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Developmental sociolinguistics and the acquisition of T-glottalling by immigrant teenagers in London*

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This study examines the acquisition of T-glottalling among teenage migrants in London. Results show that constraint hierarchies based on native input begin to be approached after two years in England. Initially, variation is completely reallocated; however, as teenagers spend more time in England, constraints are becoming increasingly similar to those of native speakers. While some constraints are replicated completely, there is also evidence that, even after three years in the country, some are altered, some are rejected, and some are re-interpreted, resulting in new constraints. Three tentative generalisations are made, relating to the order of constraint acquisition, constraint complexity and the role of grammatical category and word frequency as interpretative frameworks. In addition, the progression of constraint acquisition interacts with the increasing use of (t) as a stylistic resource, which allows teenagers to express identities based on the variation in (t) and other linguistic features. While style (as in attention paid to speech) does not appear until after three years in England in this study, qualitative analysis of interview data reveals that (t) is already available for stylistic work and experimentation after two years in England.

KEYWORDS: immigration, London, T-glottalling, teenagers, acquisition of variation

1. Introduction

This study contributes to the rapidly growing research strand of the acquisition of sociolinguistic competence by second language learners (Wolfram 1985; Young 1991; Adamson and Regan 1991; Bayley 1994; Mougeon, Rehner and Nadasdi 2004; Dewaele 2004; Major 2001; Howard, Lemée and Reagan 2006; Blondeau and Nagy 2008; Schleef, Meyerhoff and Clark 2011; Schleef 2013b). While these studies have shown that native variation is rarely replicated exactly, the patterns of variation used in the interlanguage of L2 learners do approximate those of native speakers.

However, the majority of sociolinguistic studies tend to be ‘product-oriented’ and compare non-native speakers (NNSs) with native speakers (NSs) at a single point in time (with some notable exceptions, such as Young 1991 and Regan 1996). Previous research has not made it entirely clear when patterns of variation are acquired, when informal variants start to be used as stylistic resources by NNSs, and how the acquisition process progresses. Thus, it is

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desirable to focus on the acquisition of variation as a process with distinct stages. Conceptualising—and, most importantly—investigating the acquisition of variation as a process will not only shed light on theoretical concerns within sociolinguistics and language acquisition, but it will also address general questions for theories of language evolution and contact, as the systematic study of internal variability between individuals within a bilingual community, as well as the quantitative study of developing linguistic constraints, can illuminate the linguistic nature of language contact outcomes (Sankoff 2002).

This article addresses these issues by conducting a *developmental* analysis of the acquisition of glottal replacement for (t) among immigrant adolescents in London (i.e. the alternation between alveolar and glottal stops in medial and final position, e.g. *water* /wɔ:tə/, /wɔ:ʔə/ and *what* /wɒt/, /wɒʔ/).¹ T-glottalling is restricted to a specific environment. Its occurrence depends most strongly on stress patterns and segmental context. In London English, it can occur after a preceding sonorant in coda or in non-foot-initial onset position (Tollfree 1999: 171); the latter referring to cases where ‘the stress on the syllable following /t/ is less than that borne by the preceding syllable’ (Tollfree 1999: 172), for example, in *better* and *guilty*, but not in *cartoon*. Where these conditions are met, glottal replacement of (t) may occur variably, depending on a set of internal and external constraints. I shall focus exclusively on glottal replacement of (t), also known as T-glottalling (Wells 1982: 261), i.e. realisations that have an acoustically robust glottal quality, whether this is a glottal stop or a period of creaky voice.² Thus, in the spirit of most existing sociolinguistic research on T-glottalling, the current study aims to account for the patterns of variation between (t)-realisations that have an impressionistically perceptible linguo-alveolar acoustic quality,³ and the continuum of realisations that have an acoustically robust glottal quality.

This study aims to find out whether (1) native constraint hierarchies are acquired by NNSs and, if so, when, (2) how the acquisition process of glottal replacement progresses once it has been acquired, and (3) at what point NNSs are able to use glottal replacement of (t), a variant with links to youth language (Milroy 2007; Milroy and Gordon 2003; Williams and Kerswill 1999), as a stylistic resource? In this article, I use a very wide notion of style and generally describe it as ‘variation in the speech of individual speakers’ (Schilling-Estes 2002: 375). Various approaches in the study of style have evolved in the last few decades, most notably Labov’s concept of style as attention paid to speech (Labov 1972), Bell’s audience design (2001) and style as speaker design (Schilling-Estes 2002). Considering the type of data used in this study, the current article will particularly draw on two approaches: style as attention paid to speech in a quantitative section and speaker design in a qualitative section. Briefly, the former views styles as ordered along a single dimension, measured by the amount of attention paid to speech, while the latter considers speech style to be a reflection of identity construction (see Schilling-Estes 2002 for a thorough review of the advantages and disadvantages of the various approaches).

The article begins with some background information on previous approaches to the acquisition of variation, with a particular focus on second language speakers. I set the sociolinguistic scene in which the study was conducted and outline some of the basic principles of developmental sociolinguistics. A quantitative analysis of the (t) variable is then presented. First the native sociolinguistic constraints on variation of (t) are presented. These are then compared to the sociolinguistic constraints of non-native teenagers living in London. Finally, the data are scrutinised using qualitative methods to explore the acquisition of style in more detail.

The results of this study raise several questions about the order of constraint acquisition, constraint complexity and the roles of style, grammatical category and lexical frequency. It seems that constraints are acquired one-by-one, and that some are more readily acquired than

others. Furthermore, I observe that (t) becomes available as a stylistic resource for NNSs after about two years in England.

2. Immigrant teenagers and the acquisition of variation

Research on the acquisition of linguistic variation is a relatively new, yet fast-growing, area of variationist research, with high interdisciplinary and theoretical impact potential beyond the area of sociolinguistics. It falls into various strands:

1. The acquisition of L1 variation by native children (e.g. Roberts 1994; Smith, Durham and Fortune 2007)
2. The acquisition of sociolinguistic variation by second generation native speakers in minority speech communities. These speakers have been shown to replicate local constraints (e.g. Walker and Hoffmann 2010) or show differential acquisition (e.g. Horvath and Sankoff 1987; Mougeon and Nadasdi 1998; Sharma 2005; Sharma and Sankaran 2011; Queen 2006)
3. The acquisition of L2 variation by NNSs in instructed and study-abroad environments (e.g. Regan 1996; Mougeon et al. 2004; Dewaele 2004; Howard et al. 2006; Blondeau and Nagy 2008).
4. The acquisition of L2 variation by NNSs in immigrant contexts (e.g. Wolfram 1985; Young 1991; Adamson and Regan 1991; Bayley 1994; Major 2001; Sharma 2005; Sharma and Sankaran 2011; Schlee et al. 2011).

Strands (3) and (4) investigate so-called interlanguage. Many studies (e.g. Dickerson 1975; Wolfram 1985; Young 1990; Bayley 1994; Mougeon et al. 2004; Blondeau and Nagy 2008; Schlee et al. 2011) employ data collection techniques and methods of analysis typical of variationist sociolinguistics, such as the sociolinguistic interview and multivariate analysis. All of these studies suggest that variation in interlanguage is not random but is highly systematic and constrained by a range of linguistic and social factors.

This article falls into the fourth research strand; in particular, it focuses on the acquisition of vernacular variation among Polish-born *adolescent* learners in London. These learners moved to England with at least one of their parents after May 2004 when Poland became a member of the European Union. This resulted in significant Polish immigration to the UK. Through immersion in the school system, the Polish teenagers have particularly intense contact with native-born peers, and, as a result, they have considerable opportunities to acquire local norms of variation.

These teenagers have moved to the UK often with little previous exposure to English, sometimes forming quite dense friendship networks among other migrants in their school. In this respect, this study is similar to other research on migrants learning an L2 in natural surroundings, i.e. strand (4). However, in contrast to the subjects in some of those studies, teenagers in the current research benefit from a certain amount of overt attention in the school focused on their successful acquisition of fluency in English (e.g. in remedial and regular English classes). This makes them similar to informants in research strand 3 also. Moreover, some end up with friendship networks that consist of more native speakers than migrants. This accelerates the acquisition process and renders it different from that of adult migrants.

3. The if, when and how of L2 acquisition of variation

3.1 *The if and the when*

The ability to produce patterns of sociolinguistic variation found in the target language community is part of native-like competence and has to be acquired, if such competence is desired. One important question in this acquisition process is whether variation is acquired at all, and if so, when? Studies conducted in research strand (3) often find that the acquisition of vernacular variants is quite limited (e.g. Mougeon et al. 2004 in respect to immersion students); however, extended contact with native speakers, during which the L2 is used actively, leads to an increased use of informal variants, especially those that are only mildly marked (e.g. Dewaele 2004: 444f).⁴ Thus, immigrant contexts, especially when adolescents are involved, should promote the use of such variants. This is because learners become aware of variation relatively fast when learning an L2 in natural surroundings and when being integrated into a school environment.

