3L: Language, Linguistics, Literature® The Southeast Asian Journal of English Language Studies
Vol 30(3), September 2024 http://doi.org/10.17576/3L-2024-3003-13

Intervocalic /t/ acoustic patterns in British News Analytical Discourse

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ABSTRACT

The paper aims to study word-internal and word-final patterns (allophones, phoneme substitutes and elisions) for intervocalic canonical /t/ in British English. An acoustic analysis of speech samples received from 6 male subjects (1200 intervocalic /t/-tokens, 200 tokens per speaker – 100 medial and 100 final, selected by continuous sampling method from the total of 6 hours of speech) enabled to find three common patterns word-medially (canonical including two-peak ones, taps/flaps, sibilants) and six ones – word-finally (with glottal bursts, weak voiceless and elision added). The results indicate that while word-medial intervocalic glottal burst remains stigmatized, word-final one does not. Neither does it closely correlate with the female gender or young age any more, and it might have become supra-local, supra-gender, and supra-age. Acoustic evidence for both taps and flaps in British English was found. Both of them have continuous voicing, with the first being acoustically closer to stops having a variable duration gap and impulse phase, and the second – closer to approximants demonstrating F-structure, no evidence of occlusion or burst. There was a certain statistically significant speaker-dependent variation in both word-internal and word-final allophones and substitutes. These findings show a high degree of free variation, indicating instability of British Standard Pronunciation. Word-boundary effect was statistically significant for five out of the six subjects. However, the correlation of word-internal and word-final pattern ranks was considerably lower than that between the subjects.

Keywords: intervocalic /t/-pattern; canonical allophone; tap/flap; sibilant; glottal burst

INTRODUCTION

MOTIVATION FOR THE CURRENT STUDY

Two opposite tendencies – globalization and preserving national identity – have affected the English-speaking World to a great extent. On the one hand, they gave birth to a multitude of World Englishes, but on the other hand, they brought drastic changes and instability to the Mother of those Englishes – The British English (BE). After a long period of time, American English (AE) has been considered the most unstable variable, and BE seems to have taken the lead. Watt (2010) called the territory of Britain (particularly the border between England and Scotland) the zone featuring the greatest concentration of dialect differences anywhere in the English-speaking world. According to Hughes et al., (2013), it is not just a succession of accents but an accent continuum that presupposes great interaction and such considerable variations of the standard that many linguists doubt that the standard exists anymore. British accents, including a popular formation called Estuary English (EE), have been studied by a great number of linguists. However, the complicated patterns of the British accent's interaction with the growing influence of EE and current fluctuations in Standard pronunciation (Ariffin & Mat Enh, 2022; Bezborodova, 2015; Shevchenko, 2015) encouraged us to scrutinize some aspects of BE pronunciation again.

It is a matter of common knowledge that the most frequent units are generally characterized by the highest degree of variation. Among 24 English consonants, /t/ is the most frequently used consonant in oral and written English speech – ranked 1 or 2 – as compared to the least frequent /ʒ/, ranked 24 (see Cruttenden, 2001; Denes, 1964). Therefore, it was chosen as a phonological variable for the present study. Dwelling on the finding of Wang and Crawford (1960) that the relative frequency of consonants in English is not seriously affected by the style of literary content or by the dialect of the sample, we will consider it the most frequent in contemporary spoken British English as well. Depending on phonetic environment, the variety of /t/-allophones and /t/-substitutes (see, e.g., Cruttenden, 2001; Docherty, 2007; Fabricius, 2000; Milroy et al., 1999; Penney et al., 2019, 2020; Ramsaran, 1990) includes canonical allophones, weak voiceless, dental, glottal stop, voiced, flapped/tapped ones, the ones that appear as a result of assibilation (/t/ → /tʃ/, /ʃ/). The elision of /t/ is also a frequent phenomenon. Based on Tyneside English, Dochery and colleagues (Docherty, 2007; Milroy et al., 1999) presented the evidence of 5 patterns for intervocalic and pre-pausal /p, t, k/ variation: glottal/glottalized, plain release, voiced release, tap, pre-aspirated release (including pre-aspiration, pre-affrication and spirantization or a combination of those – for pre-pausal /t/-tokens). The proportion of those is rather stable for adults. However, the number of canonical allophones is much greater in child speech as a result of mothers' infant-directed speech strategy (Dilley et al., 2019).

Previous pilot study focusing on intervocalic medial /t/-tokens (S. V. Androsova & Karavaeva, 2015) enabled to find four patterns (allophones and substitutes) in British English: canonical including two-peak ones (ambisyllabic), taps/flaps and fricatives (particularly, sibilants). Such a variety for one position was not described in the literature concerning British English. Those findings encouraged us to perform a more detailed study of British intervocalic /t/. Among the four mentioned allophones and substitutes, flaps/taps deserve special attention.

FLAP OR TAP?

