

Identity-driven variation in phonetic backward transfer: Glaswegian versus Indian identity in Glasgow-Indian bilinguals' VOT

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Abstract

This study investigated phonetic backward transfer in the ethnolinguistic minority of first-generation bilingual immigrant Indians in Glasgow 'Glasgow-Indians' in relation to Flege's Speech Learning Model, which predicts 'assimilation' and 'dissimilation' of sound categories. The study explored whether and how sounds of Glasgow-Indian native language (Hindi) and dialect (Indian English) are influenced by sounds of the dominant host language/dialect (Glaswegian English). The role of their Glaswegian and Indian Identity was also examined. Two control groups (Indians and Glaswegians) and the experimental group (Glasgow-Indians) were recorded reading in English and Hindi words containing two phones (/t/ and /d/ – voice onset time (VOT)). In both languages, Glasgow-Indian VOT became more Glaswegian-like (assimilation) and to a greater degree in English than Hindi in /t/. Increasing Glaswegian Identity increased assimilation in /t/ but had no effect on /d/, whereas increasing Indian Identity decreased assimilation in /d/ but had no effect on /t/.

Highlights

- Examined bilingual and bidialectal contact in an immigrant minority group.
- Found backward transfer via assimilation in /t/ and /d/ for VOT.
- Typologically proximate L1 (Indian English) showed more transfer than distant L1 (Hindi).
- Studied effects of Indian and Glaswegian Identity on backward transfer.
- Indian Identity reduced /d/ assimilation; Glaswegian Identity increased /t/ assimilation.

1. Background

The kind of social experiences that immigrants have in their host country can strongly affect their linguistic attitudes and output. Migration often brings drastic changes, such as cultural, economic and educational shifts, which can contrast sharply with the immigrants' ethnolinguistic, cultural and economic backgrounds (Kerswill, 2006). This may induce different social and psychological motivations in these immigrants, such as to assimilate into the host community or maintain their distinct ethnic identity. One way to fulfil these motivations is through their language behaviour and use (Labov, 1963; Sachdev et al., 2012).

This holds strong relevance for the focus of this study which is the ethnolinguistic immigrant minority of first-generation bilingual Indians in Glasgow 'Glasgow-Indians'. These Glasgow-Indians were bilingual in Hindi and English (Indian English) prior to migrating to Glasgow (Scotland), where the host dominant variety is Glaswegian English. Interestingly, Glasgow-Indians' L1 Hindi is a different language to Glaswegian English and Glasgow-Indians' L1 Indian English is a different dialect to Glaswegian English. This presents an interesting situation of simultaneous bilingual and bidialectal contact. It allows for the examination of how a host dominant language (Glaswegian English), which is both a new dialect (with respect to Indian English) and a different language (with respect to Hindi), would influence these native varieties.

It is now commonly accepted that languages in a multilingual mind interact and influence each other (Jarvis & Pavlenko, 2008). An individual's first language (L1) can affect their second language (L2) (forward transfer; Lado, 1957, or progressive cross-linguistic influence; Brown-Bousfield & Chang, 2023) or their L2 can affect their L1 (backward transfer; Cook, 2003; Kartushina et al., 2016, or regressive cross-linguistic influence; Brown-Bousfield & Chang, 2023). The present study is concerned with phonetic 'backward transfer' (also known as L1 attrition; Schmid, 2007) of a second or new language to the L1 in bilingual speakers.

1.1. Phonetic transfer across languages

A powerful theoretical explanation for backward transfer in perception and production comes from Flege and Bohn's revised speech learning model (SLM-r; Flege & Bohn, 2021). SLM-r holds

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that L1 and L2 sounds exist in a shared phonetic space. The changes in the L1 are the result of the reorganisation of this space to accommodate new L2 sounds. SLM-r argues that by the automatic and subconscious process of 'interlingual identification', L2 learners perceive the full range of L2 sounds as instances of one or more L1 phonetic categories (Bohn, 2018). In this way, 'perceptual linkages' are formed between a specific L2 sound and the corresponding L1 category that it has mapped onto, at a position-sensitive allophonic level.

One way of reorganizing the phonetic space is through a process called category dissimilation. This occurs when an L2 learner identifies enough dissimilarity between perceptually linked L1–L2 categories ('diaphones'; Weinreich, 1953), leading to a breakage of the link between these categories and the creation of a separate category for the corresponding L2 sound. In doing so, the L1 category, which specifies the language-specific features of that category, may be deflected away from this newly formed L2 category in the common phonetic system to maintain a contrast between them. Due to this deflection, the features of that L1 category are exaggerated to highlight this contrast from the corresponding L2 category. The evidence for dissimilation comes from multiple studies for different language pairing across vowels (Flege, 2003; Guion, 2003) and consonants (Flege & Eefting, 1987b, 1987a).

Another way of organising the phonetic space is through a process called L1 category assimilation. That is, it is also possible that L2 learners are unable to distinguish between highly phonetically similar diaphones because of the perceptual mechanism of equivalence classification. When that happens, then instead of creating a new L2 category, the linked L1–L2 categories are merged such that the corresponding L1 category will be changed to reflect the characteristics of the linked L2 category. Several studies have found the evidence of this in vowels (Bergmann et al., 2016) as well as consonants (for example, Bergmann et al., 2016; Mayr et al., 2012).

Positive voice onset time (VOT), which is the phonetic feature under examination in the present study, has also been the subject of much previous research on backward transfer, more so in voiceless stops (Flege & Eefting, 1987b; Stoehr et al., 2017) than voiced stops (Lev-Ari & Peperkamp, 2013; in perception). However, while there are many cases of assimilation (Lev-Ari & Peperkamp, 2013; Stoehr et al., 2017), there are also those of no change (Stoehr et al., 2017) and dissimilation (Flege & Eefting, 1987a, 1987b). Even with respect to the age of L2 acquisition, the findings have been mixed as early bilinguals have been found to have assimilated (Harada, 2003), dissimilated (Flege & Eefting, 1987a), or not changed (Kang & Guion, 2006) their L1 categories. The studies have been conducted on multiple language pairs which may have contributed to findings of such different transfer patterns on the basis of differences in the phonetics of their respective stop series. It could also be due to the involvement of a variety of sociolinguistic and psycholinguistic variables that are responsible for shaping the multilingual experience.

