Inferring Pokémon types using sound symbolism: The effects of voicing and labiality[*]

Abstract

Recent studies show that sound symbolic principles are operative in Pokémon characters' names; e.g., those characters with names that contain more voiced obstruents tend to be larger and heavier (Kawahara et al. 2018b). One question that arose from this line of research is whether other attributes of Pokémon—specifically their types—show any tangible effects of sound symbolism. This question is related to the more general issue of what kinds of semantic attributes/dimensions can be signaled by sound symbolism. In answer to this question, Hosokawa et al. (2018) showed that the dark type characters are more likely to contain voiced stops and less likely to contain labial consonants in their names than the fairy type characters. The current judgment experiment shows that these associations are productive. Moreover, the effect sizes of sound symbolism were not correlated with each participant's familiarity with Pokémon, suggesting that the sound symbolic knowledge is more abstract than what can be gleaned from the Pokémon lexicon.

1 Introduction

The conventional wisdom in modern linguistic thinking is that the relationships between sounds and meanings are arbitrary. Saussure (1916), the foundational work of modern linguistics, discusses this principle of arbitrariness as the first organizing principle of natural languages. Hockett (1959) argues that arbitrariness is one of the design features of human languages, distinguishing them from non-human communication systems. There is no doubt that arbitrariness is one distinct feature of human languages, which allows flexibility to express many real world attributes as well as abstract concepts in different ways (see Lupyan & Winter 2018 for a recent discussion). At the same time, it has been recurrently observed that some types of sounds are systematically associated with some meanings, the phenomenon known as "sound symbolism."

While the debate regarding the (non-)arbitrariness goes back at least to the time of Plato's *Cratylus*, it was not until recently that researchers from various fields such as linguistics, phonetics, psychology and cognitive science started actively exploring the extent to which sound symbolism occurs in human language systems. This rise of interest in sound symbolism is partly evidenced by the number of recent overview articles on sound symbolism, each written from a slightly different perspective (Akita 2015; Dingemanse et al. 2015; Hinton et al. 2006; Lockwood & Dingemanse 2015; Nuckolls 1999; Sidhu & Pexman 2018; Spence 2011; Schmidtke et al. 2014; Svantesson 2017). For phonetic studies, explicating the sound symbolic nature of human languages is important, since some if not all sound symbolic patterns have phonetic bases; for example, [i] is often considered to be smaller than [a] (Sapir 1929), and this pattern may arise because [i] has much higher F2 compared to [a] and moreover, higher F2 implies a smaller resonance cavity (Ohala 1983b, 1994). Similarly, voiced stops are associated with images of largeness in various languages (Newman 1933; Shinohara & Kawahara 2016), and this association may have its root in the oral cavity expansion that is necessitated by the aerodynamic challenge that voiced stops present (Ohala 1983a).

Against this theoretical background, a series of recent papers explored sound symbolic patterns in Japanese by analyzing names of Pokémon characters (Kawahara et al. 2018b) and move names that Pokémon characters use during their battles (Kawahara et al. 2019). These studies found, for example, systematic correlations between the numbers of voiced obstruents contained in the names and Pokémon's several attributes such as weight, size, strength parameters, evolution levels, and move strengths. By judgment studies that make use of new Pokémon characters and move names (Kawahara et al. 2018a, 2019; Kawahara & Kumagai 2019; Kumagai & Kawahara 2019), these sound symbolic patterns have been shown to be productive.

One question that arises from these studies, which also pertains to the general inquiry regarding sound symbolism, is what kinds of real world attributes can be cued by sound symbolic patterns. Perhaps the two most well-studied patterns of sound symbolism are size-related sound symbolism (e.g. Berlin 2006; Newman 1933; Sapir 1929; Shinohara & Kawahara 2016; Ultan 1978) and shape-related sound symbolism (e.g. D'Onofrio 2014; Kawahara & Shinohara 2012; Köhler 1929; Maurer et al. 2006; Ramachandran & Hubbard 2001). For example, [a] is often judged to be larger than [i] across many languages (Sapir 1929; Shinohara & Kawahara 2016; Ultan 1978). The nonce word *takete*—and more generally nonce words with obstruents—is usually associated with angular shapes, whereas the nonce word *maluma*—and those words with sonorants—is associated with round shapes (Drijvers et al. 2015; Kawahara & Shinohara 2012; Köhler 1929; Nielsen & Rendall 2013). It seems safe to conclude based on these studies that size and shape are two dimensions that can be signaled via sound symbolism. However, it remains to be investigated whether other

concepts or dimensions can be expressed via sound symbolic principles.[1] To put the question more concretely in the context of sound symbolic studies of Pokémon names, what kinds of semantic information other than size, weight and evolution levels can be encoded in their names through sound symbolic principles?