Articulatory difference between 'flap' and 'tap' was described by a number of linguists including Abercrombie (1966), Laver (1994), Wells (1982), Ladefoged (1975), Ladefoged and Maddieson (1996): 'tap' is understood as 'one-tap-trill', while 'flap' – as 'ballistic movement' (in other words, according to Laver (1994) flapping occurs when "the tip of the tongue starts from a curled retroflex position, with the tip behind the alveolar ridge. It is made to uncurl forwards rapidly, and uncurling hits the alveolar ridge, momentarily making an airtight against the ridge while sliding forward". Roach (2001) finds 'tap' and 'flap' similar with the only difference that while flapping "the tongue is curled back and then flicked forward against the alveolar ridge". According to Lodge (2009), the difference between the two is that in 'tap', the upward movement is present, while in 'flap' – the forward one. C. Cathcart (2012) found two variations of the tongue shape for tap produced by one American English speaker, not depending on vowel quality – concave and flat (p. 97).

So far, there are no acoustic or perceptual studies that directly address the possibility of both taps and flaps in English in *putting, pudding, get a, had* a, etc., and the difference between their acoustic and perceptual cues. At times, the terms 'flapped' and 'tapped' are used as synonyms, e.g., (Broadbent, 2008, p. 142; Janicki, 1977, p. 35; Kahn, 1976; Ottenheimer, 2012). Wells (1982) mentioned that double terminology might have been due to the popularization of the phenomenon in recent American discussions. Wells, Laver, and Cruttenden insisted on using the term 'tap' for the phenomenon in American English and some British dialects (Cruttenden, 2001; Laver, 1994; Wells, 1982). Although O'Grady (2013) described the articulatory difference between flap and tap,

he referred to both 'flap' and 'tap' terms for English accents). Fischer and Hirch (1976), Port (1977), Zue and Laferriere (1979), Warner (2005), Warner and Tucker (2007), Odden (2008, p. 47–48), Herd et al., (2010) and many others apply the term 'flap' for American English tokens in question. As we can see from literature analysis, mostly with regard to American English (Fischer & Hirch, 1976; Herd et al., 2010; Horna, 1998; Language files, 1998; Mills, 1990, p. 119; Orion, 1988, p. 199; Port, 1977; Zue & Laferriere, 1979), tap or flap or both of them are used to denote one and the same allophone with a number of acoustic cues most of which turn out quite variable:

(a) voicing – always present;
(b) friction and/or aspiration – mostly absent;
(c) stop-gap – variable duration, variable presence;
(d) burst – variable presence;
(e) approximant-like structure (see also Bouavichith & Davidson, 2013) – variable (56% of the tokens in question in American English with no data on British English);
(f) total token duration – a variable with different speaker-dependent ranges: 10–40, 43–69, etc., averaging at 24–41 as compared to 129 msec of pre-stressed/t/.

The literature review shows the need for a more thorough integration and structuring of what is known about the phonetic cues of taps and/or flaps in English. As far as the articulatory mechanisms and, therefore, typical acoustic properties of taps and flaps still remain ambiguous, we introduce the term 'voiced super-short alveolar consonants' (VSSACs) referring to both flaps and taps.

We hypothesize that:

(i) Growing instability of standard British pronunciation triggered by the abundance of local accents as well as RP and Estuary English competing for the dominant status gives way to a high degree of free variation of phonemes and allophones that is most perfectly expressed in intervocalic /t/ manifestation. Just in this one position, seven patterns might occur: canonical aspirated/affricated allophone, tap/flap, weak voiceless allophone, voiced allophone, glottal stop, fricative allophone and elision of /t/. It seems much more variable than that reported for American English, where it is limited to 3 patterns: canonical aspirated/affricated allophone, tap/flap, and glottal stop.

(ii) Word-medial and word-final intervocalic /t/ variation patterns, having much in common (canonical, tap/flap and fricative), demonstrate certain differences, with the latter having more variants (with weak voiceless, voiced, glottal stop, and elision added).

(iii) There are both taps (one-tap-trill type) and flaps (rapid curling-uncurling gesture type) in British English, each having characteristic acoustic cues that can be seen on a dynamic spectrogram. First, tapping/flapping goes far beyond functional (grammatical) words (e.g., pronouns, conjunctions, etc.) and involves meaningful (lexical) words (e.g., nouns, verbs, etc.). Second, it goes beyond mono- (e.g., *that*, etc.) and disyllabic (e.g., *bottom*, etc.) words and involves words consisting of more than two syllables (e.g., *competitive*, etc.).

An acoustic study was carried out to prove the hypotheses.

MATERIALS AND METHODS

SUBJECTS AND MATERIAL

Six native male British English speakers (SB1, SB2, SB3, SB4, SB5, SB6), aged 50–56, educated in England, were the subjects in the acoustic study. Their accent was estimated as standard British by the native speakers who took part in the phonetic analysis. The subjects were presenters of 8 BBC radio programs: Hardtalk (2014, 2015), Outlook (2014), Last Word (2015), The Bottom Line (2016), The Soundtrack of My Life (2015), The Business of Film (2015), Confessions (2016) and BBC Radio London (2016). The programs discuss current social and political issues. Twenty-eight podcasts produced during the period of 2014–2016 built the corpus for the acoustic study. The total duration of the SB1–SB6 speech selected from the podcasts was 6 hours (approximately one hour for each of SB1–SB6), including pauses. According to Son (2005), the compression algorithm MP3 (Mpeg-1 layer3) with high bitrate (80–192kbs) brings no losses for pitch and vowel and sonorant formants and less than 6% losses for consonants. Therefore, such compressed speech can indeed be used for acoustic analyses in Praat. In our files, the bitrate was 128kbs.

