Assessing the shapes and speech sounds that people associate with chocolate samples varying in cocoa content

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ABSTRACT

We report a series of three experiments designed to highlight the reliable crossmodal correspondences that exist between the cocoa content of various commercially-available chocolate products and both visually-presented shapes and nonsense words. The chocolates tested in this study included three kinds of Lindt chocolate and a milk chocolate truffle ('Koko' brand from Cadbury). Participants were given paper-based line scales, anchored at either end with either a nonsense word or simple outline shape. They tasted the chocolates and indicated whether their perception of the flavor better matched one or other of the items anchoring the scales by marking the appropriate point along the scale. The results demonstrate that certain chocolates were more strongly associated with angular shapes and 'sharp' inflected, high-pitched meaningless words, such as 'tuki' and 'takete'. Specifically, Lindt extra creamy milk chocolate (30% cocoa) and Cadbury's Koko milk chocolate truffles were both more strongly associated with rounded shapes and softer sounding, lower-pitched pseudo-words, such as 'maluma'. By contrast, Lindt 70% and 90% cocoa chocolates were more strongly associated with sharper (angular) shapes and sounds, such as 'takete'. These results demonstrate that the phenomenon of sound symbolism extends beyond the visual modality into the domain of flavor perception where, in particular, speech sounds carry meaning in terms of the taste/flavor of chocolates. These results have implications for the development of novel brand names for new products (such as, in this case, chocolate) that best connote the product's likely sensory attributes.

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1. Introduction

Recently, Gallace, Boschin, and Spence (2011) demonstrated that people are more likely to match certain words to the tastes, textures, and flavors of various food and drink items. Their research was motivated by the extensive literature on the topic of sound (or phonetic) symbolism (see Köhler, 1929; Sapir, 1929, for early research on this topic, and Spence, 2011, for a recent review), defined as "*the direct linkage between sound and meaning*" (Hinton, Nichols, & Ohala, 1994). Numerous studies have highlighted the fact that people spontaneously associate certain speech sounds with specific visually-presented shapes (e.g., O'Boyle & Tarte, 1980; Ramachandran & Hubbard, 2001). So, for example, nonsense words such as 'takete' and 'kiki' tend to be associated with angular shapes while nonsense words such as 'maluma' or 'bouba' tend to be associated with rounded 'cloudlike' shapes instead. Interestingly, people all over the world appear to exhibit the same crossmodal correspondences (see Hinton et al., 1994,

for a review). What is more, such crossmodal correspondences appear to emerge very early in human development (i.e., within a few months of birth; e.g., Maurer, Pathman, & Mondloch, 2006; Walker et al., 2010).

The majority of the sound symbolism research that has been published to date has focused on the nature of the crossmodal correspondences that exist between speech sounds and the attributes of objects presented visually (see Hinton et al., 1994, p. 4; Lowry & Shrum, 2007). That said, report by Fónagy (1963) nearly half a century ago suggested that there might be a crossmodal correspondence between foods on the bitter–sweet continuum and front/back vowel sounds (e.g., an example of a frontal vowel sound is the 'i' sound in the word 'hit', whereas a back vowel sound would be the 'o' in 'home'; Ladefoged, 1993). Suggestive evidence that the phenomenon of sound symbolism might extend to the case of crossmodal associations between sounds and tastes/flavors comes from marketing research conducted by Yorkston and Menon (2004). They demonstrated that people are more likely to believe that an ice cream will have a creamy taste if it is called 'Frosch' than if it is called 'Frisch' (see also Klink, 2000). It is important to note, though, that the participants in Yorkston and Menon's study never actually tasted anything, they merely read a short textual description about a fictional product. Thus, to date, there has been

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virtually no research that has specifically attempted to investigate whether certain phonological stimuli (i.e., speech sounds) also bear a non-arbitrary relationship to non-visual stimulus attributes, be they modality-nonspecific (i.e., amodal), such as an object's shape, or modality-specific (i.e., modal), such as a food or drink's bitterness. One recent exception to this generalization comes from a study by Gallace et al. (2011).

