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Bringing indexical orders to non-arbitrary meaning: The case of pitch and politeness in English and Korean

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In this study, we investigated whether the relationship between pitch and politeness is mediated through iconic relationships between pitch and other talker attributes, and whether these relationships can differ across languages. US and South Korean listeners completed a speaker perception task in which they heard utterances and rated the speaker on a number of attributes, including politeness. The pitch of each utterance was unmanipulated, raised, or lowered. The results confirm previous work suggesting that in Korean, lower pitch is associated with politeness, which contrasts with both the English results we find, and claims of a universal association between higher pitch and politeness (i.e., Ohala's Frequency Code). At the same time, the impact of pitch on attributes like perceived height, strength, and emotion are similar across listener groups: Speakers in higher pitched guises are heard as shorter, weaker, and more emotional. Like others, we argue that pitch can be associated, non-arbitrarily, with a range of meanings, but additionally appeal to orders of indexicality (Silverstein, 2003) to account for the similarities between the groups, as well as the differences. Our results are of significance for researchers looking at non-arbitrary meaning of acoustic cues as well as the acoustics of politeness, especially in interaction with polite registers in Korean.

1. Introduction

While the arbitrary relationship between linguistic form and function is a founding principle of linguistics as a broader field (Saussure, 1916), there has long been interest in cases of apparent non-arbitrary meaning in language, and arguably a resurgence of interest in the last decade (e.g., Eckert, 2010; D'Onofrio, 2014; Podesva, Callier, Voigt, & Hilton, 2015; Pratt, 2018; Salffner, 2017; Kawahara, Noto, & Kumagai, 2018; Wong & Kang, 2019). The most iconic example of non-arbitrary meaning is codified in Ohala's *Frequency Code* (1984, 1994; see also Morton, 1977): Noises made by smaller things have higher frequencies than noises made by larger things, and through this fact of the physical world, higher pitch non-arbitrarily signals smallness and attributes associated with smallness, including deference and politeness (Ohala, 1994, p. 327). Critically, because the relationship between the form (high pitch) and the meaning (i.e., deference) is non-arbitrary, it is framed as universal: "there is something common to all human speakers, at all stages in history" (Ohala, p. 326). ln fact, Ohala's argument for the non-arbitrary relationship largely relies on "high cross-language incidence" (p. 326).

Many studies have confirmed an association between pitch and perceived size (e.g., Apple, Streeter, & Krauss, 1979; van Bezooijen, 1995; van Dommelen & Moxness, 1995; Feinberg, Jones, Little, Burt, & Perrett, 2005; Puts, Gaulin, & Verdolini, 2006; Drager, Hardeman-Guthrie, Schutz, & Chik, 2021). This is the relationship central to the Frequency Code, and the relationship which Ohala (1994, pp. 336–342) even posits shaped the evolutional development of (relative) sexual dimorphism of larynx size and position in humans and other species. However, the evidence for a relationship between higher pitch and "social" meanings, like more polite speech, is messier. Some studies have found an association between higher pitch and politeness (e.g. Brown & Levinson, 1987, p. 267; Loveday, 1981; Ohara, 2000; Idemaru, Winter, Brown, & Oh, 2020), some have found no evidence of a clear relationship (Tsurutani & Shi, 2018; Idemaru et al., 2020), and increasingly, some have found evidence of the opposite relationship: Low pitch is associated with more polite speech (Winter & Grawunder, 2012; Shin, 2005). In a meta-analysis of seven studies using the same production task in different languages (from four language families), Winter, Oh, Hübscher, Idemaru, Brown, Prieto, and Grawunder (2021) found that in *none* of the languages included did they see people raise their pitch to be polite, and in fact, in five of the languages people significantly *lowered* their pitch in more polite situations.

The politeness paradigm used in those seven studies comes from Winter and Grawunder's (2012) study on Korean. Student participants in that study were recorded responding to imagined situations where they were interacting with a friend, or with an authority figure like their professor (the "polite" condition). In Korean, these different contexts would trigger essentially obligatory use of two different grammatical registers that primarily affect verb endings: *contaymal* (존댓말), an honorific register typically used with seniors and unfamiliars (collectively referred to as *wi salam*, or "above people"), and *panmal* (반말), literally "half speech," used with juniors

and intimates (*alay salam,* or "below people") (Kim, 2011). This task reflects a specific sort of implementation of politeness, one centered on formality and discernment.

To explain how listeners could develop an association between lower pitch and more polite speech in some of these studies, Winter et al. (2021) argue that lower pitch can represent "damped down" (p. 8) emotions, a sign of restraint that is appropriate for formal situations. In support of this interpretation, other work in Korean suggests that contaymal is associated with restricted physical movements (Brown & Winter, 2018), and a correlation between higher pitch and increased physical movement has also been found in U.S. English (Voigt, Podesva, & Jurafsky, 2014). This association between pitch and emotion can also be understood to be non-arbitrary, rooted in the physical world: Work on vocal emotion has emphasized the impact that emotionally-induced physiological reactions can have on the vocal folds, with greater emotional activation resulting in higher mean f0 (Scherer, 1986; Laukka, Juslin, & Bresin, 2005). While the relationship between vocal fold activation and valence is independent (i.e., both positive and negative vocalizations will have higher f0 if they are energetic), there is also evidence of an association between sadness and lower f0, and happiness (or smiling) and higher f0 (Juslin & Laukka, 2003; Pell, 2001; Podesva et al., 2015; see also Ohala, 1994), presumably through associations with emotional activation.

Winter and colleagues do not argue that this observed association between low pitch and politeness invalidates the Frequency Code, as many studies do find a relationship between politeness and high pitch. Rather, they underscore the "pluripotentiality"[1] of pitch as an iconic marker: Lower pitch can be associated with larger size non-arbitrarily, but it also has other non-arbitrary associations (Gussenhoven, 2002, 2016; see also Eckert, 2019, p. 768).