STIMULI AND MEASUREMENTS

For this study, the intervocalic position was chosen since consonants tend to occur in this position more often in the speech flow (see Picket et al., 1995). From SB1–SB6 speech, 1200 intervocalic /t/-tokens were segmented with the previous and the following vowels by continuous sampling method. Segmentation was performed with audiovisual control of the waveform and dynamic spectrogram using standard principles. We set all the boundaries at the nearest zero crossings and split the transitional phases equally. We set the left boundaries of our stop token at the beginning of their occlusion phase. In case of aspiration and/or high-frequency friction present, we put the aspirated/affricated consonant right boundary at the end of the fricative phase. The boundary in VC was set at zero after the last clear period of the vowel, and the boundary in CV was set at zero before the first clear period of the vowel. We aimed at analyzing 200 tokens per speaker – 100 medial and 100 final ones – and managed not to fall short of that target. A total of 600 word-medial and 600 word-final tokens were taken for analysis. As far as the tokens were selected from the environment potentially encouraging tapping/flapping, medial tokens were chosen only if followed by unstressed vowels (V). The ones followed by stressed vowels (ˈV) were ignored as potentially untappable/unflappable. Word-final tokens were chosen not depending on lexical stress pattern as far as both unstressed and stressed word-initial vowels encourage tapping/flapping. However, it turned out that most final tokens occurred before V and only some of them – before ˈV.

The acoustic study was performed using Praat version 5.4.15 speech analysis software package (Boersma & Weenink, 2014) and was based on spectrographic representations (waveforms, dynamic spectrograms, fundamental frequency (F0) and intensity graphs) of the tokens of interest. Following (S. V. Androsova & Karavaeva, 2015; Docherty, 2007; Fischer & Hirch, 1976; Milroy et al., 1999; Horna, 1998; Port, 1977; Warner, 2005; Warner & Tucker, 2007; Pándi, 2014; Zue & Laferriere, 1979), the /t/-tokens were classified according to the following acoustic parameters:

(1) canonical:
a) plain canonical: silent stop gap + release (impulse + friction/aspiration);
b) two-peak canonical: pre-aspiration/pre-affrication + silent stop gap + release (impulse + friction/aspiration);

(2) VSSACs with two kinds of acoustic evidence of a single instantaneous alveolar contact:
a) taps: voicing without any interruption during the token interval, no friction/aspiration, stop-gap varying from super-short to rather long + super-short impulse or no impulse;
b) flaps: voicing without any interruption during the token interval, no stop-gap, no release burst, formant-like energies within the token;

(3) weak voiceless: silent stop-gap, F0 onset time short-lag, weak release (no intensified glottal and/or fore-lingual friction);

(4) voiced: stop gap, /d/-like release, no friction, F0 presence at all consonant phases;

(5) fricative sibilants: variable F0, no stop-gap, no impulse, friction noise like the one for /s, z, ʃ, ʒ/: a) plain sibilants (without additional friction); b) two-peak sibilants (with additional friction at the vowel-stop transition phase);

(6) glottal bust (= glottal stop followed by laringalized, in other words, creaky voice): silent stop gap followed by short impulse (or several impulses).

All quantitative data were dealt with by means of appropriate statistical procedures. Statistical analysis was made using GNU PSPP version 0.8.5 (2016) and R version 3.2.2 (2015).

RESULTS

WORD-INTERNAL VS WORD-FINAL INTERVOCALIC PATTERNS

Basically, three patterns common for the majority of SB1–SB6 were found word-internally: canonical, VSSACs and fricative sibilants (except for SB6). These allophones and substitutes differed in frequency rate. Canonical allophones appeared most frequently in SB1–SB6 speech, with the range of 40–81% of all intervocalic /t/-tokens. VSSACs had rank 2 in SB1, SB2, SB4, and SB5, with the range varying between 12 and 31%. In SB3 and SB6, they were ranked 3. Sibilants were the 3d frequent ones in SB1, SB4 and SB5 with 6–17% and the 2nd frequent in SB2, SB3 with 27–35%. None of those were found in SB6. Weak voicelessness was very rare, occurring only in SB3–SB5. Although glottal bursts were uncommon for most subjects, they were ranked 2 in SB6, accounting for over 1/3 of all patterns. Elision was rare but common, occurring in all subjects except for SB3. Voiced allophones were found only once in SB3 and SB5; therefore, they were excluded from the list of common patterns.

