VOWEL DISPERSION IN ENGLISH DIPHTHONGS: EVIDENCE FROM ADULT PRODUCTION

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This study addresses two main omissions in previous work on vowel inventories in Dispersion Theory. The first is to evaluate the ability of Dispersion Theory to account for actual production data; Flemming's (2004) similarity space is an idealized version of what the vowel space should look like, with very strict segmentation of the space into the corresponding vowels. In addressing vowel inventories, Flemming does not base inventories on actual production; instead, he assumes production matches the common IPA transcriptions used for a language's inventory. This study addresses this first issue by measuring a set of monophthongs in connected speech to make the vowel inventory reflect true production. The second aspect addressed is the omission of diphthongs from Flemming's vowel inventories, despite diphthongs being common productive members of vowel inventories in a large number of languages cross-linguistically.

Flemming (2004)'s analysis adapts the ranking and competition framework of OT to the goals and hypotheses of Dispersion Theory. Two goals are perception-based: (1) maximize the distinctiveness between the contrasts by maximizing their distance with the MINDIST constraint, and (2) maximize the number of contrasts the speaker can make with the MAXIMIZE CONTRASTS constraint. These perception-based goals are in competition with a speaker-oriented goal: (3) minimize effort of articulation with the *EFFORT constraint. Problematically, the strict F1 and F2 coordinates of the similarity space do not accurately reflect the positions of the vowels as they are spoken, leading to a discrepancy between the idealized theoretical analysis and true production. Additionally, this analysis can only account for monophthong vowel inventories; ideally, vowel inventories with diphthongs should be included in this framework to create a unified theory.

To address the first issue, data was collected from three native English speakers, from which recordings monophthong and diphthong data were extracted. Previous literature guided choices in diphthongs to be evaluated, points of measurement, and cues that are most important to diphthong perception (Gay 1968, Miret 1998, Morrison 2013). The purpose of measuring monophthongs in addition to the diphthongs is twofold: (i) to establish a basic map of the vowel space against which the diphthongs can be plotted; (ii) to determine the nature of where the diphthongs are in the vowel space without relying on the orthographic transcription, which the previous literature cites as untrustworthy when it comes to vowels (Lehiste & Peterson 1961, Gay 1968).

Data was then plotted and against Flemming (2004)'s similarity space for comparison, see Figure 1. From the three speakers, monophthong formant measurements were taken from a total of 252 tokens and diphthong formant measurements from 200 tokens. Compared to the similarity space, monophthongs (especially lax vowels) were consistently centralized. Actual monophthong and diphthong production both do not align with how they are transcribed. The Euclidean distance is shorter in all the phonemic diphthong pronunciations than where they would be placed by their IPA labels in Flemming (2004)'s similarity space. The two phonetic diphthongs, [eɪ] and [oʊ], however, have equal or longer distances.

In the analysis, I first provide Dispersion Theory OT derivations for the entire monophthong production data set on the F1 and F2 dimensions. The constraints and procedure from Flemming (2004) were sufficient to provide correct rankings for the monophthongs, despite the fact that the monophthongs showed a large amount of vowel reduction. To derive the correct diphthongs, additional constraints were introduced to account for the diphthong production data, including the inherently ranked *EffortNucleus=x (Grosz 2006), HearClear (Minkova & Stockwell 2003), and the constraint proposed here, *ReduceOnset. These additional constraints were based on articulatory goals to minimize effort: on one hand, reduced effort led to shorter diphthongs; on the other, reduced effort caused the onset target to be reduced to a central vowel position. Each derivation evaluated one diphthong amongst a set of possible candidates; I derive the individual diphthongs as they are pronounced compared to losing forms (ie. the vowels within diphthongs rather than diphthongs compared to each other in the vowel space).

Overall, it appears that (at least in reading-rate speech) the goal for minimization of effort tends to take precedence over the goal to maximize distance in individual diphthongs. This conclusion is not entirely consistent with previous literature, which mainly states that the two targets in a diphthong seek to maximize distance. The production data even suggests that the onset target may the least reliable cue for diphthong identification, contrary to Morrison (2013)'s study, due to its tendency toward reduction.

My future research focuses on expanding the analysis to evaluate diphthongs in comparison to one another in the vowel space and expanding to evaluation of cross-linguistic trends. At this next stage of implementing diphthongs in Dispersion Theory, it will become evident how the goal of maximum distinctions applies to the diphthong inventory, if at all.

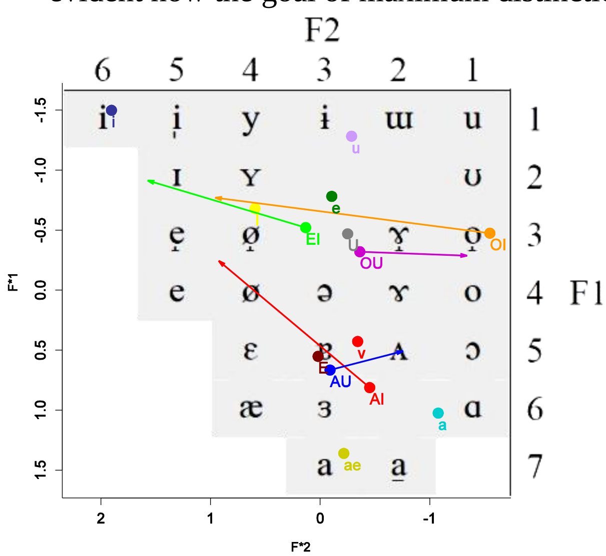

Figure 1: Normalized values plotted over Flemming (2004)'s similarity space

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