ENGLISH TRAP VOWEL IN ADVANCED POLISH LEARNERS: VARIATION AND SYSTEM TYPOLOGY

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ABSTRACT

The productions of English TRAP, DRESS and STRUT vowels are analysed acoustically in advanced Polish learners of English in an EFL setting. TRAP is shown to be less well-defined than the other two vowels, presumably due to partially fossilised "assimilation" to the corresponding Polish vowels /a/ and /ɛ/. There is considerable inter-speaker variation in the distribution of TRAP tokens, with four main configurations. Some weak lexical effects are visible, but their origin is unclear. There is a possible effect of affiliation to a specific pronunciation model, British or American.

Keywords: L2, English, vowels, variation

1. INTRODUCTION

Polish has only two vowels, usually symbolised /a/ and /ɛ/, in an area where English has three – TRAP, DRESS and STRUT (Jassem [8], Sobkowiak [14]; vowel keywords as per Wells [16]). Consequently, virtually all theories of the acquisition of L2 pronunciation will predict problems for Polish learners of English, differing only in the details of their predictions. Many sources (e.g. Sobkowiak [14], Reszkiewicz [13], Gonet, et al. [6]) suggest that Polish learners usually assimilate English TRAP to Polish /ɛ/, but inter-speaker and lexical variation is hinted at. However, actual production data are scarce (but see Gonet, et al. [6]).

This paper describes an exploratory study into the production of the TRAP vowel in advanced Polish learners of English. The specific questions are:

- What are the spectral characteristics of Polish learner productions of TRAP?
- What is the relation of learner TRAP productions to DRESS and STRUT?
- Can lexical effects be identified, and if so, what are they?
- What is the nature of inter-speaker variation?
- Does model affiliation (see below) affect production?

2. BACKGROUND

In native populations, phonetic variation – beyond the usual cross-talker effects – is understood to be allophonic or sociophonetic. English TRAP is a good example: (1) in certain accents, e.g. many types of American English, there is allophonic variation of clearly co-articulatory origin, with a raised and fronted allophone before nasals; (2) in other accents, e.g. New York or Philadelphia, similar raising and fronting is lexical rather than lexically conditioned; (3) in many accents, e.g. US Northern Cities or Northern England, the local variants have sociophonetic meaning (see e.g. Labov, et al. [10] or, for a recent study, Becker and Wong [1]). The vowel of STRUT is, of course, a rather well-known sociophonetic variable in England, while DRESS has received expectable attention e.g. in New Zealand.

There has been less research into variation in the vowels of L2 English. Acoustic studies in L2 vowel production usually present the L2 speaker data as means (often group means) and compare those against means from "native speaker" controls. Importantly, (1) intra- and inter-speaker variation in L2 speakers is seldom inspected in detail; (2) the identification of the native reference variety may be broad (e.g., "American English" or similar); and (3) most studies investigate immersion settings. Bohn and Flege [3] provide a good example, studying the production of TRAP by German learners in Birmingham, Alabama.

Studies more pertinent to the present one include e.g. Jongman and Wade [9], Lehmann [11], or Cunningham [5]. Usually, the finding is that there is more variation in L2 speakers (even though Morrison [12] found that English learners of Spanish produce less variability than Spanish native speakers, and interpreted this as a by-product of their L1 vowel system being "crowded"). Other factors, such as variation in the input, are also suggested (cf. e.g. Bohn and Bungaard-Nielsen [3]).

3. PILOT STUDY

A pilot study investigated a mini-corpus of read English speech from 50 advanced Polish learners enrolling in an "English studies" programme at a Polish university. The results suggested that there is a considerable amount of inter- and intra-speaker variability in the production of TRAP. While the distributions of DRESS and STRUT on the F1-F2 plane showed expectably good separation, the distribution of TRAP was almost completely "overlaid" on DRESS and STRUT. Inspection of individual speakers revealed that all logical "assimilation" possibilities were attested. Some speakers had been (more or less) successful in acquiring a separate TRAP category; some merged it with DRESS (suggesting assimilation to Polish /ɛ/); others with STRUT (arguably, Polish /a/); and, most importantly, there was also a group of speakers for whom TRAP showed a "bimodal" distribution, with some instances clustering with DRESS, and some with STRUT. Also, the results suggested that there might be lexical effects, as there was variability between words that was seemingly not due to phonetic context. However, due to the opportunistic character of the material (the wordlist was phonetically unbalanced, with too few repetitions per speaker), no firm conclusions could be drawn.

4. METHODS

As a follow-up, a new corpus was collected of read and semi-spontaneous English speech from 106 Polish students of English. The participants were first-year students newly enrolled in the same "English studies" programme as above. The recordings were made before they received any substantial systematic training in English pronunciation. There was no formal placement test with respect to their level of English, but the mere fact of being enrolled in the programme meant they had achieved results of 80% or more during their final high school exam in advanced English.

