Are Tims hot and Toms not?

The effect of sound symbolism on perception of facial attractiveness

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Abstract

Sound symbolism – the idea that there are motivated links between the sound of a word and its meaning has been established to be an existing phenomenon across different languages. Especially size sound symbolism seems to be a functional feature in many languages meaning that different types of vowels in words are associated with different physical size. Words with front vowels (e.g. *little*, *tiny*) are more likely to be used to indicate small physical size whereas words with back vowels (e.g. *humungous*, *huge*) are more likely to indicate large physical size. Because physical size plays an important role in ratings of attractiveness, we tested whether vowels in first names can influence how attractive the bearer of the name is perceived. In our experiment, participants saw faces paired with popular first names and rated the attractiveness of the depicted person. Masculine names were paired with pictures of men and feminine names with pictures of women. The names either contained a front or back vowel in the accented syllable and were within gender group randomly paired with pictures. We found that female raters preferred faces paired with back vowel names while male raters preferred faces paired with front vowel names, showing that the rater's gender – far more than the gender of the depicted person – determined the relationship between vowel quality and perceived attractiveness of faces. Our results confirm the role of sound symbolism in perception of attractiveness.

Keywords: sound symbolism; arbitrariness; attractiveness; names; vowel quality; face perception; aesthetics.

1 Introduction

2 Would a rose by any other name smell as sweet? And would Romeo by any other name
3 retain his 'dear perfection' for Juliet as she claims? Or, more generally, is there any inherent
4 relationship between a name and the named? This question has been puzzling researchers for
5 centuries. The issue was first addressed by Plato (app. 400 B.C.), when the protagonists of his
6 fictitious *Cratylus-dialogue* argue about whether names for things in the world are naturally
7 given or created arbitrarily by convention. An influential contribution to this debate is
8 Saussure's arbitrariness hypothesis, stating that there is no motivated connection between
9 words and their referents: names are assigned arbitrarily by convention (Saussure 1916).

10 In contrast with the Saussurean hypothesis, researchers in the field of sound symbolism
11 argue that there can be motivated links between the sound of a word and its meaning (e.g.
12 Hinton et al. 1994). Some sounds ('phonemes') seem to suit a given concept better than
13 others as shown by experimental evidence contradicting the arbitrariness hypothesis (e.g.
14 Lockwood & Dingemanse 2015). For example, when presented with geometrical figures,
15 people tend to assign names like *takete* or *kiki* to sharp shaped objects, while round shaped
16 objects are more reliably assigned names like *maluma* or *bouba* (Köhler 1949;
17 Ramachandran & Hubbard 2001; Maurer et al. 2006). This association of back vowels like
18 [a], [u] and [o] and sonorants like [l] or [m] with roundedness, and front vowels like [i] and
19 [e] and plosives like [k] and [t] with pointiness is taken as evidence for sound symbolic
20 associations. Such iconic motivation linking acoustic features to object or action features has
21 been shown in typologically diverse languages (Haynie et al. 2014; Dingemanse et al. 2015;
22 Blasi et al. 2016). Sound symbolism also affects behavior and development (see Lockwood &
23 Dingemanse 2015 for a review) and there is evidence that it facilitates novel word learning in
24 toddlers and adults (Imai et al. 2008; Kantartzis et al. 2011).

25 The acoustic properties of sounds have also been shown to influence our perception of
26 named things (Shrum et al 2012; Sidhu & Pexman 2015). In several studies, Sidhu and
27 Pexman (2015) have shown that people perceive a form as rounder if its name contains
28 voiced consonants (e.g., [b], [m], [l], [n]) and perceive it as sharper if it contains unvoiced
29 consonants (e.g., [k], [p], [t]). Such multimodal sensory associations play a crucial role in
30 marketing strategies, where an optimal name can boost a product's sales. Studies in the realm
31 of product branding found evidence that consumers are affected by the name of a product,
32 e.g. they assign certain qualities to products based on the acoustic properties of brand names
33 (e.g. Klink 2000). Vowel quality in particular seems to create sensory associations. For
34 example, products whose names contain front vowels ([i] or [e] as in *pip* or *pep*) are
35 perceived as cleaner, crispier, faster, brighter, harder and smaller. Back vowel sounds (like
36 [ɔ] in *pop*) on the other hand make a product sound creamier, thicker, softer, darker, slower
37 and larger (Klink 2000; Lowrey & Shrum 2007; Shrum et al. 2012).