There will be an initial period after arriving in the host country when variation is not immediately acquired, as it takes NNSs a certain amount of time to determine that it exists in a particular locale, what that variation means and how it is constrained. Speculations have been advanced in terms of the length of this period and when speakers start to acquire local variation. Length of residence in the new environment (and, hence, exposure to local variation) seems to be the most promising indicative factor. Drummond (2011: 296) suggests that the likelihood of glottal replacement increases after his adult Polish learners in Manchester have spent two years in England. The current study will provide more evidence for a very clear two-year cut-off.⁵

3.2 *The how: social and linguistic factors*

A variety of factors have been shown to influence the acquisition of variation, and they are reviewed here briefly, as some of these will help explain the findings of this study. One such factor is the type of variable and its constraint complexity. Complexity has been identified as an important factor in the L2 acquisition of variation (see Ender 2011 for a review), and one would expect variables with less complex social and linguistic constraints to be acquired first. For example, Meyerhoff and Schlee (2013) found that Polish-born teenagers in Edinburgh are acquiring variation in (ing), (t) and quotative *like* at different rates. The acquisition process seems to be dependent on the character of the variable and the complexity of constraints on the variable. In particular variables with complex syntax-discourse interface, such as quotative *like*, seem to be beyond NNSs' ability at earlier stages of acquisition, while variables that are mostly phonologically constrained, such as word-final (t), are acquired much faster. However, as will be shown below, this is not the case for word-medial (t).

A further very important factor influencing the acquisition of variation must certainly be language proficiency, which, in immigrant contexts, is to a very large extent influenced by contact with native speakers of L1 and L2, i.e. social networks (e.g. Flege, Frieda and Nozawa 1997). Contact with native speakers may determine to a large extent if and when variation is acquired (e.g. Mougeon and Nadasdi 1998, Mougeon et al. 2004). Positive attitudes towards the locale and the local variety or alignment with the host culture also seem to play a positive role in the acquisition of variation (Sharma 2005; Drummond 2011; Schlee et al. 2011).

The authors in Regan and Ní Chasaide (2010) tackle the thorny issue of identity construction by multilingual speakers. Such constructions often interact with other factors that may influence the acquisition of variation. These include age, length of exposure to L2, L1

background, age at arrival in a new L2 context, amount of L1/L2 use, motivation, aptitude and proficiency, formal instruction, social class, gender, etc. Various constructions of identity that may relate to the use of non-standard features are also always possible (see, for example, Fox and Torgersen 2011), and some such identities are discussed in the results section.

Apart from the sociolinguistic factors discussed above, constraint (re-) construction may be attributed to phonological naturalness, L1 transfer, universal constraints and markedness hierarchies (Altenberg and Vago 1983; Eckman 1984), social salience of a variable and similarity of phonological elements in L1 and L2 (Major 2001). However, for lack of space, I shall not consider these aspects in detail here. What happens in the acquisition of variation is, thus, not only interesting to research on language acquisition, but it also leads to a better understanding of the nature of language itself, of which language variation and language contact form an inherent part.

3.3 *The how: product versus process*

In this section, I consider the process of acquisition in more detail. Meyerhoff and Schlee (2012: 409) outline several aspects of variable grammars that have to be acquired. They argue that acquiring variation is extremely challenging for NNSs and that transformations of constraints are, therefore, likely. And indeed, many studies of L2 acquisition of variation show that NNSs often replicate native constraints, but not in exactly the same way as native speakers do (e.g. Adamson and Regan 1991). Mougeon et al. (2004) point out that acquisition of variation differs from variable to variable. They synthesise the results of a large-scale project on the acquisition of several sociolinguistic variables among French immersion students in Canada and found that the NNSs had fully acquired native speaker constraints on five variables under analysis. Two variables showed only one of the native speaker constraints; two variables showed constraints that were particular to the L2 group; and two variables showed none of the native speaker constraints.

While findings concerning these strategies are important, most studies on L2 acquisition of variation are based either on a comparison of native and non-native constraints at one point in time or, rarely, on the comparison of non-native constraints at two points in time, usually before and after an immersion or study abroad experience. For example, Young (1991) documented developmental phases and changes in constraint ordering in the acquisition of English morphology among Chinese learners of English. Regan (1996) provided evidence for changes in constraint ordering in study-abroad contexts of Irish learners of French. Both show changes in constraint ordering based on developmental stages. However, the majority of studies only provide partial answers as to the *progression* of the acquisition of variation. A full answer to this problem clearly requires researchers to compare the acquisition of variation at several points in (real or apparent) time. It also requires the discussion of individual differences in variation, as some speakers eventually acquire variation, while others do not, or do so to a limited extent.

Comparative, sociolinguistic methods can usefully address the former while qualitative methods, such as discourse analysis, are particularly suited to address the latter. While the use of qualitative analysis will be demonstrated below, a few brief notes are appropriate here explaining the comparative variationist approach and how it can shed light on the questions investigated here.

The comparative variationist approach (Poplack and Tagliamonte 1991; Tagliamonte 2002) makes variation itself the focus of statistical comparisons by subjecting data from different groups of speakers to the same multivariate analysis with factor groups and factors within groups being held constant across populations. The resulting weightings are then compared in relation to significant factor groups and the ranking of constraints within them.

This allows us to identify (i) whether the same factor groups are significant constraints for different groups of speakers, and (ii) whether the factors within each group are ordered the same. Meyerhoff (2009) and Buchstaller and D'Arcy (2009) have argued that these are implicationally related.

There are some methodological procedures to follow when comparing different groups of speakers. It is essential that token collapses and exclusions are held constant across groups. This can be difficult as non-variable data should be excluded, while it is important to hold on to variable data, if possible. Resulting factor groups must be organised by effect size using one consistent system. The need to hold exclusions and collapses constant may result in models that are not necessarily the best and most economical for the data in each group, although the best and the best comparative model are rarely considerably different. Applied to the current study, holding the models the same across different groups (as much as possible) allows us to describe the patterns of variation for native speakers, and explore whether (and if so, how much) non-native speakers have picked up and replicated these patterns in their variation. A comparison with native speakers (ideally the NNSs own native peers) is extremely important. When conducting comparative, developmental studies, we should ensure that we have such data available.

3.4 Conclusion

The sociolinguistic variable (t) is ideal to investigate for the current purposes: it occurs very frequently in conversation and, hence, results in a large number of tokens, even from less fluent speakers of English; it is associated with a set of youth norms, which makes it ideal for an investigation of its acquisition by immigrant teenagers; it can be analysed auditorily; and it has been studied in a number of varieties of English. In fact, T-glottalling is spreading rapidly in Britain and is now perceived as stereotypical of British urban speech in general (Milroy et al. 1994: 328; also see Britain (2005: §3 and references therein) for evidence of T-glottalling from all over England).

The question now is if immigrant teenagers also acquire this feature, when does this occur and how does acquisition proceed? Based on the discussion above, several outcomes are possible.

1. When is variation acquired?

H1: The acquisition of T-glottalling is extremely limited and is not influenced by the length of stay in England.

H2: The acquisition of variation is limited at first, but then increases substantially after two years in England.

2. How does the acquisition of variation progress, and when is T-glottalling used as a stylistic resource?

H3: Once variation is acquired, migrant adolescents show the same distribution of constraints as their locally-born peers.

H4: Once variation is acquired, migrant adolescents show variation that reflects the same underlying constraints operating on the variation of their locally-born peers, but the strength of these constraints differs or the strength of individual factors within factor groups differs.

H5: Once variation is acquired, migrant adolescents reinterpret the variation producing patterns of variation radically divergent from their locally-born peers.

H6: Once variation is acquired, migrant adolescents acquire constraints one by one, and their patterns of variation become increasingly similar to those of their native peers.

My results provide evidence for H2 and H5 for the early phase of acquisition, and H6 for later phases; i.e., there is evidence of a system of reallocation, initially diverging from locally-born peers, followed by a stepwise reallocation towards the native target.

4. Methods

4.1 Data collection

This study was conducted in a high school in West London. Students volunteered for the project following a presentation from a research assistant about the general nature of the tasks. They were interviewed in friendship pairs of matched origin in order to facilitate the most casual atmosphere possible given the school-based setting for the interviews (Milroy and Gordon 2003: 66; Schlee and Meyerhoff 2010: 3-5).

The sample consisted of 21 Polish migrants (8 males, 13 females) and 24 London-born teenagers. The results for the native Londoners have already been reported in a cross-varietal study in Schlee (2013a). The Polish teenagers were all aged between 12 and 18, with a mean age of 14. All Polish teenagers have been learning English for at least 1.5 years. The length of time that each adolescent had spent in the UK varied from seven months to 5 years, with an average of 2.5 years. A locally-born female research assistant carried out sociolinguistic interviews, which were transcribed orthographically using ELAN.