Six patterns common for the majority of SB1–SB6 were found word-finally. Three of them – canonical, VSSACs and fricative sibilants – were similar to the ones that occurred word-internally, with the second overtaking the first and the third being less frequent word-finally. The other two – glottal burst and elision – were not common word-medially (except for glottal burst for SB6); weak voiceless allophones were more common word-finally than word-medially,

although they were rare in both word positions. Unlike word-medially, in five of the six subjects, VSSACs were ranked 1. Glottal bursts turned out to be common compared to word-internal positions: with rank 2 for SB1 and SB4, rank 3 for SB2 and SB5, rank 4 for SB5, and rank 1 for SB6. Elision was common but rare. Voiced allophones were found only once in SB3 and four times in SB5; therefore, they were excluded from the list of common patterns. However, it must be mentioned that for SB5, it occurred a little more often (4) compared to weak voiceless (3), sibilants (2), and elision (2).

The findings concerning within-speaker and across-speaker variation prove the hypothesis of the growing instability of Standard British pronunciation. Our results demonstrate a wider intervocalic /t/-pattern-range than previously reported. It should be noted that in American English, intervocalic context, both word-medially and word-finally, strongly favored VSSACs that accounted for the average of 90% of all tokens [Androsova, Karavaeva 2015], thus, showing much greater stability at this part of the phonological system compared to British.

We used Pearson correlation to find out if there is any statistically significant speaker-dependent variation in the pattern ranks in SB1–SB6. The results demonstrate (i) close correlation word-internally among SB1, SB2, SB4, and SB5 ($p<0,05$), and statistically significant lower correlation of them with SB3 and SB6, (ii) close correlation word-finally among SB1, SB2, SB4, SB5, SB6, and statistically significant lower correlation of them with SB3. Thus, the subjects were more unanimous in word-final patterns rather than in word-internal ones.

We used Spearman's rank correlation to find out whether there is any statistically significant word-boundary-dependent variation concerning the pattern range for intervocalic /t/. The results (see table 1) do not show close correlation of ranks for five of the six speakers (R 0,40–0,57), except SB3 showing high correlation (R=0,74).

TABLE 1. Pattern ranks for intervocalic /t/ for SB1-SB6

Pattern	SB1		SB2		SB3		SB4		SB5		SB6	
	w-i	w-f	w-i	w-f	w-i	w-f	w-i	w-f	w-i	w-f	w-i	w-f
canonical	1	3	1	2	1	3	1	3	1	2	1	3
glottal stop	4	2	4	3	5	4	5	2	5	3	2	1
tap/flap	2	1	3	1	3	1	2	1	2	1	3	2
voiced	--	--	--	--	6	6	--	--	7	4	--	--
weak voiceless	4	5	--	--	4	4	4	4	4	5	--	--
fricative	3	4	2	4	2	2	3	4	3	6	--	--
elision	4	6	4	5	--	--	5	4	5	6	4	4
n	6		5		6		6		7		4	
R	**0,57**		**0,45**		**0,74**		**0,54**		**0,54**		**0,40**	

Note to Table 1: Correlation of pattern ranks for intervocalic /t/ for SB1-SB6 word-internally (w-i) and word-finally (w-f). Viewed patterns: 6 for SB1 and SB4 (no occurrences of voiced allophones), 5 for SB2 (no voiced and weak voiceless allophones), 6 for SB3 (no elision), 7 for SB5, and 4 for SB6 (no voiced, weak voiceless, elision). Designed by authors.

The data enable the state of statistically significant speaker-dependent variation that is better expressed world-medially (four subjects vs two subjects) than word-finally (five subjects vs one subject). For five out of six subjects, word-position difference turned out statistically

significant for pattern ranking. These data prove the hypotheses about speaker-dependent and word-position-dependent variation of intervocalic /t/-patterns (the latter, however, bigger than the former) in contemporary British English.

TWO-PEAK CANONICAL ALLOPHONES

The acoustic features of canonical allophones are well-known; therefore, there is no necessity to describe them here. Interestingly enough, some of those allophones demonstrated the signs of what might be called ambisyllabicity. Phonologically, it is connected with syllabification and can be applied both to intervocalic single consonants and clusters (including vowel clusters) (Anderson & Jones, 1974; Hogg & McCully, 1987; Trager & Bloch, 1941). For the purposes of our study, we will concentrate on the former ones. Single intervocalic consonants can be viewed as being simultaneously codas for the previous syllables and onsets for the following ones. Double-spelled consonants are perfect candidates for being ambisyllabic (Kurath, 1964).

Phonetic cues for ambisyllabicity are not well-defined in the literature. Kahn (1976) just mentioned that in words like *happy, hobby, hammer, and money*, the medial consonant is phonetically ambisyllabic, giving no phonetic cues for ambisyllabicity: it would seem reasonable to maintain those words bisyllabic, though there is no well-defined syllable boundary, in other words, it is difficult to say where one syllable ends and the other begins due to uncertainty about arbitrary syllabification conventions in these cases. Kahn (1976) admits that according to the term sonority, there must be one peak of sonority in each syllable, but there appears to be a sonority trough at the [p] in *happy*, [b] in *hobby*, [m] in *hammer* and [n] in *money*.