38 Associations of vowel quality with magnitude seem to be of particular prominence
39 across studies. Experimental and typological studies in languages as diverse as English,
40 Japanese, Chinese, Korean and several Native American and Australian languages
41 consistently show that front vowels are associated with smallness and back vowels with
42 largeness (Sapir 1929; Newman 1933; Fischer-Jorgensen 1978; Ultan 1978; Ohala 1994;
43 Shinohara & Kawahara 2010; Haynie et al. 2014; Thompson & Estes 2011; e.g. *mini* vs.
44 *maxi*, *little* vs. *large*). Similar effects have been shown for words expressing close and distant
45 proximity (Ultan 1978; e.g. *near* vs. *far*) as well as diminutive and augmentative meanings
46 (Ultan 1978; Haynie et al 2014; e.g. Italian *gattino* 'little cat' vs. *gattone* 'big cat').

47 Words with front vowels make their referents not only appear smaller, but also more
48 feminine. For example, Wu and colleagues (2013) showed that consumers prefer front vowel

names for products targeting women, whereas back vowel names are preferred for brands targeting men meaning that consumers get attracted by products targeting their gender as indicated by vowel quality in the brand name. They suggest that front vowels create a more feminine brand personality because these sounds are often associated with characteristics like smallness, light weight, etc. Low, back vowels, on the other hand, are more often associated with masculinity and thus create a masculine brand personality.

The finding that front vowels are more often associated with femininity also seems to apply to human names. A study by Cutler et al. (1990) investigated phonological peculiarities of British and American first names and found that “[w]omen's names are on the average longer than men's; they are more likely to begin with an unstressed syllable; and they are more likely to contain the vowel [i]” (Cutler et al. 1990: 480). While traditionally masculine names may also exhibit [i]-sounds (as in *Anthony*), traditionally feminine names tend to exhibit the front vowel more often in their stressed syllable (e.g. *Charlene*, *Maxine*, *Tina*, *Doreen*). A more recent study by Pitcher and colleagues (2013) yielded similar results. Inspecting the most popular British, Australian and American first names from 2001 – 2010, they found that traditionally masculine names are significantly more likely to exhibit back vowels (*Thomas*), while traditionally feminine names preferably have front vowels in their accented syllable (*Emily*). The authors of both studies hypothesize that the observed naming preferences follow size-sound symbolism, causing men to appear larger and women to appear smaller: A person called *Lilly* is perceived as smaller and therefore less threatening than a *Hugh*.

One plausible reason why gender might be linked to vowel-magnitude associations is proposed in the *Frequency Code Hypothesis* (FCH), according to which higher frequencies are – across species – produced by relatively smaller individuals, whereas lower frequencies are emitted by larger sized vocalizers (Ohala 1984; 1994). Similar tendencies have been observed in human voice studies, where women, on average, have higher fundamental frequency (F0) than men (Feinberg et al. 2005; Puts et al. 2006, 2007; Borkowska & Pawlowski 2011). Because the fundamental frequencies of voices convey information about the size of the vocalizer, it is assumed that this voice dimorphism is linked to sexual selection (Puts et al. 2006, 2007). Indeed, a higher F0 is not only correlated with smallness, but also with submissiveness and a higher level of attractiveness in women (Borkowska & Pawlowski 2011). Conversely, a lower fundamental frequency is correlated with greater physical size, as well as dominance and a higher level of attractiveness in men (Collins 2000; Feinberg et al. 2005).