While the interview was structured around certain topics (e.g. living in London, school life, hobbies, attitudes towards immigrants, etc.), the conversation was not constrained by these topics, and participants were encouraged to talk freely on other subjects too. Speakers were also recorded performing a short reading task of 17 sentences that had been designed to elicit a wide range of different phonological variables. The reading task always preceded the interview. Combining reading and conversation data provides a measure for comparing differences in speech style, in the Labovian sense of attention paid to speech (Labov 1972).⁶ The conversational data further serves as a basis for exploring style beyond the Labovian concept.

4.2 The dependent variable: (t)

This study focuses on the variable realisation of (t), in particular, the alternation between [t]⁷ and glottal replacement of (t). These are the two main variants that have been coded auditorily.⁸ Each realisation of (t) occurring in the relevant envelope of variation (i.e. (t) after a preceding sonorant in coda or non-foot-initial onset position) was coded independently in ELAN by two paid research assistants. Cases of coding disagreement were discussed with a third researcher and mutually agreed, sometimes after visual inspection of the acoustic properties of particular tokens in PRAAT, an acoustic analysis programme. The coded data were then extracted from ELAN and imported into Excel for further coding, e.g. for word frequency, grammatical category, etc. The same procedure of double, independent coding by two research assistants was followed, disagreements were again resolved with a third party.

The initial coding included minority variants, such as elision \emptyset , flap/tap [ɾ], and voiced released [d]. Tokens that could not be categorised reliably were excluded; e.g. in cases of speaker overlap. Finally, only the first 10 occurrences each of the high frequency function

words *it, at, but, out, that, not* were coded per speaker. This generated 1,855 tokens of (t) from the Polish-born speakers and 2,524 tokens of (t) from the London-born speakers.

The remaining variants were reduced to two variant groups: glottal replacement and ‘other’, the dominant variant of the latter category being released [t]. As is usual in Goldvarb/Rbrul-based research on the variable (t) (cf. e.g. Drummond 2011; Roberts 2006), the glottal replacement variant was contrasted with the combined ‘other’ variants.

4.3 Coding for linguistic and social constraints

The literature on T-glottalling is quite extensive, and it is reviewed here very selectively in order to identify factors that previous research has found to constrain variation of (t) (for a more detailed review, see Straw and Patrick 2007 or Schleeff 2013a).

With respect to linguistic constraints, the majority of studies focus on accounting for the phonetic variability of (t) by considering only a very limited set of phonological factors. Previous studies typically examine (1) the position of (t) within the word (normally finding that glottal replacement occurs more frequently word-finally than word-medially — cf. Roberts 2006); and (2) the phonotactic environment (often finding that *following* segments or prosodic boundaries influence the variability of (t) in statistically consistent ways — see Drummond 2011; Fabricius 2000; Milroy et al. 1994; Straw and Patrick 2007).⁹

The preconsonantal (PreC) environment usually favours glottal variants the most; the prevocalic (PreV) environment tends to disfavour it. Straw and Patrick (2007: 390) refer to this ordering as the diffusion pattern: PreC > prepausal (PreP) > PreV. Findings tend to be constant, but some regional particularities have also been identified (cf. Docherty and Foulkes 1999a; Roberts 2006). Of particular relevance to this study of NNSs are the findings of Drummond (2011) and Straw and Patrick (2007). Drummond (2011) assumes a PreV>PreP pattern of diffusion among his Polish learners in Manchester, and Straw and Patrick (2007) found a PreV > PreC, PreP pattern of T-glottalling among native Anglo speakers in Ipswich while their Barbadian participants displayed a large degree of individual variation.

Schleeff’s (2013a) study of T-glottalling among native adolescents in Edinburgh and London represents a large step forward in identifying factors constraining T-glottalling. He found that constraints differ for word-final and word-medial (t), and that in addition to the linguistic constraints mentioned above, word frequency plays a crucial role in London in that more frequent words favour glottal replacement. Grammatical category is a highly significant constraint for word-medial T-glottalling only, when the glottal variant is contrasted with all other variants. Schleeff’s findings will be summarised in more detail in the results section in order to compare them with the use of glottal replacement among immigrant teenagers.

Several social constraints have been investigated in previous research and are often found to be significant for T-glottalling:

- Style: T-glottalling is normally less frequent in formal style (e.g. Holmes 1997).
- Age: T-glottalling is more frequent among young speakers (e.g. Fabricius 2000; Roberts 2006; Williams and Kerswill 1999).
- Socioeconomic class and gender: generally, there is more glottalling as one goes down the social scale; however, social class often interacts with gender and the pre-established patterns of use of T-glottalling in an area to generate unique, new patterns in different locales (e.g. Holmes 1997; Mees and Collins 1999; Milroy et al. 1994; Roberts 2006).

With the exception of social class, which does not vary sufficiently in this study, all of these factor groups have been included. The independent variables used in this analysis and the factors coded for under each variable are summarised in Table 1.

→Insert Table 1 about here.

For the Polish migrants, I also considered measures of: time spent learning English (months), time spent living in England (months), friendship network (mostly Polish vs mixed) and their self-assessed proficiency (little, good, very good).

5. Quantitative Results: variant frequency and constraints

5.1 Frequency of (t) variants

The data presented in Tables 2 and 3 give an overview of the distribution of all variants of (t) among the locally-born and migrant teenagers recorded in London. The glottal variant is used more frequently by the native-speaker adolescents in London than by the NNSs. While this is reminiscent of research that finds NNSs shying away from non-standard variants (e.g. Mougeon et al. 2004), they do use glottal replacement relatively frequently. I am not concerned with the other variants in this paper; suffice it to say that these are used in somewhat higher numbers by the Poland-born group than the London-born group. The tap, a Cockney, but also an American, feature (Wells 1982: 324), may be a target for the NNSs, other (t) realisations, such as /d/, may be interlanguage phenomena.

→Insert Tables 2 and 3 about here.

While the distribution of variants and their general frequency specific to their community is still being acquired by NNSs, they do seem to have acquired native-like constraints for the position of (t) within a word. That is, they produce many more instances of glottal replacement in word-final position than in word-medial position.

However, frequency counts alone are insufficient evidence for the (non-) acquisition of variation (also see Tagliamonte's 2002 cautionary note concerning the problem of overreliance on rates of occurrence). Constraint rankings of factors provide a much more thorough and reliable diagnostic tool for comparison. I now turn to the detailed analysis of constraints on the (t) variable that emerge from a multivariate analysis of all the independent variables.

As discussed above (see section 3.3), I take a comparative variationist approach to analysing this data (Poplack and Tagliamonte 1991; Tagliamonte 2002). Data from different groups of speakers (here NSs and NNSs at different acquisition stages) are subjected to the same multivariate analysis and resulting weightings are compared in relation to significant factor groups and the ranking of constraints within them. In order for the group models to be comparable, only those factors were considered which are listed in Table 1, at the exclusion of Polish-specific factor groups, such as language proficiency. A second model was then created for each NNS group that included Polish-specific factor groups. If the second model showed any divergence from the original model, this was highlighted under the relevant table in which the model is presented. This is the case in only one instance.

For the dependent variable, the non-standard glottal variant was treated as the application value in a mixed-effect multiple regression using Rbrul, a variable rule programme. The individual speaker was treated as a random effect, which, as Johnson (2009) discusses, is advisable in order to strengthen confidence in the significance of any other factors.

5.2 Stages of acquisition and native constraints

The raw data (see Tables 2 and 3) indicate that position, i.e. where in a word (t) occurs, constrains glottal variation of (t) in a highly consistent way. Glottal replacement is much more likely in word-final position. Separate statistical models have, therefore, been provided for medial and word-final (t). The tables below list Rbrul (Johnson 2009) weights for each factor followed by the number of tokens and the proportion of the application value. The same factor conflation has been made for all speaker groups, and the same token exclusions have been made when data was not variable, as far as this was possible.¹⁰

Since this study examines stages of acquisition of glottal replacement, it was necessary for statistical models to be generated based on one of the three variables associated with developmental aspects of language acquisition. These are (a) time learning English, (b) time living in London, or (c) proficiency. Age of informant was not considered for this subdivision, as age varies only minimally in this group of speakers. Previous research suggests (e.g. Flege, Frieda and Nozawa 1997) that, in immigrant contexts, contact with native speakers of L1 (i.e. social networks) are much stronger predictors of accent acquisition than age.

Paired chi-square tests were conducted with the aim of determining whether any of (a) to (c) have an effect on the degree of T-glottalling. In order to do this, (a) and (b) were converted into categorical variables. Based on 'natural' gaps in the data, a division into three groups seemed most appropriate for both (a) and (b): (Group 1) 0-2 years (0-23 months), (Group 2) 2-3 years (24-35 months) and (Group 3) above 3 years (36 months or more).

