Symbolism in Sonance: Investigating the Roles of Consonants and Vowels in the Bouba-kiki effect

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ABSTRACT (PB)

The standing notion that arbitrariness is the cornerstone in the evolution of language is widely discussed. Recent studies suggest that arbitrariness is supported by non-arbitrariness, and that the two complement each other by serving different functions in language.

This report investigates the details of one such non-arbitrary phenomenon, namely the so-called Bouba-kiki effect first observed by Köhler (1929 and 1947) and later by Ramachandran & Hubbard (2001). An experiment was conducted in which participants were tasked with matching pseudowords to one of two figures in a two-alternative forced choice task. The purpose of the experiment was to investigate the respective roles of consonants and vowels in the Bouba-kiki effect. It was possible to observe a strong Bouba-kiki effect using pseudowords consisting of consonant-vowel-pairs with similar articulatory features. In addition, it was found that consonants had a leading effect over vowels across pseudowords with both similar and dissimilar articulatory features, but that the joint effect of consonants and vowels was greater.

Keywords
Language; Sound symbolism; Bouba-kiki effect; Vowels; Consonants

INTRODUCTION (PB, LD)

Which one is "Kiki" and which one is "Bouba"?

In 1929 psychologist Wolfgang Köhler conducted a psychological experiment on the island of Tenerife. He presented participants with two simple shapes: one jagged, like the outline of a star, and one rounded, like the silhouette of a flower. The volunteers were then asked to give the two figures a name, choosing between the pseudowords "Takete" and "Baluba". Köhler observed a strong preference among the participants, who chose the word "Takete" to refer to the jagged shape and "Baluba" for the rounded in a majority of cases (Köhler, 1929). Years later, at the beginning of the 21st century,

Vilayanur Ramachandran & Edward Hubbard (2001) conducted an investigation into grapheme-color synaesthesia. As part of the investigation, Ramachandran & Hubbard devised an experiment similar to that done by Köhler[1]. Two new pseudowords, "Kiki" and "Bouba," were used in combination with a jagged and a rounded figure, and the researchers now asked American college undergraduates and Tamil speakers in India to name the figures. Like Köhler, Ramachandran & Hubbard observed a strong preference among the participants when assigning the pseudowords to the two shapes: more than 95% of both groups paired the jagged figure with the word "Kiki" and the rounded figure with the word "Bouba". As an explanation to this phenomenon, the researchers suggested that the brain constructs non-arbitrary mappings between sound and the visual characteristics of objects (Ramachandran & Hubbard, 2001).

The effect observed by Ramachandran & Hubbard, popularly called the "Bouba-kiki effect," could be an indication that one of the most widely established ideas regarding the evolution of language might not be sufficient in explaining just how this evolution came to be.

The nature of the connection between a word and its meaning

When referring to entities or concepts (so-called *referents*) in the world, humans use expressions – words – which can be either written or spoken. Though the winged words of writer Boris Pasternak make mention of calling "*each thing by its right name*," no such universally correct labels exist. Instead, each individual has their own set of representations of worldly entities and concepts, which assign the referents a specific meaning when recalled. These representations are influenced by culture and experience (Tylén, 2016). For example, American and Danish children will most likely picture a large, four-wheeled vehicle when recalling the expression "school bus". However, their representation of this referent, the school bus, may differ; American school buses generally look quite different from Danish school buses, and even the appearance of Danish school buses may differ from town to town.

But what determines the expression for a referent, and how could one possibly describe the connection between an expression and what it refers to? Why do the English use the expression "dog" to refer to a furry, four-legged pet, while the Spanish use "perro", the French "chien" and the Danes "hund"? What kind of rules, if any, are at play here?

The currently established convention concerning the relationship between the form of a word and its meaning was inspired by the Swiss linguist Ferdinand de Saussure. Saussure argued that language is made up of linguistic *signs*, which each comprise of two parts: the *signifier*, or phonetic

[1] Köhler himself conducted a revised version of his experiment in 1947, where "Baluba" had been replaced with "Maluma" (Köhler, 1947).

shape of the word, and the *signified*, the mental concept or object that the signifier represents (Berger, 2012). Saussure also suggested that these linguistic signs are symbolic and arbitrary. Expressions are, much the same as linguistic signs, viewed as arbitrary and considered determined by social and/or cultural convention: the sound of a word does not carry any meaning in relation to its referent (Tylén, 2016; Dingemanse et al.,2015). Hence, language may be considered a social product made by its community of users, and all the structures on which a language is constructed – the grammar, the syntax, the words – are considered unmotivated and guided by no objective other than chance when created. Should language be completely arbitrary, it is, in some way, removed from all aspects of human evolution and remains without an origin (or at least with one that is hard to discover).