Non-arbitrary meanings then, are not just the logical and necessary outcome of a relationship between a linguistic form and a physical property or speaker type, but critically require the noticing and interpretation of that potential relationship (Peirce, 1903, p. 273). Which relationships are likely to be noticed is entrenched in not only significant cultural but also interactional context (Gal & Irvine, 2019, pp. 97-101; D'Onofrio & Eckert, 2021, p. 35; Winter et al., 2021, p. 8). This distinction between a correlation existing and a correlation being noticed has obvious parallels with the concept of *orders of indexicality*. Using terms from Silverstein (2003), we can call patterns that happen to co-exist between linguistic forms and contexts *first-order* indexicality, and relationships that build on these associations *n +* orders of indexicality. The relationship between each order is centered on evocation, and "something can evoke other things in the world with a flexibility limited only by common ground" (Eckert, 2019, p. 754). In regard to iconic meanings, Eckert has argued that "orders of indexicality can start with the iconic association of sound and

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[1] This concept has overlap with Eckert's (2008) notion of the indexical field; the central distinction may be whether the different potential meanings of a variable are "ideologically linked" (p. 94; for a discussion, see Maegaard & Pharao, 2021 and Gafter, 2021).

human qualities and move to categories of speakers based on the social associations with those qualities" (p. 763). In this understanding, the physical fact that smaller things typically have higher pitch is a first-order indexicality, the interpretation of higher pitch as *meaning* smallness is a second-order indexicality, the interpretation of higher pitch as meaning that something is submissive (along with the practice of then using higher pitch to sound submissive) is a higher order indexicality,[2] and the interpretation of higher pitch as meaning that someone is polite is a higher order still, etc.

When we call different meanings of high/low pitch pluripotential then, we could be talking about potentials for meaning at the second-order of indexicality—the potential to *notice* the first-order relationships between high pitch and small size, or high pitch and vocal emotion—or we could be talking about potential at higher orders. So, when we find a lack of a relationship between things like high pitch and politeness, it could be because listeners don't hear high pitch as small, or because they do hear high pitch as small, but that it is irrelevant for their conception of politeness. When it comes to the Frequency Code, there is already evidence that cultural differences are driven by differences at higher levels of indexicality. Van Bezooijen (1995) explored potential causes for larger gendered pitch differences in speakers of Japanese versus Dutch. Using a matched-guise study, she showed that while listeners in both countries heard female talkers with higher vocal pitch as smaller, only Japanese listeners rated such talkers as more attractive. She also asked participants to rate how important physical size and strength were to their definition of an "ideal man" and "ideal woman," and it was found that Japanese participants reported larger differences than Dutch participants. These results suggest that cross-cultural differences in gender and pitch and attractiveness were not being driven by a lack of noticing a first-order relationship between pitch and size, but rather a difference in interpreting higher order relationship between size and gendered desirability.

It is reasonable to posit then that conflicting patterns surrounding pitch and politeness are similarly centered on differences in politeness, not in lower-order associations between pitch and size. These politeness differences could be at the cultural level, and indeed, a large body of politeness research has focused on cross-linguistic differences in conceptualizations of politeness (e.g., Brown & Levinson, 1987, pp. 244-249; Watts, 2003). Critically for the current study, these differences in politeness have implications for the significance and interpretation of attributes like deference, friendliness, or seriousness (Ide, Hill, Carnes, Ogino, & Kawasaki, 1993; Lakoff, 1973, p. 298; Hill, Ide, Ikuta, Kawasaki, & Ogino, 1986 that can be linked through lower indexical orders to pitch through size or emotion.

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[2] These higher orders of indexicality regarding pitch may map onto what Ohala (1994, p. 327) called the "'social' messages" carried by pitch. This idea is echoed in Sneller & Roberts (2018, p. 299), who posited that "[h]igher-order indices are associated with traits that are both (a) inalienable and (b) socially relevant, while first-order indices are associated with traits that are neither."

In the current study, we investigate cross-linguistic associations of vocal pitch, including but not limited to the relationship between pitch and politeness. Specifically, we directly compare listeners of Korean, a language where an association between low pitch and politeness has been found (Winter & Grawunder, 2012, though see also Idemaru et al., 2020), and English, a language where an association between high pitch and politeness has been found (Uldall, 1960, 1964; Loveday, 1981; LaPlante & Ambady, 2003). Our study allows us to see whether these results hold in a direct comparison of the two languages, and if they do, whether they reflect across perceptions of first-order attributes of pitch (e.g., physical size, emotion), and/or other higher-order attributes (e.g., seriousness, friendliness).

Our study tests for the effect of pitch using a different paradigm than Winter et al. (2021), who note that "more methodological diversity… [is] needed in order to shed light on the variegated meanings of the pitch [of polite utterances]" (p. 8). Specifically, we use the matched-guise technique (Lambert, Hodgson, Gardner, & Fillenbaum, 1960; van Bezooijen, 1995), in which different versions of the same stimulus are created that differ only in the variable of interest—pitch—and we ask participants to rate the speaker in each stimulus on different attributes. In regular life, a number of acoustic and contextual cues contribute to speaker perception, including to perceptions of speaker politeness (e.g., Nadeu & Prieto, 2011; Brown, Winter, Idemaru, & Grawunder, 2014; Hübscher, Borràs-Comes, & Prieto, 2017), but the matched-guise technique allows us to narrow in on the contribution of pitch alone.

Similarly, while politeness is clearly a complex, culturally- and interactionally-situated phenomenon (Watts, 2003), this design attempts to look at how perceptions of politeness can change when holding the situation constant, and even for relatively contextually impoverished stimuli. In this way, our design also allows politeness to not necessarily be about appropriateness given formality or discernment. In the case of Korean, critically, this allows us to disentangle politeness from register. Register is at least partly obligatory, not necessarily polite, and wrong use of contaymal (the "polite" register) can be perceived as awkward or sarcastic (Hwang, 1990, p. 52; Kim, 2011, p. 195; Brown, 2013). In our study, instead of testing whether someone hears an utterance to have been produced in panmal or contaymal (Brown & Winter, 2014), our study tests whether pitch impacts perceived politeness *within* panmal, and *within* contaymal sentences. It is possible that when politeness is defined differently, different patterns of pitch and perceived politeness could emerge (Winter et al., 2021, p.4).

We supplement our result from the matched-guise task with descriptions from participants about what they think "politeness" ("공손함") means to them. While this sort of direct question is not typical in phonetic studies, given the complexity of politeness as a concept, we find the direct input from our participants to be invaluable in building our interpretation of the results. As a preview of those results, we find that pitch manipulation impacts English and Korean listeners similarly for first-order ratings (e.g., physical size, emotion), but is completely opposite for

politeness ratings. In our discussion, we talk about the implications of these findings for work looking at non-arbitrary meaning, especially in cross-cultural contexts.

