UPTALK AND THE FREQUENCY CODE: HOW GENDER AFFECTS ICONIC ASSOCIATIONS OF PITCH

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ABSTRACT

Meanings of linguistic features are generally taken to be socially constructed. According to the Frequency Code, however, uptalk, involving high, rising pitch, has iconic associations with small body size and female gender, which should influence its affective meanings, e.g., being associated with submissiveness or deference. While uptalk is reported to have some associations consistent with this, the Frequency Code approach assumes culture- and individual-specific ideological links, e.g., between submissiveness and femininity. We used Implicit Association Tests to measure associations between uptalk and each of body size and binary gender. Uptalk was robustly implicitly associated with gender and more weakly with body size. However, the strength and availability of these associations depended on the listeners' gender, gender views and the gender of the voice. We propose physical associations with pitch provide an 'extra-linguistic' basis for meaning, but the salience and availability of these associations differs depending on individuals' beliefs and experience.

Keywords: uptalk, Frequency Code, sociophonetics, iconicity, gender and language.

1. INTRODUCTION

In sociophonetics, social meanings of linguistic features are generally taken to be socially constructed (e.g. [1]). Prosodic features have, however, long been claimed to have universal pre-linguistic associations according to biological codes such as the *Frequency Code*, which links, e.g., high or rising f0 with female gender and small body size [2, 3, 4]. According to this theory, *uptalk* (see [5]), characterised by high rising f0, should have these iconic physical associations, which may lead to affective associations such as submissiveness or friendliness [3, 4, 6]. While this aligns with some proposed meanings of uptalk [5], it does not account for all or for social factors that contribute to establishing such meanings, e.g. listeners who ideologically associate submissiveness with femininity [1, 7]. We seek to reconcile these approaches, proposing the availability of iconic associations of uptalk varies by listeners' experiences and beliefs, particularly about gender [6, 8]. We investigate physical associations of uptalk, and how these vary by listeners' gender and gender beliefs, using Implicit Association Tests (IATs) [9].

Biological codes link physiological properties of pitch production iconically with informational and affective interpretations of pitch in language, which may be phonologized within a language [3, 4]. In many mammalian and avian communication systems, f0 in vocalisations conveys not only physical size but *apparent* size, with, e.g., higher f0 used when acting submissively. Following this, Ohala ([3], p. 327) proposed the Frequency Code: affective meanings such as "deference, politeness, submission, lack of confidence, are signaled by high and/or rising F0". Because of sexual dimorphism, Ohala [3] extended this to human sex differences, as females tend to be smaller than males.

Uptalk, a well-studied feature of many varieties of English, is rising intonation at the end of a declarative [5]. It is found to have many affective associations consistent with the Frequency Code, including deference, uncertainty/lack of confidence, submissiveness and inclusiveness [10, 11, 5, 12, 13, 6]. However, these may be context-dependent: [12] found such associations only in "stereotypical" utterances (about shopping) and [14] found uptalk indexed authority for high status speakers. Further, many of these associations do not match discourse functions of uptalk, e.g. floor-holding [5].

Uptalk is stereotypically associated with women's speech [12]. Many, but not all, studies find uptalk used more frequently by women than men [5]. It attracts significant negative social commentary, so is stigmatised in at least some contexts [5]. The negative affective associations of uptalk above may thus arise through (negative) ideological associations with female gender, whether or not these are seeded or strengthened by iconic pitch associations. To try to unpack this, we consider listeners' implicit associations of uptalk with physical concepts from the Frequency Code: female gender and small body size. We propose iconic pitch associations provide a shared 'extra-linguistic' basis for affective associations, but the salience and availability of both the physical and affective associations differs according to alignment with the listener's 'world view' and the affordances of the context [1, 15, 7, 16, 6].

In [8], we showed implicit associations between high/low pitch and each of female/male gender and small/large body size using IATs. IATs are a well-established task to measure implicit association strength between paired concepts and attributes [9, 17]. We found stronger associations for male than female listeners and for male than female voices. We argued this is because males, as the historically dominant and privileged gender, have more entrenched ideologies relating to the Frequency Code, so relevant physical associations are more salient. Associations were also stronger with gender than size, which we argued is because cultural stereotypes relating to gender are stronger. Listeners with stronger gender bias (measured in attitude surveys) had stronger pitch associations, although only in 'consistent-first' order (see section 2.3) for some bias measures.