The dissociation of front and back vowels ties in with differences in acoustic frequency which might be the reason for vowel-size associations. Back vowels typically have lower formant frequencies and lower formant dispersion compared to front vowels, (Ultan 1978; Tsur 2006; Traunmüller 2000). Back and front vowels also differ in their intrinsic pitch, meaning that front vowels (e.g. [i], [e]) have a higher intrinsic pitch than back vowels (e.g. [u], [a]; see Hoole & Honda 2011; Reubold 2012; Fenk-Oczlon 2017). Moreover, differences in formant frequencies result from the configuration of the resonating cavity, in this case the vocal tract. These resonance frequencies are inversely correlated with size. Large individuals have longer vocal tracts and therefore overall lower formant frequencies (Fant 1966; Chuenwattanapranithi et al. 2008), whereas small individuals have shorter vocal tracts and thus a smaller resonating cavity, causing shorter wavelengths of the resonance frequency and acoustically higher frequencies. Females have on average a 15% smaller vocal tract than males (Fant 1966), producing characteristically higher formant frequencies. Humans are highly sensitive to these differences as studies have shown that people reliably recognize both the size and the sex of the vocalizer based on the height of the formants that are produced

(Bachorowski & Owren 1999; Smith & Patterson 2005). Moreover, these features have been shown to influence preference for sexual partners (Collins 2000; Feinberg 2005; Hodges-Simeon et al. 2010). Lower frequencies (both F0 and formant frequencies) in men are not only indexical of physical dominance (Puts et al. 2007), but are also rated as more attractive by women (Hodges-Simeon et al. 2010), whereas increasing frequencies in women emanate decreasing dominance but increasing attractiveness (Borkowska & Pawlowski 1999). The gender-vowel quality association may therefore be a direct instantiation of the size-sound interlinkage and size-related preference for sexual partners. English first names may have developed to match this acoustic gender-size congruity (Pitcher et al. 2013). Following this logic, a person with a back-vowel name like *Tom* sounds larger, more dominant and therefore potentially more attractive to women than a *Tim*, while a person with a front vowel name like *Jean* would appear smaller, less dominant and potentially more attractive to men than a *June*. Some research suggests that sexual orientation plays a larger role in voice or sound preferences than gender identity (Munson et al 2006; Valentova et al 2013) but it is unclear whether such preferences generalize over size-sound symbolism.

Some preliminary evidence also suggests that vowel quality in given names can influence how attractive the bearer of the name is perceived (Perfors 2004). Whether front or back vowel names are preferred seems to be gender specific. In an online study testing the effect of vowel quality in first names on attractiveness ratings Perfors found that pictures of men presented with front vowel names such as *Tim* were perceived as more attractive than when combined with back vowel names like *Tom*. For pictures of women the direction of the preference was inverted: the attractiveness of a women's face increased when paired with a back (*Sue*) as opposed to a front vowel (*Eve*). This seems to be at odds with the FCH (Ohala 1984; 1994) and sound symbolic studies on size sound associations (e.g. Ultan 1978; Shinohara & Kawahara 2010; Haynie et al. 2014). Perfors' study, however, had a few methodological shortcomings which might tarnish the results. The biggest problem is that the gender of the participants was not recorded. As discussed above, sex or gender is likely a crucial factor in sound-size associations and a sample population bias could drastically influence the direction of the effect.

In the present study, we tested whether faces of men and women are rated as more (or less) attractive depending on whether they are presented with a front or back vowel name. We also replicated Cutler (1990) to test whether popular German first names follow a similar pattern for gender specific vowel quality preference as English names. Because German is closely related to English, but has a very different vowel system it offers an interesting contrast to test for validity across languages. Moreover, other than English names some of which can be gender-neutral, German first names by law had to clearly indicate a person's biological sex until 2009¹.