An opposing idea to this convention is non-arbitrariness in language. Here, the connection between the physical aspects of the sound of a word and the meaning that is derived from it is determined by a system instead of chance. The meaning of a word can as such be predicted by its sound. This hypothesized relationship is commonly called *sound symbolism* (Hinton, Nichols, & Ohala, 2006). John Ohala, professor of linguistics at University of California, Berkeley, suggests that the explanation of sound symbolism in language must be found in biology. To support this proposal, he notes that 1) across languages, a question can be formed from a statement purely by changing the intonation, and that 2) across languages, certain speech sounds are systematically related to objects' physical aspect of size[2]. He argues that these sound symbolic statements can be used to explain biological phenomena such as the origin of the smile as well as the proposed link between human vocal anatomy and the evolution of speech (Ohala, 1997).

The Bouba-kiki effect, observed first by Köhler and later by Ramachandran & Hubbard, is an example of a non-arbitrary tendency in the relationship between sound and meaning. In their task on which pseudoword to assign to which figure, participants in the experiments may have based their decision on an implicit "mapping" between the sound of the word and the characteristic of the shape, such as suggested by Ramachandran & Hubbard. With more than 95% of participants making the same decision, it could be suggested that this connection is not guided by chance, but is controlled by some kind of objective or system.

Iconicity, systematicity and arbitrariness

Recent studies suggest that it is not a question of arbitrariness versus systematic connections in language. Rather, it would appear arbitrariness is supported by common forms of non-arbitrariness, such as iconicity and systematicity, when language is constructed. In their paper *Arbitrariness,*

[2] The described examples are just a few of the ideas presented by Ohala to support the proposal.

Iconicity, and Systematicity in language from 2015, Dingemanse et al. describe the proposed collaboration between arbitrariness and non-arbitrariness in language. They illustrate how recent research suggests that arbitrariness in language is complemented by forms of non-arbitrariness, and that these two different types of connections between expression and meaning serve separate functions in language.

Dingemanse et al. further elaborate on iconicity and systematicity in their paper. Iconicity is the mapping between sound and meaning based on imitation and resemblance. Here, expressions and referents "are related by means of perceptuomotor analogies" (Dingemanse et al., 2015, p. 604). Iconicity is also seen across languages in ideophones – words that, by their sound alone, can evoke intense sensory perceptions. Iconicity is usually divided into two types: *absolute iconicity*, where the relationship between word and sound is very apparent, and *relative iconicity*, where the relationship is less straightforward and more analogical. The other form of non-arbitrariness mentioned – systematicity – is a "statistical relationship between patterns of sound for a group of words and their usage" (Ibid, p. 606). It is suggested that different phonological cues predict meaning in different word classes (Dingemanse et al., 2015).

Dingemanse et al. considered the different roles of these two forms of non-arbitrariness and how they could complement arbitrariness. One of the challenges in language acquisition is to categorize words by their context and when it would be appropriate to use them. If every aspect of language were arbitrary, this would be a tremendous (and energy consuming) task, as words would not in themselves carry any clues as to their meaning or usage. Here, systematicity provides the language learner with phonological cues assisting in the learning of categories (Dingemanse et al., 2015).

Similar to systematicity, iconicity is able to provide assistance in language acquisition. Iconicity works by way of different mechanisms, including 1) the collaboration between meaning and articulation of words, 2) neural coding across different modalities, which provides association of pitch, and 3) across-modality associations with general perceptual cues. These various mechanisms enforce the perceptuomotor analogies, which support generalizations and explanations in more complex areas of life. Dingemanse et al. also address the advantages of arbitrariness. They note that it ensures flexibility in language and assists in describing more abstract concepts for which perceptual sensations might not be available. In addition, arbitrariness prevents overuse of similar meanings to similar words, which would cause confusion and misunderstanding in communication (Dingemanse et al., 2015).

Another recent study by Monaghan et al. (2014) examined the degree to which arbitrariness in language appears by collecting English words from a database and measuring the amount of sound-meaning systematicity in the vocabulary. It was found that "the English vocabulary was more systematic than expected by chance, $p<0.0001$, though the amount of variance explained was very small ($r^2<0.002$)" (Monaghan et al., 2014, p. 5). The researchers concluded that arbitrariness and sound

symbolism can both be found in the English language, but the degree to which the two phenomena appear varies for different regions of the vocabulary. They argue that sound symbolism seems to "promote language acquisition" (Ibid, p. 10) and that arbitrariness "facilitates efficient communication in later language" (ibid). This appears much in line with the conclusions made by Dingemanse et al.