Time learning English was excluded from further consideration as a basis for categorisation since not all paired tests were significant at the .01 level. The tests for both time living in England and proficiency were significant at $p < .01$. A decision was made to base further statistical models on length of time spent in London rather than proficiency, in view of the findings of Flege et al. (1997), but also because the majority of students selected the category 'good' to describe their proficiency. Statistical models based on proficiency are, therefore, not possible as an insufficient number of speakers is available in the categories 'little' and 'very good' to generate statistically sound regression models.

These models, based on time spent in London, are compared with the native constraints of London-born adolescents presented in Schlee (2013a). Table 4¹¹ shows the relevant results from this study. The main results are summarised here briefly in order to compare them with the NNSs: readers are referred to Schlee (2013a) for a more detailed discussion of the data. The native constraints for word-final and word-medial T-glottalling are similar but not identical. The constraints for the native speakers are organised as follows:

Word-final:

Following context > preceding context > style — frequency

Word-medial:

Following context > style > grammatical category > preceding context — frequency

In word-final position, the two constraints with the highest effect size are both phonological. Preceding nasals and liquids tend to disfavour glottal replacement; preceding vowels favour its occurrence. By contrast, a following vowel (PreV) disfavors glottal replacement, whereas pauses (PreP) and consonants (PreC) favour it. There is, thus, very clear evidence here for the typical pattern of PreC > PreP > PreV (cf. Fabricius 2000; Straw and Patrick 2007). Glottal replacement is also more likely to occur in conversational style and there is an effect of lexical frequency. More frequent words favour glottal replacement.

In word-final position, the grammatical category of the word is not a significant constraint for the London-born speakers when glottal variants are contrasted with all other variants. This is common practice in previous work on T-glottalling in English (e.g. Fabricius 2000; Roberts 2006; Drummond 2011). In the current analysis, I have contrasted glottal replacement with other variants that include an oral stop, but also an elided stop. However, one could assume that [ʔ] is a step in a debuccalisation process that can continue to omission/deletion. If this is the case, then elided forms should *not* be included with the variants that have some form of oral closure. In a separate analysis, which excluded the elided forms from the analysis, grammatical category *does* emerge as a significant constraint on (t) for the London-born adolescents. I have indicated this alternate analysis by placing the weightings for grammatical category in square brackets in Table 4. I will return to this point in my discussion.

→Insert Table 4 about here.

The sociolinguistic constraints on word-medial (t) differ from those of word-final (t) in three major respects: (1) the frequency effect is much stronger in word-medial position; (2) the style effect is more pronounced in word-medial position, possibly due to a more pronounced stigma attached to word-medial glottal replacement, especially intervocalically (cf. Fabricius 2000: 141); and most importantly, (3) there is a strong effect of grammatical category. Adjectives and nouns disfavour glottal replacement, function words, as well as progressives (i.e. present participles), and past participles favour glottal replacement. It is well known that function words are more susceptible to reductive processes (Phillips 1983), but the emergence of present and past participles cannot be due to this effect. Schlee (2013a) shows that the presence of a morpheme boundary affects the rate of glottal replacement in a consistent way. The overwhelming majority of past participles in the corpus end in /-t+əd/, and the verb progressives end in /-t+ɪŋ/. Space constraints do not allow me to discuss these data in more detail: see Schlee (2013a) for discussion.

In sum, the native constraints in word-final and word-medial position are somewhat similar, but those for (t) in word-medial position seem slightly more complex. How does this affect learners of English in London? I will now describe the NNSs results phase by phase.

5.3 Phase 1: less than 2 years resident in London

Tables 5 to 7 show significant constraints for three groups of speakers based on the length of time spent in England. The data show very clearly that sociolinguistic constraints do not surface at the same time. This analysis indicates that some constraints are (1) replicated, (2) some are altered (transformed), (3) some are rejected or abandoned, and (4) some are re-interpreted, supporting hypothesis H5. However, results also show how NNSs build up their grammar step by step and how they become more similar to NSs in their T-glottalling as they spend more time in London, supporting hypothesis H6. In phase 1, the constraints for the Polish teenagers are organised as follows:

Word final:

Grammatical category > age > frequency

→Insert Table 5 about here.

In phase 1, Polish teenagers do not replicate a single significant native constraint. All constraints are rejected and the variation is reallocated. Word-finally, grammatical category, lexical frequency and speaker age are the significant constraints in this context. While lexical

frequency is a significant constraint for natives, it is inverted here: more frequent words are *less* likely to be glottalled.

This is not entirely surprising as language learners are subject to various other frequency effects associated with instructed language acquisition. More frequent words are normally taught first, and they are modelled by the teacher who will have less T-glottalling than teenage peers, especially if the teachers are themselves NNSs. This frequency effect clearly trumps that which is active among the native peers. There is an age effect: younger speakers glottal more; however, considering the low number of speakers in this group, this finding must be viewed with caution. The effect of grammatical category is somewhat puzzling. The discussion will focus on it in more detail. This effect continues to be replicated in stages 2 and 3 for word-final position.

Teenagers who spent fewer than two years in London do not use any word-medial glottal replacement. This may be due to its relatively low occurrence in the input.

5.4 Phase 2: Two to three years resident in London

The first signs that the Polish teenagers are moving towards the constraint hierarchies of their native peers (in respect to T-glottalling) appear after two years in England. Replicated constraints are marked in bold. Transformed constraints are marked in bold italics:

Word final:

Grammatical category > **following context**

Word-medial:

Following context > *Grammatical category* — frequency

➔Insert Table 6 about here.

In word-final position, following context is a significant constraint, essentially replicating the native factor ordering within this factor group. An emergent pattern of word-medial T-glottalling is also observed. This is conditioned both by phonotactics—specifically, the following phonological context—and by word frequency, with more frequent words exhibiting more glottal replacement. This is a predictable result assuming that the NNSs model their usage of T-glottalling on native input in which more frequent words are likely to be glottalled, especially so in medial position. Furthermore, grammatical category is also a significant predictor of word-medial glottal replacement (marked in bold italics). This result obtains because of significant differences in /t+ɪŋ/-sequences straddling a morpheme boundary. By contrast, the function-word effect, observed among native speakers, is not duplicated here. The Polish speakers produced all function words with a fully released (t), so these items are not appropriate for being included in the model of variation.

The word-medial grammatical category constraint seems to be a very difficult constraint to acquire as it disappears again in stage 3. This could suggest a pattern of trial and error in the identification and replication of NS constraints similar to that documented for learners' identification and analysis of syntactically complex structures like negation (Cancino et al. 1978). However, an exploration of this leads me beyond the scope of this chapter.

In summary, there is continued evidence for reallocation (grammatical category word-finally) and rejection (e.g. preceding context) in this phase, but there is also evidence for new strategies in this phase. Some constraints are altered (grammatical category word-medial) and some are completely replicated (following context and word-medial frequency).

5.5 Phase 3: Over three years resident in London

In phase 3, the constraints for the Polish teenagers are organised as follows:

Word final:

Preceding context > grammatical category > **following context** > *style*

Word-medial:

Following context > *style* — **frequency** — **preceding context**¹²

→ Insert Table 7 about here.

In phase 3, the constraints of preceding context and style are added to the word-final model, replicating the same factor ordering as the natives, with one exception: in word-final position, the style effect is not only very weak, it is also reallocated. Conversational style disfavours T-glottalling, while reading style favours it (however, note the application values, which indicate that learners are well on their way to acquiring this constraint). This leaves us with a constraint pattern for word-final T-glottalling that includes the major constraints as used by the native peers. However, there are also differences: a grammatical category effect has been added, there is an inverted style effect, there is no significant frequency effect, and factor groups are in a slightly different order.

Almost all constraints for T-glottalling in word-medial position have been replicated in stage 3, with the exception of grammatical category, which seems to be a tough nut to crack for learners of English, as it is completely rejected.

I am now in a position to answer research questions (1) and (2) from a quantitative point of view. This study has shown that native constraint hierarchies for T-glottalling are very clearly being acquired after two years in England. Concerning the acquisition process, more time in the country does seem to mean that speakers get increasingly closer to native norms, as they acquire native constraints one by one; i.e., some constraints are (1) replicated completely. However, there is also evidence that even after three years in the country (2) some are altered, (3) some are rejected, and (4) some are re-interpreted, resulting in new constraints. I was able to show that strategies (1) and (2) appear only after two years in the country, since variation is completely reallocated initially. In the section below, I will focus on the issue of whether there are any underlying generalisations to this acquisition process, in particular in relation to the order of constraint acquisition and the question why grammatical category is reinterpreted and transformed even after three years in London.