The SLM-r implies the involvement of three main factors in the process of backward transfer: age of L2 learning/acquisition, perceived similarity between L1 and L2 categories and L2 input and experience. Over time, research has discovered that apart from these several other factors affect the process of backward transfer. These factors are the age of entry in the host country (Shaktawat, 2023), L2 proficiency (Mayr et al., 2012; Sancier & Fowler, 1997), individual inhibitory skills (Lev-Ari & Peperkamp, 2013), speech style (Major, 1992), length of residence in the host country (Lev-Ari

& Peperkamp, 2013) and gender (Chang, 2012). So, while previous research has emphasized and examined bilingualism as an individual phenomenon, its examination from a sociolinguistic perspective remains scarce.

As a sociolinguistic phenomenon, bilingualism is the result of contact between different languages when communities from different cultural/linguistic backgrounds interact with each other (Deumert, 2012), and multiple languages are used in society. As a psycholinguistic phenomenon, bilingualism (synonymous to multilingualism in this study) is a situation where two or more languages that are used alternately by the same bilingual speaker come into contact with each other and interact in the bilingual mind (Deumert, 2012; Weinreich, 1953). As Weinreich (1953) puts it, 'from the point of view of the individual, the two languages are two types of activity in which the same organs are employed' (71). And since 'multilingual speakers do not exist in a sociolinguistic vacuum' (Muysken, 2010:267), the present study approaches Glasgow-Indians not only as individual bilinguals but also as members of an immigrant community.

The only factor that has been examined to affect backward transfer processes from a sociolinguistic perspective is contact with L1/L2 language and community (de Leeuw, 2009; Shaktawat, 2024; Stoehr et al., 2017). However, more recent research has been acknowledging the role of and need for examining sociolinguistic predictors to achieve a better understanding of cross-linguistic interactions and influences (De Leeuw & Chang, 2024; Flege & Bohn, 2021). The aim of this study is to address this gap and investigate the extent to which one of these factors, namely the multilingual immigrant individual's identity, plays a role in affecting transfer across languages and dialects.

1.2. *Phonetic transfer across dialects: speech accommodation*

The role of sociolinguistic variables is primary in models such as the speech accommodation theory (SAT; Giles, 1973; Giles & Powesland, 1997; Niedzielski & Giles, 1996) (later communication accommodation theory - CAT; Ogay & Giles, 2007). Simply put, speech accommodation is the tendency of speakers to align or adjust their speech to the patterns of their speech partner or partners (Wagner et al., 2021). Instances of accommodation across dialects at the acoustic–phonetic level come under the term 'phonetic accommodation' (Babel, 2009; Wagner et al., 2021). This adjustment can be expressed in three ways: convergence, divergence and maintenance (Giles & Powesland, 1997), which are somewhat functionally similar to SLM-r's outcomes of assimilation, dissimilation and no change. In convergence, the speaker adjusts their speech in the direction of their speech partner, whereas in divergence, the speaker adjusts their speech away from their speech partner. In maintenance, the speaker maintains their speech and does not adjust to the speech of their partner in either direction. These outcomes may be related to the social and psychological motivations for the speaker to manage their social distance from their speech partner/s and are considered an indication of social category membership and desire for social approval (Ogay & Giles, 2007).

In case of ethnolinguistic minorities, there may even be an uneven power dynamic between ethnolinguistic immigrant minorities and the host community due to the former's lowered social status in the host country. To counter this and gain a sense of security and support, immigrants may prefer to create 'linguistic enclaves' by clustering geographically and forming distinct ethnolinguistic communities where the use of their native language/s and

customs is facilitated. While the motivation for the creation of linguistic enclaves could be mainly support-oriented, some migrants may be motivated by the fear of extinction of their minority ethnolinguistic group or to preserve their ethnolinguistic/cultural/religious/linguistic identity and maintain 'intergroup distinctiveness' (Sachdev et al., 2012:397). This may also limit their interaction with the host community, specifically their language/s, thus preventing notable language contact. Medvedeva (2010) argues that heritage language maintenance is associated with stronger ethnic identity – immigrants who feel strongly affiliated with their ethnic and cultural identity may maintain their heritage language as it forms a big part of their ethnic and cultural identity. An example of this comes from Labov's (1963) now classic investigation of the PRICE and MOUTH diphthongs on the island of Martha's Vineyard. The examination revealed that the locals who strongly identified as 'vineyarders' and wished to continue to reside there had a more centralised first element of these diphthongs. This is in contrast to the more open realisations of these diphthongs with the mainlander 'summer people'. The results also revealed a strong correlation between vineyarder's expression of contempt and resistance towards the mainlanders and their high centralisation of the first element of these two diphthongs.

A completely reverse motivation to this is attempting plenty of contact and participation with the host community and the use of host languages to improve one's social mobility and economic circumstances as an ethnolinguistic minority. Such groups will exhibit notable language contact with the host community, which may also result in them converging towards the host language to signal their desire for approval and conformity to the host norms (Coupland, 1984; Labov, 1966). Labov highlighted this in his examination of pronunciation shifts in Lower East Side New Yorkers in 1966. He found that speakers used more prestige pronunciation variants in formal contexts and less so in casual contexts. Labov argued that speakers bear the knowledge of the social significance of phonological variants whereby some variants are recognised as prestige markers. As a result of their linguistic insecurity and resultant pressure to conform to 'establish oneself as an authentic member of one's immediate groups' (Labov, 1966:567), speakers used this linguistic knowledge to shift between prestige and native variants according to different contexts to satiate their need for 'self-identification with particular sub-groups in the social complex' (Labov, 1966:450).

1.3. The present study

In this study, 'identity' refers to Glasgow-Indians' recognition of themselves as members of the given ethnic groups (Indian or Scottish). It can be related to Hazen's (2002:241) concept of 'cultural identity' which is 'how speakers conceive of themselves in relation to their local and larger regional communities.' Cultural identity, according to Berry (2001:621), is based on two dimensions: (1) identification with one's heritage or ethnocultural group and (2) identification with the larger or dominant community. Berry (2001) further clarifies that both these dimensions are not only independent of each other such that an increase in one does not imply a decrease in the other, but are also nested, such that one's heritage identity is contained within the larger national identity (621), in the sense that one may identify themselves as Indian Scots. This also gives rise to hyphenated labels such as 'Scottish-Indians' or 'Glasgow-Indians' or 'Glasgow-Asians' (Alam, 2015; Alam & Stuart-Smith, 2014) to represent their biculturalism and 'hyphenated identities' (Robinson, 2005). For instance, the hybrid 'Brasian'

(Harris, 2006) accent of second and so forth generation of Asians from the Indian subcontinent in England is seen as a reflection of their hybrid British-Asian identity (Sharma, 2011; Sharma & Sankaran, 2011; Wormald, 2015). Alam & Stuart-Smith (2014:29) also found a hybrid 'Glaswegian' accent in second-generation adolescent schoolgirls of Pakistani heritage in Glasgow, reporting that 'at the phonological level, subtle differences in phonetic characteristics may index locally-situated social/ethnic identities.' The authors used the Communities of Practice (CoP) framework which located the girls on a continuum representing their affiliation from more western/British to more eastern or traditional ideologies, values and practices. The results showed fine variations in the realisation of /t/ across the various CoPs and provided evidence of a hybrid Glasgow-Asian accent which was representative of the 'Glaswegian' identity of these second-generation speakers (Alam, 2015; Stuart-Smith et al., 2011). However, most of this research on hybrid accents in the UK is concentrated on second and following generations. The effect of identity is still unknown with respect to the backward transfer and in first-generation ethnolinguistic minorities.

