara, 2010).

Moreover, for the voicing to sustain, the speaker has to continuously maintain this pressure differential across the cavities, otherwise the vocal cord vibration will cease and so in turn will the voicing. This complex exercise of voicing, also called Aerodynamic Voicing Constraint (Ohala, 2011), takes less than 15 ms (Chollet, Di Benedetto, Esposito, & Marinaro, 2012).

Specifically, based on voicing there can be three types of voiced (vs. voiceless) obstruents: stops (voiced & voiceless; /p/ & /b/; /t/ & /d/; /k/ & /g/), fricatives (voiced & voiceless; /f/ & /v/; /θ/ & /ð/ as in Theatre vs. Then; /s/ & /z/ as in See vs. Zoo; /ʃ/ & /ʒ/ as in She vs. Measure) and affricates (/tʃ/ & /dʒ/). Out of these voiced obstruents, in the current paper we excluded /θ/ & /ð/ and /ʃ/ & /ʒ/ as the differences in these speech sounds is purely auditory and not visual (e.g., a hypothetical name Thodake, can be pronounced by a respondent in two different ways, one with /θ/ as in Theatre and other with /ð/ as in /Then/ and in a visual stimuli, these can be a confound1).

2 Methods (common to all the studies)

Twenty-five hypothetical brand names (HBNs) in a CV-CV-CV structure were created using voiced (/b/, /d/, /g/, /z/, and /v/) vs. unvoiced (/p/, /t/, /k/, /s/ and /f/) obstruents (Appendix
VOICING AND TASTE ATTRIBUTES

1) and the HBNs were tested for similarity with the existing words or known brands. To reduce the known sound symbolic associations linked to vowels, three different vowels were used within the HBNs. All studies were designed on Inquisit 5 software (millisecond.com) and participants were native English speakers, recruited from the USA through Amazon Mechanical Turk (Paolacci & Chandler, 2014; also see Woods, Velasco, Levitan, Wan, & Spence, 2015 for a recent review on the online experimental research). The Institutional Review Board of a large South East Asian university approved the research and respondents who consented to participate, were paid for their time and effort. Each respondent was allowed to participate only in one of the studies. In all studies, participants were asked to guess the purpose of the experiment; none of the participants could correctly guess the hypotheses, except for two participants in Study 1, whose data was excluded. With N≈60, the power to detect a medium-sized effect (0.5) in the Wilcoxon Signed Rank tests and paired t-tests ($\alpha = 0.05$) was found to be, $1 - \beta = 0.96$ (approx.) (using G*Power 3.1.9.2; Faul, Erdfelder, Lang, & Buchner, 2007).

3 Study 1

3.1 Participants

A total of 61 participants between the ages of 24 to 70 years completed the study (2 participants guessed the hypothesis to some extent and were excluded from analysis); $M_{age} = 40.58$ yrs., $SD = 12.83$, $Males = 37$, $Females = 22)$. All participants were English speakers (one participant also knew the Thai language).

3.2 Procedure and design

Participants were told that a company was launching two new chocolates (one sweet and one bitter) in an international, non-English speaking market and was looking for suitable brand names for them. They were then shown fourteen HBN pairs (one with voiced obstruents and
another with voiceless obstruents), chosen randomly from the 25 HBNs created. Each HBN was presented only once. Participants were asked to ‘drag and drop’ the HBNs to one of the product categories (sweet and bitter) shown on top, which they felt was appropriate for the HBN shown. Position mapping of the HBNs was counterbalanced within-subjects and those of the product categories was counterbalanced between-subjects. Before the study, participants were familiarized with the ‘drag and drop’ procedure in a few practice trials, where real brands were used (e.g., Mars). Participants also signed an electronic consent and provided demographic information before commencing the study.

3.3 Results

The results show that participants rated HBNs with voiced (vs. voiceless) obstruents as more appropriate for a bitter (vs. sweet) chocolate. It was labelled as a congruent response for our analysis, incongruent being voiced obstruents with sweet chocolate, and vice-versa; data was segregated into total number of congruent vs. incongruent trials, $Z = 25.10, p < 0.0001, r = 0.17$. To explore the individual differences across participants, a Wilcoxon Signed Rank test was conducted which revealed significant differences between the proportions of congruent and incongruent responses ($M_{congruent} = 58.72$, $SD = 20.72$, $M_{incongruent} = 41.28$, $SD = 20.72$, $Z = 2.94$, $p = 0.003$, $r = 0.27$). In the English language, the phoneme /g/ can have a different sound depending on its usage e.g., a hard /g/ sound (as in Gate) or a soft /g/ sound (as in Gem).