They read a wordlist of 80 items, with two to four repetitions per item (a total of 240 items), divided into four blocks, and presented on a computer screen. The list elicited all English monophthongs in the *b_t* consonantal frame, the three vowels investigated here in that and three additional consonantal frames, and the TRAP vowel in a set of word pairs designed to tap into lexical factors in a way that would be as independent of phonetic conditioning as possible (e.g. *can–scan*, *standing–standard* etc.). One important limitation of the wordlist was that it was designed so as to contain real words that were either (1) of sufficient frequency to be reasonably expected familiar to the speakers or (2) of a transparent grapho-phonemic form.

In addition, the participants read two short texts, and about two minutes of spontaneous speech was also recorded.

The recordings were made in a sound-treated room using a condenser microphone connected to a PC computer via a USB audio interface.

Here, results are discussed from a subset of the corpus: four repetitions of 24 items from the wordlist (*bet*, *bed*, *Beck*, *head*, *bat*, *bad*, *back*, *had*, *sad*, *cat*, *scat*, *band*, *banned*, *can*, *scan*, *lack*, *black*, *standing*, *standard*, *but*, *bud*, *buck*, *Hudd*, *cut*) read by 30 female students. The sound files were annotated in Praat (Boersma and Weenink [2]); means of F1, F2 and F3 were taken over the middle 10% of each vowel, and were subsequently normalised according to the Labov ANAE model (Labov, et al. [10]) as offered by the NORM vowel normalisation suite (Thomas and Kendall [15]).

5. RESULTS AND DISCUSSION

5.1. Summary

The overall results were similar to the pilot study. There was good separation between the distributions of DRESS and STRUT, while the distribution of TRAP was superimposed. The mean for TRAP was located, in a sense appropriately, between those for DRESS and STRUT, even though STRUT was the most open vowel (albeit by a very small margin). This is in contrast with many varieties of native English, where TRAP is usually the most open vowel. Figure 1 and Table 1 summarise the results.

Figure 1: Aggregate results for all speakers. Means (IPA symbols) and 2SD confidence ellipses.

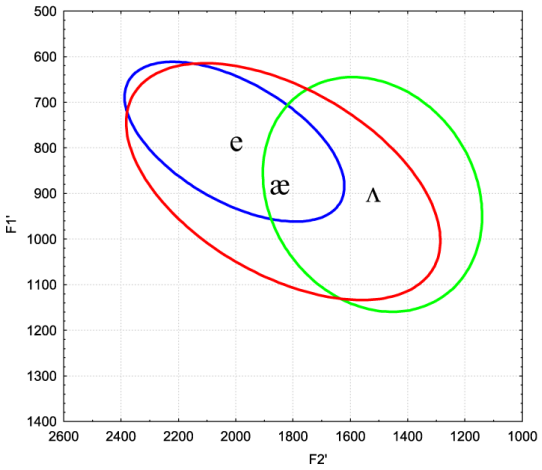


Table 1: Mean F1′ and F2′ values.

	DRESS	TRAP	STRUT
F1′	786	874	902
F2′	2004	1834	1523

A MANOVA for the F1′ and F2′ values of TRAP showed effects of Student Group (see below) and Right Phonetic Context. While the latter is fully expectable (even though, here, the highest and frontest values came from following /d/ – see Section 5 for a possible explanation), the former is interesting. In the "English studies" programme, new students are given the option of enrolling into "American" or "British" groups which differ with respect to the model used in "Practical English" (general EFL) courses, including pronunciation, and the "Descriptive Grammar Part 1" (descriptive phonetics and phonology) course. Since earlier research (Janicka, et al. [7]) showed that the students make their choices based on attitudinal factors rather than perceptual familiarity with the varieties or any declarative knowledge, group affiliation was not an obvious effect to expect. However, here, the "American" group students produced a slightly fronter and higher TRAP vowel on average, which is compatible with reference descriptions of the two pronunciation standards.

However, a mixed-model variance components analysis, with Speaker as a random independent variable, failed to return Student Group as a significant effect. Thus, the variability within TRAP might seem to be due at least to some extent to inter-speaker variability. The results are summarised in Tables 2 and 3.

Table 2: MANOVA for TRAP. Wilks' lambda.

Effect	Value	F	df	df error	p
Intercept	0.004	209461.1	2	1668	0.000
{1}Group	0.968	27.6	2	1668	0.000
{2}RightPhon	0.881	36.3	6	3336	0.000
{1}×{2}	0.992	2.1	6	3336	0.051

Table 3: Variance components for TRAP.