2. Method

2.1. Stimuli

Separate sets of Korean and English stimuli were constructed for this study.

2.1.1. Materials

Five one- to two-sentence-length utterances were constructed in both Korean and English. The utterances (see Appendix A in the Additional Files) were declarative, non-interactional statements (i.e., not requests) around topics likely to be relevant to university students, and had roughly equivalent meanings in both languages. Because we also wanted to test the assumption in previous work that contaymal is perceived as more polite than panmal, there were three versions[3] of each Korean sentence, one for panmal (PANMAL), and two for contaymal (SUPNITA and YO). Sentences across these guises were identical except for the sentence-final inflectional morphology required to mark each register; this also meant contaymal sentences were a few syllables longer than panmal sentences.

2.1.2. Recording

For the Korean stimuli, four female and four male native speakers of Seoul Korean, age 26–32 were recruited. Each speaker recorded each of the stimulus utterances in the three registers, for a total of 15 recordings per talker. Recordings took place in a sound-attenuated booth. Talkers were presented with a printed list of the stimuli, and were instructed by the third author, a native speaker of Seoul Korean, to read each utterance as naturally as possible and to keep speed and intonation as controlled as possible across registers.

For the English stimuli, we recruited four female (one Latina, one Asian, two White) and four male (two Black, two White) speakers who were age 18–23, from Virginia, and all native speakers of U.S. English. They were recorded in a quiet room reading each sentence in a naturalistic style, for a total of five utterances per talker.

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[3] Many Korean linguists further divide contaymal and panmal into six distinct speech levels. The two contaymal levels used here, SUPNITA and YO, correspond to the "deferential" and "polite" levels in Sohn (1999, p. 413), with the former considered more formal and deferential than the latter. Our PANMAL level corresponds to "intimate" in Sohn (1999). The remaining three levels are either nearly obsolete or have much more restricted use.

2.1.3. Pitch manipulation

For both languages, the pitch in each stimulus was manipulated to produce a raised and lowered version that was approximately ± 0.5 ERB (≈ 20 Hz) from the original stimulus. While some other studies have used larger pitch shifts (van Bezooijen, 1995; Drager et al., 2021), we chose this value both because it avoided obviously synthetic sounding stimuli (especially in the male recordings), and it matched the size of pitch difference observed between contaymal and panmal forms of ≈ 17 Hz for Korean (Winter & Grawunder, 2012).[4] The pitch manipulation was done in Praat (Boersma & Weenink, 2018) using the "Shift pitch frequencies..." function.

2.2. Listeners

The Korean listeners were 37 native speakers of Korean (19 female, 18 male), with a median age of 25 (M = 27, range 20–55). The English listeners were 20 native speakers of US English (18 female, one genderfluid, one male) with a median age of 21 (M = 26, range 18–54). Informed consent was obtained from all listeners. The research protocol was approved by the Virginia Tech Institutional Review Board (#18-1027).

2.3. Procedure

There was a total of 360 unique sound files for the Korean study (8 speakers $\times$ 5 sentences $\times$ 3 grammatical levels $\times$ 3 pitch levels), and 120 unique sound files for the English study (8 speakers $\times$ 5 sentences $\times$ 3 pitch levels). These sound files were distributed across lists (9 for Korean, 3 for English) so that a given participant only heard 40 tokens. The lists were organized so that each participant heard all five sentences and at least once instance of all three pitch guises and grammatical guises from each talker, but never the same base sentence twice from a given talker. At least four participants were assigned to each list.

The experiment was set up in Qualtrics, and was run in person in quiet rooms at Korea University or Virginia Tech. For each sound file, participants were asked to rate the speaker on 14 attributes (listed in both Korean and English in Appendix B in the Additional Files) using a 7-point scale, to rate their age on a 7-point scale moving from 15–19 to 45+, and to leave any further comments they had about the speaker. Participants were able to play the sound file multiple times, but could not move backwards during the experiment.

The 14 attributes were selected for the following reasons. First, *polite* was included as it was the main focus of the study. Next, *tall*, *strong*, *dependent*, *humble*, and *attractive* were all investigated by van Bezooijen (1995), and were thus included here as well. The politeness literature, and in particular comparisons between conceptions of politeness in east Asian and

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[4] In Idemaru et al. (2020, p. 131), it is also suggested that the stimuli recordings in Brown et al. (2014) showed a similar sized effect.

Western societies, motivated the inclusion of *serious*, *confident*, *sincere*, and *friendly*. We included *emotional* based on its suggested connection to politeness, and also for its potential first-order indexical connection to the Frequency Code. Lastly, *masculine*, *cute*, and *educated* were included as exploratory attributes, and are not analyzed in the current study.

After the rating task, on the final screen of the experiment listeners were asked the following open-ended question in either Korean or English: What does politeness mean to you? (당신이 생각하는 "공손함"이란 무엇입니까?)

2.4. Research questions and analysis

Our investigation aimed to address four questions. First, do the data support a noticed relationship between vocal pitch and first-order, iconic attributes, such as tall, strong, and emotional? We tested this using mixed effects ordinal regression models to check whether the pitch manipulations affected the ratings, and whether this effect was the same in Korean and English. Each of these models predicted the attribute rating (tall, strong, or emotional) by pitch condition, with random intercepts for talker, listener, sentence, and (in Korean only) register, with random slopes for talker and listener.

Second, what is the relationship between vocal pitch and perceived politeness? This was the main purpose of the study, and was also addressed using mixed effects ordinal regression models, with the same structure as the models above except that random slopes for register were added to the Korean model to reflect our belief that the effect of pitch on politeness could differ across registers. We followed this up with an exploratory analysis looking at the relationships between vocal pitch and some of the other higher-order attributes to try to better understand why the relationship between pitch and politeness may differ across languages.

Third, what is the relationship in Korean between politeness and register? Is contaymal speech perceived as more polite than panmal speech? Previous studies operationalized politeness using register, but it has not been shown whether politeness ratings actually differ between them in a matched-guise-like task. This question was also addressed using a mixed effects ordinal model, predicting politeness rating by register, with random intercepts and slopes for talker, listener, and sentence.

Lastly, how do native speakers of Korean and English define politeness in their own words when asked directly? This question was addressed by analyzing the responses to the open-ended question at the end of the experiment in which the listener was asked how they define "politeness."