Research suggests that often the phoneme /g/ is pronounced as hard whenever it precedes vowels /a/, /o/ and /u/, and as a soft sound, whenever it precedes the vowels /e/, /i/ and /y/ (Emerson, 1997). In view of this confound, we reanalyzed the data after excluding the affected HBNs. Specifically, seven such HBNs (e.g., Zadoge) were found. The affected trials were excluded and the rest of the data was reanalyzed. The results showed that participants rated HBNs with voiced
VOICING AND TASTE ATTRIBUTES

(vs. voiceless) obstruents as more appropriate for a bitter (vs. sweet) chocolate. Here, we refer to these as congruent (voiced with bitter) and incongruent (voiceless with sweet) combinations, $Z = 22.08, p < 0.0001, r = 0.19$. Across participants, a Wilcoxon Signed Rank test showed significant differences between the proportions of congruent and incongruent responses ($M_{congruent} = 59.53$, $SD = 22.32$, $M_{Incongruent} = 40.49$, $SD = 22.32$, $Z = 3.10$, $p = 0.002$, $r = 0.29$). The results of Study 1 provide evidence for a link between brand names (voiced vs. voiceless) and expected taste attributes (bitter vs. sweet).

4 Study 2

Study 1 employed a forced-choice task. Forced-choice tasks have been used extensively by scholars working in the field of sound symbolism. However, they have received some criticism (Lockwood, Dingemanse, & Hagoort, 2016; Lockwood, Hagoort, & Dingemanse, 2016; Monaghan, Mattock, & Walker, 2012; Saji, Akita, Imai, Kantartzis, & Kita, 2013). Firstly, the contrast between two given choices is often maximal (i.e. often the choices presented have a maximum possible difference, e.g., very angular vs. very rounded or the two extremes of a continuum). Secondly, forced-choice tasks are argued to be unrepresentative of natural language learning or the way in which we use novel words (e.g., new brand names) (Lockwood, Dingemanse, & Hagoort, 2016). To control for these potential confounds, in Study 2 we asked participants to create novel brand names for sweet and bitter chocolates in a free choice task, and explored the differences in the use of voiced (vs. voiceless) obstruents. In Study 2a, a few participants used some known English words or random, unpronounceable letters (e.g., SZV) as the brand names. Consequently the study was repeated (Study 2b) with clearer instructions.
4.1 Study 2a

4.1.1 Participants

A total of 60 participants between the ages of 24 to 68 years completed the study ($M_{age} = 42.4$ yrs., $SD = 11.68$, Males = 38, Females = 22). All participants were English speakers (seven participants could speak a foreign language; five knew Spanish, one Arabic and one Chinese).

4.1.2 Procedure and design

Participants were told that a company was launching two new chocolate brands (one sweet and one bitter) in an international non-English speaking market, and was looking for suitable brand names for both its products. Participants were then asked to create three pairs of HBNs, from a given set of letters continually displayed at the top of the computer screen (consonants: /p/, /b/, /k/, /g/, /t/, /d/, /f/, /v/, /s/, /z/) and vowels: (/a/, /e/, /i/, /o/, /u/). Participants were told to create BNs, such that the name itself can suggest to the consumer whether the chocolate is sweet or bitter. Participants then typed in the HBNs in six text boxes in pairs (e.g., HBN Sweet 1 and Bitter 1) and could proceed further only when they had provided all six HBNs.

4.1.3 Results

The number of voiced (vs. voiceless) obstruents used for creating the HBNs for sweet (vs. bitter) chocolates were segregated. Only the number of voiced (vs. voiceless) obstruents were included in the analysis (vowels and consonants (e.g., /t/) other than obstruents were excluded). Wilcoxon Signed Rank tests revealed that participants chose a significantly higher number of voiced obstruents in the BNs for bitter (vs. sweet) chocolates, $Z = 2.26, p = 0.024, r = 0.21$. No difference was observed in the use of voiceless obstruents, $Z = 0.83, p = 0.41$.

However, the results were not entirely clear-cut as some participants used known English words as BNs (e.g., ‘delightfully sweet’, ‘better bitter’) which might be argued, does not constitute the
testing of our hypothesis due to the semantic connotations these words might have.
Consequently, we decided to repeat the study with stricter instructions.

In Study 2b, participants were asked to create brand names with a few additional instructions, 1) BNs should be pronounceable (i.e., no random placement of letters e.g., SZV), 2) BNs should contain at least three consonants, 3) BNs should not be an English word or a known brand name.