Hosokawa et al. (2018) was the first attempt to address this question. Specifically, they investigated the possibility that certain Pokémon character types are expressed by sound symbolism. Pokémon characters are classified into different types, such as fire, water, electric and grass. They compared the names of the dark (= *aku*, "evil") type Pokémon characters and the fairy (= *fearii*, "fairy") type characters, and found that the dark type of Pokémon characters are more likely to contain voiced stops and less likely to contain labial consonants than the fairy type characters. The first observation is perhaps related to the sound symbolic pattern that is well known in Japanese: voiced obstruents are associated with negative images (e.g. Hamano 1986; Kawahara et al. 2008; Kubozono 1999; Suzuki 1962; Uemura 1965 among others), often appearing in villains' and monsters' names (Kawahara 2017; Kawahara & Monou 2017). Because voiced stops are associated with negative images, they are suited to express the dark type Pokémon, especially their evil and villainous nature, while they may be avoided for names of the fairy type Pokémon. The second observation may be, at least partly, related to the recent finding that labial consonants are associated with images of babies and/or innocence (Kumagai & Kawahara 2017), which itself is likely to be rooted in the observation that labial consonants very frequently appear in babbling (Jakobson 1941). We particularly find the latter pattern to be interesting and worth further investigation, as the sound symbolic association between labiality and innocence has not been explored much in the literature. The current paper sets out to explore whether these two sound symbolic principles are productive.

2 Method

2.1 Task

The current experiment followed the format of the previous experiments on sound symbolic effects in Pokémon names (Kawahara et al. 2018a; Kawahara & Kumagai 2019; Kumagai & Kawahara 2019). Within each trial, a pair of two non-existing Pokémon characters was presented, together with a pair of nonce names. The task for the participants was to choose which name is better for the fairy type Pokémon character, and which name is better for the dark type Pokémon character. The pictures of Pokémon were those that were drawn by *toto-mame*, a digital artist who draws

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[1]We have, for example, been asked whether there is any way to express *love* with sound symbolism. Other typical examples of this kind, discussed by Lupyan & Winter (2018), include *freedom* and *justice*.

original Pokémon characters.[2] A sample pair of these characters is given in Figure 1. In the current experiment, a fairy type Pokémon appeared on the left, whereas a dark type Pokémon appeared on the right.

Figure 1: A sample pair of Pokémon pictures used in the experiment. Left = fairy type; right = dark type.

2.2 Stimuli

Table 1 lists the stimuli of the experiment. The first five comparisons tested pairs of a labial consonant ([p], [b], [m], [ɸ] and [w]) and a non-labial consonant with the same manner of articulation. The last comparison paired names with voiced stops and names with voiceless stops. Within each stimulus, the target consonant appeared twice, and the two paired names were identical except for the target consonants. To minimize the sound symbolic effects of other consonants, the only non-target consonants that appeared in the stimuli were onset [r] and coda nasals. Each comparison had five items. There are therefore 30 trials in total (6 comparisons × 5 items).

2.3 Procedure and participants

The experiment was distributed online using SurveyMonkey, an online platform for experimentation. All the stimuli were written in the *katakana* orthography, which is the standard way to write nonce words in Japanese. Within each main trial, they were told that the pair consists of a fairy type Pokémon and a dark type Pokémon, and they were asked to choose a better name for each type of character. Each trial used a different pair of characters. 68 native speakers of Japanese completed the task. The order of trials was randomized per each participant. Before the experiment, they read

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[2]`https://t0t0mo.jimdo.com` (last access, 2019/03/28). All the pictures were used in the experiment with the permission of the artist. Those characters drawn by *toto-mame* are not a priori assigned to a particular type. Hence the second author, who is very familiar with the Pokémon game, chose those characters that look representative of the fairy and dark characters. Since we do not own the copyright of these pictures, we are not able to make those pictures publicly available. However, the list of pictures used in the experiment can be shared upon request for the sake of replicability.

Table 1: The list of stimuli. "y" represents a palatal glide.