2. METHOD

The IAT experiments aimed to find out if listeners showed implicit associations between uptalk and each of gender and body size, and whether the strength of these associations was affected by listeners' gender, age and experiences and beliefs around gender. The method closely followed [8].

2.1. Participants

Data is reported from 64 female and 67 male participants recruited on Prolific (www.prolific.co). Their median age was 31 years (range 19-72), they had English as their first language and were living in New Zealand or Australia. The study was approved by THW-VUW Human Ethics Committee (No. 29710).

2.2. Materials

Two sets of concept stimuli (gender and size, see [8]) and one set of attribute stimuli (no uptalk/uptalk) were used in the IAT. For gender, twelve names were chosen strongly associated with female (e.g. *Claire*) and male (*Andrew*) gender. For size, photographs of animals (from [18]) were chosen which were either small (e.g. *mouse*) or large (*elephant*).

The stimuli were recorded on discourse markers (DMs), being short phrases which are pragmatically appropriate with either uptalk or falling intonation [19]. The DMs *you know* and *I mean* were used as these are frequent, similar in length and contain only sonorant sounds (important for pitch resynthesis). They were recorded by three female and three male New Zealand English speakers in their thirties and then resynthesised using STRAIGHT in Matlab. Tokens were length normalised to 520ms, with mean F0 values of 195Hz (females) and 115Hz (males). After pretesting, a declination of 1.2 ERB for females and 0.5 ERB for males was imposed over the first 60% of the token. For uptalk, f0 then rose by 8 ERB to the phrase end, while for no uptalk it stayed flat. In a norming study (N=32), participants' accuracy at categorising stimuli as no uptalk or uptalk was 95.2%.

A questionnaire collected basic demographic information and language background, along with responses to statements from established gender surveys that aim to quantify gender attitudes and beliefs. We used five statements from each of the Benevolent Sexism and Hostile Sexism scales [20] used in the New Zealand Attitudes and Values Survey [21], e.g. "Women, compared to men, tend to have greater moral sensibility" and "Women are too easily offended"; six from Social Dominance Orientation, e.g. "Inferior groups should stay in their place" [22]; the five-item Male Norms Inventory [23], e.g. "Boys should prefer to play with trucks rather than dolls"; and two Transgender/Non-Binary Attitude statements adapted from the New Zealand Gender Attitudes Survey [24], e.g. "I would be comfortable with a transgender or non-binary person as a colleague". We used a Likert scale from 1 (strongly disagree) to 7 (strongly agree).

2.3. Design and procedure

The IAT experiments were constructed and run online in PsyToolkit 3.4 [25], following a standard IAT design [9, 26], see Table 1. Participants first learn to classify stimuli from each concept/attribute pair (blocks 1-2), linked to the left ('E') or right ('I') response key. These are then combined. Blocks 3-4 are 'consistent', i.e. the expected concept/attribute pairing on the same response key, e.g. male names and low pitch. The response key for the concept is then reversed (Block 5), and the 'inconsistent' concept/attribute pairing tested (Blocks 6-7). If a participant has an implicit association between concepts and attributes, they should be faster and more accurate in the 'consistent'

(4) than 'inconsistent' (7) blocks.

There were eight IAT versions, crossing two orders of the Gender and Size concepts, each voice gender and two orders of consistent and inconsistent blocks (as effects may be smaller when inconsistent is first, [26]). In inconsistent-consistent order Blocks 1, 3-4 were switched with 5-7. Participants completed the IAT and then the demographic and gender attitude questions.

Table 1: Example sequence of blocks for IAT Experiments. Shows Consistent-First order.