4.2 Study 2b

4.2.1 Participants

A total of 60 participants between the ages of 25 to 75 years completed the study ($M_{age} = 42.49$ yrs., $SD = 12.57$, $Males = 29$, $Females = 30$; one participant completed the study twice and his/her data was deleted). All participants were English speakers (one also knew Russian and one Turkish). The rest of the instructions and experimental design was similar to Study 2a.

4.2.2 Results

As in Study 2a, only the number of voiced (vs. voiceless) obstruents used for creating the HBNs were included in the analysis. Wilcoxon Signed Rank tests revealed a significantly higher use of voiced obstruents in the BNs for bitter (vs. sweet) chocolates, $Z = 3.39$, $p = 0.001$, $r = 0.31$. No difference was observed in the use of voiceless obstruents, $Z = 1.48$, $p = 0.14$. Study 2 confirms our findings and demonstrates that even in a free choice task, respondents tend to use a higher number of voiced (vs. voiceless) obstruents for creating names for bitter (vs. sweet) chocolates. The results also suggest that while voiced obstruents are more associated with the expectation of bitterness, the same may not be true for the link between voiceless obstruents and sweetness (as no difference was found in the usage of voiceless obstruents across sweet vs. bitter chocolate categories).
5 Study 3

It is important to note that multiple meanings can be associated with a brand name, depending on the context and goals of a consumer (Motoki et al., 2020). For example, it is likely that a luxurious sounding brand name can evoke a sense of rarity and uniqueness simultaneously (Pathak, Calvert, & Lim, 2017; Pathak, Calvert, & Velasco, 2017). In the F&B sector, research on sound symbolism has mostly linked brand names with gustatory and other sensory attributes or shapes (e.g. flavor, color, sounds, roundness, spikiness), but not with brand personality traits. As with any category, a brand name used in connection with a food product does not only signify the gustatory attributes of the product. While the taste of a food product is important for a brand in the F&B space, other, non-gustatory brand attributes are also considered in the naming process (e.g., sincerity and honesty). For a brand across any category, sound symbolic congruency between the brand name and the multitude of traits that it evokes is important. Indeed, no company would wish for their brand name to connote sweetness and dishonesty at the same time. Given this, we feel that it is appropriate to explore the link between sound symbolic taste attributes with the other brand personality dimensions. To our knowledge, there has been only one study (e.g., Klink & Athaide, 2012) that has linked brand personality traits with sound symbolic attributes (though not related to taste per se). Therefore, in Study 3, we aimed to extend this research further, and explored the link between sound symbolic attributes of taste (sweetness vs. bitterness) with well-known brand personality traits.

To date, sound symbolic associations related to brand names have been found for a large pool of product traits (e.g., slow, fast, luxury, heavy, sharp, round, feminine). The same BN has been shown to evoke multiple simultaneous connotations. For example, apart from being sweet or bitter, a brand name can also be perceived as round or spiky. Many previous studies have
linked sounds with shapes (e.g., Kovic, Plunkett, & Westermann, 2010; Ramachandran & Hubbard, 2001). This body of research suggests that voiced consonants are generally considered rounded, and voiceless consonants spiky (D’Onofrio, 2014; McCormick, Kim, List, & Nygaard, 2015). These results have been demonstrated using a mix of consonants and not exclusively with obstruents alone, as in the current paper. In order to explain our results, we also explored the association of voiced (vs. voiceless) obstruents with roundedness (vs. spikiness), but our results were inconclusive. We did not find a link between voiced obstruents and spikiness or vice versa (61 participants were asked to match the HBNs with either rounded or spiky shapes [similar to D’Onofrio’s (2014) and McCormick et al.’s, (2015) study]. Voiced with roundedness = 0.54, Voiced with spikiness = 0.46, SD = 0.22, t (60) = 1.58, p = 0.12; Voiceless with roundedness = 0.53, Voiceless with spikiness = 0.47, SD = 0.20, t (60) = 1.30, p = 0.20).

Research suggests that consumers create an image of a brand based on the sound of its name, even if it is hypothetical² (Klink & Athaide, 2012). Moreover, many of the perceived attributes of a brand name are sound-symbolically congruent with each other, for example, spikiness, harshness, bitterness and angularity are all linked attributes of a brand. Similarly, all brands are known to have a personality with many dimensions (Aaker, 1997; Eisend & Stokburger-Sauer, 2013). In Study 3, we aimed to explore the other linked sound symbolic dimensions of the brand personality. For example, it is likely that a bitter/harsh sounding food brand name is also perceived as more masculine (vs. feminine), rugged (vs. soft), tough (vs. soft), dishonest (vs. honest), less cheerful (vs. less cheerful) and less friendly (vs. more friendly).