[p] vs. [k]	[b] vs. [d]	[m] vs. [n]	[ɸ] vs. [s]
[parapiru] vs. [karakiru]	[bamberu] vs. [danderu]	[mararimo] vs. [nararino]	[ɸureɸuu] vs. [suresuu]
[perapoɴ] vs. [kerakoɴ]	[berebaɴ] vs. [deredaɴ]	[meremoɴ] vs. [nerenoɴ]	[ɸunɸuru] vs. [sunsuru]
[porupiɴ] vs. [korukiɴ]	[borimbo] vs. [dorindo]	[mommeru] vs. [nonneru]	[ɸuraɸɸu] vs. [surassu]
[paripee] vs. [karikee]	[baaboru] vs. [daadoru]	[marirumu] vs. [narirunu]	[ɸuruɸuɴ] vs. [surusuɴ]
[popporu] vs. [kokkoru]	[boraibo] vs. [doraido]	[miraami] vs. [niraani]	[ɸureɸuru] vs. [suresuru]
[w] vs. [y]	voiced stops		
[waroowa] vs. [yarooya]	[paapaɴ] vs. [baabaɴ]		
[wanweru] vs. [yanyeru]	[taataɴ] vs. [daadaɴ]		
[wonwoo] vs. [yonyoo]	[kaakaɴ] vs. [ɡaaɡɡɴ]		
[waroowa] vs. [yarayan]	[panpaa] vs. [banbaa]		
[waroowa] vs. [yarooya]	[kankaa] vs. [ɡanɡaa]		

through the consent form to participate in the web-based experiment. After the experiment, they provided some demographic information, including how familiar they are with Pokémon using a 7-point scale, in which higher numbers represent higher familiarity.[3]

3 Results

Figure 2 is a boxplot illustration of expected response ratios for each condition (labials = fairy type and non-labials = dark type; voiceless stops = fairy type and voiced stops = dark type). The white circles represent the means. The grey bars around the means represent 95% confidence intervals of those means, calculated over the 68 participants. We observe that all the comparisons except the [w]-[y] comparison show expected response ratios above the 50 percent level (from left to right: 78.5%, 59.7%, 57.4%, 67.6%, 44.7%, and 87.6%). The 95% confidence intervals generally do not overlap with the 50 percent level.

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[3] 1 was labeled "I have never played (Pokémon)", 7 was labelled "Pokémon is my life," and 4 was labelled "so so." The other numbers were not labelled.
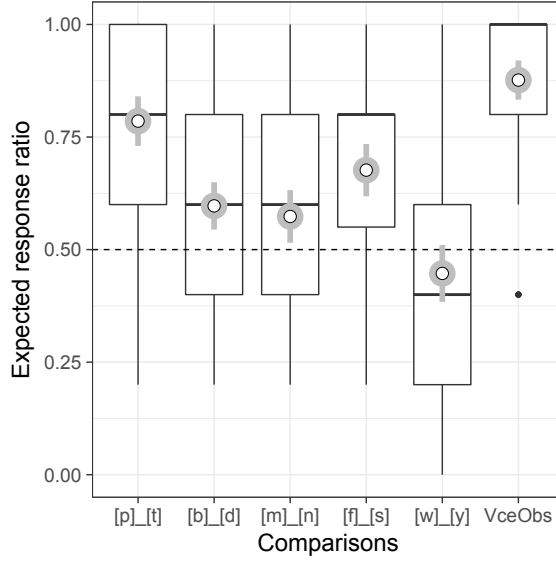
Figure 2: A boxplot illustration of expected response ratios for each condition. The white circles represent the means. The grey bars around the means represent 95% confidence intervals. For typographical convenience, "f" is used in the figure to represent [ɸ].

To assess the results statistically, following Daland et al. (2011), each trial was split into two observations, each corresponding to one member of a stimulus pair. A logistic linear mixed model was fit with "expectedness" as a fixed factor and subject and item as random factors. A model with maximum random structure with both slopes and intercepts was fit first. In case it failed to converge, a simpler model with only random intercepts was interpreted (the [s]-[ɸ] comparison); if the model with maximum random structure successfully converged, that model was interpreted (for all other comparisons). These analyses show that the deviations from the chance level is significant for all the comparisons except for the [w]-[y] comparison ([p] vs. [k]: $z = 6.83, p < .001$; [b] vs. [d]: $z = 5.03, p < .001$; [m] vs. [n]: $z = 3.82, p < .001$; [ɸ] vs. [s]: $z = 9.00, p < .001$; [w] vs. [y]: $z = -0.73, n.s.$; voiceless stops vs. voiced stops: $z = 5.87, p < .001$).

4   Discussion

The results of the current study show that generally, Japanese speakers associate labial segments, except for [w], with the fairy type Pokémon characters, and they also associate voiced stops with the dark type characters. As discussed in the introduction, the effects of labiality may be related to the observation that labial consonants are often associated with babies/innocence: Japanese speakers tend to associate names that contain labial consonants with diaper names for babies (Kumagai & Kawahara 2017). This sound symbolic knowledge arguably stems from the (pro-

totypical) observation that babbling contains labial consonants (Jakobson 1941). The lack of significance for the [w]-[y] comparison is not too surprising, since whether [w] is phonologically specified as [labial] or [dorsal] in Japanese phonology is debated in the literature.[4] Among all the labial conditions, the [p]-[k] comparison showed a particularly high expected response ratio— this result may be due to the fact that [p] in particular is associated with an image of cuteness in Japanese (Kumagai 2019), and hence the current participants may have actively associated names with [p] with the fairy type characters. Overall, the sound symbolic effects of labial consonants have not been studied much in the literature, and thus the current results expand our knowledge of sound symbolic patterns in natural languages.