The idea of ambisyllabicity is not supported by all linguists. Thus, Selkirk (1982) insisted that the syllable boundary cannot be set both before and after the segment. Later, Jensen (1993) stressed that it is by no means clear that there is evidence for ambisyllabicity that is strictly phonetic. Jensen also pointed to serious contradictions in viewing geminates as a case for ambisyllabicity because geminates are the result of consonant strengthening, while ambisyllabicity is the result of consonant weakening.

We do not aim to speculate on syllabification principles. However, it seems logical to consider that the segment holding two burdens – being both coda and onset – should demonstrate signs of strengthening rather than weakening. The examples we have found in our acoustic study should rather be interpreted as strong than weak. Dynamic spectrograms show impulse noise (first peak) before the occlusion phase, followed by another impulse combined with friction (second peak). It looks like a double-burst with the stop gap (intensity drop on the graph) inside (see Fig. 1). As far as we would like to avoid addressing syllabification, we will refer to such consonants as two-peak ones.

Two-peak intervocalic allophones occurred both word-internally and word-finally. Word-internally, one-peak canonical allophones prevailed over two-peak ones for four out of six subjects (SB1: 52% vs 48%, SB3: 73% vs 27%, SB4: 63% vs 37%, SB5: 67% vs 33%), although for SB1 the prevalence was small. For SB2 and SB6, two-peak canonical allophones prevailed over one-peaks, although the prevalence was small for SB6. Finally, one-peak canonical allophones prevailed over two-peak ones for three out of six subjects (SB1: 71% vs 29%, SB2: 58% vs 42%, SB5: 64% vs 36%) with a larger difference for SB1 and SB5. In SB3–4 and SB6, the number of two-peak canonical allophones exceeded one-peak ones (with, however, only one vs. four occurrences for SB6, meaning that word-final canonical allophones were rare for this speaker). No word-initial or word-internal pre-stressed canonical /t/ demonstrated that feature. This kind of manifestation has not been reported before.

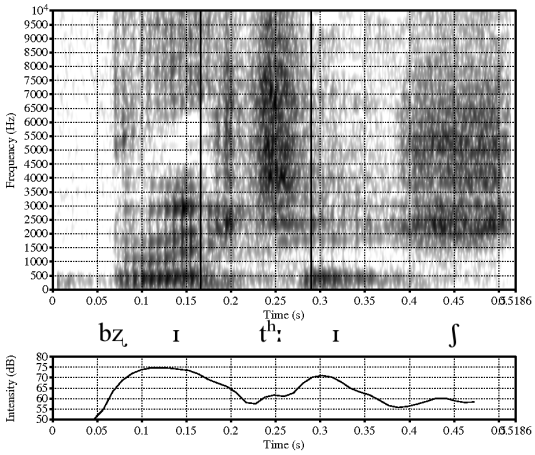

FIGURE 1. Two-peak word-internal plosive allophone [tʰː] of /t/ in British. Designed by authors

TAPS AND FLAPS

Acoustic picture and frequency of occurrence. As expected, there were two kinds of acoustic pictures of VSSACs that might refer to taps and flaps. Typical taps were characterized by variable but mostly super short stop-gap and impulse phase while typical flaps demonstrated F-structure characteristic for an approximant with no evidence of occlusion and impulse (cmp. fig. 2 and fig. 3 word-medially; similar acoustic patterns were found word-finally). Both taps and flaps had continuous voicing.

Taps and flaps appeared both for -t- and -tt- word-medially. Among word-final intervocalic VSCASs spelled as -t-, both taps and flaps were found. Word-internal tapping and flapping were not much dependent on the number of syllables in a word. Among those words, there were disyllabic (*beating, better, bottom, Betty's, British, city, eighty, forty*, etc.), three-syllabic (*monitor, poverty, Saturday, citizen, united, whatever*), four-syllabic (*competitive, Katerina, operating, political, security, societies*) with various parts of speech involved. Word-final tapping and flapping occurred both in functional and notional words. Among functional words, being mostly monosyllabic by nature, there were conjunctions, prepositions, pronouns (*what, it, that, but, out, at, about*) and the negative adverb *not*. Notional words were also involved in the process, most of them being monosyllabic (*bit, lot, part, great, set, thought, might*, etc.).

Word-internal taps and flaps occurred in different tokens with different frequencies. In one and the same word, both taps and flaps could occur: *British* (SB1, SB2, SB4), *getting* (SB2, SB3), *pretty* (SB2, SB5). The same was true for two-word groups: in one and the same group both taps and flaps occurred: *but it* (SB1), *out of* (SB1), *it is/isn't* (SB1, SB6), *that is* (SB1, SB2), *but I* (SB2, SB3, SB5), *got a* (SB2), *got involved* (SB2), *what is* (SB2, SB4), *what about* (SB2), *get it* (SB3), *that I* (SB6) etc.