Klink and Athaide (2012) have used the Brand Personality Scale (BPS) to explore the sound symbolic associations of HBNs and in Study 3, we use a similar method to explore
specifically, three BPS factors (ruggedness, sophistication and sincerity), eight BPS facets contained within these factors (outdoorsy, tough, charming, upper-class, down-to-earth, honest, wholesome and cheerful) and twenty-two BPS traits contained within these facets (masculine, outdoorsy, western, rugged, tough, charming, feminine, glamorous, good looking, smooth, upper-class, down-to-earth, family oriented, small town, honest, sincere, real, wholesome, original, cheerful, sentimental and friendly).

5.1 Participants

A total of 61 participants between the ages of 22 to 67 years completed the study, $M_{age} = 38.59$ yrs., $SD = 10.62$, $Males = 30$, $Females = 31$. All participants were native English speakers (one participant knew Western Armenian and another Spanish).

5.2 Procedure and design

Participants were told that all brands have a personality (e.g., BMW is upper-class and Nike is sporty) and in this study we were interested in finding out the personality traits of two chocolate brands, judged purely on the basis of their names. Participants were told that they would be shown two new brand names for chocolates. They were asked to read the name aloud and to rate them on different personality trait dimensions displayed on the computer screen [e.g., ‘How tough do you think this brand is?’ on a Likert scale from 1 (not at all) to 11 (very much)]. There were ten practice trials to familiarize them with the procedure, in which car brands were used (e.g., Ford, Mercedes). Participants then rated only two HBNs (one each of voiced and voiceless, e.g., Satoke vs. Zadoge) for all the 22 BPS traits. Presentation of the HBNs was random and counterbalanced between participants, with a break in between. The HBN being rated was continuously shown on top of the screen, while the question on the BPS trait kept on changing.
5.3 Results

Ratings of the BPS traits for the HBN$^{\text{voiced}}$ vs. HBN$^{\text{voiceless}}$ were compared using paired sample t-tests; BPS trait ratings were also collapsed into eight BPS facets and three BPS factors to compare (see Table 1). The means of the BPS factors and facets were calculated as the averages of the means of the associated BPS traits with them. For example, the BPS facet of outdoorsy ($M_{\text{Voiced}} = 5.34$) was computed as the average of the BPS traits of masculine ($M_{\text{Voiced}} = 6.34$), outdoorsy ($M_{\text{Voiced}} = 5.62$) and western ($M_{\text{Voiced}} = 4.07$) (see Table 1 for the mappings of BPS traits on to the BPS facets and factors). Out of the three BPS factors, voiced (vs. voiceless) HBNs were found to be significantly different in their perceived ruggedness and sophistication, but not on the sincerity factor (Table 1 & Figure 1). In a view to control the Type I errors, three univariate repeated measures ANOVA were conducted, with the Likert ratings of the HBNs (voiced vs. voiceless) as the independent variables and the three BPS factors (ruggedness, sophistication and sincerity) as the dependent variables. The results revealed that ruggedness and sophistication factors (ruggedness, $F (1, 60) = 9.76, p = 0.003, \eta^2_p = 0.14$; sophistication, $F (1, 60) = 4.91, p = 0.03, \eta^2_p = 0.08$) were significantly different in the voiced vs. voiceless HBNs, whereas no difference was observed in the sincerity factor ($F (1, 60) = 1.99, p = 0.16, \eta^2_p = 0.03$). The results are reported below for each BPS factor.

Insert Table 1 & Figure 1 about here

Ruggedness HBNs with voiced obstruents were found to be significantly more rugged compared to their voiceless counterparts ($Ruggedness_{\text{Voiced}} = 5.64, SD = 2.28$; $Ruggedness_{\text{Voiceless}} = 4.68, SD = 1.90$; $t (60) = 3.12, p = 0.003, d = 0.40$). Within the rugged dimension too, both toughness ($Tough_{\text{Voiced}} = 6.90, SD = 2.76$; $Tough_{\text{Voiceless}} = 4.73, SD = 2.28$; $t (60) = 3.33, p = 0.002, d = 0.43$) and outdoorsy ($Outdoorsy_{\text{Voiced}} = 5.34, SD = 2.17$; $Outdoorsy_{\text{Voiceless}} = 4.66$, ...
SD = 1.90; t (60) = 2.38, p = 0.02, d = 0.30) facets were found to be significantly higher for the voiced obstruents than for the voiceless.