All quantitative analyses were conducted in R (ver. 4.1.3; R Core Team, 2022), run in RStudio (ver. 2022.02.3+492; RStudio Team, 2022) and Tidyverse (Wickham et al., 2019). The ordinal models were run using the *ordinal* package (ver. 2019.12-10; Christensen, 2019), and **Figures**

1, 2, and **3** were produced with the help of the *patchwork* package (ver. 1.1.1; Pederson, 2020). The R code, dataframes, and supplemental plots for the current study can be found at https:// osf.io/ztxwh/.

3. Results

3.1. Relationship between vocal pitch and first-order Frequency Code attributes

Figure 1 shows the mean by-talker tall, strong, and emotional rating in each pitch condition in the matched-guise task, separated by talker gender and language. A clear difference between the two languages can be observed in the gender separation in both tall and strong ratings given by the native English listeners, as opposed to the completely overlapping ratings given by the native Korean listeners. One possible cause of this difference could be that the native Korean listeners were normalizing their ratings of these particular attributes according to the perceived gender of the talker, whereas the native English listeners might not have.
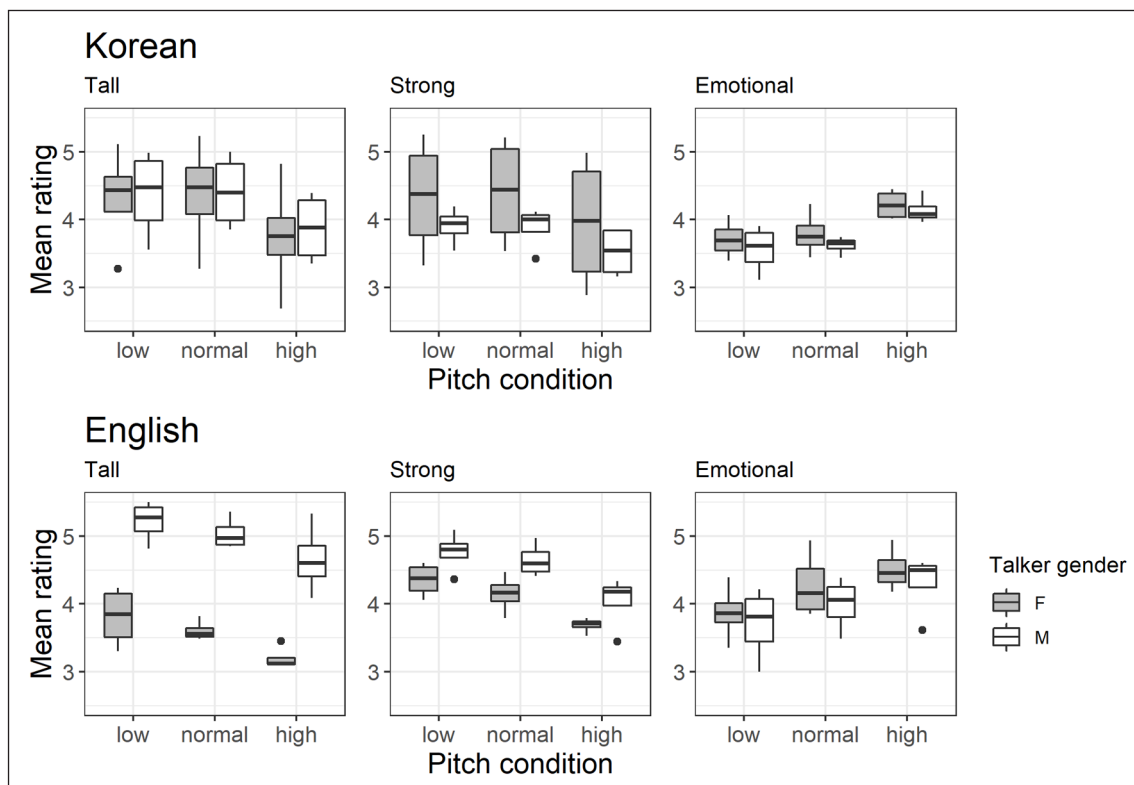

Figure 1: Mean *tall, strong,* and *emotional* ratings of each talker in each pitch condition.

It can also be seen, however, that higher pitch is perceived as less tall, less strong, and more emotional in both languages. The output of the regression models supported this observation,

confirming that in both languages higher pitch was perceived as less tall and less strong than both normal pitch and lower pitch (all $p < .001$). In the case of emotion, the same result held for Korean, with higher pitch being perceived as more emotional than normal and lower pitch ($p < .001$), whereas in English the direction of the effect was the same, but it was lower pitch that was perceived as less emotional than normal and higher pitch ($p = .007$). It appears then that listeners in both countries have noticed (at least) three different first-order indices of high pitch: It is associated with smallness, weakness, and with higher emotion. Any differences at higher order interpretations are not based on differences here then.

3.2. Relationship between vocal pitch and perceived politeness

Figure 2 shows the mean politeness rating of each talker in each pitch condition in the matched-guise task, separated by talker gender and language. The output of the regression models confirmed that in Korean higher pitch was perceived as significantly less polite than normal pitch ($b = -0.469$, SE $= 0.172$, $z = -2.733$, $p = .006$) and lower pitch ($b = -0.526$, SE $= 0.160$, $z = -3.284$, $p = .001$), while low and normal pitch were perceived as equally polite. In English, on the other hand, high pitch was perceived as significantly more polite than low pitch ($b = 0.487$, SE $= 0.206$, $z = 2.368$, $p = .018$), while normal pitch was not significantly different from either.
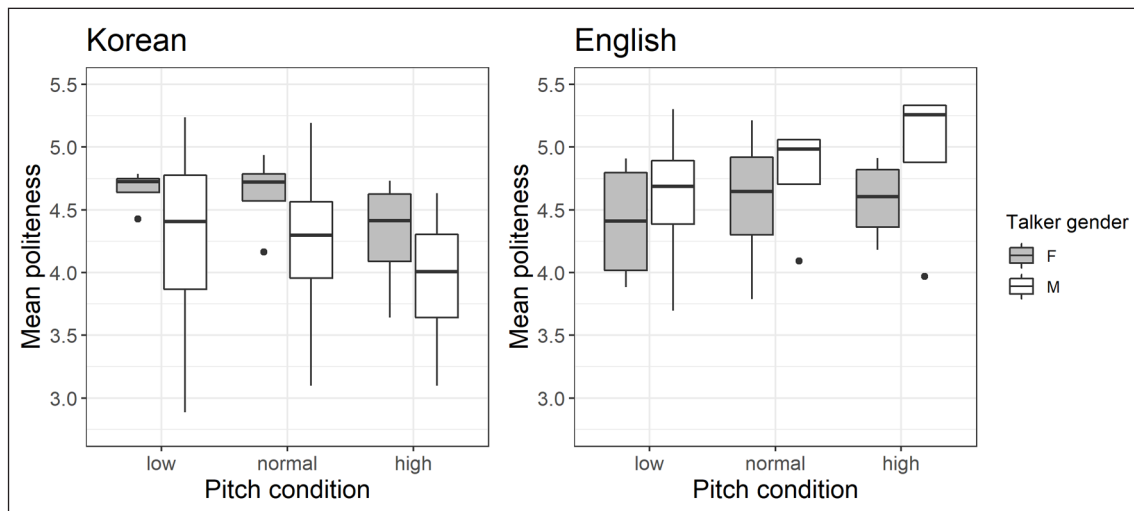