Therefore, the goal of the present study is to examine the role of identity, if any, on backward transfer. There are two research questions guiding this investigation:

1. Is there a backward transfer of the host variety, Glaswegian English, on the Glasgow-Indians' native varieties Hindi and Indian English?
2. If yes, then what effect, if any, does Glasgow-Indians' identity have on the transfer outcomes?

Yoshizawa Meaders (1997) proposed three types of immigrant subgroups. The first group employs an 'assimilation' strategy (Berry, 2001) where members are quicker to superficially assimilate to the new environment, language and culture, with a neglect of their original culture and languages. The second group consists of migrants who are unwilling to assimilate and choose to cling to their original culture, identity and languages; this is the 'separation' strategy (Berry, 2001). Finally, members of the third group employ an 'integrative' strategy (Berry, 2001) by being open not only to assimilation into the host culture and languages but also trying to retain their original culture, languages and identity. Roughly based on this categorization, three types of identities are recognised in this study with respect to Glasgow-Indians: (1) Indian Identity, that is, recognition of the self as Indian, (2) Glaswegian Identity, that is, recognition of the self as Glaswegian and (3) Both Identity, that is, recognition of the self as both Indian and Glaswegian – a kind of hyphenated identity.

With respect to these three Identity types, three predictions are made. First, higher Indian Identity will be associated with reduced backward transfer effects. Second, higher Glaswegian Identity will be associated with increased backward transfer effects. Third, higher Both Identity will be associated with moderate transfer effects or higher transfer effects in either phone category or language.

2. Methodology

2.1. Participants

Three groups of speakers (two control groups and one experimental group) of mixed sexes were recruited in 2022. The first control group, 'Glaswegians', comprised 34 adult speakers (10 M, 22 F, 2 non-binary) of Glasgow Standard English. These were

Glaswegian locals and belonged to a large age range (min. = 18, max. = 69, mean = 32.3, SD = 14.4). The second control group, 'Indians', (12 M, 19 F; age: min. = 18, max. = 62, mean = 31.32, SD = 9.76) comprised 31 adult native speakers of Hindi and Indian English, the variety of English spoken in India. These speakers resided in India, used Hindi and Indian English to communicate in their daily lives and had never had any contact with Glaswegian English. The experimental group, 'Glasgow-Indians', comprised 38 adult speakers (7 M, 31 F; age range: min. = 21, max. = 83, mean = 46.02, SD = 17.59). These Glasgow-Indians were first-generation immigrant Indians in Glasgow. They were native speakers of Hindi and Indian English and acquired both before coming to Glasgow. They had been living in Glasgow for at least 3 years at the time of data collection (range of length of residence: min. = 3, max. = 63, mean = 18.98, SD = 20.89). Notably, the difference in mean age between the control and experimental groups has not been controlled for, which could have affected the results.

Unlike Indians, these Glasgow-Indians in Glasgow were in contact with the host variety of Glaswegian English, Indian English spoken by other Indian immigrants in Glasgow, as well as the hybrid 'Glaswasian' (Glasgow-Asian) English spoken by the pre-established second- and third-generation Glaswasian population (Alam 2015; Alam & Stuart-Smith, 2014; Stuart-Smith et al., 2011). However, like Indians, the experimental group also spoke Hindi and Indian English as their native languages. Furthermore, some of the members of both Indian and Glasgow-Indian groups spoke another regional language as their native language in addition to Hindi and Indian English, which they acquired since birth. These languages were Punjabi, Haryanvi, Rajasthani, Malvi, Gujarati, Odia, Sindhi, Konkani and Marathi in Indians and Garhwali, Punjabi, Bhojpuri, Bengali, Rajasthani, Malvi, Gujarati and Marathi in Glasgow-Indians. Moreover, both Glaswasians and Indians were very diverse with respect to how and at what age they acquired their native languages. Some participants were early simultaneous multilinguals, whereas some were early sequential multilinguals (where exposure to Hindi preceded exposure to English). However, it is important to note that all members of both groups had acquired all their languages before the age of 9 and had studied in English-medium schools. Eventually, a limitation of this study was that the differences in age of acquisition, type of bilingualism or the regional varieties spoken by the members of the Glaswasian and Indian groups were not accounted for and may have affected the results.

Glasgow-Indians are a linguistically diverse but minority population in Glasgow. Therefore, it was not possible to limit all Glasgow-Indians to the same linguistic background. That is, it was not possible to recruit Glasgow-Indians (and Indians) who all spoke the same dialect of Hindi and the same regional language as another L1. To control for this, at a minimum, those speakers were recruited as members of the Glasgow-Indians and Indian groups, who spoke only Indo-Aryan varieties along with Hindi and Indian English. Since the sound categories examined here are similar across Indo-Aryan varieties, it was possible to limit transfer from more dissimilar languages such as the Dravidian languages spoken in South India.

2.2. Target sounds and feature

On the one hand, Glaswegian English has a two-way voicing contrast at three places of articulation: bilabial (/p b/), coronal (/t d/) and velar (/k g/). On the other hand, Hindi has a four-way system of contrast at four places of articulation: bilabial (/p b p^h b^h/),

dental (/t̪ d̪ t̪^h d̪^h/), retroflex (/ʈ ɖ ʈ^h ɖ^h/) and velar (/k g k^h g^h/). Like Glaswegian English, Indian English also has a two-way voicing contrast at three places of articulation. The present study focuses on the coronal stops /t/ and /d/ and specifically on voice onset time (VOT).