*Sophistication* Similarly, for the sophistication dimension, HBNs with voiceless obstruents were found to be more sophisticated than their voiced counterparts (Sophistication \textit{Voiced} = 5.48, SD = 2.02; Sophistication \textit{Voiceless} = 6.22, SD = 2.05; t (60) = 2.22, p = 0.03, d = 0.28). Within the sophistication dimension, it was the charming BPS facet which was found to be different between the HBNs (Charming \textit{Voiced} = 5.30, SD = 2.03; Charming \textit{Voiceless} = 6.25, SD = 2.16; t (60) = 2.76, p = 0.008, d = 0.35), but not the upper-class facet (Upper-class \textit{Voiced} = 5.65, SD = 2.31; Upper-class \textit{Voiceless} = 6.18, SD = 2.22; t (60) = 1.39, p = 0.17).

*Sincerity* No differences were found overall in the BPS factor of sincerity, but within the sincerity factor, there were differences found in the cheerfulness facet (i.e., cheerful, sentimental and wholesome BPS traits) (Cheerful \textit{Voiced} = 5.74, SD = 2.04; Cheerful \textit{Voiceless} = 6.39, SD = 2.01; t (60) = 2.08, p = 0.042) and the wholesome facet (only the wholesomeness BPS trait was found to be different, but not the originality trait, i.e., both type of HBNs were found to be equally original), Wholesome \textit{Voiced} = 5.77, SD = 2.16; Wholesome \textit{Voiceless} = 6.47, SD = 2.33; t (60) = 2.78, p = 0.007; Sentimental \textit{Voiced} = 5.03, SD = 2.18; Sentimental \textit{Voiceless} = 5.77, SD = 2.32; t (60) = 2.10, p = 0.04), no differences were found between honest and down-to-earth BPS facets.

The results of Study 3 suggest that the HBNs with voiced obstruents are perceived to be more masculine, rugged and tough, but at the same time, less charming, glamorous, honest, wholesome, cheerful and sentimental than their voiceless counterparts.

6 General discussion

Taste is a multi-sensory experience (Reinoso Carvalho et al., 2015) and not only the appearance of food, but even cues unrelated to food e.g., lighting (Cho et al., 2015) or color of
the plate can influence taste expectations and perceptions (Piqueras-Fiszman, Alcaide, Roura, & Spence, 2012). Topolinski and Boecker (2016) showed that a simple imitation of inwards (i.e. imitating deglutition) vs. outwards (i.e. imitating regurgitation) muscle movement involved in spoken words (e.g., brand names) could increase the palatability of the associated food product. Similarly, sound symbolic associations of non-words (i.e. inwards and outwards) have been linked with approach vs. avoidance states (Topolinski, Maschmann, Pecher, & Winkielman, 2014) and even with likeability of persons and products (Topolinski, Boecker, Erle, Bakhtiari, & Pecher, 2017; Topolinski et al., 2014). Even the fluency of a brand name (e.g., ease vs. difficulty of pronunciation) (Janiszewski & Meyvis, 2001; Topolinski, Likowski, Weyers, & Strack, 2009) has been shown to affect consumers attitudes (e.g., likability, willingness to pay) towards brands. The purpose of the current paper was to examine the sound symbolic associations between voiced (vs. voiceless) obstruents and product taste expectations.

 Across three studies, we show that consumers associate HBNs containing voiced obstruents with a bitter tasting product, and voiceless obstruents with a sweet tasting product. We demonstrate the results by using a forced-choice task and a free-choice task. By using the BPS traits, we additionally show the link between other associated (or similar) sound symbolic dimensions of the voiced obstruents (i.e., higher toughness, ruggedness and masculinity and a lack of charming, glamorous, honest, wholesome, cheerful and sentimental traits, which were instead found to be more closely associated with voiceless obstruents). We contribute to the literature by providing empirical evidence to connect voiced (vs. voiceless) obstruents with a sensory dimension (i.e. taste) and at the same time integrating the widely followed BPS framework with the research on sound symbolism. The only other paper which integrates these
VOICING AND TASTE ATTRIBUTES

two theories is Klink and Adelaide (2012), in which they link front and back vowels with BPS traits.