Being skeptical about the reproducibility of Perfors' findings, we based our hypotheses on previous work in size sound symbolism and the FCH. Assuming that size-sound symbolic associations are not language specific (Ultan 1978; Ohala 1994; Shinohara & Kawahara 2010; Haynie et al. 2014; Lockwood & Dingemanse 2015) and therefore similar in German and in English, we hypothesized that men are more attracted to women bearing feminine (front vowel) names while women would be more attracted to men bearing masculine (back vowel) names.

¹ http://www.bundesverfassungsgericht.de/entscheidungen/rk20081205_1bvr057607.html

Study 1: Gender specific vowel type preference in popular German Names

We examined the most popular German names of the last decade to test whether we would find similar trends as previous research with English first names (Cutler 1990; Pitcher et al 2013). The names were taken from the lists of the most popular names in Germany, published on <http://www.beliebte-vornamen.de>. On this website, the 35 most popular feminine and the 35 most popular masculine first names are listed for each year.

We did a Chi-square test on popular German feminine and masculine names between 2008 and 2016. Confirming previous findings, we found that women are more likely to have a front vowel in the accented syllable of their first name, whereas men's names, showed a tendency to exhibit back vowels more often in the accented syllable ($\chi^2_{(1, N=202)}=11.96$, $p<0.001$; see Figure 1).

Figure 1: Distribution of front and back vowels in accented syllables of German popular first names

Study 2: Testing the effect of vowel type in names on perceived attractiveness

Experiment and Methods

All experiments were conducted at the Ludwig-Maximilians-University (LMU) of Munich in 2008. Pre-tests were conducted to assure homogeneity of the presented material.

Pretest 1: Rating of Names

Participants

33 German native speakers, of which 15 were male and 18 female, participated in the study on a voluntary basis. Their ages ranged from 20 to 25 years.

Materials

We chose 168 given names from the lists of the most popular names in Germany between 1977 and 1989, published on <http://www.beliebte-vornamen.de> (see above). We chose names from this period, because they should come closest to the probable names of the research subjects as well as of the pictured face stimuli with regard to age.

Procedure

Every item on the list of 168 names was rated for its attractiveness value on a 10-point scale.

Pretest 2: Rating of Faces

Participants

24 German native speakers (14 male, 10 female), participated in the study on a voluntary basis. Their ages ranged from 20 to 27.

Materials

A set of 90 photographs was created, depicting 45 faces of men and 45 faces of women. Each photo consisted of a frontal shot against the same neutral background. Photographed people were students who agreed to having a photo of their face taken for research stimulus development purposes. The mean age of the photographed persons was 22.6 years. The pictures were standardized in size for the experiment.

Procedure

Participants rated all 90 pictures. The pictures were presented in random order on a black monitor. The participants evaluated the attractiveness of the depicted faces individually on a 10-point scale. The instructions did not focus on whether people found the depicted faces 'sexy,' but rather 'attractive' in a broader sense (e.g. *Would you like to be friends with this person*). Trial duration was not limited and participants could take as long as they needed to rate each picture.

Main Experiment

Participants

53 German native speakers (27 female, 26 male) participated in the experiment. The mean age of the participants was 22.47 (s.d. = 2.24), ranging from 19 to 32 years of age.

Materials

From the 90 photographs described in Pretest 2, 70 photos (35 faces of men and 35 faces of women) were selected for the main experiment. In each gender group the five pictures with the highest and the lowest ratings were not used. The photos were paired with 94 names (46 feminine names and 48 masculine names) selected from the 168 names used in pretest 1. For the selection of names, we first excluded names with very low ratings in pretest 1. This was done because factors not of interest to the current study (i.e. socio-economic associations) have been shown to influence perceived attractiveness of names (Hensley & Spencer 1985; Erwin 1993, Rudolph et al. 2007). In addition, we excluded names that did not fit the typical German phonotactic patterns to ensure that correct pronunciation was clear for all participants. Feminine names (23 with front vowels, 23 with back vowels) were combined with pictures of women, masculine names (24 with front vowels, 24 with back vowels) with pictures of men.