Figure 2: Mean *polite* rating of each talker in each pitch condition.

A post hoc investigation showed that these trends do not necessarily hold for every individual talker, however. Specifically, the Korean data include one talker, KM4, who was rated as far less polite than all talkers in both languages (see **Table 1**), and whose data are responsible for the long lower tails in **Figure 2**. His vocal pitch was also significantly lower than the other Korean

talkers (although not lower than three of the English talkers). To the authors, this talker sounds somewhat bored or uninterested, which could have been perceived as impolite by the listeners. In this case, lowering his pitch even further could have reinforced this impression and made him sound even less polite. Thus, it seems that what leads to the perception of politeness is not simply the physical lowering of vocal pitch, but rather an impression of the speaker's demeanor or attitude that pitch contributes to. Nevertheless, the overall trends in each gender and for each language seem to hold.

Korean			English		
Talker	Pitch (Hz) Mean (SD)	Politeness Mean (SD)	Talker	Pitch (Hz) Mean (SD)	Politeness Mean (SD)
KF1	226 (38)	4.08 (1.34)	EF1	196 (25)	4.85 (1.28)
KF2	239 (46)	4.57 (1.25)	EF2	214 (15)	3.95 (1.33)
KF3	204 (25)	4.74 (1.13)	EF3	200 (17)	4.96 (1.31)
KF4	204 (27)	4.75 (1.25)	EF4	186 (27)	4.32 (1.29)
KM1	129 (13)	4.39 (1.38)	EM1	109 (15)	5.05 (1.29)
KM2	127 (21)	4.09 (1.42)	EM2	87 (7)	4.95 (1.34)
KM3	131 (26)	5.03 (1.21)	EM3	100 (6)	3.92 (1.32)
KM4	100 (11)	3.03 (1.32)	EM4	97 (12)	5.18 (1.08)

Table 1: Mean vocal pitch and mean perceived politeness averaged over all of each talker's stimuli. K = Korean, E = English, F = Female, M = Male. The mean pitch for each stimulus was calculated as the mean pitch of all voiced portions after removing the top and bottom 5% of f0 values. Each talker's mean pitch was then calculated as the mean of their five unmanipulated stimuli (using the YO version only for the Korean talkers).

The fact that the relationship between vocal pitch and politeness can go in the opposite direction in Korean and English suggests that politeness is fundamentally different from attributes that are first-order indexicals, like physical size and emotion. The relationship between vocal pitch and the perception of other attributes, like *confident*, *friendly*, and *serious*, demonstrates this possibility as well.[5] In **Figure 3**, we can see that the perception of serious patterns with vocal pitch the same way in both Korean and English, whereas *confident* and *friendly* seem to be unrelated with vocal pitch in Korean, but related with vocal pitch in English. What these attributes share is that there is no direct physical connection between the attribute and vocal pitch in the way that there is for physical size or emotion.

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[5] Plots for other attributes not discussed in the text can be accessed in the OSF repository.
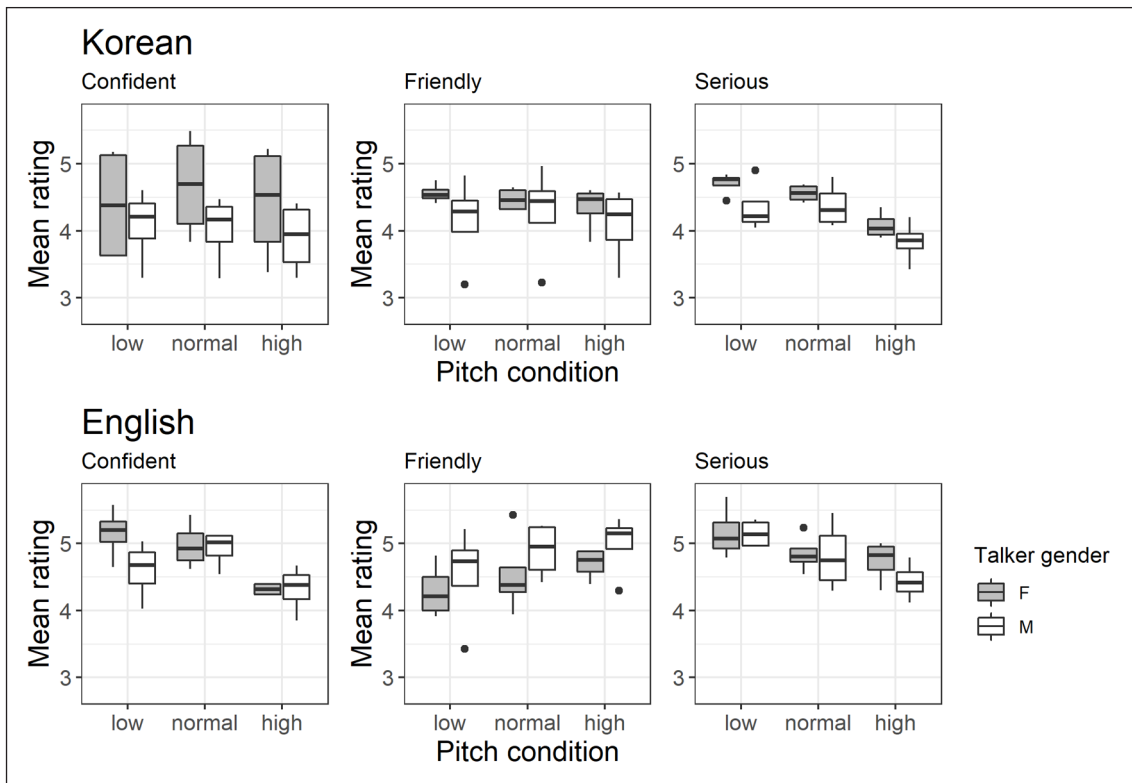
Figure 3: Mean *confident, friendly,* and *serious* rating of each talker in each pitch condition.