The coronals /t/ and /d/ have a denti-alveolar realisation in Glaswegian English (Stuart-Smith et al., 2015). Hindi phonology exhibits a phonemic contrast between dental and retroflex stops (M. Ohala, 2014) and influenced by it. A retroflex stop is used for Indian English coronals /t/ and /d/ (Awan & Stine, 2011; Wiltshire & Harnsberger, 2006). Ohala (1991) argued that retroflex stops are perceptually closer to alveolar stops than dental stops, which is why Indian English uses the retroflex stop in place of alveolar stop instead of a dental stop, even though Indian languages have both dental and retroflex stops. This is also why retroflex stops, instead of dental stops, were chosen to be examined in Hindi.

The present study is concerned with possible transfer related to fine phonetic detail in positive VOT. In addition to short-lag VOT, positive VOT can also be 'long lag', characterized by a longer delay between burst release and onset of voicing (as generally found in English voiceless aspirated stops). Table 1 presents the findings from previous research on VOT in /t/ (collective VOT across /p t k/ in cases where VOT on /t/ was not provided) and VOT in /d/ across Glaswegian English, Indian English and Hindi. As there is very limited research on Hindi and Indian English for positive short-lag VOT for /d/, the research available on /b/ and /g/ is also included in Table 1 to provide context.

An examination of Table 1 shows that Hindi /d/ might have shorter VOT than Glaswegian English /d/. Furthermore, while there is no research on positive short lag VOT in Indian English, previous research agrees that it is strongly influenced by the Indic languages (Gargesh, 2008; Wells, 1982). Therefore, one can expect positive VOT for Indian English /d/ to be similar to that of Hindi /d/ and therefore shorter than VOT for Glaswegian English /d/. Further examination of Table 1 also shows that in word-initial position, Glaswegian English /t/ is aspirated, which is reflected in longer lag/positive VOT (Sonderegger et al., 2020). By contrast, in both Hindi and Indian English, /t/ remains unaspirated and has short-lag positive VOT. This is because aspiration is contrastive in Hindi. This short-lag nature of VOT in Hindi /t/ is confirmed by various studies over the years (Benguerel & Bhatia, 1980; Hauser, 2016; Lisker & Abramson, 1964; M. Ohala & Ohala, 1992), and when compared with VOT for /t/ in Glaswegian English, there is no denying that Hindi VOT for /t/ is much shorter than the VOT reported for Glaswegian English /t/ (Sonderegger et al., 2020; Stuart-Smith et al., 2015). When compared to Hindi VOT for /t/, Indian English VOT seems longer (Awan & Stine, 2011; Das & Hansen, 2004; Wiltshire & Harnsberger, 2006), but nonetheless, much shorter than the VOT for /t/ in Glaswegian English. So, the pattern for VOT for /t/ across Glaswegian English, Indian English and Hindi appears to be Glaswegian English > Indian English > Hindi.

2.3. Materials

The target categories /t/ and /d/ occurred in the word-initial position in the target words. These target words were embedded in carrier sentences. In English, the carrier sentence was Say ____ again and in Hindi, it was /kəha ____ apne?/, which can be translated as 'Did you say ____?'. The participants in the Indian control group and Glasgow-Indian experimental group were recorded reading these sentence lists in English and Hindi, but the participants in

Table 1. Short-lag and long-lag positive ‘VOT’ values across voiced and voiceless stops across Glaswegian English and Indic languages (refer to Shaktawat, 2023 for extensive review)

Study	Speech type	Language	Stop/s	VOT	Positive VOT type
Stuart-Smith et al. (2015)	Spontaneous	Glaswegian English	/d/	~20 ms	Short-lag
Sonderegger et al. (2020)	Spontaneous	Glaswegian English	/b d g/	18 ms	
Davis (1994)	Isolated words	Hindi	/g/	11.58 ms	
Schertz and Khan (2020)	Isolated words	Hindi/Urdu	/b/	~12.5 ms	
Stuart-Smith et al. (2015)	Spontaneous	Glaswegian English	/t/	70–80 ms (approx.)	Long-lag
Sonderegger et al. (2020)	Spontaneous	Glaswegian English	/p t k/	50 ms	
Lisker and Abramson (1964)	(Isolated words/ within sentences)	Hindi	/t/	9 ms	
Benguerel and Bhatia (1980)	CV syllabic utterance	Hindi	/t/	15.24 ms	
Ohala and Ohala (1992)	Wordlist	Hindi	/t/	~10 ms	
Hauser (2016)	Wordlist	Hindi	/t/	11.25 ms	
Das and Hansen (2004)	Monosyllabic isolated words	Indian English	/t/	28.58 ms	
Wiltshire and Harnsberger (2006)	(Isolated words, within sentences)	Gujarati English	/t/	16 ms	
Awan and Stine (2011)	Continuous speech	Indian English	/t/	36.02 ms	
		American English		86.63 ms	

the Glaswegian control group recorded them in English only (since they do not speak Hindi). When in disyllabic words, these target sounds always occur in the stressed syllable. There were 10 words per target sound in each language. Each target word was uttered only once, and there were no repetitions. Please refer to the supplementary material for the wordlists (Figures S2 and S3).

2.4. Procedure

The University of Glasgow College of Arts Ethics Committee granted the ethical clearance for data collection, which was conducted entirely online.

All three participant groups participated in the speech production task, which was designed and hosted online using the LaBB-CAT Speech Elicitation Tool (Fromont & Hay, 2012). LaBB-CAT’s Elicit Speech Tool records all audio as 16 kHz mono WAV files. Therefore, all recordings have the same sampling rate, and all remain uncompressed. In recent years, there has been much discussion around the quality of speech data collected remotely over various online platforms using various recording devices, particularly in relation to the reliability of acoustic measures for comparison across speakers. However, it is unlikely that the durational measure of VOT is as susceptible to these effects as formant or intensity measures. There were a few certain cases where there were instances of non-speech click-like artifacts in the recordings that could have been caused by equipment noise or poor shielding. These were especially problematic when directly imposed on the part of the audio signal that was being measured. Such tokens were discarded from the analysis.

All groups also completed a questionnaire to provide more information on their demographics, and in case of Glasgow-Indians, also on their identity. Scores were collected separately on

the extent to which Glasgow-Indians identified as (1) Indians, (2) Glaswegians and (3) both Indians and Glaswegians, using only one question. For example, to elicit data on the participants’ ‘Indian Identity’, the following question was used: ‘How do you identify yourself?: I think of myself as an Indian.’ Participants responded using a 5-point scale running from ‘not at all’ (1) to ‘very well’ (5). The higher the value, the more highly the participant identified themselves as Indian (min. = 4, max. 5, mean = 4.88, SD = .331; scored out of 5). In the above question, the statement was changed to ‘I think of myself as a Glaswegian’ to elicit identity scores on ‘Glaswegian Identity’ (the higher the value, the more highly the participant identified as Glaswegian; min. = 1, max. 4, mean = 2.2, SD = 1.19; scored out of 5). To elicit scores on ‘Both Identity’, the statement was changed to ‘I think of myself as both Glaswegian and Indian’ (the higher the value, the more highly the participant identified as Indian as well as Glaswegian; min. = 1, max. = 5, mean = 3, SD = 1.5; scored out of 5). For a bigger study, data were also collected on Glasgow-Indian’s age of entry and length of residence in Glasgow, gender, amount of contact with Indian and Glaswegian communities, proficiency and dominance in English and Hindi, inhibitory skills and language switching ability in English and Hindi. However, the present study is only concerned with and reports the effect of Identity predictors and its interactions (if any) with other predictors.