Procedure

All 70 faces with randomly paired names as primes were presented to all participants. The names were shown first and remained on the screen for 2000 milliseconds. Then after an interval of 500 milliseconds where the screen was black, the picture appeared and remained on the screen until the participant responded. After an interval of 800 milliseconds, the subsequent cycle began and the next name appeared. Stimuli were presented using PsyScope Build 51 (Cohen et al. 1993). The task for the participants was to evaluate each of the faces for attractiveness on a 10-point numerical scale on a computer keyboard. As in pretest 2, the instructions did not ask whether people found the depicted faces ‘sexy,’ but rather ‘attractive’ in a broader sense (e.g. *Would you like to be friends with this person*). Participants responded by pressing one of the number keys (from 1 to 9, and 0, with ‘0’ corresponding to 10) on the top row of the keyboard.

Data Analysis

The data were analyzed with R implemented in the RStudio GUI, using the nlme library for testing linear mixed models (Pinheiro, Bates, DebRoy, Sarkar, & (R CoreTeam), 2014). We built one maximum likelihood model with vowel (front or back vowel in accented syllable) and gender of the subject as predictors which were allowed to interact, and subject, name, and picture as random effects with random slopes for vowel, and trial number as a random effect with a random intercept (Baayen, Davidson, & Bates, 2008). In addition, the gender of the depicted person and age of the participant were included as factors in the model. P-values for specific effects were obtained by a model comparison procedure using the asymptotic chi square distribution. Statistical details about all models and results can be found in the supplementary materials (S1).

Results

Pretest 1: Rating of Names

Masculine names with front vowels in the stressed syllable were rated as slightly more attractive (mean = 3.96, s.d. 0.74, $t(49)=0.18$, $p=0.86$) than masculine names with back vowels in the stressed syllable (mean = 3.91, s.d. 1.05). Feminine names with front vowels in the stressed syllable (mean of 4.14, s.d. = 1.08) were rated slightly less attractive than feminine names with back vowels in the stressed syllable (mean = 4.62, s.d. = 1.12, $t(71)=1.85$, $p=0.07$).

Pretest 2: Rating of Faces

The mean rating of all faces was 5.05, s.d. = 0.91. Female raters rated the faces as slightly more attractive (mean = 5.50, s.d. = 0.36, mean range per item = 2.0 - 7.8) than male raters (mean = 4.52, s.d. 0.75, mean range per item 2.71 – 6.68). Faces of women were rated as more attractive (mean = 5.94, s.d. = 0.53, mean range per item = 3.75 - 7.33) than faces of men (mean = 4.40, s.d. = 0.67, mean range per item = 2.46 - 5.92).

Main Experiment

There was a main effect of vowel quality, meaning that pictures paired with front vowels are rated as less attractive ($\beta=-0.14$, s.e.=0.07, $t=-2.00$, $p<0.05$). Moreover, there was a trend

that male subjects rated faces generally as less attractive than female subjects ($\beta=-0.40$, $s.e.=0.22$, $t=-1.83$, $p=0.07$). In addition, we found that female faces in our sample were generally rated as more attractive ($\beta=0.98$, $s.e.=0.27$, $t=3.63$, $p<0.0001$). Most importantly, there was a significant interaction of vowel quality and gender of the rater ($\beta=0.29$, $s.e.=0.10$, $t=2.96$, $p<0.001$; see Table 1, Figure 2) showing that male raters find faces paired with front vowel names more attractive, whereas female raters find faces paired with back vowels more attractive. In both cases, the effect was mainly based on the ratings of male faces.