Block	Trials	Type	Left-key response	Right-key response
1	24	Practice	Male names	Female names
2	24	Practice	No uptalk	Uptalk
3	4	Practice	Male + No up	Female + Up
4	48	Consistent	Male + No up	Female + Up
5	36	Practice	Female names	Male names
6	4	Practice	Female + No up	Male + Up
7	48	Inconsistent	No up + Low	Male + Up

2.4. Analysis

Gender attitude responses were analysed through Principal Components Analysis (*prcomp*, with permutation tests in *syndRomics*), which reduced the dimensionality of the 23 questions to 2 significant components. PC1 had positive loadings for all but one question, while PC2 had positive loadings for benevolent sexism, and weaker negative loadings for transgender attitudes and social dominance.

Implicit association strength for each concept-attribute was measured by D-scores [27, 26]. A D-score is a participant's mean RT difference between inconsistent and consistent blocks (i.e. 7 and 4 in Table 1), divided by their SD in these blocks. RTs for incorrect responses were replaced with the participant's mean RT+600ms.

Linear regression models were built in R, with D-score as the dependent. Initial models included three-way interactions of Concept (Gender or Size), Voice Gender (Male or Female voices), Listener Gender, Listener Age, PC1 and PC2, apart from interactions with two or more of Age, PC1 and PC2, as this led to overfitting. The interaction of Order (Consistent-first or Inconsistent-first) and Half (first or second half of the experiment), and listener Handedness (left or right) were also included. Non-significant effects were eliminated using *buildmer*. Model estimates were extracted using *ggeffects*.

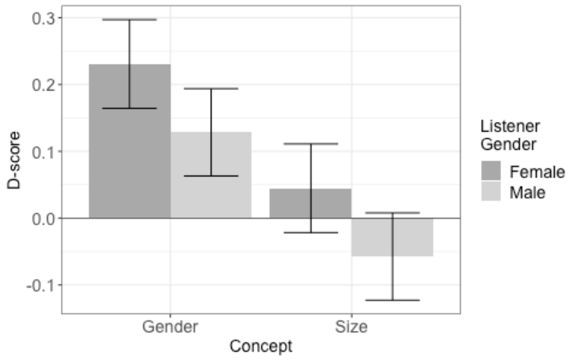

Figure 1: Fitted D-scores by Concept and Listener Gender. Error bars show 95% CIs.

3. RESULTS

The final model contained significant simple effects for Concept (F(1, 254) = 23.19, p<0.001), Listener Gender (F(1, 254) = 6.84, p=0.009), PC2 (F(1, 254) = 6.83, p=0.009) and Order (F(1, 254) = 30.99, p<0.001) and interactions of Gender:Voice Gender (F(1, 254) = 4.42, p=0.037) and Gender:PC2 (F(1, 254) = 3.8, p=0.052). For Order, D-scores showed an implicit association in Consistent-first order (D = 0.19, 95% CI = 0.14, 0.24) but not in Inconsistent-first (D = -0.01, 95% CI = -0.07, 0.04).

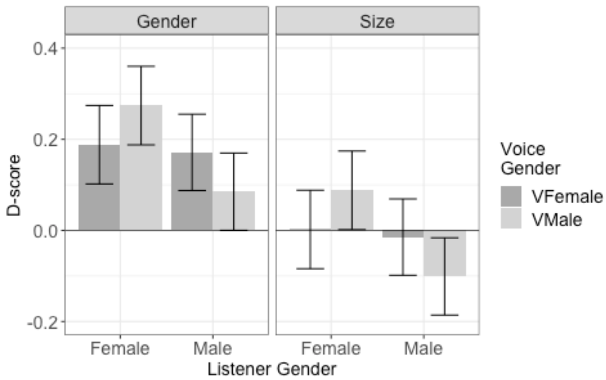

Figure 2: Fitted D-scores by Concept, Listener Gender and Voice Gender. Error bars show 95% CIs.

Remaining effects are presented with the additive effect of Concept, as we are interested in association strength with Gender and Size separately. Comparisons using *emmeans* (fdr method) showed D-scores for Gender are higher than for Size (t=4.82, p<0.001) and for female listeners than male (t=2.66, p=0.008). Both genders show the expected association with Gender, e.g. uptalk with female gender, but this is stronger for female listeners (Figure 1). For Size, females show a weak association, while males show a weak reverse association, i.e. uptalk with large body size and/or no uptalk with small.