We propose two reasons behind our findings: the frequency code hypothesis and aerodynamic difficulties associated with the utterances of voiced obstruents. In the animal kingdom, lower frequencies are used to express hostility and threat, and higher frequencies for friendliness and non-threatening behavior (Morton, 1977). Because of this evolutionary link between sound harshness (vs. softness) and stressfulness (vs. pleasantness), scientists believe that across all languages, swear (and cuss, threatening) words often use more voiced obstruents (Nielsen & Rendall, 2011; Nielsen & Rendall, 2013; Van Lancker & Cummings, 1999). Humans too associate low (vs. high) frequency sounds with aggressive (vs. submissive) behavior (Dahl, 2010; Krishna, 2012; Pogacar et al., 2018). Similarly, the pronunciation of voiced obstruent requires extreme aerodynamic control which likely explains why these are rare in many languages, and some languages do not use them at all (e.g., Cantonese, Hawaiian, Zuñi, Ainu, Korean, Mandarin) (Major & Faudree, 1996; Ohala, 2011; Žygis, Fuchs, & Koenig, 2012). Voiced obstruents have also been shown to be associated with negative meanings (e.g., concepts of dirtiness, sneakiness and negative images in listeners on hearing the hypothetical words containing voiced phonemes) (Hamano, 1998; Hinton et al., 1994; Kawahara et al., 2008). Since the sound symbolic association of voiced obstruents is with harshness and negative images/perception, the present research extends these findings to a sweet-bitter continuum (here note that the voiced phonemes are of low frequency and are perceived as harsh; Kingston et al., 2008; Slepian & Galinsky, 2016).

A large body of research now shows a strong association between high (vs. low) pitches with sweet and sour (vs. bitter) tastes (Crisinel & Spence, 2009; also see Knöferle & Spence,
VOICING AND TASTE ATTRIBUTES

2012 for a review). A similar association of tastes has been shown with certain musical instruments; for example, pleasant/sweet tastes with piano (or high pitches) and unpleasant/bitter tastes with the brass instruments (or low pitches) (Crisinel & Spence, 2010). It has also been shown that even the perception of taste can be altered by changing the music being played in the background. For example, the same toffee can taste slightly more bitter (vs. sweet) with low (vs. high) pitched sounds being played (Crisinel et al., 2012). It is worthwhile to note here that low (vs. high) pitch associations between sounds and tastes may be explained by the linkages of oro-facial responses with unpleasant (vs. pleasant) tastes (Spence, 2012).

According to this explanation, babies of different mammals (e.g., humans, monkeys, rats) protrude their tongues outwards (vs. inwards) in response to pleasant (e.g. sweet) vs. unpleasant tastes (e.g. bitter) (Steiner, Glaser, Hawilo, & Berridge, 2001). Since humans imitate characteristic facial expressions for disgust, distaste and unpalatable taste (e.g., bitter) (Forestell & Mennella, 2017), in this account (i.e., due the learned associations between specific gustatory responses and associated tongue position and vice versa), one would expect utterances with the same or matching tongue positions to have similar meanings (Knöferle & Spence, 2012). Since gustatory centers (e.g., insular cortex) and regions processing phonology (e.g., Broca’s area) in the brain are said to lie in close proximity to each other (Colizoli, Murre & Rouw, 2013; Ward, Simner, & Auyeung, 2005), this might explain these linguistic-sensory pairings.

In contrast to the large body of literature on the cross-modal association between tastes and sounds, there is scant evidence specifically connecting consonants with taste associations. Most research demonstrates the connection of tastes with either sounds or musical notes (e.g., Crisinel & Spence, 2010, 2011; Ngo & Spence, 2011), but not with consonants per se. This is surprising given the fact that sound symbolic associations were initially popularized by scientists
linking psycholinguistic properties of words with sensory attributes (see Lockwood & Dingemanse, 2015 for a review; Ramachandran & Hubbard, 2001) and that consonants substantially outnumber vowels across most languages (Maddieson & Disner, 1984; Nespor et al., 2003).

We believe that the perception of voiced obstruents/consonants, in the context of brand-naming and product attributes, is an under-researched area (Guevremont & Grohmann, 2015) and that the current research contributes to our understanding of how consumers associate BNs with expectation of taste attributes. An obvious extension of this research is to investigate whether our results generalize to a sweet-sour continuum. We hypothesize that voiced obstruents would be more preferred in brand names for sour products, compared to voiceless for the sweet ones.