	female face		male face	
	female rater	male rater	female rater	male rater
back vowel	5.87 (sd=1.92)	5.16 (sd=1.85)	4.27 (sd=1.85)	4.73 (sd=2.17)
front vowel	5.67 (sd=1.94)	5.31 (sd=1.90)	4.63 (sd=1.94)	4.49 (sd=2.20)
overall	5.77 (sd=1.93)	5.24 (sd=1.88)	4.45 (sd=1.90)	4.61 (sd=2.19)

Table 1: Mean ratings of attractiveness by group

Figure 2: Attractiveness rating by Vowel Type and Gender of the rater

Women rate male faces paired with back vowel names as more attractive whereas men prefer faces paired with front vowel names. There was no relationship between attractiveness rating and vowel quality depending on the gender of the depicted person. Lines indicate medians and dots indicate means per group.

Discussion

In the present study, we tested whether front and back vowels in first names can influence how attractive we perceive faces. We found that vowel quality in the accented syllable of given first names indeed can affect the perceived attractiveness of a person - particularly if the person is a man. In addition, we found that the gender of the rater is the strongest predictor of the direction of preference. While male raters prefer men with a front

vowel in their name (*Tim*), female raters prefer men with back vowel names (*Tom*). This finding confirms the link between size-sound-symbolism and perceived attractiveness and highlights the importance of the gender of the rater for such effects.

Our findings provide evidence that the beauty of a face given its name is not only in the eye but also in the ear of the beholder primarily as a function of her or his own sex and are in line with the Frequency Code Hypothesis (FCH) and previous research on sound symbolism and attractiveness.

Our first study confirms that popular names follow a pattern of gender differences in their preference for different vowel qualities in first names of men and women (e.g. Cutler et al. 1990, Pitcher 2013). Similar to English first names, feminine German names are more likely to contain front vowels in the stressed syllable (*Emily*) than back vowels (*Susan*), while masculine names more often have a back vowel (*Thomas*) than a front vowel (*Peter*). Such effects might be rooted in size-sound symbolic associations and suggest that when naming their children parents follow intuitions regarding how the sound of a name influences person perception. Back vowel names like *Tom* can make a man seem larger, more dominant and therefore more attractive to women than a *Tim*, while front vowel names like *Emily* can make a person appear smaller, less dominant and more feminine (see Pitcher et. al. 2013). At least in Western populations, men are on average taller than women and tend to be attracted by smaller size, whereas women, being smaller on average than men, are attracted by larger size (Pawlowski et al. 2000; Stulp et al. 2012; Stulp et al. 2012). Choosing an appropriate name can therefore be an advantage for a child.

One limitation in our study was that we did not collect data about gender identity and sexual orientation and therefore it remains an open question whether these tendencies only hold for heterosexual or cisgender people. We strongly encourage future research to explore this further as this is a promising approach to test whether these effects are linked to sexual selection or gender identity.

In our main study we found that the gender of the rater is the main predictor of the vowel-attractiveness effect and not the gender of the depicted person. Men overall preferred people with front vowel names, but particularly rated men with front vowel names as more attractive. This effect was reversed for women showing that women liked faces with back vowel names better, particularly for faces of men. While there are overall effects of vowel quality on attractiveness ratings, it is interesting that this effect is attenuated for faces of women and amplified for faces of men. Vowel quality seems to have little effect on the perceived attractiveness when people judge attractiveness of women (see Figure 1), whereas people appear to be more sensitive to vowel quality when judging men. This could be explained by the assumption that body size is far more relevant for the attractiveness of males than females, meaning that the height of women is barely important compared to facial attractiveness whereas the body size of man matters much more. Women have a preference for taller and men for smaller men. Smaller men might appear less dominant and ‘threatening’ to other men and are therefore preferred (see also Puts et al 2006; 2007).