The differences in higher-order attributes could come from multiple sources. First, they could be driven by a perceived irrelevance of iconic pitch meanings to concepts like politeness or friendliness. Alternatively, they could be driven by the association with different iconic/first-order meanings. For example, in English the association between higher pitch and politeness could be driven by an association between politeness and submissiveness (via smallness), or between politeness and engagement (via emotional intensity). There is no single, clear path, and different communities (and perhaps even different speakers) could end up associating vocal pitch with different attributes in different ways. To understand what is driving the relationship it is necessary to probe how community members assess the attribute, as we explore below in Section 3.4 for politeness.

3.3. Relationship between perceived politeness and register

Our third question, related specifically to Korean, was whether politeness ratings were correlated with speech register: SUPNITA and YO (both contaymal forms) and PANMAL. **Figure 4** presents boxplots of mean politeness calculated for each talker in each register, additionally separated by pitch condition to show the effect of pitch within each register. The SUPNITA utterances were

rated as most polite (M = 4.48, SD = 1.42), followed by YO (M = 4.41, SD = 1.43) and PANMAL (M = 4.11, SD = 1.37). The output of the regression model confirmed that PANMAL utterances were rated as less polite than both SUPNITA ($b = -0.536$, SE = 0.171, $z = -3.125$, $p = .002$) and YO ($b = -0.449$, SE = 0.141, $z = -3.190$, $p = .001$) utterances. No significant difference was found between SUPNITA and YO utterances. This difference between PANMAL and the other registers, while statistically significant, is quite small, however: An average of 0.49 on a seven-point scale, which is equivalent to the mean difference between high and normal/low pitch. Of course, the appropriateness of a register can only be interpreted with more complete context, but the fact that any difference at all was found even when all other properties are held constant suggests that the choice of register does correlate with the perception of politeness in Korean.
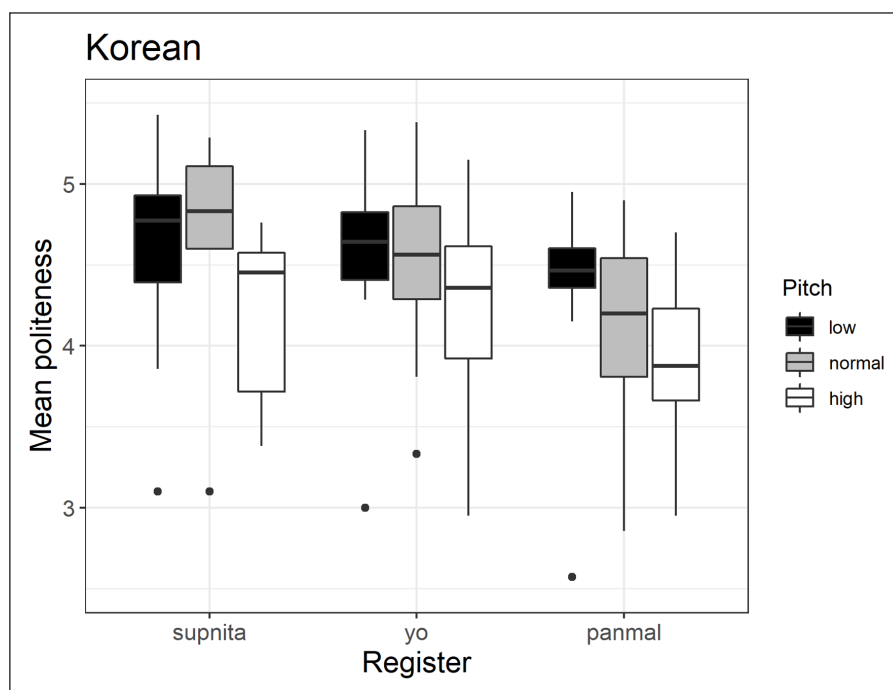

Figure 4: Mean *polite* rating of each Korean speech register by pitch condition.

3.4. Listener definitions of "politeness"

For our final analysis, we examined the responses to the open-ended question at the end of the experiment using a keywords approach (Garrett, Williams, & Evans, 2005; Evans, 2011), in which responses were coded for recurring keywords in each language under semantically unifying labels. For example, references to "voice" ("목소리"), "intonation" ("억양"), and "pronunciation" ("발음") were grouped together under the label SPEECH. An individual response could contain multiple keywords, and could therefore be covered under multiple labels. Because the Korean

participants tended to provide more detailed responses, this method yielded a total of 11 labels for Korean but only five for English.

3.4.1. Korean

First, in Korean one of the most frequent labels was RESPECT, which included keywords such as "respect" (both "존경" and "존중"), which was found in 11 of the responses. For example, one subject wrote that politeness was, "an attitude, voice, or way of speaking that respects ("존중") the other person." The closely related label MANNERS, which included references to "manners" ("예의"), and "formality" ("격식") was found in seven of the responses. The other most commonly mentioned label was what we are calling CONSIDERATION, which included keywords such as "consideration" ("배려"), "understanding" ("이해"), and "mood" ("기분"). This label differs from RESPECT in that these keywords reflect a bit more focus on the thoughts and feelings of the other person. As a typical response carrying the CONSIDERATION label, one subject wrote that politeness was, "to consider the feelings of the other person" ("상대방의 감정을 헤아리면서"). Lastly, there were eight responses included in the label POSITION, which made explicit reference to the speaker or listener being "above" or "below" the other person. Representative responses included in this label were that the speaker "makes oneself lower than the other person" ("상대방보다 나를 낮추는 것"), or has, "an attitude that raises the other person" ("다른 사람을 높여주는 듯한 태도").