5.6 Further implications

While I acknowledge that the answers to these questions may involve the interplay of factors and processes, I will highlight here the variationist contribution to these issues. We know that, among native speakers, the order of constraint acquisition may differ from variable to variable (cf. Labov 1989; Youssef 1991; Roberts 1994); however, very little is known about the order of constraint acquisition among NNSs. In respect to the variable under discussion, there is evidence that constraint strength may influence rate of acquisition. While Schlee (2013b) could not find evidence for such an effect, a refined *developmental* analysis shows that NNSs do acquire the strongest (and one would expect most easily analysable) native linguistic constraint (following context) relatively fast. It is not unlikely that there are additional, more general phonetic and phonological constraints operating on this phenomenon that interact with the phonotactic principles of English and which are beneficial to the acquisition process

of this constraint. For example, the consistent finding that following consonants favour the glottalling of preceding (t) may be due to perceptual factors; namely, that, in pre-consonantal position, glottal replacement is less perceptible (Tollfree 1999). The same holds true for [t] before a consonant. In the current study, other (weaker) constraints seem to appear shortly after the strongest constraint, unless acquisition is hampered due to constraint complexity.

I turn to those factor groups now that are being transformed and re-interpreted even after three years in England, especially grammatical category. Why is grammatical category not fully acquired for word-medial position, even after a period of three years in England? One would expect variables with less complex social and linguistic constraints to be acquired faster, and constraint complexity has indeed been identified as an important factor in the L2 acquisition of variation (e.g. Ender 2011, Meyerhoff and Schleeef 2013).

While the native constraint rankings for most factor groups in the current data are guided by only one generalisation (e.g. manner of articulation for following context, attention paid to speech for reading vs. conversational style), grammatical category in word-medial position is guided by two generalisations among native speakers: there is a function word effect and a morphophonological effect.

The function-word effect arises because function words are more susceptible to reductive processes like T-glottalling (Phillips 1983). As for the morphophonological effect, words ending in *-ed* and *-ing* are more likely to be glottalled (see Schleeef 2013a for a more detailed discussion). The grammatical category constraint is, thus, difficult for the NNSs to acquire because they have to imitate the effects of two interacting generalisations. My data show that they manage to replicate one generalisation, but that they fail to accurately acquire the interaction of the two generalisations that we see in the native data. The emergence of word-medial grammatical category in stage 2 shows this very well: there is evidence for the morphophonological effect, but not of the function word effect. Since speakers who base their output on only one of these generalisations will continue to encounter contradictory data, the constraint disappears again in stage 3. Thus, constraint strength in combination with constraint complexity among natives may be a good indication of rate of acquisition of constraints among NNSs.

One final question remains. Why does grammatical category significantly influence the use of T-glottalling for the NNSs in word-final position, but not for the native speakers? What is created here by NNSs for word-final position seems to be initially a function word effect, an effect for which there is evidence in the word-medial native input. It is possible, but unlikely, that this function word effect is a misapplication of a generalisation. That is, the NNSs realise that function words are special, but they fail to realise that there is a contextual asymmetry: only word-medial (t) is strongly affected by the special status that function words have, not word-final (t). However, this cannot be the complete answer as there is no evidence of a function word effect in word-medial T-glottalling among NNSs.

On the contrary, the fact that NNSs are moving towards a noun-verb continuum while maintaining a function word effect may be evidence for their sensitivity to the non-significant native constraint of grammatical category discussed in section 5.2 (see Table 4). Alternatively or additionally, there may be some constructs that learners frequently fall back on when making sense of variation in the input as the variation they are acquiring is layered with social and linguistic complexity. Grammatical category may be one such construct. Word frequency may be another one (see the frequency effect in Table 5). Reinterpretation and transformation or reallocation of constraints is a very likely outcome in the complex task of replicating variable input (Meyerhoff and Schleeef 2012). This process of reinterpretation or transformation of the constraints operating on variation for the native adolescents among the non-native peer group is particularly interesting as it is similar to findings reported elsewhere in work on long-term language and dialect contact (Meyerhoff 2002; Meyerhoff 2009;

Buchstaller and D'Arcy 2009). Thus, the results of this study raise several questions about the changing role of grammatical categories throughout the process of acquisition of variable phonological processes like T-glottalling.

There are good reasons why NNSs may be guided by concepts such as word frequency and grammatical category. Word frequency is directly linked to input frequency (you acquire faster what you hear more often). Similarly, research shows that functional categories are extremely important in L2 acquisition and learners are very good at identifying functional categories.¹³ Valian and Levitt (1996) show that, in particular, adult learners rely primarily on distributional and semantic cues in morphosyntactic segmentation rather than on prosodic cues, which is more important in L1 child language acquisition. Carroll (2001: 183) argues that they 'are good at learning distributional properties of "words"', and that they learn functional categories based on these distributional analyses. These functional categories are therefore a crucial parsing mechanism when learning a second language.

Thus, in the process of acquiring variation, data are categorised and re-categorised and grammatical categories seem to offer a framework that is very suited to older learners of a language in forming hypotheses about data – to an extent that, in this case, learners overshoot the target and replicate a constraint as significant that is not significant among NSs. Thus, a predisposition of older learners to use grammatical category as an important interpretative framework when making sense of variation, in combination with non-significant NS patterns, may very well explain the generation of the particular constraints in the current data set.

6. Qualitative Results: Individual and stylistic variation

While answers to the *when* and the *how* of constraint acquisition have now been provided and discussed, an answer to research question (3) concerning the acquisition of stylistic variation is still outstanding. Table 7 shows that style in the sense of attention paid to speech only starts to emerge three years after arrival in England; however, this is only a partial answer. As discussed above, the concept of style encompasses much more than attention paid to speech (see for example Schilling-Estes 2002).

In the following section, I address this question from a qualitative point of view. This is important as the progression of the acquisition of variation in (t) differs somewhat from individual to individual when considering token frequencies rather than sociolinguistic constraints. Figure 1 shows frequencies of glottal replacement produced by NNSs as a percentage of all (t) realisations. Speakers are organised by the length of time they have spent in England. The figure provides evidence for a high degree of interspeaker variation, increasing roughly – again – at about two years in the UK.¹⁴

→Insert Figure 1 about here.

This individual variation needs a more nuanced account. It is very likely that the individual variation is at least in part due to (t) becoming available as a stylistic resource.¹⁵ The following paragraphs explore this hypothesis further, based on a selection of brief case studies. While these case studies may appear vague and idiosyncratic, they are very much a reflection of the variation in stylistic practice observed and the kinds of identities indexed through these practices. Identities are by their very nature dynamic and idiosyncratic constructions. Evidence of stylistic practice involving (t) in the language use of even a few participants is in itself a worthwhile finding as it highlights some of the complexities in the acquisition of stylistic practice that quantitative studies are unable to show.

Before 18 months, the potential to use glottal replacement as a stylistic resource in medial position is non-existent, and it is extremely limited in word-final position. Stylistic success is, as Sharma (2005: 215) also argues, affected by proficiency. Any speculation about the incorporation of T-glottalling into speech styles would be very difficult here.

However, after stage 1 (two years), T-glottalling is combined with several other linguistic features, and Figure 1 indicates that there is a large degree of individual variation that does not seem to be linked directly to time spent in England, but may be due to stylistic experimentation, practice and individuals' identities. This is reminiscent of Sharma's (2005) study of speakers of Indian heritage, whose use of phonological variables did not correlate with proficiency but their degree of alignment with American culture.

As I show below, degree of alignment with British culture, however, does not seem to fully explain the results in the current study. Results suggest that disalignment with England may well be reflected in T-glottalling use; alignment with England, however, need not be reflected in the use of this feature. While it is true that T-glottalling has, first and foremost, associations with British youth culture and casualness, non-use of glottal replacement can mean a lot of things. It can be a reflection of an intense connection with Poland, but non-use can also be a reflection of alignment with British average culture. Below, I outline four, of many, styles that adolescents in stages 2 and 3 use and by which they seem to express different identities: (1) the casual London adolescent, (2) the middle-class, educated youth, (3) the Polish-English teenager, (4) the average London youth. Variants other than a moderately aspirated (t) are marked in brackets.

The first excerpt is of Mokry (13, male, 78 months in England), a highly integrated individual. Mokry uses many vernacular features and shows clear evidence of stylistic practice involving (t). When asked, below, whether he wanted to move to the UK, his answer is very positive (lines 3 and 4) but he does indicate that moving to the UK was not *his* choice (lines 4 to 6).

(1) MOKRY (MOVE)

1 Int: so did you want to move to the UK? Is that something
2 you wanted to do?
3 Mokry: [f]inking abou[?] i[?] now, kind of yeah because I
4 me[?] new people and I'm like proud of i[?] but then I
5 really didn' want to do i[?]. I was kind of like
6 forced to because my parents are moving

Mokry uses many features of London youth language: TH-fronting in line 3, the discourse particle *like* in lines 4 and 5 and, of course, T-glottalling. His demeanour is very casual and his language use contributes to a casual, London speech style. Mokry is also very aware of the vernacular and the way he speaks, and he seems to consciously style his language use. In the excerpt below, he describes his style-switching practices which are clearly influenced by different audiences (Bell 2001).

