

INDIE-POP VOICE: HOW A PHARYNGEAL/RETRACTED ARTICULATORY SETTING MAY BE DRIVING A NEW SINGING STYLE

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1 Introduction

Different genres of singing may be characterized in part by singers' articulatory settings [1]. Bateman [1], for example, notes that pop singing is often characterized by horizontal expansion and vertical compression of the lips, while jazz singers tend to use labial protrusion. The articulatory settings associated with a given singing style are known to have noticeable, systemic effects on the acoustics of the singer's pronunciation [2].

Recently, a new singing quality has emerged. Initial popular descriptions have sometimes called this quality "indie-pop voice" [3], and have focused on unusual vowel pronunciations and characteristic front-rising diphthongs. Our study investigates the possibility that indie-pop singers use a pharyngealized articulatory setting that may be motivating other vowel changes. As a precursor to the present experiment, we impressionistically evaluated the sounds of indie-pop, including the front-rising diphthongs and the contexts in which they appear, the overall vowel qualities, as well as certain consonant sounds, especially /r/. Careful observation suggests that, while the details and degree of these characteristics vary from artist to artist, they have a few important features in common.

First, we found that front-rising diphthongs can occur after any vowel except /i/, /ɪ/, or /u/, and most occur before coronal consonants. We took this to suggest that the diphthongs are prolonged audible transitions between the tongue's vocalic position and the articulatory target for the following consonant. Second, we observed a pervasive pharyngeal sound. Reinforcing this, we observed that, in some artists, /r/ sounds were realized postvocally as high-front vowels, which could indicate that the pharyngeal component of /r/ was not distinctive in that environment. Pharyngeal constriction can be achieved via various articulations [4], but we interpreted these initial observations as consistent with retraction of the tongue body. In addition to reducing pharyngeal volume, this could also prolong the transitions between vowels and coronal consonants, simply by increasing the physical distance the tongue must travel.

To investigate the articulatory setting used in the indie-pop singing style, we conducted an acoustic study of several different artists, comparing the vowel formant values of sung vowels in indie-pop songs to the same vowels in spoken interviews produced by the same artists. We expect

to see that, as compared to the interviews, vowels in indie-pop singing will exhibit higher F1 values, an acoustic correlate of pharyngeal constriction [5], and lower F2 values, a correlate of tongue dorsum retraction [6].

2 Method

The artists and songs were chosen based on the description of indie-pop voice in [3] (i.e., all have the characteristic diphthong). From an initial 9 artists, 4 were excluded for having native dialects from outside English-speaking North America. Interviews were chosen for clarity and ease of access. Songs and interviews on YouTube were recorded using peggo.tv, converted into .WAV format with Audacity 2.1.1, and spectral measurements were taken using Praat 5.4.19.

A subset of the English vowel inventory was analysed. No distinction was made between /a/ and /ɒ/, nor between /ɔ/ (preceding /r/) and /o/. Diphthongs and schwas were excluded, as were any vowels that were too short to clearly distinguish from their environments. Spectral measurements were taken from either the first stable formant area of the vowel, or if there was none, from its approximate midpoint.

The measurements we took were as follows (listed as "vowel: number of samples from songs, number of samples from interviews"): i: 25, 18; ɪ: 21, 17; ε: 19, 19; æ: 21, 19; a: 26, 26; o: 21, 13; u: 10, 15; ʊ: 9, 7; ʌ: 17, 22.

3 Results

In general, the sung vowels exhibit a qualitative trend of higher F1 compared to the spoken vowels, particularly in high and front vowels. We also observed lower F2 values, particularly in high vowels. These apparent patterns are absent in the low back vowels.