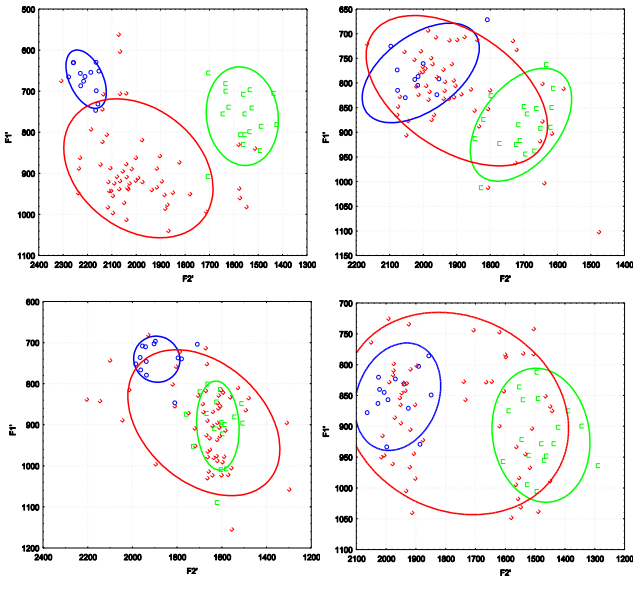
Effect	F/R	df	MS	F	p
{1}Group	Fixed	1	2818026	2.71432	0.110
{2}RightPhon	Fixed	3	617747	9.29473	0.000
{3}Speaker	Random	28	1038869	14.17022	0.000
{1}×{2}	Fixed	3	122836	1.87572	0.140

There was little variability in terms of L2 length of instruction (all of the subjects started English instruction in the primary school) and in first-hand experience from visits to English speaking countries (which was very limited). These factors were not significant, in contrast to usual findings in L2 literature, but they were not part of the design.

5.2. System typology

To explore inter-speaker variability, a system typology was attempted. Four types of distribution of TRAP tokens were attested. A categorisation of the individual speakers' systems was performed on the basis of the distribution of TRAP tokens with respect to 2-standard-deviation (2SD) ellipses for DRESS and STRUT. Eighteen systems were classified as "TRAP systems", with most tokens outside of the 2SD ellipses of DRESS and STRUT; of these, 5 were impressionistically "good". Four systems were classified as "TREP" systems, with a majority of TRAP tokens within the 2SD ellipse of DRESS. Two systems were classified as "TRUP" systems, with a majority of TRAP tokens within the 2SD ellipse of STRUT. Finally – and most interestingly – six systems were classified as "bimodal" systems, with roughly equal numbers of TRAP tokens within the DRESS or STRUT ellipses, and less than one third of the tokens outside of them. Good examples of the four system types are shown in Figure 2.

Figure 2: 2SD ellipses for typical systems. Top left, "good TRAP"; top right; "TREP"; bottom left, "TRUP"; bottom right, bimodal. Blue circles, DRESS; red diamonds, TRAP; green squares, STRUT.



5.3. Lexical effects

It is difficult to test lexical effects independently from possible co-articulatory/allophonic effects. The wordlist included a number of word pairs selected so as to ensure the same immediate context on both sides of the vowel. Here, five such pairs

were considered: *can–scan*, *cat–scat*, *black–lack*, *band–banned* and *standard–standing*. Of these, all showed an effect of Student Group in a MANOVA analysis, with the "American" group consistently displaying higher and fronter realisations. However, only the pair *standard–standing* showed an effect of Lexical Context itself ($F(2,216) = 135.12$, $p < .001$), and an interaction of Student Group × Lexical Context. The vowel in *standing* was considerably higher and fronter; notably, the /n/ in *standard* did not cause raising or fronting. Due to this, /n/ generated lower and backer mean values than /d/ as the Right Phonetic Context.

The lexical effect in *standing–standard* may at first seem to be a "false friend" effect due to the existence of a Polish cognate, *standard*, with /a/. However, the same effect was not observed for *can–scan* despite the existence of Polish *skan*. It may be the case that the effect of interference is mixed with some kind of co-articulatory effect – possibly even vowel harmony (as the second vowel of *standard* was almost uniformly realised as an unreduced central [a]-like vowel, usually with some r-colouring).

6. CONCLUSIONS

The considerable variability in the production of TRAP is likely to have its main source in the usual cross-linguistic effects in phonological acquisition, including interference from L1 and lack of experience in L2. There seem, however, to be at least two additional factors: (1) There is some influence of variability in the input – even in a foreign-language setting that differs from immersion settings usually explored in phonological SLA literature (but cf. Bohn and Bungaard-Nielsen [3]; Jongman and Wade [9]; Morrison [12]). It may be understood as "model affiliation", i.e. modelling one's production on a specific (here, American vs. British) model even without immersion or instruction. (2) Phonetic context effects may be mitigated by case-by-case lexical effects. However, the nature of the latter is not entirely clear. Further research is needed to tap into lexical effects more successfully.

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