For SB1 and SB3–SB5, word-internal taps had a higher frequency of occurrence than flaps (SB1: 64% vs 36%, SB3: 78% vs 22%, SB4: 83% vs 17%, SB5: 85% vs 15%); for SB2, word-internal taps and flaps were distributed almost equally (54% vs 46%). For SB6, VSCASs were rare, with seven taps and only one flap. Word-final taps had a higher frequency of occurrence for all subjects, with bigger contrast for SB1, SB3, SB4, SB6 compared to SB2 and SB5 (SB1: 77% vs 23%, SB2: 63% vs 37%, SB3: 87% vs 13%, SB4: 80% vs 20%, SB5: 56% vs 44%, SB6: 92% vs 8%).

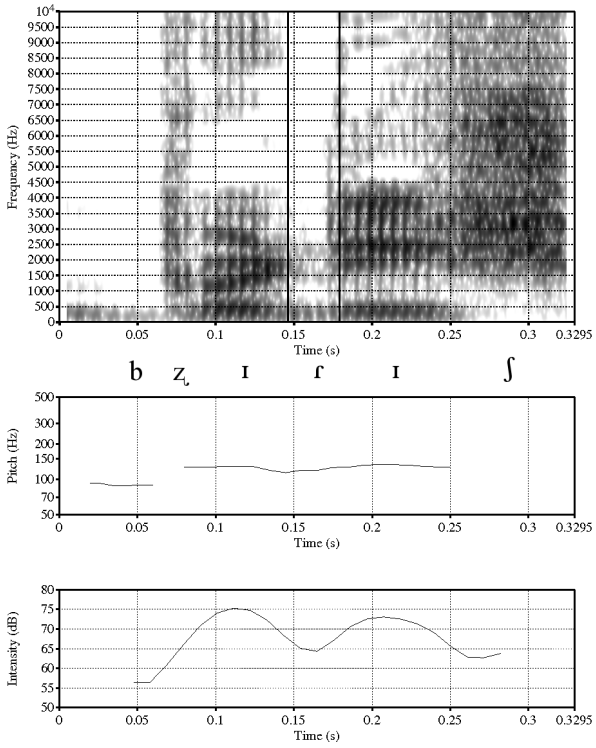

FIGURE 2. Word-internal tap in *Bri**t**ish.* Designed by authors

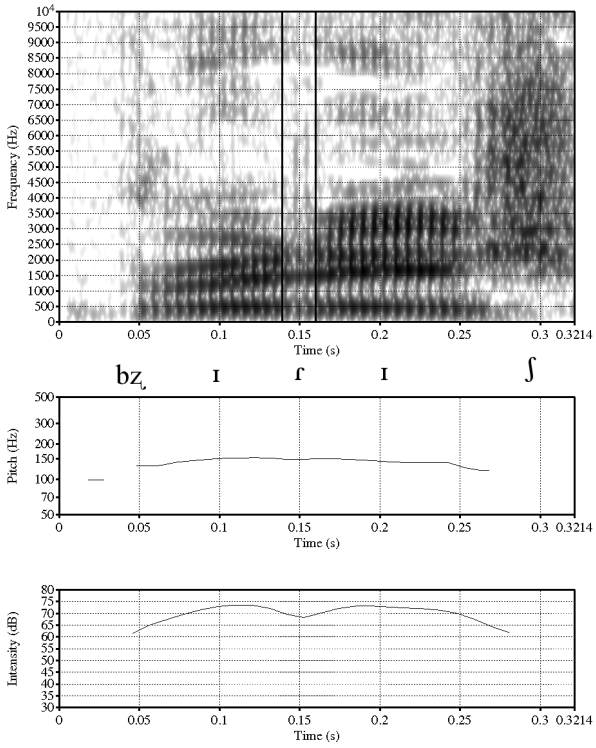

FIGURE 3. Word-internal flap in *Bri**t**ish.* Designed by authors

Duration. Welch's sample t-test was performed to compare the duration of word-internal and word-final intervocalic taps and flaps for SB1–SB6. As far as there were only a few occurrences of word-internal flaps and taps for SB6 – the allophone was not characteristic for that particular speaker word internally – those data were not considered. The test demonstrated a statistically significant ($p<0,05$) duration difference between flaps and taps both word-medially and word-finally for SB1, SB2, and SB5 (although for SB5 word-internal $p = 0.05$), and no significant difference for SB3 and SB4; word-final flaps and taps showed no statistically significant duration difference in SB6. These data prove considerable speaker-dependent variation as far as flap and tap duration is concerned.

FRICATIVE SIBILANTS

Another previously undocumented pattern of intervocalic /t/ is a fricative sibilant substitute. Fricative sibilants (FS) are the result of spirantization that was considered by Milroy et al. (1999) as a part of pre-aspirated pre-pausal patterns of /t/ but not intervocalic ones. Typical examples of word-internal FSs can be seen in Fig. 4–5. The location of the friction on the spectrogram varied, demonstrating similarity either with [s] (fig. 4) or [z] (weaker friction and F0 presence on the pitch graph) with higher peaks of friction 3000–3500 Hz or with [ʃ] (fig. 5) or [ʒ] (weaker friction and F0 presence on the pitch graph) with lower peaks of friction from 2000 Hz compared to [s], [z]. In our material, word-medial FSs occurred in notional 2–5 syllable words. Some FSs demonstrated two peaks in their noise structure like the one in Fig. 4 (see intensity drop within the sibilant) – a feature not reported in the literature before. Intervocalic FSs occurred world-finally in both notional and functional 1–3-syllable words. Some of them, like a number of word-internal ones, demonstrated two peaks in noise structure.