Dissecting the Bouba-kiki effect

The results observed by Ramachandran & Hubbard (2001) were obtained by using the pseudowords "Kiki" and "Bouba". Both consisted of consonant-vowel combinations of similar articulatory features. /k/, which is an unvoiced consonant, and /i/, which is a front vowel, can both be considered "hard" in their pronunciation. On the other hand, /b/ is a voiced consonant while both /o/, /u/ and /ɑ/ are categorized as back vowels – all of which could be considered "soft" sounds. Hence, it may not be that surprising that participants paired "Kiki" with the jagged figure and "Bouba" with the rounded figure. This raises the following question: what if participants had to assign pseudowords consisting of consonant-vowel pairs with dissimilar articulatory features to either a round or a jagged figure? And under such circumstances, would it be possible to discern a leading effect in either consonants or vowels?

Inspired by the discussion of arbitrariness versus non-arbitrariness in language and, in particular, the investigations conducted by Köhler (1929 and 1947) and Ramachandran & Hubbard (2001), an experiment on sound symbolism was conducted. The experiment was designed around a recreation of the Bouba-kiki effect as well as an investigation into the individual roles of consonants and vowels, and how they influence this effect. The experiment set out to investigate the two following hypotheses:

1) It will be possible to observe a Bouba-kiki effect using pseudowords constructed from consonant-vowel pairs of similar articulatory features, analogous to the pseudowords used in earlier experiments (see section *Word stimuli* for details).
2) It will be possible to find a leading effect in either consonants or vowels in predicting responses across all types of pseudowords.

METHODS

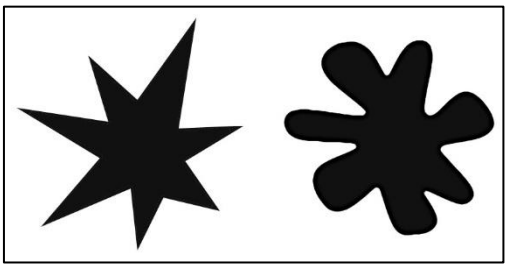
Participants (PB)

A total number of 100 people participated in the experiment (67% female and 33% male, with a mean age of 22 years and a range of 15-49 years). Approximately 10% of the participants were enrolled in

Cognitive Science studies at Aarhus University, Denmark. The remaining participants were acquired by asking passers-by in Nobelparken Cantina at Aarhus University, as well as acquaintances of the researchers. Participants were not offered any kind of incentive for their assistance in the experiment. All participants were native Danish speakers.

Image stimuli (LD)

The image stimuli used in the experiment consisted of two figures; one jagged and one rounded (see example 1). These were similar to the figures used in former studies by Köhler (1929 and 1947) and Ramachandran & Hubbard (2001). Two mirrored but otherwise identical versions of the shown image stimuli were created in order to account for repetition bias.



Example 1: The figures used in the experiment.

Word stimuli (LD, PB)

Word stimuli consisted of a total of 36 four-letter pseudowords generated from a set of specific criteria to best investigate the hypotheses. To construct the pseudowords, a total of 12 letters were selected based on their phonetic and articulatory properties. The selection comprised of six consonants and six vowels: P, K, T, B, L and M as well as O, U, A, I, E and Y.

Consonants were selected and grouped based on the articulatory feature "voicing". Consonants P, K and T were selected due to their classification as unvoiced, while consonants B, L and M were chosen due to their classification as voiced. The consonants were divided into two groups, with P, K and T being grouped as unvoiced, "hard" consonants (hereafter denoted C_H), and B, L and M grouped as voiced, "soft" consonants (denoted C_S).

Vowels were selected and grouped based on the articulatory feature "backness," specifically in regards to the Danish language. I, E and Y, which in Danish are generally pronounced /i/, /e/ and /y/, were selected due to their characterization as front vowels. O and U, which in Danish are generally pronounced /o/ and /u/, were selected due to their characterization as back vowels. While A is generally pronounced /a/ in the Danish language and would fall under the category of front vowel, it was suspected that, due to the nature of the pseudowords, participants would instead opt for the pronunciation /ɑ/, which is characterized as a back vowel. With this in mind, the vowels were finally divided into two groups, with I, E and Y being grouped as "hard" front vowels (denoted V_H) and O, U and A grouped as "soft" back vowels (denoted V_S).