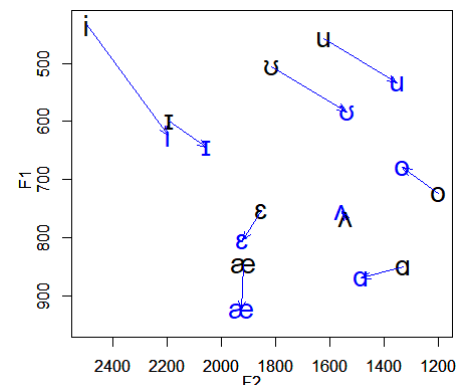


Figure 1: Average vowels in speech (black) and singing (blue)

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Performing ANOVAs of F1 by condition (sung; spoken) for each vowel, and another set of ANOVAs of F2 returned two significant results, both for the vowel /i/. The difference between the average spoken F1 and average sung F1 was significant ($p=0.03$), as was the difference between spoken and sung F2 ($p=0.03$). Additionally, for the vowel /a/, the difference between spoken and sung F2 was nearly significant ($p=0.051$).

4 Discussion

Qualitatively, the pattern in Figure 1 aligns with our hypothesis. High and front vowels display an increase in F1 which can be attributed to pharyngeal constriction. The absence of this pattern in the low- and mid-back vowels is consistent with our hypothesis: these are the vowels whose constrictions are the farthest back in the mouth, so their inherent features are redundant with the proposed articulatory setting [4]. This can also explain why sung low vowels do not exhibit decreased F2: their features may be partially or entirely redundant with the articulatory setting of tongue retraction.

Similarly, it is noteworthy that the vowel which exhibited a significant difference between sung and spoken formant values was /i/. Its features are least redundant with our proposed articulatory setting, so the difference between sung and spoken /i/ should be the largest and easiest to detect. This may also shed light on indie-pop's characteristic diphthongs. Given that we found /i/ to be the most displaced vowel in indie-pop, and that indie-pop's diphthongs move toward the space which /i/ is leaving, it may be possible to apply a chain-shift model of sound change to indie-pop. This discussion, however, will be left for future study.

Another factor likely contributing to the weak p -values for vowels other than /i/ is variability between artists. There were insufficient measurements from each artist to perform individual statistical analyses, but this variability appears substantial. Some artists even show opposite patterns to those in Fig.1. For example, Shawn Mendes' sung high front vowels exhibit raised F2, despite his being qualitatively one of the strongest examples of indie-pop voice. This raises questions as to why artists with similar stylistic markings have different acoustic signatures. To address this, we draw analogy to sound change in spoken language.

In models of sound change, the initial stage might be more physiologically driven, but the resulting shift is later adopted as phonology [7]. Similarly, while indie-pop's distinctive diphthongs may originally have been a by-product of an articulatory setting, they have since been adopted as part of a musical style. For example, one online tutorial instructs the viewer to "add the letter i... after vowels" [8]. If the diphthongs are deliberately articulated, they can occur over a variety of articulatory settings and environments. Since there are many ways to reduce pharyngeal volume, a singer could even use a different articulatory setting despite exhibiting both pharyngealization and indie-pop's characteristic diphthongs. This poses difficulties for phonetic study as the presence of

these diphthongs was the primary basis for an artist's inclusion.

A follow-up study should analyze more artists, and acquire enough data from each to compare them so as to construct a better picture of how the style is produced. It could also prove beneficial to include artists who do not prominently exhibit the front-rising diphthongs, but who bear other characteristics of the indie-pop style [3].

Finally, the present study relies exclusively on indirect measurements of articulation, which leaves room for alternative explanations of the acoustic results. With this in mind, future work may use ultrasound measurements of the tongue-root, ideally with professional artists, or possibly with trained phoneticians imitating indie-pop.

5 Conclusion

Acoustic analyses of five singers with an indie-pop style support the presence of an articulatory setting featuring pharyngeal constriction via tongue retraction. This may explain the style's characteristic diphthongs and vowel quality, though more robust data are needed. We also observed substantial variation between artists, possibly due to the stylistic adoption of diphthongs originally produced via an articulatory setting. Further research may use direct articulatory measurements and a larger sample size of both vowel measurements and artists.

Acknowledgments

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