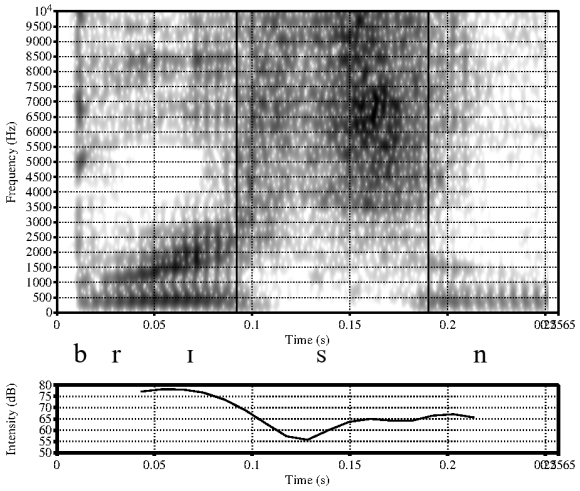

FIGURE 4. Fricative [s]-like a two-peak substitute for intervocalic /t/ in *Britain.* Designed by authors

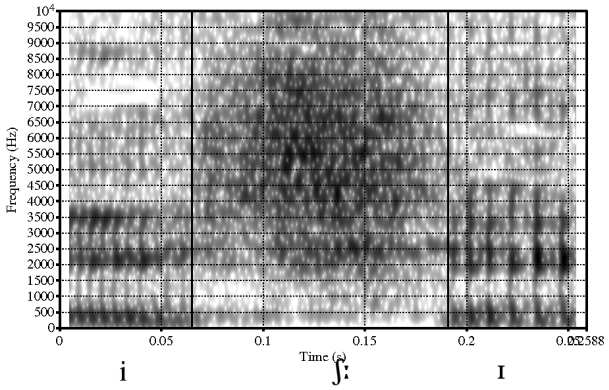

FIGURE 5. Fricative [ʃ]-like substitute for intervocalic /t/ from *ha**t**ing*. Designed by authors

WORD-FINAL AND WORD-INTERNAL GLOTTAL STOPS

Following Milroy et al. (1999), Ashby and Przedlacka (2014), we strictly separate glottalized variants of /t/ (with the alveolar articulation reinforced by a glottal articulation) from glottal ones (with the alveolar articulation replaced by a glottal stop accompanied by laryngealized/creaky phonation). We also differentiate between glottal stop and glottal burst. The first presents just a stop gap that substitutes /t/ if followed by a stop or fricative of other than fore lingual articulator (*a**t** first, tha**t** call*, etc.), while the second presents a stop-gap and laryngeal gesture if followed by a vowel or a sonorant. In our material, only glottal bursts occurred.

Intervocalic word-final glottal bursts consistently occurred in all six subjects. This fact indicates that supra-local change has occurred since the results reported by Milroy et al. (1999) when the change was robust and when intervocalic glottal stop was characteristic mostly of young middle-class women. At the same time, word-final glottal bursts demonstrate speaker-dependent rank variation, being rare for SB2 and SB3 and much more frequent for the other four subjects. There were very few occasions of word-internal glottal bursts for SB3 and SB5. For SB6, however, they turned out to be the second most frequently used pattern. This across-speaker variation is very likely to be the result of the different regional accents the subjects speak.

Acoustically, intervocalic glottal bursts were characterized by an occlusion of variable duration followed by a burst (short impulse noise) before the next vowel. At times, there could be several glottal bursts that formed so-called creaky voices.

Comparing this finding with the previous results on American and British English (S. V. Androsova & Karavaeva, 2015), it is clear that the British subjects used glottal burst for intervocalic word-final /t/ much more often than the American subjects who strongly favored taps and flaps, and for who the use of intervocalic word-final glottal burst was rather an exception.

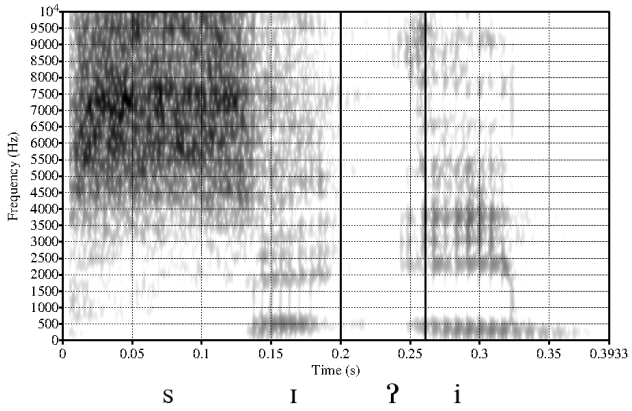

FIGURE 6. Glottal burst in *the city*. Designed by authors

WEAK VOICELESS AND VOICED

All weak voiceless tokens were characterized by a bigger duration than that of taps and flaps and a larger intensity drop than that of taps and flaps. Unlike taps and flaps that were always accompanied by F0, weak voiceless tokens had no F0 whatsoever. After the impulse, there was a little friction that, however, was not enough to characterize the tokens as fortis.