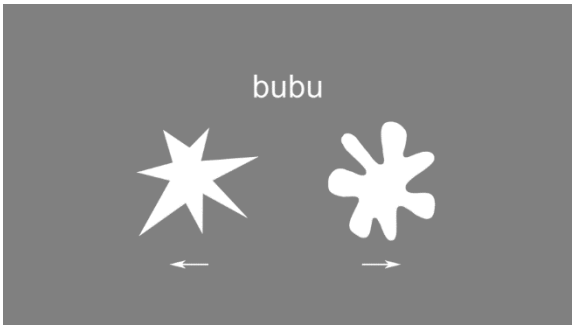
As previous studies have found no consonantal bias due to onset effect in consonant-initial pseudowords (Fort et al., 2015), only a single word construction archetype was used in the experiment. Using the selected pool of vowels and consonants, the archetype CV_iCV_i was used to construct a total of 36 pseudowords across four distinct word groups. Each of the four word groups comprised of different combinations of the vowel and consonant types C_S, C_H, V_S and V_H. For WORD GROUP 1 and WORD GROUP 2, pseudowords were created using the combinations $C_SV_SC_SV_S$ and $C_HV_HC_HV_H$, respectively. These groups were made to mimic the setup of previous Bouba-kiki effect studies: the combination of soft-sounding unvoiced consonants and soft-sounding back vowels was expected to be associated with the rounded figure, while the combination of hard-sounding unvoiced consonants and hard-sounding front vowels was expected to be associated with the jagged. For WORD GROUP 3 and WORD GROUP 4, pseudowords were created using the combinations $C_SV_HC_SV_H$ and $C_HV_SC_HV_S$, respectively. These groups were created to further explore both the dependent and independent roles of both types of consonants and vowels in predicting participant response. Table 1 shows all generated pseudowords and word groups.

WORD GROUP 1 ($C_SV_SC_SV_S$)	WORD GROUP 2 ($C_HV_HC_HV_H$)	WORD GROUP 3 ($C_SV_HC_SV_H$)	WORD GROUP 4 ($C_HV_SC_HV_S$)
momo	kiki	mimi	koko
mumu	keke	meme	kuku
mama	kyky	mymy	kaka
bobo	titi	bibi	toto
bubu	tete	bebe	tutu
baba	tyty	byby	tata
lolo	pipi	lili	popo
lulu	pepe	lele	pupu
lala	pypy	lyly	papa

Table 1: Pseudowords used in the experiment by word group.

Experimental design (LD)

The experiment was programmed in Python (v. 2.7) and conducted on computers. Participants were placed in front of a computer and presented with a consent form followed by instructions on the experimental task. They were told that two figures and a word would be presented, and specifically informed to read aloud the word using their inner voice. Participants were asked to attempt to ignore similarities between the presented word and existing words or names, and told to consider the presented word as novel. In addition, they were asked to use their inner voice to pronounce the presented word as they



Example 2: One of the stimulus screens presented to the participants

would a Danish word. Participants were finally asked to, after careful consideration, indicate which of the two presented figures was best described by the sound of the presented word. After having read the instructions, the experiment was initiated, and participants were presented with the first set of stimuli (see example 2).

The experiment consisted of two parts:

1) In the first half of the experiment, participants were briefly presented with a fixation cross (500 ms) followed by a stimulus screen. This consisted of a randomly selected pseudoword from either WORD GROUP 1 or 2 (see section *Word stimuli*) as well as a randomly selected image-stimulus (see section *Image stimuli*). After using the arrow keys to indicate an answer, participants were again presented with a fixation cross followed by the next stimulus screen. This procedure was repeated a total of 18 times, cycling through all possible word-stimuli from WORD GROUP 1 and 2.
2) In the second half of the experiment, the previous procedure was repeated using randomly selected pseudowords from WORD GROUP 3 and 4 (see section *Word stimuli*). This was also repeated a total of 18 times, cycling through all possible word-stimuli from WORD GROUP 3 and 4.

No pause or break was implemented and participants were not informed or made aware of the change of stimuli type mid-experiment.

Data analysis (PB, LD)

Based on the hypotheses, we expect to see a significant difference in means of the responses between WORD GROUP 1 and WORD GROUP 2. In addition, we expect to see a significant difference between consonants and vowels as predictors for response for pseudowords in all word groups.