We argue that sound symbolism should be considered carefully by marketing managers during the process of product and brand naming, as we now know that consumers intuitively expect a congruency of sensory expectations. For example, the brand name for a hiking boot should better be rugged; Klink and Athaide (2012) and that of a skin conditioner should be soft and gentle. A similar congruency is desired between brand names of food products and their taste expectations (Crisinel, Jones, & Spence, 2012) as incongruent combinations may affect the subsequent product ratings. For example, in the context of medications for cancer /p/, /t/, /k/, /f/ and /s/ (mainly voiceless obstruents), are over represented whereas /b/, /d/, /g/, /v/ and /z/ (mainly voiced obstruents) are underrepresented (Abel & Glinert, 2008). Most researchers (e.g., Spence, 2014) attribute this to the fastness vs. slowness of these phonemes. Since we now suggest that voiced obstruents can also signify bitterness, is it likely that these inherent ‘bitter’ associations cue manufacturers sound symbolically to avoid these phonemes. This is perhaps
especially pertinent when naming drugs designed to combat a disease that in any case induces public fear (e.g., cancer).

We acknowledge a few potential limitations of this paper, which generates some suggestions for future research. Firstly, we used only tri-syllabic names (e.g., Sa-to-ke); and research suggests that even the syllabic length of a word can affects its perceived attributes (e.g., luxury; Pathak, Velasco, Petit, & Calvert, 2019). It is likely that the length of a name itself holds meaning (in terms of taste) for consumers, and this has not been tested in the current paper. Secondly, the word structure used to create the HBNs in the current paper was a simple CV-CV (Consonant-Vowel) structure. It is unlikely that the results will be different for HBNs with complex linguistic structures (e.g., the word ‘trap’ has a more complex CCVC structure), but the current paper has not tested this. Similarly, HBNs with even more complex consonant clusters (e.g., /Zk/) can be created and tested. Thirdly, we have used an equal number of consonants in HBNs and have not tested the increase (vs. decrease) in the perceived sweetness (vs. bitterness) of a brand name with a varying number of voiced (vs. voiceless) obstruents. It might be the case that the perceived sweetness (vs. bitterness) associated with an HBN vary with the number of obstruents used (e.g., one vs. two vs. three voiced obstruents in an HBN). Future studies could use HBNs with one, two vs. three voiced obstruents to examine the effect of the number of voiced obstruents present in an HBN on the perceived sweetness (or bitterness). Lastly, in this paper we have only chosen to study the sound symbolic attributes associated with brand names of chocolates. Further research is required to determine whether our results extend to other product categories (e.g., sweet vs. bitter beer/jams).

Sensory perceptions play an important role in a consumer’s interaction with brands and research has consistently shown that colors, sounds, textures, tastes and smells can often affect a
product’s perception. However, when it comes to *expressing* the multitude of sensory feelings *through speech*, one encounters linguistic limitations (Caballero & Paradis, 2015). For example, how can one communicate different types of *smells in speech*, or how can one talk about flavors which go beyond traditional sweet, bitter, salt and sour axes? The findings of this paper will help brand managers to communicate some of these complicated sensory experiences through novel names and psycholinguistic elements.
VOICING AND TASTE ATTRIBUTES

References


VOICING AND TASTE ATTRIBUTES


VOICING AND TASTE ATTRIBUTES


VOICING AND TASTE ATTRIBUTES


VOICING AND TASTE ATTRIBUTES


VOICING AND TASTE ATTRIBUTES


VOICING AND TASTE ATTRIBUTES

Experimental Psychology/Revue canadienne de psychologie expérimentale, 65(2), 115-124.


VOICING AND TASTE ATTRIBUTES


Pathak, A., Calvert, G. A. & Lim, L. (Submitted). Harsh voices, sound branding: How voiced consonants in a brand’s name can alter its perceived attributes. *Psychology & Marketing*


Piqueras-Fiszman, B., Alcaide, J., Roura, E., & Spence, C. (2012). Is it the plate or is it the food? Assessing the influence of the color (black or white) and shape of the plate on the perception of the food placed on it. *Food Quality and Preference, 24*(1), 205-208.


VOICING AND TASTE ATTRIBUTES


VOICING AND TASTE ATTRIBUTES


Footnotes

1 Words with /g/ also can be pronounced in two different ways, with a hard g (as in Gate) sound vs. a soft /g/ (as in Gem). This was an oversight in the design of our Study 1, which was kindly pointed out by an anonymous reviewer; we now report an additional analysis excluding the /g/.

2 Recent studies also point out that our brain processes the personality of a brand vs. that of a person differently, and not in a way that marketing scholars have proposed for long (Yoon, Gutchess, Feinberg, & Polk, 2006).

3 Another probable explanation can be the temporality of tastes, as described by Obrist et al. (2014). These authors argue that some tastes (e.g. sour) are short-lived and explosive in nature whereas others (e.g. sweet) are lingering, pleasant and slow. Participants describe these tastes in a similar fashion (e.g. instant vs. slow). Similarly, voiced (vs. voiceless) obstruents can be perceived as harsh and more intense (vs. smooth and less intense) and may explain their linkages with bitterness (vs. sweetness).