Although we drew distinctions among these first four labels, RESPECT, MANNERS, CONSIDERATION, and POSITION, they also share the semantic property of putting focus on the other person, and it could be argued that they are just different shades of some broader category. A total of 28 subjects' responses (75.6%) were associated with at least one of these four labels, making them, by far, the dominant theme among the Korean responses. Importantly, there was no obvious gender difference in the distribution of the labels, either: These 28 subjects comprised 13 females and 15 males. Thus, it was not the case that RESPECT, MANNERS, CONSIDERATION, or POSITION were mentioned significantly more often by subjects of one gender, either individually or taken together.

Gender differences were observed in the distribution of the labels SPEECH and WARMTH. As mentioned above, the SPEECH label included any references to speech itself (e.g., voice, pronunciation, or speaking rate). This was observed in seven responses, and six of these responses came from female subjects. The WARMTH label included the keywords "smile" ("웃음"), "warmly" ("따뜻하게"), and "softly (tactile)" ("부드럽게"), and was used in four responses, all from female subjects. There was no overlap between the SPEECH and WARMTH labels, meaning that 11 of the 19 female subjects mentioned either SPEECH or WARMTH, whereas only one of the 18 male subjects did so.

There were also five responses assigned the CALM label, which made reference to "calmness" ("차분함"), "mature/careful" ("점잖다"), or "stable" ("안정적"). This label differs from the first four labels (RESPECT, MANNERS, CONSIDERATION, and POSITION) in that they are centered on the actions of the speaker rather than the listener, and they differ from SPEECH and WARMTH in that it puts more emphasis on negative (as opposed to positive) politeness.

There were several labels that we might have expected to be used frequently that we did *not* see. One of these, KIND, represented the single keyword "친절" ("kind, friendly"). There were only two subjects (one female, one male) who mentioned this word at all. Since the relative age of interlocutors is a crucial factor dictating linguistic and other behavior in South Korea, we were also surprised that only two (both female) respondents made any specific references to the age of the speaker or listener, and they contradicted each other: One saying that age did not matter, and the other saying that politeness was even more important when an age gap exists. Lastly, despite the centrality of contaymal to linguistic politeness in Korean, there were only four subjects (two female, two male) who made explicit reference to word choice or register (i.e., contaymal), which we assigned to the label REGISTER.

3.4.2. English

The analysis of the English responses only yielded five labels, but this was not due to the smaller number of subjects, or the fact that the English subjects were almost entirely women. Of the 11 Korean labels, eight were represented among the male listeners and all 11 were represented among the female listeners. Instead, it seems that the English subjects simply exhibited less variation in how they described politeness. Their responses were also somewhat shorter.

The five labels observed among the English responses were RESPECT, MANNERS, CONSIDERATION, SPEECH, and KIND. The first, RESPECT, represented the keywords "respect" and "dignity," which were used by nine (out of 20) subjects. The closely related label, MANNERS, represented the keywords "manners" and "civility" and a specific example of manners, "holding the door." This label was used by seven subjects. The label CONSIDERATION, much like in Korean, represented keywords that reflected more focus on the thoughts and feelings of the other person, such as "taking others into account," "how you want to be treated," and "emotional and physical needs of others," and was used by five subjects. At least one of these three labels, RESPECT, MANNERS, and CONSIDERATION, was used by 16 of the English subjects, representing 80% of subjects. This number is close to the 75.6% of Korean subjects whose response was included in one of the four labels RESPECT, MANNERS, CONSIDERATION, and POSITION. Thus, putting a focus on the other person and their needs and dignity seems to be an element of politeness common to both listener groups. Similarly, the rate of reference to SPEECH ("tone,"

"sound(s)") was somewhat similar by the US subjects (4/18 women) to the Korean female listeners (6/19).

The primary difference between Korean and English seems to be in the frequency of the KIND label and the lack of a CALM label in English. The KIND label, which represented the keywords "kind," "nice," "approachable," and "pleasant" in English, was used by nine English subjects (45%), but only two Korean subjects (5.4%). One English subject mentioned "speaking with a soft, nonabrasive tone," which could possibly be construed as something similar to the CALM label in Korean, but none of the other English responses made any reference to remaining calm or reserved as observed in five of the Korean responses (13.5%).

4. Discussion

In a matched-guise speaker perception study in which we manipulated pitch across guises, we found that South Korean listeners heard lower pitched guises as more polite, while U.S. English listeners heard higher-pitched guises as more polite. However, for some other attributes like height, strength, and emotion, listeners in both groups responded similarly to pitch manipulations: Higher pitch led to speakers being perceived as smaller, weaker, and more emotional. In support of the Frequency Code, these results suggest that listeners in both countries have noticed the first-order associations between higher pitch and smaller body size, and also between higher pitch and increased speaker emotion. The cross-linguistic difference, then, appears to exist at a higher indexical order: physical size (and subsequently dominance or submissiveness) and/or emotion (and subsequently restraint or engagement) may play different roles in the two languages when assessing politeness. In this way, our results mirror van Bezooijen (1995), who argued that pitch differences across Japanese and Dutch women do not reflect differences in how lower and higher pitch are understood in terms of size and dominance (i.e., the Frequency Code), but instead reflect differences in the gendered values of these attributes across the two societies.

Participant definitions of politeness give further insight into why the relationship between pitch and politeness may differ in the two populations sampled in the current study. While there was substantial overlap between how South Korean and U.S. listeners conceptualize politeness— both groups' answers frequently involve RESPECT, MANNERS, and CONSIDERATION—there are also some key differences. The U.S. listeners frequently mentioned KIND in their understanding of politeness, which was rarely mentioned by the South Korean listeners. Conversely, a number of Korean listeners referenced CALM, which was arguably never mentioned by the U.S. listeners. This observed difference in conceptions of politeness is not inconsistent with existing, general descriptions of American versus Asian politeness as one of positive politeness versus negative politeness (Brown & Levinson, 1987, pp. 244–249) and also with Ide et al.'s (1992) finding that friendliness appears to be part of the US concept of politeness but is an independent component in

Japanese.[6] Moreover, the idea of CALM matches Hwang's (1990, p. 52) claim that "'reservedness' has traditionally been a typical form of politeness in Korean society." But most critically for our study, these different emphases in conceptions of politeness appear to impact how higher or lower pitch is evaluated as (im)polite. For Korean listeners, we can posit that lower pitch tends to be heard as more polite due to its association with formality, reservedness, and calmness (Winter et al., 2021). For U.S. English listeners, lower pitch tends to be heard as less polite due to its association with dominance, or possibly *because* of its association with formality, reservedness, and calmness. One question raised here is how even work that appears to support the Frequency Code (i.e., the English results in this study) may in fact be grounded in different acoustic causes (in this case, pitch and emotion versus pitch and size).