Using RStudio, a dependent t-test was conducted to investigate the first hypothesis. Responses were assigned a value of either 1 or 0; 1 being jagged and 0 being rounded. To account for repeated measures, a mean response for each group of pseudowords was calculated per participant, resulting in a total of 100 response means per word group.

To investigate the second hypothesis, a repeated measures two-by-two factorial logistic regression analysis was performed on the data. Four different mixed effects models (including a baseline model) were constructed to best investigate the hypothesis. Participant ID was noted as the random effect to account for repeated measures. The models were then compared using an ANOVA and by consulting the Akaike Information Criterion (AIC).

RESULTS (LD, PB)

On average, participants paired pseudowords of the type $C_HV_HC_HV_H$ significantly more often with the jagged figure (M = 0.769, SE = 0.018) than with the rounded figure (M = 0.127, SE = 0.016), and pseudowords of the type $C_SV_SC_SV_S$ more often with the rounded figure (M = 0.873, SE = 0.016) than with the jagged figure (M = 0.231, SE = 0.018), $t(99) = 24.064$, $p < 0.001$, $r = 0.924$ (see figure 1).

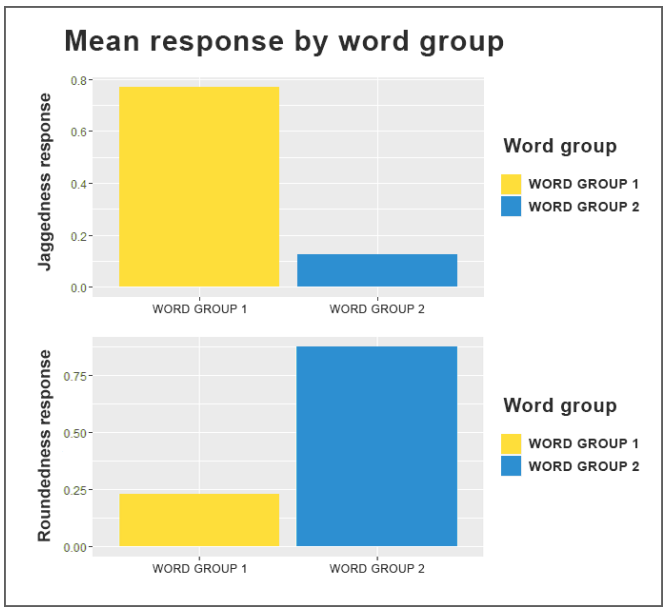


Figure 1: Mean jaggedness and roundedness response by word group.

Consonants were found to have a significantly better ability in predicting response (*AIC* = 4373.3, R^2 = 0.177) compared to vowels (*AIC* = 4711.1, R^2 = 0.078), $X^2(1) = 237.88$, $p<0.001$. However, consonants in conjunction with vowels were found to have a significantly better ability in predicting response (*AIC* = 4088.7, R^2 = 0.276) compared to consonants alone (*AIC* = 4373.3, R^2 = 0.177), $X^2(1) = 286.66$, $p<0.001$.

DISCUSSION (PB, LD)

It was possible to observe a Bouba-kiki effect when using pseudowords constructed from consonant-vowel pairs of similar articulatory features. Generally, participants assigned pseudowords consisting of unvoiced consonants in combination with front vowels to the jagged figure, and pseudowords consisting of voiced consonants in combination with back vowels to the rounded figure. In addition, it was observed that consonants had a significant leading effect over vowels in predicting participant response for pseudowords of both similar and dissimilar articulatory features. However, the role of vowels cannot be disregarded completely, as consonants in combination with vowels were a significantly stronger predictor of response than consonants alone.

Examining the components

To investigate the roundedness and jaggedness of individual pseudowords, the percentage of jagged versus rounded responses for each word were calculated (see figure 2).