2.5. Data analysis

The data were analysed in two steps.

First, the data from the speech production task were acoustically analysed and compared across the three groups separately for /t/ and /d/. The audio files were annotated in PRAAT (Boersma & Weenink, 2024) with segment boundaries positioned according to

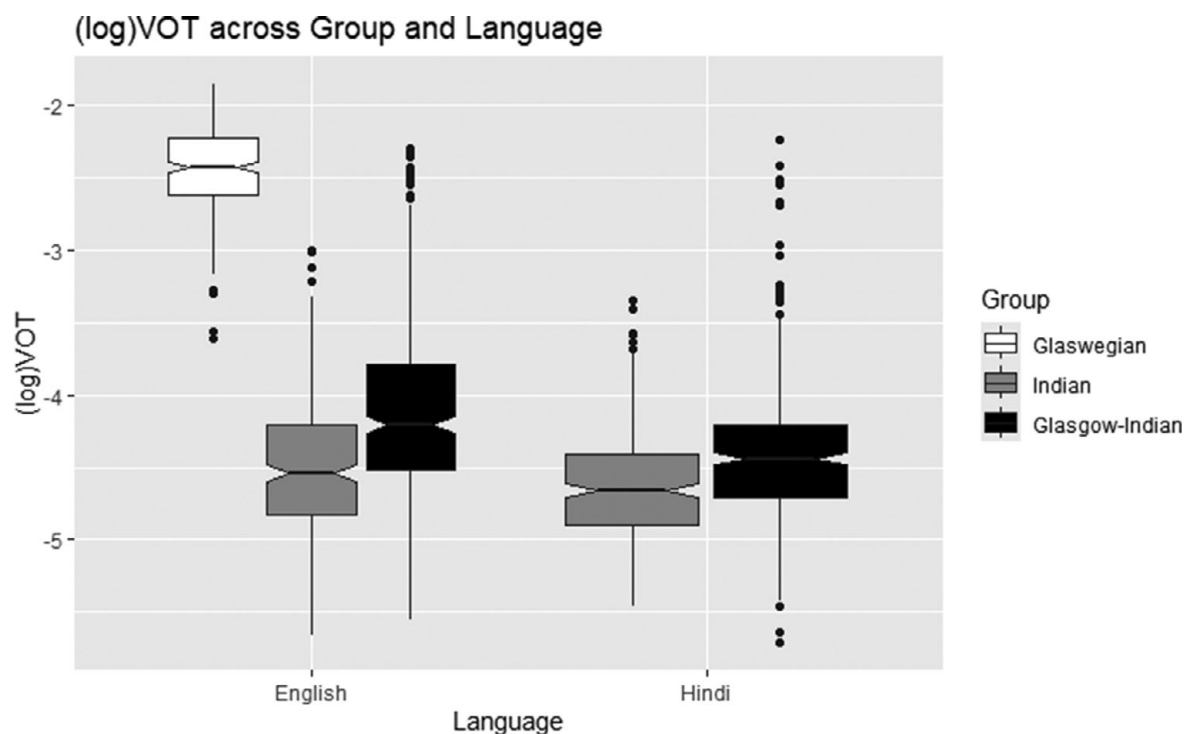


Figure 1. Log VOT in /t/ across Group and Language.

acoustic landmarks on both waveform and spectrogram (described in detail in Supplementary Materials, [Appendix S1](#)). A PRAAT script was run on these annotations to extract VOT measurements. The data were then subjected to linear mixed effects modelling using the `lmer()` function in the `lme4` package (Version 1.1.29; Bates et al., 2015) in R (Version 3.6.3; R Core Team, 2020). The model summary and p-values were generated using the `summary()` function in the `lmerTest` package (Version 3.1.3; Kuznetsova et al., 2017). The random effects included Speaker and Word. Fixed effects included Vowel Height (the height of the vowel following the target sound: high/non high), Language (English/Hindi) and Group (Glaswegian/Glasgow-Indian/Indian). The analysis of each phone category and corresponding feature was carried out in two stages using two separate mixed effects models. In stage 1, only the two control groups (Glaswegian/Indian) were compared for production in English only. This model provided the baselines for the two control groups in English (since Glaswegians do not speak Hindi). In this model, the fixed effect of Group was effect-coded, with weights of 0.5 for Glaswegian and -0.5 for Indian. These control baseline values were used to assess the direction of transfer in Glasgow-Indians in stage 2. In stage 2, the experimental group (Glasgow-Indians) was compared with the Indians for English and Hindi. This analysis examined whether there was transfer in either language in Glasgow-Indians. In this model, the fixed effect of Group was effect-coded, with weights of 0.5 for Glasgow-Indians and -0.5 for Indian. A Group effect indicated that there was a difference between the relevant groups, and specifically, in stage 2 analysis of Glasgow-Indians and Indians, this effect indicated backward transfer. An interaction between Group and Language indicated if one language was more susceptible to transfer than the other.

Second, backward transfer outcomes of assimilation or dissimilation (where present) were analysed as a function of the Identity predictors using linear mixed-effects modelling. Other variables

such as the age of entry and length of residence in Glasgow, Hindi and English dominance, Glaswegian and Indian contact, gender, inhibitory skill scores and language switching costs were also included in these models, but the results of these are not reported in the present study.¹ All continuous variables, including the Identity predictors, were converted to z-scores using the `scale()` function in R. It was ensured that none of the above predictors was correlated using the `corrplot()` function in the `corrplot` package (Wei & Simko, 2021; version 0.92) in R. All correlations at or above $\pm .5$ were evaluated as they represented a large effect size. The variables Both Identity and Glaswegian Identity were found to be positively correlated with a score of .86. Considering this and because Both Identity was correlated with certain other predictors as well, Both Identity was removed from further analysis whereas Glaswegian Identity was retained. The models were created by manually adding linguistic control and subject variables, interactions one by one. If adding a variable significantly improved the fit of the model, as determined by a loglikelihood ratio test, then that variable was retained, otherwise, it was not. All variables were tested in this manner until a final model was created.