While our results support the idea of the pluripotentiality of vocal pitch (Winter et al., 2021), the current study, along with van Bezooijen (1995), highlights the fact that there can be multiple levels of potential meaning. That is, when framed in terms of orders of indexicality pitch is pluripotential at the first and at the $n+$ indexical order, and a lack of a relationship at one order (politeness and pitch) does not mean a potential relationship at an earlier order (size and pitch) has not been noticed. This leads us to also argue that cross-linguistic differences in how politeness correlates with vocal pitch become somewhat removed from the evolutionary foundations of the Frequency Code. Locating the relationship between politeness and pitch at a higher order of indexicality that requires a noticing within a specific linguistic community opens up the possibility that not all listeners will notice a relationship between pitch and politeness, and not at all times.

This fact can help explain the variable results within and across studies, as well. Idemaru et al. (2020) also manipulated f0 across guises in Korean, and found weak evidence of an effect in the *opposite* direction to what we found here (though participants were asked if the speaker was talking to a *wi salam* or *alay salam*, not if they sounded polite). In looking at individual participants, they found that the weak effect appeared to be the result of opposing effects at the individual level, with some listeners hearing lower pitched guises as towards *wi salam*, and others as towards *alay salam*. In our own data, while we saw that lowering pitch made our speakers sound more polite to Korean listeners overall, the speaker with the lowest mean pitch (KM4) was rated as the least polite speaker, and lowering his pitch actually made him sound even less polite. Moreover, some studies have found that pitch has little or no effect on perceived politeness (Tsurutani & Shi, 2018; Idemaru et al., 2020), and in these cases the potential meanings may

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[6] While it is common to group different Western, and different East Asian countries together in discussions of politeness, as we are implicitly doing here, it is worth noting that it is not clear that the pitch-politeness patterns seen in Korean hold for other Asian languages, like Japanese (Loveday, 1981; Ohara, 2000), or that the English patterns reflect Western standards (Winter et al., 2021). We would therefore be wary of arguing that we have demonstrated differences here along those broader lines.

be unnoticed or overwhelmed by other, more contextually relevant cues. In other words, just because iconic connections *can* be made, doesn't mean they *will* be, within and across cultures, and within and across individuals and situations.

As a final note, we believe the results of this study also shed light on the distinction between politeness and register (i.e., contaymal vs. panmal) in Korean. Hwang (1990, p. 47) essentially equates the use of an honorific register with deference, claiming that the choice of register is determined largely, "by such power-coded relationships as age disparity and rank in various hierarchical social structures, and by solidarity relationships between the participants."[7] Because registers are marked by morphology, and not phonetics, it is straightforward to judge whether or not an utterance is sufficiently deferential.

Naturally, using an honorific register is a requirement for politeness in a context that requires it. Kim (2011, p. 176) suggested that native Korean folk perceptions of politeness are indeed "intricately associated" with contaymal, and that it is impossible to be polite to a superior without using the correct register. Kim also pointed out, however, that while "an act of showing one's deference to others is itself a display of politeness, politeness may not necessarily be contingent upon honorifics" (p. 198). In other words, although using a context-appropriate register is a necessary condition for politeness, it may not be sufficient (see examples in Hwang, 1990, p. 48). Thus, although contaymal utterances are considered more polite than panmal utterances, we should not expect all contaymal utterances to be perceived as *equally* polite, or even necessarily more polite than any and all panmal utterances.

This possibility was demonstrated in the current study in a few ways. It was shown in Section 3.3 that while talkers were indeed rated as more polite when speaking in contaymal (using either SUPNITA or YO) than when speaking in panmal, the size of the difference was quite small (0.49 on a 7-point scale). Moreover, the lowest mean ratings (excluding speaker KM4) given to speakers in the SUPNITA and YO conditions, 4.07 and 3.89, were far lower than the highest mean rating given to a speaker in the PANMAL condition, 4.85, indicating plenty of overlap in how polite the registers sounded. There is also our basic finding that independent of register, pitch level affected politeness ratings (e.g., lower pitch panmal sentences were rated as more polite than higher pitch panmal sentences), and the fact that in their responses to the open-ended question about what politeness means to them, only four (out of 37) Korean listeners made explicit reference to contaymal or register. Taken together, our results emphasize how Korean conceptualizations of politeness are much richer than register alone.

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[7] Brown (2013) correctly points out that Korean speakers have more flexibility in register than is often assumed in the literature, and can shift back and forth within a conversation. However, it remains true that in many contexts speakers often have very little flexibility in terms of whether to use contaymal or panmal.

5. Conclusion

The present study conceptually replicates previous work showing that lower pitch is heard as more polite in Korean and higher pitch is heard as more polite in English. While this finding goes against some predicted higher order associations of pitch in Ohala's Frequency Code, we also found that South Korean and US listeners share lower order associations between pitch and size, strength, and emotion. The cross-linguistic differences are therefore the result of differences in how politeness is conceptualized, with metacommentary from participants suggesting this is driven by a greater focus on calmness in Korean politeness, and of kindness in American politeness. Like others, we argue this shows the pluripotential associations pitch can have, but additionally highlight the fact that pluripotentiality operates on multiple levels of indexicality.

Additional file

The additional file for this article can be found as follows:

- **File 1:** A PDF file containing the stimuli sentences (Appendix A) and a complete list of rating attributes (Appendix B) in both Korean and English. DOI: https://doi.org/10.16995/labphon.9112.s1

Acknowledgements

Competing interests

The authors have no competing interests to declare.

Author contributions

Both Jeffrey Holliday and Abby Walker contributed to the study conceptualization, experiment design, data analysis, and writing the manuscript. Mihyun Jung contributed to conceptualization, experiment design, and data collection, and Esther Cho contributed to conceptualization and experiment design.

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