While preliminary data (Perfors 2004) showed that the effect of vowel quality (front or back vowel) on attractiveness ratings differed for pictures of men and women, our results indicate that it is primarily the gender of the rater that determines whether names with front or back vowels increase the perceived attractiveness. The fact that we found no interaction between vowel quality and gender of the depicted person in our study could be due to a difference of power. An alternative explanation would be that mainly men contributed to the online ratings on the website hotornot.com, which would account for the outcome that photos of men matched with front vowels were preferred overall. We consider it unlikely that the difference between the two studies is due to language-specific size-sound symbolism in

English vs. German as the association of front vowels with small size and of back vowels with large size (Frequency Code) seems to be well established across languages (Ohala 1984, 1994; Pitcher 2013).

Another difference to the preliminary data is that women with back vowels in their names were rated as more attractive in Perfors' (2004) study while we only observed a small effect of vowel quality on attractiveness of women and moreover, in the opposite direction. In the original study, masculine and feminine names were paired with pictures regardless of gender which might have tainted gender-specific vowel preferences for first names. Moreover, neither the selection of names nor the selection of pictures was normed and it is unclear how often and in which combination the names and images were used and which kind of randomization –if any- was used. It is therefore unfortunately impossible to evaluate whether an unintended bias in name and picture combination could have accounted for this effect.

Another factor which is linked to size-sound symbolism and likely interacts with vowel quality is vowel length. Longer vowels are associated with larger physical size or distance and shorter vowels with small physical size or distance. While we believe that interactions of vowel length and vowel quality likely amplify or attenuate sound symbolic effects of vowel quality, it is beyond the scope of the present study to discuss this in detail. Especially given the non-standardized pronunciation of first names with wide regional variability, first names are not a good basis to investigate such interactions. We however encourage future sound symbolic research to take this into account for experimental designs.

Despite these differences, both studies provide evidence that sound symbolism is a real phenomenon and has measurable effects. We hypothesize that the mechanism behind such effects is explained by the FCH which relates acoustic frequency to information regarding the size and dominance of the vocalizer. Our results are fully in line with the FCH where high pitch is more common for small animals, and low pitches for big animals as front vowels have more high acoustic frequencies and back vowels have more low acoustic frequencies (Ohala 1984). The same is true for the human species: women have typically higher frequency voices whereas men have lower frequency voices (Feinberg et al. 2005; Puts et al. 2006, 2007; Borkowska & Pawlowski 2011). Both voice and formant frequencies seem to be a robust indicator for differences in the size of the sound-producing membranes and vocal tracts and therefore overall body size.

Converging evidence from multiple studies showed that women generally prefer lower frequencies while men overall prefer higher frequencies, even in same-sex ratings. Our study confirms that this is also true for acoustic frequencies in vowels of first names. While it is unclear why men also prefer higher frequencies in other men it is imaginable that male-male dominance competition might be involved (see Puts et al. 2006). Lower frequencies are associated with greater physical dominance, interpersonal power and deference relations and it has been shown that men adapt vocally to their relative dominance in verbal interaction (Puts et al. 2006: 292). Men preferring higher frequencies in other men might be indicative of being intimidated by other men that are greater in size and more dominant, and more comfortable with men displaying less dominance. Front vowels might be indicative of a smaller body size, while back vowels may indicate a greater body size. Taken together with women's preference for tall men this would explain their higher rating of a face presented as Tom compared to the same face introduced as Tim.

This suggests that Juliet may be wrong: perhaps she would have found less 'dear perfection' in Montague's son had he been called Pietro and not Romeo.

Author Contributions

The idea for this experiment was conceived by DZ. All authors contributed to the experimental design. FH, DK, and LS prepared the experiment, and collected the data under the supervision of DZ. The data analysis was performed by FH. All authors were involved in the interpretation of the results and the writing of the manuscript.

Acknowledgments

This project was carried out as a student project in 2009, inspired by a workshop by Daniel Casasanto and Patric Bach. We thank both for sparking our enthusiasm for experimental studies on language, and introducing us to experimental methods.

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19 Supplementary Materials:

20 DOI 10.17605/OSF.IO/5M89B | ARK c7605/osf.io/5m89b