(2) MOKRY (SLANG)

7 Mokry: ...the teachers teach you somethin' else and when
8 you're talking with your English friends you'll
9 just use slang and stuff so

Marek (14, male, 36 months in England) stylises himself in a similar manner, and he too shows awareness of the need to style shift depending on the audiences and presumably also the appropriate identities associated with these. After being asked what a London accent sounds like, Marek gives an example of T-glottalling, in the word *water*, and he also mentions the tag question *innit?*, which he has, in fact, used prior to this line of conversation.

(3) MAREK (INNIT)

10 Int: What's your mum like about innit?
11 Marek: I don't really use i[?] when she's there.
12 Int: you don't. You don't use it. Do you think they get
13 cross if you use (inaudible)
14 Marek: No. They wouldn't understand i[?] probably because
15 it's a word, they didn't hear i[?].

This example shows very nicely the kind of identities migrant adolescents have to negotiate – teenager among peers, student, and son of a non-native parent. According to Mokry's and Marek's metalinguistic comments, only the first of these seem suitable to the use of vernacular features; nonetheless, they use a lot of glottal replacement during the sociolinguistic interview.

While both Mokry and Marek seem to align with London vernacular adolescent norms of speaking, other students, for example Sam (18, male, 60 months in England) and Gabriel (13, female, 48 months in England), have acquired a very strong RP accent. While prosodically they may both appear very formal, their use of T-glottalling is nonetheless very high, to an extent that the combination of prosody used and realisation of (t) occasionally seem incongruent. Sam very much constructs an educated, middle-class identity through the expression of cultural interests and aspirations to study in excerpt (4), and talks about his initial problems learning English in excerpt (5).

(4) SAM (INTERESTS)

16 Sam: mm, um, I really like um ar[t^h], jus' drawing
17 things, I have a talent for i[?] and um also
18 sociology, s-studying social trends, um I-I
19 though[?] of i[?] as a kind of star[t^h] up to
20 psychology which is really interesting

(5) SAM (ACCENT)

21 Sam: mm, well, at first I had, um maybe my language
22 skills weren't that bad but er my understanding was
23 pre[?]y poor because with the pressure of learning
24 w- with the (inaudible) talking to with a Bri[?]ish
25 accent and so at first I had um real difficulties
26 (inaudible) but it's, yeh, I go[?] on a lo[?]
27 be[?]er.

Sam does not have a strong Polish accent, and he aspires to sound native. Excerpts (4) and (5) are evidence of his attempts to sound British. He seems to be straddling two identities in these excerpts: a middle-class, cultured identity, which may appear as posh to some. This is expressed by his interests in culture, education and his very aspirated (t) in lines 16 and 19. Yet he also seems to align with a casual identity as a youth growing up in Britain. His T-glottalling is very much in line with this identity, especially in excerpt (5). This excerpt also serves as an example of the incongruence mentioned above. Sam produces very conservative-sounding RP intonation patterns, yet he glottals words such as *pretty* (line 23), *British* (line 24) and *better* (27). As discussed above, word-medial intervocalic T-glottalling is probably more stigmatised than T-glottalling in other positions, and the combination of the features here do not seem to match. However, these combinations of features are not uncommon among immigrant speakers. Fox and Torgersen (2011) discuss a similar case of Sade, whose vowel system is very close to the Nigerian vowel system; however, she also exhibits a very high rate of T-glottalling. They consider this combination an attempt to negotiate her London/Nigerian identity.

There is a third frequently-occurring identity among Polish adolescent immigrants, which relates to speakers who *can* use glottal replacement of (t) but use it to lower degrees. For

example, Alice (14, female, 54 months in England) and Rezby (14, male, 48 months in England) very much align with Poland and most of their friends are Polish. In excerpt (6) below, Rezby is very clear about his surprise at having to move to England and his desire to go back to Poland.

(6) REZBY (MOVE)

28 Int: for you? Huh, did you like moving here?
29 Rezby: um, I wasn't really prepared bu[?] my mum just told me
30 like we're going to England in like twenty days and I
31 was like woah!
...
32 Int: What about (inaudible) would you like to move there?
33 Rezby: I didn't even think about[?] i[?] bu[?] I think yeah,
34 it's, things are be[?]er in Poland, for me, yeah.

Rezby is less well integrated than Mokry, Marek and Sam, and he would like to return to Poland. He neither sounds very formal nor does he sound particularly like an adolescent from London. He speaks with a very obvious Polish accent and mentions this fact during the interview. Although he does use many features that are typical of London adolescent speech (e.g. discourse *like* and T-glottalling), these features occur less frequently in his speech when compared with Mokry, Marek and Sam (see Figure 1). When they do occur, they are combined with many Polish phonological features. Thus alignment with Poland and disalignment with England may result in low use of T-glottalling.

However, orientation towards Poland is not the only reason for a reduction of T-glottalling. Korczak (13, female, 60 months in England) and Kate (15, female, 24 months in England) are very much aligned with British culture. They have several English friends, and they speak fluent English. Nonetheless, they have very noticeable Polish accents and do not use much T-glottalling at all. There is, thus, no direct relationship between alignment with England and the level of T-glottalling. For Korczak and Kate there does not seem to be any obvious alignment with any of the identities discussed above. They seem to be aligning themselves with British and London average culture, keeping their glottal replacement in 'acceptable' rates. When asked whether she wanted to move to the UK, Korczak's answer is positive but there are few features that would be considered vernacular. The only case of T-glottalling occurs before a consonant, which is quite acceptable in modern RP (Fabricius 2000: 141).

(7) KORCZAK (MOVE)

35 Korczak: umm, my-my mum, she first moved there. I waited, I
36 had one month to think about it.
37 Int: Okay
38 Korczak: Err, I just-I just thought what the hell, just go
39 for i[?] yeah.

Although T-glottalling occurs at relatively low levels in the speech of Korczak and Kate, being a Londoner is a very important part of their identities. When asked whether she would like to have a London accent, Kate expresses what may be seen as a strong desire to fit in with London culture:

(8) KATE (LONDONER)

40 Kate: Yeah, I really want to, yeah.

In conclusion, while disalignment with England may be reflected in minimal use of T-glottalling, as was the case for the Polish-English teenager identity type, alignment with England is not necessarily reflected in high use of this feature. The notion of alignment is, thus, a more complex concept than assumed in previous research. For teenagers who align

positively with England, T-glottalling occurs in a variety of different styles, at moments when speakers present particular identities, as different cultural orientations result in different styles, stances and identities: the casual London adolescent; the middle-class, educated youth; and the average London youth. Different styles are associated with different frequencies of word-final and word-medial T-glottalling and its varying combinations with other linguistic phenomena. T-glottalling is a constant feature that is associated most strongly with the casual style of the London adolescent. This is, in fact, why it never disappears completely in the speech of any of the immigrant teenagers. They are, after all, London teenagers who negotiate a variety of identities as they align themselves with their fellow students, their families and various groups relevant to their lives. T-glottalling, thus, contributes to many individual stories once it is available for stylistic practice in stages 2 and 3. This stylistic practice is, however, often different from that of NSs; it is usually particular to the situation of Polish teenagers living in London. These points relate to the research questions outlined above in that they allow us to specify in a bit more detail what happens once T-glottalling is in more frequent use after two years in England and therefore available for stylistic practice. While I have shown quantitatively that constraints are acquired one by one, it is part of the acquisition process to reach a stage where there is choice and where it is possible to experiment with (t) in the production of styles that relate to different identities.

7. Conclusion

This study has aimed to find out when T-glottalling is acquired by immigrant adolescents in London, and how this acquisition process progresses. Concerning the *when*, I have shown that native constraint hierarchies for T-glottalling begin to be approached after two years in England, which is also approximately the time when (t) starts to become available as a stylistic resource. Concerning the acquisition process, results indicate that, initially, variation is completely reallocated; however, as teenagers spend more time in England, constraints become increasingly similar to those of native speakers, as they are acquired one by one. Thus, there is evidence of a continuous process of systematisation, which is a finding that provides much needed refinement in the field of the acquisition of variation. In the process of acquiring variation, some sociolinguistic constraints are replicated completely, but there is also evidence that—even after three years in the country—some are altered, some are rejected, and some are reinterpreted, resulting in new constraints.

Three tentative generalisations have been made, relating to the order of constraint acquisition, constraint complexity and the role of grammatical category and word frequency as interpretative frameworks that (to an extent) guide the acquisition of variation. The progression of constraint acquisition interacts with the increasing use of (t) as a stylistic resource, which allows teenagers to express identities based on the variation in (t) and other linguistic features. While style, as in attention paid to speech, does not start to appear in this study until after three years in England, the qualitative analysis has shown that (t) is already available for stylistic practice and experimentation after two years in England, as stylisations of adolescent speech play a very important role early on. Thus, what NNSs learn is not a mere reflection of relative frequencies or constraints of the input, but it is, at least, the result of a complex interaction between input and frequency of a cue, constraint strength and complexity, and the amenability of input to categorisations of various kinds appropriate to the particular stage and identity of a learner.