For Male voices D-scores for female listeners were higher than males (t=3.44, p=0.004). While no other comparisons were significant, listeners of either gender have stronger associations for the opposite gender voice (see Figure 2). In all cases listeners have the expected association of uptalk with female gender. For Size, however, females only show the expected association for male voices, while males show no association with female voices and a reversal with male.

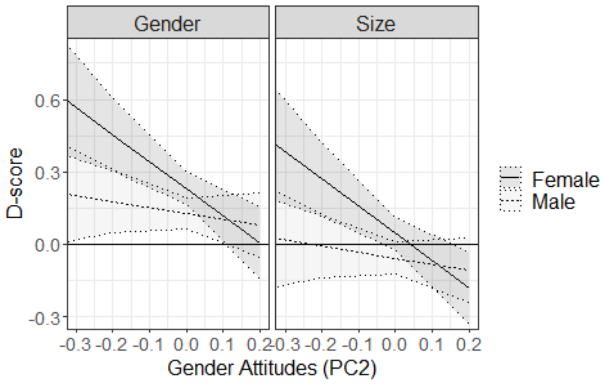

Figure 3: Fitted D-scores by Concept, Listener Gender and Gender Attitudes (PC2). Error bars show 95% CIs.

Slope comparisons in *emtrends* show a significant effect of PC2 for female listeners (t=3.29, p=0.001) but not males (p=0.4). Female listeners with lower PC2 scores have higher D-scores (see Figure 3). All listeners still show expected associations for the Gender concept. For Size, only females with low-to-average PC2 scores show the expected association, while males show a weak reversal. Listeners with low PC2 scores show lower bias on the Benevolent Sexism scale, and more weakly, higher bias on Social Dominance and Transgender Attitudes (see section 2.4).

4. DISCUSSION

We used IATs to explore implicit associations of uptalk predicted by the Frequency Code. Uptalk was robustly associated with female gender, and its absence with male gender, although the strength of the association varied by listener gender, gender bias and voice gender. This is predicted by the Frequency Code, but also follows from a socially constructed association of uptalk with women's speech. Uptalk was more weakly associated with small body size, and its absence with large body size, although only for female listeners, particularly listening to male voices. This provides some support for linking iconic pitch associations to features like uptalk, and particularly for our proposal that the strength and availability of these associations differs according to listeners' experiences and beliefs.

As expected, and matching findings for voice pitch in [8], implicit associations were stronger for the gender concept than body size. This accords with the stronger salience of pitch-related cultural stereotypes for gender than body size. However, opposite to [8], associations were stronger for female than male listeners. We suggest this is because, as stereotypical users, female listeners likely have more experience with uptalk. As uptalk is a phonologized feature, this experience affects association strength more than any gender differences in ideological beliefs re the Frequency Code. Interestingly, only female listeners showed an implicit association between uptalk and size, suggesting this makes wider iconic associations of rising pitch more salient for them, consistent with our proposal.

Both female and male listeners showed stronger associations with voices of the opposite gender. This was not predicted. In [8], stronger associations for voice pitch were found with male voices for both gender groups. We speculate that the stigmatised status of uptalk may make listeners more resistant to associating uptalk with their own gender, making the task more difficult (see also [6]). This may also explain why male listeners listening to male voices apparently show a reverse association for size.

The findings with regard to the gender bias are somewhat ambiguous, as we only found an effect of PC2, which was positively loaded for one measure of gender-related bias (Benevolent Sexism), but negatively loaded for two others (Social Dominance and Transgender Attitudes). It is not clear which of these is more important for interpretation and therefore whether the effect matches our prediction that those with stronger gender bias would show stronger iconic associations. We are still investigating this, but speculate that these explicit measures may not be sufficiently effective for gauging implicit gender bias relevant to the Frequency Code.

IATs show promise to investigate how iconic associations may form part of the cognition and meanings of pitch features. In future work, we plan to use a similar approach to look at affective meanings of uptalk and other pitch features. We believe this has the potential to offer new understandings of how iconic and social sources of meaning interact, by quantifying how differences between listeners affect what they implicitly associate with pitch.

5. ACKNOWLEDGEMENTS

This work was funded by a Faculty Strategic Research Grant from THW-VUW. Thanks to Jen Hay and Abby Walker, and the participants.

6. REFERENCES

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