4 Low (vs. high) pitch and low (vs. high) frequency sounds hold the same meaning. Pitch denotes the perceptual dimension of the frequency of sounds (Hagtvedt & Brasel, 2016).
Appendix 1

HBNs used in the current paper.

<table>
<thead>
<tr>
<th>HBN with voiceless obstruents</th>
<th>HBN with voiced obstruents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satoke</td>
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</tr>
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<td>Zogida</td>
</tr>
<tr>
<td>Sipetu</td>
<td>Zibedu</td>
</tr>
<tr>
<td>Sukapi</td>
<td>Zugabi</td>
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<td>Sekuto</td>
<td>Zegudo</td>
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<td>Kaseti</td>
<td>Gazedi</td>
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<tr>
<td>Ketiso</td>
<td>Gedizo</td>
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<td>Kipotu</td>
<td>Gibodu</td>
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<td>Kopusa</td>
<td>Gobuza</td>
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<td>Kutape</td>
<td>Gudabe</td>
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<tr>
<td>Tupasi</td>
<td>Dubazi</td>
</tr>
<tr>
<td>Tosepa</td>
<td>Doząba</td>
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<td>Tekopu</td>
<td>Degobu</td>
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<td>Tisuko</td>
<td>Dizugo</td>
</tr>
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<td>Tapise</td>
<td>Dabize</td>
</tr>
<tr>
<td>Pokasi</td>
<td>Bogazi</td>
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<td>Pesoka</td>
<td>Bezoga</td>
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<tr>
<td>Pituse</td>
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<td>Pukeso</td>
<td>Bugezo</td>
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<td>Vibadu</td>
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<td>Fokuta</td>
<td>Voguda</td>
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Source: Pathak, Calvert & Lim (Submitted)
VOICING AND TASTE ATTRIBUTES

Appendix 2

A sample of brand names created by participants in Studies 2a and 2b.

<table>
<thead>
<tr>
<th>Study 2a</th>
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<td><strong>Bitter chocolates</strong></td>
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<td>good</td>
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<td>debita</td>
<td>apedis</td>
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<td>paive</td>
<td>pugie</td>
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<td>set</td>
<td>svt</td>
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<tr>
<td>sweecho</td>
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<td>delightfully sweet</td>
<td>ohh so sweet!</td>
</tr>
<tr>
<td>svet</td>
<td>zeap</td>
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<tr>
<td>kast</td>
<td>dak</td>
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</table>

BN= Brand name
Figure 1. Study 3: Brand Personality Scale (BPS) factors, facets and traits of the HBNs.
BPS factors: HBNs containing voiced obstruents are perceived as more rugged whereas HBNs containing voiceless obstruents are perceived as more sophisticated.

BPS facets: HBNs containing voiced obstruents are perceived as more outdoorsy and tough, whereas HBNs containing voiceless obstruents are perceived as more charming, cheerful and wholesome.

BPS traits: HBNs containing voiced obstruents are perceived as more masculine, rugged and tough, whereas HBNs containing voiceless obstruents are perceived as more charming, feminine, glamorous, honest, wholesome, cheerful and sentimental.)
### Tables

**Table 1. Results of Study 3.**

<table>
<thead>
<tr>
<th>BPS traits</th>
<th>Voiced obstruents</th>
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<th>Voiceless obstruents</th>
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<th>SD</th>
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Figures in bold show significantly different results.
Ruggedness (BPS factor) = Average means of the BPS facets (outdoorsy and tough)
Sophistication (BPS factor) = Average means of the BPS facets (upper-class and charming)
Sincerity (BPS factor) = Average means of the BPS facets (down-to-earth, honest, wholesome and cheerful)
Outdoorsy (BPS facet) = Average means of the BPS traits (masculine, outdoorsy and western)
Tough (BPS facet) = Average means of the BPS traits (rugged and tough)
Upper-class (BPS facet) = Average means of the BPS traits (upper-class, glamorous and good looking)
Charming (BPS facet) = Average means of the BPS traits (charming, feminine and smooth)
Down-to-earth (BPS facet) = Average means of the BPS traits (down-to-earth, family oriented and small town)
Honest (BPS facet) = Average means of the BPS traits (honest, sincere and real)
Wholesome (BPS facet) = Average means of the BPS traits (wholesome and original)
Cheerful (BPS facet) = Average means of the BPS traits (cheerful, sentential and friendly)