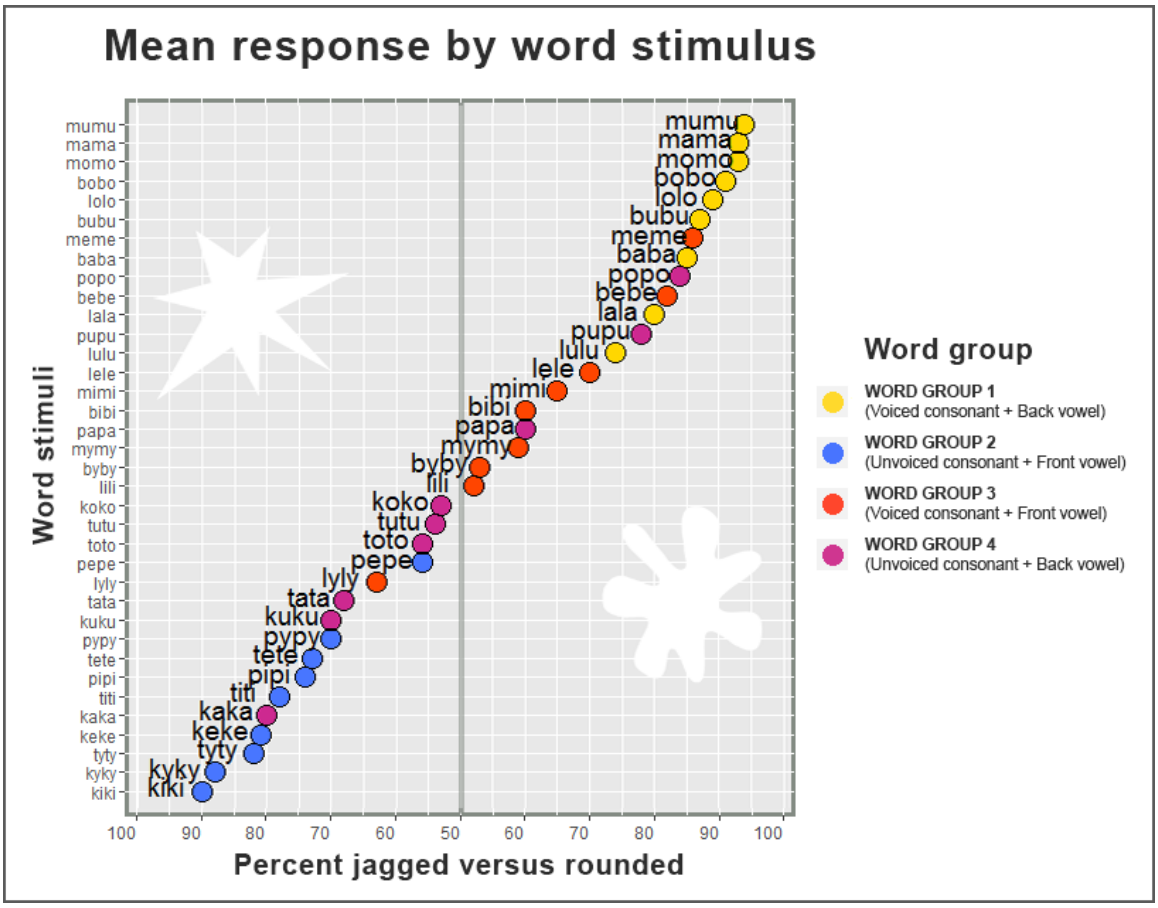


Figure 2: Mean response for individual pseudowords by word group.

The figure shows that participants generally paired pseudowords from WORD GROUP 1 with the rounded figure, with individual word responses ranging from 74 to 94% rounded. In contrast, participants generally paired pseudowords from WORD GROUP 2 with the jagged figure, with individual word values ranging from 56 to 90% jagged. This is in line with predictions made by the researchers.

At the jagged extreme of the graph, with a jaggedness response of 90%, we find the pseudoword "kiki"; a finding which seems to reaffirm its titular role in the Bouba-kiki effect. At the rounded extreme, however, the case is not as clear. Here, the pseudoword "mumu" is found with a roundedness response of 94%, closely followed by the two other WORD GROUP 1 pseudowords generated with the consonant M – "mama" and "momo" – with a shared roundedness response of 93%. Meanwhile, the three WORD GROUP 1 pseudowords containing the consonant B – "bobo," "bubu" and "baba" – are consistently rated comparatively less rounded, with a respective 91, 87 and 85% roundedness response. Although none of these three pseudowords are completely identical to the pseudoword "Bouba" used in previous experiments, they do share very similar articulatory features. As such, findings could suggest that the very name of the Bouba-kiki effect could perhaps be due for an update.

Responses from WORD GROUP 3 and 4 are more ambiguous. While percentages are generally lower for each word, participants paired eight of the nine pseudowords from WORD GROUP 3 with the rounded figure, with individual word responses ranging from 37 to 86% rounded. In WORD GROUP 4, participants paired six of the nine pseudowords with the jagged figure, with individual word responses ranging from 16 to 80% jagged. The skew towards rounded responses for pseudowords in WORD GROUP 3 could be an indicator that voiced consonants have a small leading role over front vowels in predicting response. In contrast, the large spread in responses for pseudowords in WORD GROUP 4 seems to suggest no such leading role for either unvoiced consonants or back vowels.