Gallace et al. (2011) demonstrated that people reliably associate nonsense words (e.g., 'maluma' and 'takete', as originally popularized by Köhler, 1947; and 'bouba' and 'kiki', as popularized by Ramachandran & Hubbard, 2001) with specific tastes/flavors/foodstuffs. The participants in Gallace et al.'s study were given a range of up to ten different foods, including jam, chocolate, crisps, and yoghurt. They had to rate each foodstuff using 24 different visual analogue linear scales with a pair of words such as good/bad and salty/sweet, at the end-points. Amongst these scales (presented via computer) were three scales designed to test whether the phenomenon of sound symbolism extends to the flavor and/or oral-somatosensory (i.e., textural) attributes of foodstuffs, namely: bouba/kiki, takete/maluma and decter/bobolo. The results highlighted the fact that people consistently rated salt and vinegar crisps (potato chips) as much more kiki (or takete) than cheddar cheese, yoghurt, or blueberry jam. Meanwhile, chocolate with mint chips and crisps (potato chips) were rated as significantly more kiki/takete than regular chocolate.
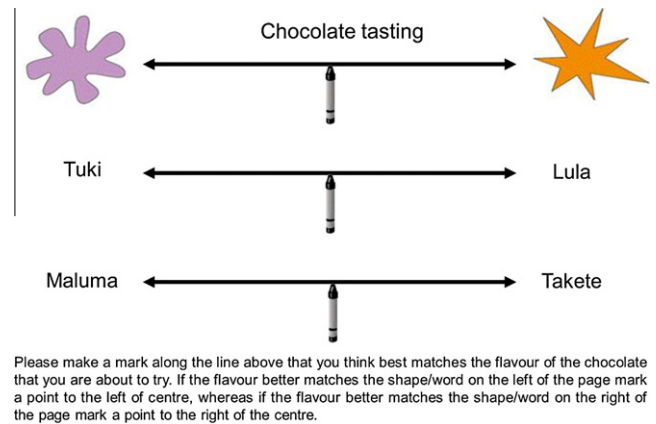
The goal of the present study was to test whether certain meaningless speech sounds and shapes are associated with the taste/flavor/oral-somatosensory attributes of chocolate samples varying primarily in their cocoa content. Here, we report a number of simple demonstrations highlighting the fact that people really do reliably link certain attributes of shapes and nonsense words to chocolate samples of varying cocoa content. Furthermore, we demonstrate that these crossmodal correspondences can be observed in relatively small groups of participants using nothing more than a quick and easy to administer pencil-and-paper task. We believe that the findings reported here, and the methodology used to obtain them, are therefore potentially important in terms of the marketing and branding of chocolates, not to mention other food and drink products.

2. Experiment 1

In Experiment 1, participants evaluated three pieces of chocolate: one piece of 30% cocoa milk chocolate and two pieces of dark chocolate, one with a cocoa content of 70% and the other made with 90% cocoa. The question to be addressed in our first experiment was whether there is a systematic crossmodal correspondence between the cocoa content of chocolate and the angularity/sharpness of shapes and the sharpness of words.

2.1. Methods

Twenty-two participants (ranging in age from 16 to 52 years; mean age of 36 years) were given paper-based analogue labeled line scales on which to score each of the chocolate samples (see Fig. 1 for the scales and labels used). The first scale was anchored with a rounded shape on the left and an angular shape on the right. The second scale was anchored with the words "Tuki" and "Lula", while the third scale was anchored with the words "Maluma" and "Takete".[1] Each line scale was 13.5 cm long with an image of a

[1] Note that the first and third scales were both anchored with the rounded shape/word on the left and the sharper, more angular shape/word on the right. This arrangement was reversed for the second scale, so as to prevent the participants from simply associating one side of the scales (or response sheet) with a particular quality/attribute.

Fig. 1. The response sheet (including instructions) given to participants. The three line scales highlighted in the figure were used in Experiments 1 and 2. In Experiment 3, the left anchor 'Tuki' was replaced by the word 'Koko' (the name of the chocolate product that participants actually) happened to be rating.

crayon centered on its mid-point. The participants were given a set of three response sheets, each with the same three scales printed on them. They were instructed to close their eyes while the experimenter placed a small piece of chocolate (1/4 of a chocolate square, approximately 3 g) in their hand. The participants tasted the sample and then rated it by marking a line on each of the three response scales on the first response sheet. They were instructed to make their ratings by placing a mark anywhere along the line of each scale in order to indicate what nonsense words and shape they felt best matched the flavor of the chocolate that they had just tasted. For example, the participants were told that if they thought the flavor of the chocolate matched more closely with Maluma than Takete, they should place their mark closer to the Maluma side of the scale. The closer the mark was to Maluma, the more participants thought that the flavor of the chocolate matched with the word Maluma. If the participants felt that the chocolate neither matched with the nonsense word Maluma nor Takete, they should place a mark in the middle of the scale. This procedure was repeated for the other two chocolate samples. Thus, in total, each participant tasted three pieces of chocolate (all Lindt Excellence brand), consisting of one piece of extra creamy milk (30% cocoa), one piece of 70% cocoa, and one piece of 90% cocoa chocolate. The order in which the chocolate samples were tasted was counterbalanced across participants.

2.2. Results

The participants' responses were measured using a ruler. The mid-point on each scale, shown by the crayon in Fig. 1, was assigned a value of zero. For the first and third scales, participants' responses to the left of the mid-point were assigned negative values, while responses to the right of the crayon were given positive values. The coding of participants' responses was reversed for the second scale. Consequently, negative values indicated more rounded/softer responses, regardless of the specific scale being used. Participants' responses for each chocolate sample on each of the three response scales (see Fig. 2) were compared using a 3 (chocolate) × 3 (scale) within-participants analysis of variance (ANOVA). The analysis revealed significant main effects of chocolate, $F(2,42) = 18.07$, $p < .001$, and scale, $F(2,42) = 3.71$, $p = .03$. Participants' ratings of the extra creamy milk chocolate ($M = -2.9$ cm) were significantly different from their ratings of the 70% ($M = 1.0$ cm) and 90% dark chocolates ($M = 2.2$ cm), $p < .001$ for both comparisons. However, their ratings did not differ significantly between the 70% and 90% dark chocolate