3. Results

3.1. Voiceless stop /t/ and the effect of identity

VOT values were converted to log for normalization. [Figure 1](#) depicts log VOT values across Glaswegians, Indians and Glasgow-Indians. In this graph, the more negative the log VOT value, the shorter the VOT duration. Please refer to supplementary material

¹However, even without these additional predictors, the effects of Indian Identity and Glaswegian Identity in the next section were significant (the associated data files for this analysis can be accessed at <https://osf.io/7kpdtd/>).

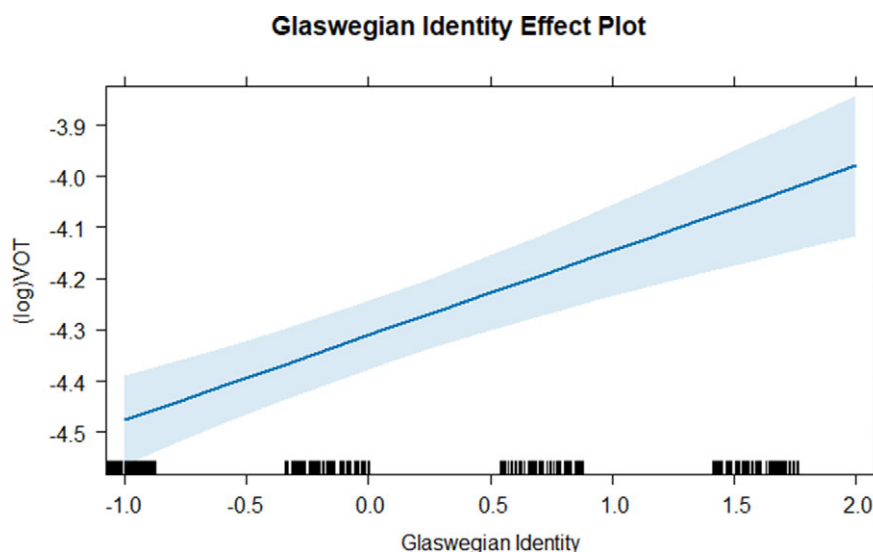


Figure 2. Effect of Glaswegian Identity on log VOT in /t/.

for raw VOT values in /t/ across Glaswegians, Glasgow-Indians and Indians in Hindi and English (Table S4).

In stage 1, the linear mixed model predicted log VOT in English as a function of Group (Glaswegian/Indian) and Vowel Height (High/Non-High). The model included a random intercept for Speaker but no interactions. A significant effect emerged for Non High Vowel Height ($\beta = -.06$, $t(589) = -2.09$, $p = .037$) and Group ($\beta = -2.05$, $t(589) = -76.31$, $p < .001$). Glaswegians had less negative log VOT (longer VOT) than Indians in English. This is important for stage 2: if Glasgow-Indian /t/ has longer VOT than Indians (in the direction of Glaswegians), then it would be indicative of assimilation; if Glasgow-Indian /t/ has shorter VOT than Indians, then it would indicate dissimilation in Glasgow-Indians. However, if Glasgow-Indians /t/ has similar VOT as Indians, then that would indicate no change in Glasgow-Indians.

In stage 2, another linear mixed model was fitted to predict log VOT by Language (Hindi/English), Group (Glasgow-Indian/Indian), Vowel Height (High/Non-High) and the interaction between Language and Group as fixed effects. The model included a random intercept for Speaker. The effect of Vowel Height again emerged as significant ($\beta = -.117$, $t(1272) = -4.69$, $p < .001$). Significant effects emerged for Language ($\beta = -.22$, $t(1272) = -9.01$, $p < .001$) and Group ($\beta = .35$, $t(1272) = 9.58$, $p < .001$), along with an interaction between them ($\beta = -.18$, $t(1272) = -3.57$, $p < .001$). The nature of the effect of Language was that Hindi had more negative log VOT (shorter VOT) than English in general. The nature of the significant Group Effect was that in English, Glasgow-Indians had less negative log VOT (longer VOT) than Indians. Finally, the significant interaction between Language and Group indicated that the difference in VOT between the two groups was significantly bigger in English than in Hindi.

These results indicate that in English and Hindi, Glasgow-Indians had longer VOT than Indians (in the direction of Glaswegians). This is evidence of assimilation in both L1 towards Glaswegian English.

To analyse the effect of Identity on /t/, a linear mixed effects model was created as described in the Data Analysis section. Among other variables, the linear mixed model of the best fit contained the fixed effects of Vowel Height and Language. Indian Identity, whether included alone or in interaction with other

predictors, did not enhance the model's fit and was therefore excluded from the final model. Glaswegian Identity was retained as a fixed effect in the final model, but no interactions involving it were included. The results showed significant effects of Vowel Height and Language (Vowel Height: ($\beta = -.13$, $t(410) = -3.72$, $p < .001$); Language: ($\beta = -.70$, $t(410) = -10.28$, $p < .001$)). The effect of Glaswegian Identity on log VOT emerged to be significantly positive ($\beta = .17$, $t(410) = 5.49$, $p < .001$). This is to say that an increase in Glaswegian Identity was associated with longer VOT, that is more transfer in general. This is depicted in Figure 2.

3.2. Voiced stop /d/ and the effect of identity

VOT values were converted to log for normalization. Figure 3 depicts log VOT values across Glaswegians, Indians and Glasgow-Indians. In this graph, the more negative the log VOT value, the shorter the VOT duration. Please refer to supplementary material for raw VOT values in /d/ across Glaswegians, Glasgow-Indians and Indians in Hindi and English (Table S5).

In stage 1, the linear mixed model predicted log VOT in English as a function of Group (Glaswegian/Indian) and Vowel Height (High/Non-High). The model included a random intercept for Speaker but no interactions. A significant effect emerged for Non High Vowel Height ($\beta = -.11$, $t(608) = -3.78$, $p < .001$) and Group ($\beta = -.51$, $t(608) = -17.43$, $p < .001$). Glaswegians had less negative log VOT (longer VOT) than Indians in English. This is important for stage 2: if Glasgow-Indian /d/ has longer VOT than Indians (in the direction of Glaswegians), then it would be indicative of assimilation; if Glasgow-Indian /d/ has shorter VOT than Indians, then it would indicate dissimilation in Glasgow-Indians. However, if Glasgow-Indians /d/ has similar VOT as Indians, then that would indicate no change in Glasgow-Indians.