Furthermore, the roundedness and jaggedness of individual letters was examined by comparing mean responses for pseudowords containing each letter (see figure 3). The graph shows that participants generally paired voiced consonants with the rounded figure and unvoiced consonants with the jagged figure. For vowels, participants generally paired back vowels with the rounded figure and front vowels with the jagged figure.

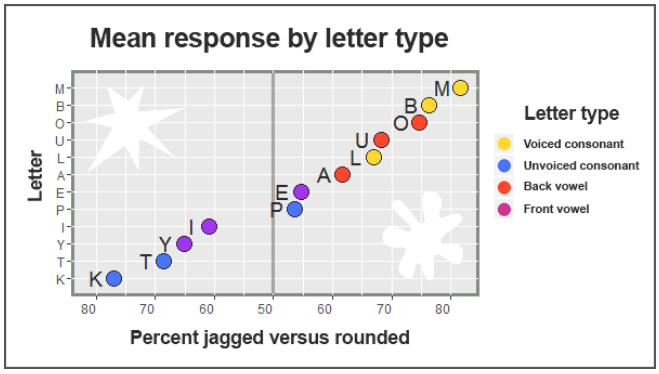


Figure 3: Mean response for individual letters by letter type.

However, two letters deviate from predictions. Although the consonant "P" is unvoiced, words containing this letter were on average rated less jagged (46%) than words containing the remaining unvoiced consonants "T" (68.5%) and "K" (77%). Similarly, words containing the front vowel "E" were on average rated much less jagged (45.3%) than words containing the remaining front vowels "I" (60.8%) and "Y" (65.2%).

Considerations

During the pseudoword creation phase in the planning of the experiment, a conscious decision was made not to exclude any of the pseudowords created from the selected letter pool. As a result, some of the generated pseudowords used in the experiment were similar or identical to existing words or names in both Danish as well as English. This includes words such as "mama" and "papa" as well as names like "Kiki," "Lili" and others. Although participants were specifically informed to ignore any such similarities, association or familiarity bias may still have played a role. As such, participants may have, more or less unconsciously, projected preconceived characteristics onto the figures based on personal experience, which in turn may have contradicted cues provided by sound symbolism. For example, if a participant had previous personal experience with the not uncommon Danish name

"Kiki," either through personal acquaintanceship or in popular culture, they may have associated the corresponding pseudoword with a specific type of personality or appearance. If this association had characteristics of a round, friendly or perhaps soft nature, it may have overridden cues given by sound symbolism and affected the outcome of their response from jagged to rounded.

A similar contradiction may have affected "mama" and "papa," words that are commonly used in place of "mother" and "father". Although rarely spoken by Danes themselves, the words are used extensively in both the English language as well as popular culture, resulting in most native Danes being familiar with their associations. Once again, this could have influenced the response of participants, who may to some degree have attributed the words with characteristics associated with their own parents.

Another aspect of the experiment from which problems could arise is the very nature of the experimental design. Constructing an experiment on sound symbolism around written stimuli comes with an inherent risk, as it is up to each participant to use their inner voice to provide an interpretation of the sound of the presented stimuli. Because of this, there may have been between-participant variance in the way the presented pseudowords were interpreted and, consequently, assigned a response. A specific instance of this problem was touched upon in the section *Word stimuli*: here, the vowel A – which in and of itself is generally pronounced as the front vowel /a/ – instead has a tendency to be pronounced as the back vowel /ɑ/. Although this experiment assumed that participants would follow this tendency, it is uncertain whether this was the case. A solution to problems of individual variance would be to construct the experiment as a listening task, where replacing the pseudowords with prerecorded audio bits would assure homogeneity in the presented stimuli.

Sound symbolism in naming: understanding why "Oreo" beat "Hydrox"

That certain words and letters seem able to carry built-in clues about their meaning can have a very tangible influence on real life. When naming a product or brand, for instance, choosing a fitting name can be essential, as consumers might base their preferences on the sound symbolic connotations evoked by the name. As such, the very success of a product may hinge on its given name.

One such example involves the American company Sunshine Biscuits who, in 1908, debuted a cream filled chocolate sandwich cookie under the name "Hydrox". Four years later, in 1912, a knockoff cookie was released on the market by a competitor. The name of this cookie was "Oreo," and in the years that followed, it went on to become the best-selling cookie in the US. Meanwhile, Hydrox dropped in popularity and went on to be considered a cheap knock-off of the Oreo until finally, in 1999, it was discontinued.