Notes

¹ This article is based on a larger data set than Schlee (2013b), a non-developmental study of the non-native acquisition of (ing) and (t) in Edinburgh and London, and also includes word-medial (t).

² The percept of glottal replacement may be cued not only by full glottal closure (i.e. a glottal stop), but also by articulations involving controlled vocal fold tension, such as creaky voice (Docherty and Foulkes 1999a :55). In fact, Docherty and Foulkes (1999b :1040) argue that glottal variants of British English usually are not produced with a glottal stop, but that the most typical characteristic associated with this sound is ‘an interval of laryngealised voice quality’.

³ I categorise glottal *reinforcement* of /t/ with those realisations of /t/ that have an impressionistically perceptible linguo-alveolar acoustic quality, as an auditory discrimination of [t] and [ʔ] would be highly unreliable.

⁴ It is not entirely clear to what degree T-glottalling is marked. There is evidence that it is perceived as more or less acceptable in certain positions, so its degree of markedness does in fact vary. For example, Fabricius (2000: 141) conducted acceptability tests of word-final T-glottalling. Her informants found T-glottalling to be most acceptable before consonants, less so before pauses, and least acceptable before vowels.

⁵ Sharma and Sankaran (2011: 417) suggest a three-year lag in the onset of accent change among Indian-born speakers in London. However, they refer to retention of the Indian accent, rather than the acquisition of T-glottalling, whose occurrence is, in fact, very limited among her Indian-born Asians in London.

⁶ The shortcomings associated with using reading and conversational data to elicit different styles are well known, see for example Schilling-Estes (2002: 382-3). Most notably, this method is unidimensional and cannot capture the multitude of different speech styles one may encounter in naturally-occurring speech. Nonetheless, this method can give us some indication of more formal versus less formal speech, and it also allows us to compare the current data to those in other studies.

⁷ This includes variants, such as [t^(h), ʔ, ʔ^ˀ, t^ˀ, t̤].

⁸ Although some studies have shown that instrumental analysis can uncover finer details in the analysis of glottal and glottalised variants, particularly studies documenting (t) in Newcastle (Milroy et al. 1994; Docherty and Foulkes 1999a), auditory analysis is sufficient for this study for two reasons. First, in line with studies such as Fabricius (2000) and Drummond (2011), this investigation does not aim to describe the phonetic characteristics of variants of (t) but rather, it aims to probe its sociolinguistic constraint hierarchies. Second, this study is interested in finding out what NNSs do with the variation they encounter. The presence of a glottal variant in their speech patterns will be enough by itself to decide whether or not NNSs acquire the variation they encounter among NSs as analogous variation does not exist in Polish.

⁹ The preceding context is usually limited to only postvocalic (t). Roberts (2006: 235) is a notable exception. She codes for vowels, obstruents, liquids, glides and nasals both preceding and following (t) and the possibility of a pause following (t). Preceding vowels favour glottal replacement, consonants disfavour it in her study.

¹⁰ The following tokens were excluded or merged. For NNSs phase 1 word-final (t): number of syllables – three (1 token excluded), grammatical category – adjectives (7 tokens excluded), all nouns were merged; for NNSs phase 2 word-final (t): number of syllables – three (4 tokens excluded); for NNSs phase 3 word-final (t): three-, four- and five-syllable words were merged; for NNSs phase 2 word-medial (t): grammatical category – function words (9 tokens excluded), all nouns were merged, verb and verb participle were merged; for NNSs phase 3 word-medial (t): preceding context – consonants (16 tokens excluded), verb and verb participle were merged.

¹¹ Tables 4 to 7 provide Rbrul weights for each factor followed by the number of tokens and the proportion of the application value. Rbrul weights describe how a specific factor influences the probability that the variant of the application value is selected. For example, a high weight value indicates that a particular factor favours glottal replacement. The proportion of the application value indicates the percentage of the relevant number of tokens that are realised as glottal replacement (e.g. the proportion value of 68.6 under *following context* in Table 4 means that in 68.6% of cases where (t) is followed by a vowel, (t) is realised as glottal replacement).

¹² Preceding context could not be included in the statistical analysis for (t) in medial position for this group of speakers as the factor ‘consonant’ was non-variable, i.e. consonants are never followed by glottals. This is an indication that the Polish teenagers have essentially acquired this constraint as NSs also disfavour T-glottalling after consonants.

¹³ Carroll (2001: 180) argues that prosodic words can be easier extracted from the speech stream and that prosodic words tend to be tokens of the lexical classes of noun, verb and adjective. And indeed, research shows that words in those word classes tend to be the first words learners learn (Klein and Dittmar 1979; Clahsen, Meisel and Pienemann 1983). This research also shows that functional categories are often not expressed consistently in the earliest stages of L2 acquisition; not, however, at the level of acquisition investigated here.

¹⁴ This interspeaker variation is not unusual at all; the native speakers in the present sample, too, have a large degree of interspeaker variation, ranging from 68-97% of T-glottalling in word-final and 0-71% in word-medial position. These are merely token-type count effects; the underlying assumption is, of course, that for variable speakers the constraint ordering is the same in the respective group even for speakers with very different token-type counts. These constraints appear to find their reflection in Figure 1, for example, in that every single individual uses word-final T-glottalling more frequently than word-medial T-glottalling.

¹⁵ While these results confirm that even a marked variant like word-medial glottal replacement of (t) is used by some NNSs, it is unclear whether the same social meanings are at play when this feature is used for stylistic work among NNSs as they are for NSs. This is beyond the scope of this article. There is evidence that the acquisition of social information lags behind that of linguistic information in Clark and Schlee (2010).

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Table 1: Independent variables used for modelling T-glottalling in Rbrul

Categorical Variables	Factor Levels
Speaker sex	male ~ female
Speaker age	continuous measure in years
Style	conversation ~ reading
Grammatical category	proper noun ~ pronoun ~ simple noun ~ adjective ~ adverb ~ conjunction ~ verb ~ past participle ~ verb progressive ~ preposition
Position in word	final ~ medial
Word frequency	Log ₁₀ transformed*
Syllable count	Number of syllables of the word in which (t) occurs: 1 to 5
Preceding context	vowel ~ pause ~ nasal ~ liquid
Following context	vowel ~ pause ~ nasal ~ liquid ~ plosive ~ fricative and affricate ~ glide

*Frequency counts are based on the frequency rankings in the spoken component of the British National Corpus (BNC) which lists frequencies per million words (Leech, 2001). Words that are not listed in the BNC were assigned a value of zero. The value of 1 was added to all frequency counts in order to permit words of zero-frequency in the BNC also to be included in the next step: the log transformation. The frequency indexes were log₁₀ transformed, as, according to Hay and Baayen (2002: 208), ‘there is evidence that humans process frequency information in a logarithmic manner – with differences amongst lower frequencies appearing more salient than equivalent differences amongst higher frequencies’.

Table 2: Realisational variants of (t) for London-born speakers

Variant	Medial Conversation		Medial Reading		Final Conversation		Final Reading		Total	
	N	%	N	%	N	%	N	%	N	%
Glottal	144	43.0	36	6.6	796	87.4	624	85.2	1600	63.4
[t]	172	51.3	500	91.6	60	6.6	86	11.7	818	32.4
[d]	—	—	—	—	—	—	1	0.2	1	0.0
Tap	15	4.5	8	1.5	8	0.9	1	0.2	32	1.2
Elided	4	1.2	2	0.3	47	5.15	20	2.7	73	2.9
Total	335	100	546	100	911	100	732	100	2524	100

Table 3: Realisational variants of (t) for Poland-born speakers

Variant	Medial Conversation		Medial Reading		Final Conversation		Final Reading		Total	
	N	%	N	%	N	%	N	%	N	%
Glottal	45	20.5	15	3.3	330	58.5	262	42.5	652	35.2
[t]	142	64.9	404	88.6	129	22.9	222	36.0	897	48.3
[d]	7	3.2	10	2.2	42	7.5	96	15.6	155	8.4
Tap	17	7.8	23	5.0	7	1.2	2	0.3	49	2.6
Elided	8	3.6	4	0.9	56	9.9	34	5.6	102	5.5
Total	219	100	456	100	564	100	616	100	1855	100

Table 4: Significant constraints for word-final and word-medial (t) (in order of effect size), listing weights, tokens and proportion of application value. Application value: glottal replacement.