In stage 2, the linear mixed model predicted log VOT by Language (Hindi/English), Group (Glasgow-Indian/Indian) and Vowel Height (High/Non-High). The model included a random intercept for Speaker and an interaction between Language and Group. The effect of Vowel Height again emerged as significant ($\beta = -.05$, $t(1319) = -2.85$, $p = .005$). Significant effects emerged for Language ($\beta = -.17$, $t(1319) = -6.86$, $p < .001$) and Group ($\beta =$

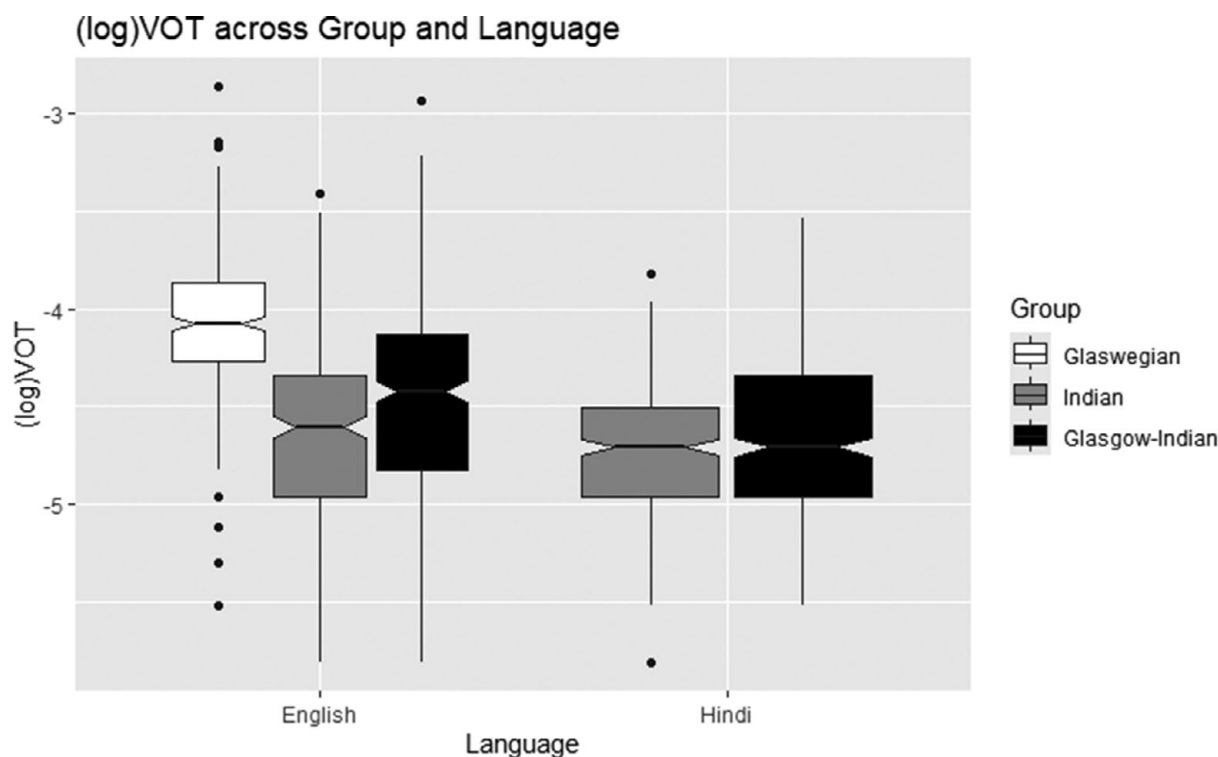


Figure 3. Log VOT in /d/ across Group and Language.

$-.12, t(1319) = -4.53, p < .001$). However, the interaction between them was not significant ($\beta = .07, t(1319) = 1.78, p = .075$). The nature of the effect of Language was that Hindi had more negative log VOT (shorter VOT) than English in general. The nature of the significant Group Effect was that in English, Glasgow-Indians had less negative log VOT (longer VOT) than Indians. Finally, the absence of a significant interaction between Language and Group indicated that the difference in VOT between the two groups was similar in English and Hindi.

These results indicate that in English and Hindi, Glasgow-Indians had longer VOT than Indians (in the direction of Glaswegians). This is evidence of assimilation in both L1 towards Glaswegian English.

To analyse the effect of Identity on /d/, a linear mixed effects model was created as described in the Data Analysis section. Among other variables, the linear mixed model of the best fit contained the fixed effects of Vowel Height and Language. Glaswegian Identity, whether included alone or in interaction with other predictors, did not enhance the model's fit. Indian Identity was retained as a fixed effect in the final model, but no interactions involving it were included. The results showed significant effects of Vowel Height ($\beta = -.06, t(437) = -2.28, p = .023$) and Language ($\beta = -.10, t(437) = -3.38, p < .001$). The effect of Indian Identity on log VOT emerged to be significantly negative ($\beta = -.15, t(437) = -2.65, p = .008$). This is to say that with higher Indian Identity, VOT decreased leading to reduced transfer. This is depicted in Figure 4.

4. Discussion

The goal of the present study was twofold. First, to investigate backward transfer in the first-generation bilingual immigrant ethnolinguistic minority of Glasgow-Indians who are in contact

with Glaswegian English post migration to Glasgow from India. These Glasgow-Indians present an interesting situation of simultaneous bilingual and bidialectal contact. That is, their native varieties, Hindi and Indian English, are put into contact with Glaswegian English, which is both a separate language to Glasgow-Indians' native language Hindi, and a new dialect with respect to their native variety of English, Indian English. While research has separately examined phonetic backward transfer in languages and phonetic accommodation in dialects, backward transfer across languages *and* dialects in the same speaker group has not been examined together. Glasgow-Indians afford us to investigate this. The other goal of this study was to examine the role of Identity in influencing backward transfer outcomes. Movement across international borders may equip ethnolinguistic minorities with different social and psychological motivations to integrate (or not) with the host community. This response may be reflected in their linguistic behaviour. Therefore, while recent research deems sociolinguistic variables to play an important role in affecting cross-linguistic transfer (De Leeuw & Chang, 2024; Flege & Bohn, 2021), this remains an under-researched area. The present study attempted to mitigate this by examining the role of an immigrants' sense of self-identity in affecting phonetic backward transfer effects.