The voiced pattern differed from the weak voiceless one only by F0 presence at both phases of the consonant – occlusion and bust. The pattern is characterized by no or little friction – a typical acoustic picture for d-tokens that do not undergo tapping or flapping and are located before central and back vowels, which is a condition that considerably weakens or cancels friction characteristic for /d/ in certain positions.

We might suppose that using intervocalic weak voiceless and voiced patterns before an unstressed vowel could have been the intermediate stage of the lenision process that quickly developed further to tapping and flapping that displaced weak voiceless and voiced allophones under the simultaneous pressure from a number of dialects of British English and American English.

CONCLUSION AND OUTLOOK

To sum up, first, the present study enhances our understanding of the tendencies of phonological variation and the change that the British standard pronunciation is still undergoing. Second, our innovative findings, through demonstrating the variation of word-medial and word-final intervocalic /t/-patterns, provide an important insight into lexical phonology with a focus on the distinction between lexical and post-lexical rules. It showed not only the variation of allophonic word pattern but phoneme word pattern variation word-medially and across boundaries.

It was demonstrated that the classical phonological statement "one position – one allophone" does not work for British intervocalic /t/. Three basic patterns – types of allophones (with subtypes) and substitutes – were found word-medially (canonical, VSSACs, fricative sibilants) and six – word-finally (canonical, VSSACs, fricative sibilants, glottal bursts, weak voiceless, and elision). Some canonical /t/-allophones and fricative sibilant substitutes demonstrated two peaks of noise in their acoustic picture, both word-medially and word-finally.

These patterns may, in a certain way, be associated with speech rhythm (see Shevchenko & Sokoreva, 2016).

There was a certain statistically significant speaker-dependent variation in both the word-internal and word-final spectrum of allophones and substitutes for canonical /t/ and in the frequency of their occurrence. Word-boundary effect was statistically significant for five of the six subjects and was particularly strong for SB2 and SB6. The correlation of word-internal and word-final allophone-and-substitute ranks was considerably lower than that between the subjects. This indicates a greater magnitude of the word-boundary effect than the speaker-dependent effect on the degree of intervocalic /t/ variation. It provides a peculiar insight into the linguistic effect of homogenization as a result of a more widespread contact between speakers of different varieties, pointed out by Foulkes and Docherty (2007), particularly in word-final VSSACs and glottal bursts. Word-final intervocalic glottal stops do not closely correlate either with female gender or young age anymore. They might have become or at least will soon become supra-local, supra-gender and supra-age. However, medial intervocalic glottal stops seem to still remain a stigmatized feature.

These findings concerning three word-medial and six word-final realization patterns for intervocalic /t/ in British English vs one (VSSACs) in American English show high degree of free variation of the former that, in its turn, is an indication of predicted greater instability of British Standard pronunciation compared to American Standard pronunciation in terms of intervocalic /t/.

Finally, we found that the simultaneous use of the terms "tap" and "flap" is not just due to the popularization of the phenomenon in recent American discussion. The existence of both taps and flaps in British English was proven, both of them having continuous voicing, with the first being acoustically closer to stops having variable duration gap and impulse phase, and the second – closer to approximants demonstrating F-structure, with no evidence of occlusion and burst. Unlike in American English, where approximant-like tokens amounted to 56% of all VSSAC (Warner, 2005; Warner & Tucker, 2007), in our material, they accounted for much less per cent, being significantly speaker-dependent. In British English, VSSACs can be evidence of neutralized distinctions between /t/ and /d/ between vowels, as is the case in American English.

As expected, the use of VSSACs generally did not depend on whether the word was notional or functional and on the number of syllables in a word as far as both notional and functional words, mono- and multisyllabic words were involved. This finding contradicts the one obtained earlier by Foulkes and Docherty (2007) about [ɾ] being restricted to a small set of lexical items, mostly in the final position, with very few tokens medially in *better* and *getting*. Besides, in our material, tap and flap could occur in one and the same word or a two-word group within one speaker – the brightest example demonstrating free variation.

There are some questions that have to be addressed further in terms of our findings. First, how will native British listeners react to those allophones and substitutes while performing a discrimination task in a limited context? Could any of those patterns be programmed for automatic British text transcription as offered by (S. Androsova & Androsov, 2016) for taps and some glottalized allophones in American English automatic text transcription? Second, what implications does such high variation have for English-as-L2 learners in developing listening skills? Flap-production ability was found to correlate positively with the effectiveness of its perception (Areej, 2019). It means that teaching to pronounce non-canonical allophones, including taps/flaps, should definitely become a part of an English teacher's armoury. The question still remains whether learners will need special training to perceive these variations to understand the flow of British-English speech more effectively or whether they will do it effectively enough without it.

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