How come the Oreo, a product similar in both taste and looks, beat the original Hydrox out of the market? A possible answer could be found in the sound symbolic associations given by the two

brand names. In deciding a name for their original cookie, the creators at Sunshine Biscuits were indeed aware of finding one with the right connotations; they wanted to evoke associations of purity and goodness, and concluded that the element water lived up to the criteria. As such, they combined the names for the two atomic elements of water – hydrogen and oxygen – and ended up with "Hydrox". While their intentions were good, and the name may have had a certain ideological value behind it, "market research has confirmed [that] this is a much better way to name a cleaning fluid than a cookie" (Paul Lukas, 1999, p.1). In comparison, the name "Oreo" is not only shorter and easier to pronounce, but the very shape of the letters bear visual resemblance to the cookies themselves.

Consulting the results of the experiment conducted in this report, the individual letter analysis gives additional clues as to the rise and fall of the two products. While "Oreo" begins and ends with the letter "O," which was found to be the roundest of the tested vowels, the word "Hydrox" has a phonetic ending similar to that of the letter "K," which was rated the most jagged of the tested consonants. With this in mind, the simple question arises: do you prefer your cookies jagged or round?

In a study by Yorkston & Menon (2004) it was demonstrated that consumers do indeed attend to sound symbolic cues, both when evaluating brands and when inferring attributes to products. The researchers state that "creating a successful brand name depends not only upon the creation of a name that is congruent with the product category, but one that phonetically fits the precision of the brand within the product category" (Yorkston & Menon, 2004, p. 50). According to a different study by Sidhu & Pexman (2015), attending to sound symbolic cues when connecting attributes to words does not only occur for pseudowords, but for first names as well. Sidhu & Pexman found that not only did the roundness/sharpness of phonemes in a first name determine whether the name belonged to a sharp or rounded character silhouette, but also that participants made a connection between femaleness and round shapes, as well as between maleness and sharp shapes. In addition, it was discovered that the sound association of first names also influenced which personality traits participants would assign to the name. Names containing rounded sounds were paired with adjectives judged to be describing a "round" personality, whereas names containing sharp sounds were paired with adjectives judged to be describing a "sharp" personality (Sidhu & Pexman, 2015).

Further investigations: the degree of sound symbolism in language

Previously in this paper, it was suggested that forms of non-arbitrariness may aid language acquisition; when the sound of a word holds clues to its meaning, it takes less effort to remember it and understand its correct usage. Based on this, it might be interesting to examine how the amount of sound symbolism in different languages corresponds with the difficulty of acquiring said language. Bleses et al. (2011) studied past-tense acquisition in Danish, Norwegian, Swedish and Icelandic children. They observed how this acquisition in Danish children was delayed compared to their Nordic

neighbors. These results support the hypothesis that, due to phonetic structure in the Danish language – such as the influence of cues relevant for identification of suffixes - Danish children are slower in acquiring their native language compared to the other Nordic countries, even though the languages share a lot of similarities. Could part of the explanation be, that the Danish language is more arbitrary in its structure than its Nordic counterparts? Perhaps further research into this topic could shed some light on the matter.

CONCLUSION (PB, LD)

Sound symbolism is the idea that the meaning of a word can be predicted by its form, and that language might not be guided wholly by chance, but partially by a system. This idea stands in contrast to the notion of arbitrariness in language. Here, language is random and does not follow an objective. This report outlined how recent studies have suggested, that it may not be a matter of arbitrariness versus non-arbitrariness, chance versus system. Rather, it is proposed that language is created through a combination of these different connections between word and meaning, each supporting different functions in language.

An experiment was conducted to investigate the nature of the "Bouba-kiki" effect, a well-known example of non-arbitrariness in language, in which participants show strong preferences when pairing pseudowords with figures. It was possible to observe a "Bouba-kiki" effect when asking native Danish speakers to pair pseudowords consisting of consonant-vowel pairs of similar articulatory features with either a jagged or a rounded figure. Furthermore, it was discovered that consonants had a significant leading effect in predicting response compared to vowels, when participants had to assign pseudowords consisting of consonant-vowel pairs of both similar and dissimilar articulatory features. However, the effect of vowels is not to be disregarded, as consonants in combination with vowels had a significant leading effect in predicting response compared to consonants alone.

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