London-born teenagers							
Word-final (t)			Word-medial (t)				
	weight	N	%		weight	N	%
Following context				Following context			
nasal	.78	106	95.3	obstruent	.89	36	94.4
fricative & affricate	.68	408	94.4	nasal & liquid	.61	45	57.8
liquid	.54	107	93.5	vowel	.07	800	15.0
plosive	.48	235	88.5	range: 82			
glide	.46	190	86.3	Style			
pause	.43	269	88.1	conversational	.83	335	43.0
vowel	.16	328	68.6	reading	.17	546	6.6
range: 62				range: 66			
Preceding context				Grammatical category			
vowel	.61	1513	87.8	function word	.79	54	48.1
nasal & liquid	.39	130	70.8	verb progressive	.57	103	24.3
range: 22				past participle	.55	103	6.8
Style				verb	.52	119	10.1
conversational	.59	911	87.4	proper noun	.41	98	18.4
reading	.41	732	85.2	adjective	.32	180	18.9
range: 18				simple noun	.32	224	25.9
Lexical frequency				range: 47			
continuous +1, LOG .418*	n/a	n/a	n/a	Preceding context			
Grammatical category (not significant)				vowel	.67	824	21.1
adverb	[.59]	[241]	[90]	nasal & liquid	.33	57	10.5
verb	[.55]	[392]	[87]	range: 34			
pronoun	[.53]	[230]	[94]	Lexical frequency	n/a	n/a	n/a
simple noun	[.52]	[321]	[78]	continuous +1, LOG			
conjunction	[.48]	[99]	[91]	1.142			
proper noun	[.47]	[39]	[85]				
adjective	[.45]	[146]	[85]				
preposition	[.40]	[175]	[85]				
range: 19							
Deviance: 1108.558				Deviance: 398.48			
Df: 11				Df: 13			
Speaker ID random sd: .627				Speaker ID random sd: 2.239			

*Johnson (2009: 361) lists log-odds and their weight correspondences, which help to interpret these numbers. For example, log-odds of -0.405 and +0.405 correspond to weights of .400 and .600 respectively. Log-odds of -0.847 and +0.847 correspond to weights of .300 and .700 respectively; log-odds of -1.386 and +1.386 correspond to weights of .200 and .800 respectively, etc.

Table 5: Significant constraints for word-final and word-medial (t) among Polish-born speakers who have lived in London between seven and 23 months (in order of effect size), listing weights, tokens and proportion of application value. Application value: glottal replacement.

Polish-born teenagers: up to two years			
Word-final (t)	Word-medial (t)		
	weight	N	%
Grammatical category			No variation
conjunction	0.90	12	33.3
pronoun	0.89	27	44.4
adverb	0.77	11	27.3
preposition	0.58	24	16.7
verb	0.12	34	11.8
noun	0.02	39	5.1
range: 88			
Age			
continuous +1, LOG	n/a	n/a	n/a
-0.89			
Lexical frequency			
continuous +1, LOG	n/a	n/a	n/a
-1.643			
Deviance: 110.077			
Df: 9			
Speaker ID random sd: 0			
*Addition of network, time learning English and proficiency does not change the model			

Table 6: Significant constraints for word-final and word-medial (t) among Polish-born speakers who have lived in London between 24 and 35 months (in order of effect size), listing weights, tokens and proportion of application value. Application value: glottal replacement.

Polish-born teenagers: two to three years							
Word-final (t)				Word-medial (t)			
	weight	N	%		weight	N	%
Grammatical category				Following context			
adverb	0.75	43	74.4	consonant	0.86	18	50.0
pronoun	0.71	67	62.7	vowel	0.14	227	4.8
conjunction	0.66	46	56.5	range: 72			
preposition	0.50	59	44.1	Grammatical category			
verb	0.48	107	43.0	verb progressive	0.75	41	14.6
adjective	0.38	22	40.9	noun	0.68	79	6.3
proper noun	0.28	11	36.4	verb & past participle	0.43	58	1.7
simple noun	0.24	92	22.8	Adjective	0.17	67	11.9
range: 51				range: 58			
Following context				Lexical frequency	n/a	n/a	n/a
Liquid	0.65	24	70.8	continuous +1, LOG			
fricative & affricate	0.61	83	60.2	2.08			
pause	0.57	65	47.7				
nasal	0.54	31	61.3				
plosive	0.43	97	40.2				
glide	0.35	65	33.8				
vowel	0.35	82	34.1				
range: 30							
Deviance: 514.076				Deviance: 88.203			
Df: 15				Df: 7			
Speaker ID random sd: .923				Speaker ID random sd: 1.5			

*Addition of network, time learning English and proficiency does not change the model

Table 7: Significant constraints for word-final and word-medial (t) among Polish-born speakers who have lived in London for 36 months or more (in order of effect size), listing weights, tokens and proportion of application value. Application value: glottal replacement.

Polish-born teenagers: more than three years							
Word-final (t)				Word-medial (t)			
	weight	N	%		weight	N	%
Preceding context				Following context			
vowel	0.79	554	63.7	consonant	0.71	25	60.0
consonant	0.21	21	19.0	vowel	0.29	260	9.6
<i>range: 58</i>				<i>range: 42</i>			
Grammatical category				Style			
adverb	0.72	80	81.2	conversation	0.63	93	32.3
pronoun	0.59	100	70.0	reading	0.37	192	5.2
conjunction	0.58	57	64.9	<i>range: 26</i>			
verb	0.57	98	58.2	Lexical frequency			
adjective	0.55	39	74.4	continuous +1, LOG	n/a	n/a	n/a
preposition	0.36	82	54.9	1.938			
proper noun	0.35	10	60.0	Excluded from model			
simple noun	0.29	109	44.0	due to exclusive use of			
<i>range: 43</i>				[t] after consonants:			
Following context				Preceding context			
pause	0.65	92	73.9	vowel		[285]	[14.0]
nasal	0.60	41	65.9	consonant		[16]	[0]
fricative & affricate	0.56	100	71.0				
liquid	0.55	41	78.0				
vowel	0.45	108	58.3				
plosive	0.36	116	50.0				
glide	0.34	77	49.4				
<i>range: 31</i>							
Style							
reading	0.57	266	57.1				
conversation	0.43	309	66.3				
<i>range: 14</i>							
Deviance: 621.585				Deviance: 146.553			
Df: 17				Df: 5			
Speaker ID random sd: .978				Speaker ID random sd: 1.215			

*Addition of network, time learning English and proficiency creates a word-final (t) model in which proficiency is an additional significant factor: very good speakers are more likely to T-glottal than good speakers. No such effect emerges for word-medial (t).

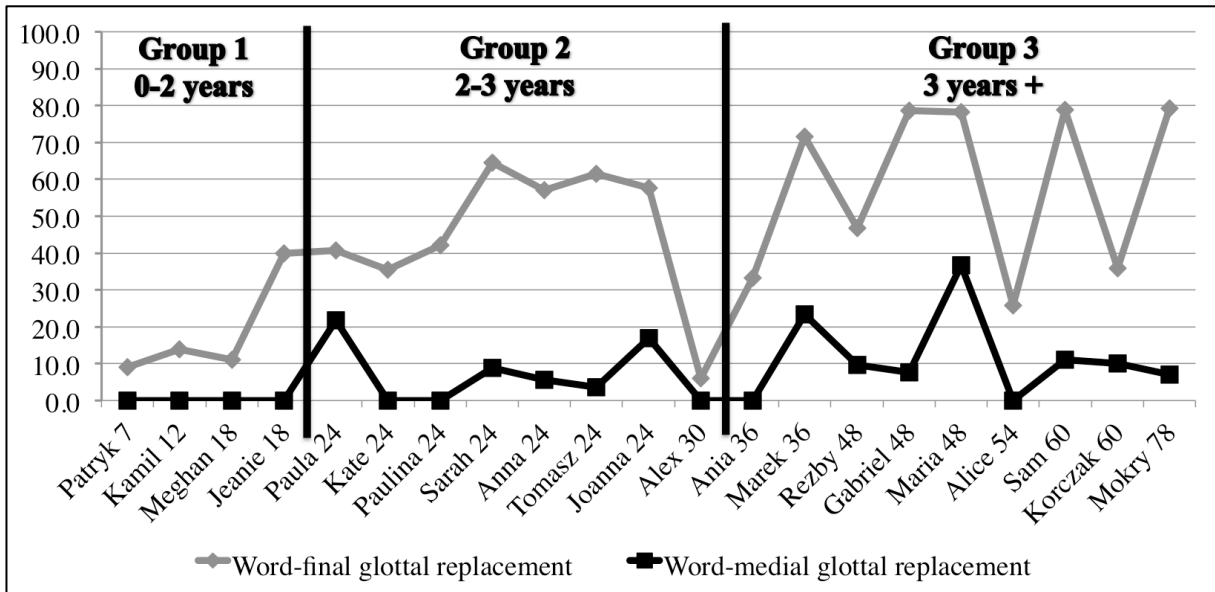


Figure 1: NNSs production of glottal replacement as a percentage of all (t) realisations, organised by months spent in England. Time given is self-reported. All names are pseudonyms.