The effects of voiced stops may be less surprising than the effects of labiality, as sound symbolic values of voiced stops are very clear in Japanese (e.g. Hamano 1986; Kawahara et al. 2008; Kubozono 1999; Suzuki 1962; Uemura 1965); in particular, voiced obstruents are known to appear often in monsters' and villains' names (Kawahara 2017; Kawahara & Monou 2017). Nevertheless, we believe that it is a non-trivial result that voiced stops can signal a particular type of Pokémon character.

One general question that arises at this point is whether these results are due to the exposure to Pokémon games—after all, Hosokawa et al. (2018) showed that these patterns are present in the existing Pokémon data. Or do the current results derive from more abstract sound symbolic knowledge of Japanese speakers, as implied in the discussion above? To address this question, Figure 3 plots correlations between expected response ratios and familiarity with Pokémon for each speaker. If the current results are driven by exposure to actual Pokémon names, those who are very familiar with Pokémon should show high expected response ratios, and those who are not familiar with Pokémon should fail to show high expected response ratios. Contrary to this prediction, we observe that if anything, there are only negative correlations between the two measures ([p] vs [k]: $r = -0.17, n.s.$; [b] vs [d]: $r = -0.04, n.s.$; [m] vs [n]: $r = -0.19, n.s.$; [ɸ] vs [s]: $r = -0.01, n.s.$; [w] vs [y]: $r = -0.12, n.s.$; voiceless stops vs. voiced stops: $r = -0.13, n.s.$). It thus seems safe to conclude that what we are observing in the experiment is not merely a reflection of the existing patterns in the Pokémon lexicon.

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[4]Kubozono (2015) considers [w] to be labial, Tsujimura (2014) considers it to be velar (dorsal), and Labrune (2012) considers it to be labio-velar. Kumagai (2017) shows that [w] does not trigger OCP([labial]) in blocking rendaku, and argues that [w] is not specified for [labial].
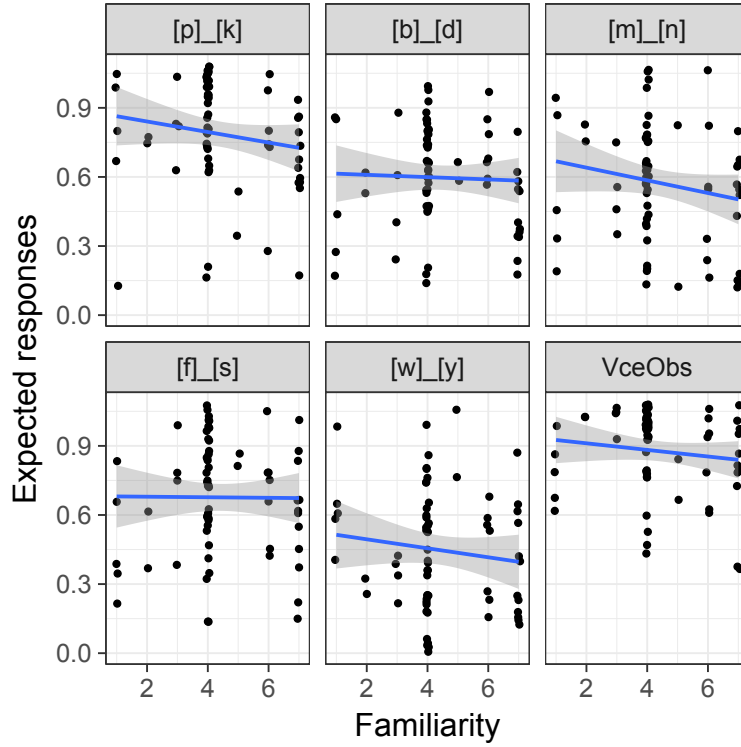
Figure 3: Correlations between expected response ratios and familiarity with Pokémon. Each dot represents each participant (jittered).

To summarize, the current experiment shows the productivity of the sound symbolic patterns found by Hosokawa et al. (2018), lending further support to the thesis that sound symbolic effects are present in the classification patterns of Pokémon types. The current work thus demonstrates that sound symbolism can signal concepts that are arguably more complex than size or shape. Previous studies of Pokémon names have already established that concepts like evolution levels and strengths of the moves can be cued by sound symbolic patterns, and the current result offers at best a very partial answer to the general question of which semantic dimensions can be signaled via sound symbolism—we believe that only through extensive case studies are we able to answer these general questions. We hope to situate the current study as a small stepping stone toward that goal.

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