To answer the first question, the results revealed a backward transfer from the host variety Glaswegian English to Glasgow-Indians' native varieties Hindi and Indian English in both phonetic categories that were examined. This appeared in the form of assimilation in both /t/ and /d/ for VOT. This adds to the existing evidence that positive VOT might be particularly susceptible to assimilation (Bergmann et al., 2016). According to SLM-r (Flege & Bohn, 2021), assimilation represents the merging of perceptually linked L1 and L2 categories, where the L1 category shifts in the direction of the L2 category in the common phonetic space. This

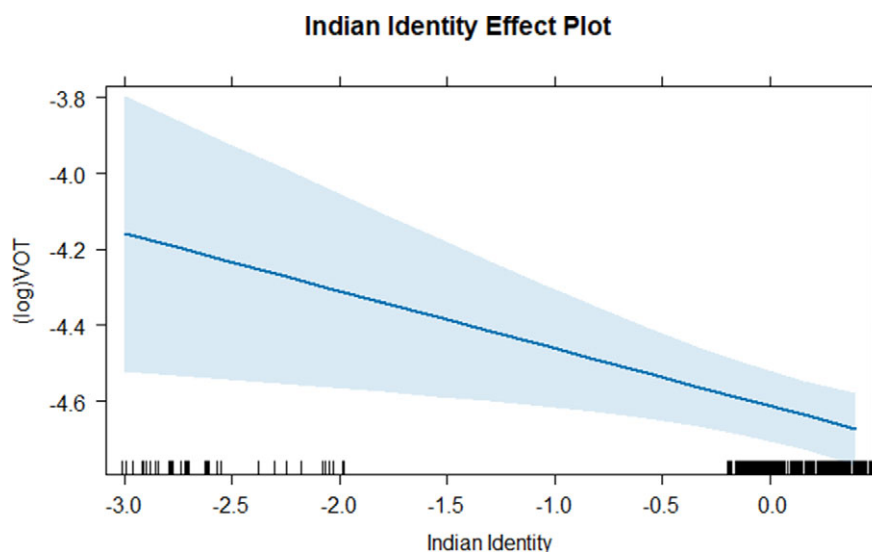


Figure 4. Effect of Indian Identity on log VOT in /d/.

'composite' L1–L2 category is based on the combined distribution of the respective L1 and L2 sound category tokens that the speaker has encountered. Consistent with this, the evidence from VOT in /t/ and /d/ in the present study indicates merged host and native category cues such that the assimilated values are intermediate between Glaswegian and native realisations. At the same time, it is also important to note here that although Glasgow-Indians have assimilated their VOT in the direction of Glaswegian VOT, it is still only slightly lengthened in comparison to what is found for second-generation heritage speakers as recorded for Indians recorded in the US (Das & Hansen, 2004, Awan & Stine, 2011) or second and so forth generation Asians in Glasgow (Glaswasians; Alam, 2015). Therefore, the findings from the present study offer an insight into the initial stages in the formation of hybrid ethnolectal norms as seen in second and so forth generation heritage speakers (please refer to Al-Asiri et al., 2025 for a discussion).

Furthermore, these findings revealed equivalent behaviour of sound categories for features in both languages. That is, both /t/ and /d/ exhibited assimilation for VOT in both native varieties, Hindi and Indian English. Interestingly, /t/ showed more assimilation in English than Hindi. This seems to indicate that transfer effects may be modulated by the typological proximity between the linguistic varieties. That is, Indian English being the more proximate variety to Glaswegian English showed more transfer than Hindi. However, this was not the case in /d/ where Hindi and English showed the same amount of transfer in VOT. In any case, it is possible that on some level, linguistic proximity affects transfer patterns in a situation of simultaneous bilingual-bidialectal contact, as has been shown by research on third language acquisition (Westergaard et al., 2017). That is, Indian English being the more proximate variety, whether typologically or psychotypologically, showed more transfer from Glaswegian English than Hindi. Although /d/ did not show this pattern, the fact that it at least did not show less transfer than its Hindi counterpart might be supportive of the linguistic proximity hypothesis. However, another factor that may contribute to this pattern is articulatory constraints on voiced stops, as pointed out by one of the anonymous reviewers. Voiced stops with negative VOT (pre-voicing) are known to be more challenging in production (Ohala, 1983, 2011; Solé, 2018) and emerge later in speech

development (Macken & Barton, 1980). While the current study did not investigate pre-voicing, it is possible that similar articulatory constraints affect the degree of transfer observed in /d/. In some languages, such as Dutch, the perception of voiced stops is primarily based on the presence or absence of pre-voicing rather than its duration (van Alphen & Smits, 2004). This suggests that certain phonetic features may be more susceptible to transfer than others, and the interaction between linguistic proximity and articulatory/perceptual factors remains an avenue for future research. Moreover, it is possible that linguistic proximity interacts with some other factor, such as salience, to moderate these results. Though there is no research to support this, it is likely that /t/ is more salient in this case than /d/. Therefore, /t/ showed this effect of linguistic proximity and /d/ did not. To arrive at a better understanding of the role of typological proximity in specifically this kind of situation of linguistic contact, more phone categories and multiple corresponding phonetic features need to be examined in other language combinations as well.

To answer the second question, the results showed significant effects of Indian Identity and Glaswegian Identity. This is important because, to the best of my knowledge, these factors have not been examined before in relation to backward transfer. The predictions made regarding these variables were borne out. First, higher Indian Identity was found to be associated with reduced backward transfer effects (reduced assimilation to Glaswegian English). While the range of Indian Identity scores was small (min. = 4, max. = 5), a significant effect was still observed, suggesting that even within this limited variability, identity played a role in affecting backward transfer outcomes. Second, higher Glaswegian Identity was found to be associated with increased backward transfer effects (higher assimilation towards Glaswegian English). Here, on the one hand, a higher Glaswegian Identity reflects a strongly positive affiliation with the host community, which might motivate them to integrate and be associated with the local Glaswegian community (Coupland, 1984; Labov, 1966). Increasing their contact with the host community is one of the ways of achieving this, and previous research on first-generation Glasgow-Indians has found higher contact with the Glaswegian community to be associated with assimilation (Shaktawat, 2024). Thus, to identify more closely with the host community, these

Glasgow-Indians relied on their knowledge of the social significance of phonological variants (Labov, 1966) and assimilated their VOT towards the host Glaswegian pattern. On the other hand, higher Indian Identity reflects a strongly positive affiliation with their ethnic and cultural identity. Whether it was to represent belongingness and pride in their ethnic and cultural identity, or to maintain intergroup distinctiveness, it was found to be associated with reducing assimilation to Glaswegian VOT patterns and maintaining their original VOT pattern.

More interestingly, what was not predicted and yet revealed in the results, was the differential effect of the two Identity predictors across the two phonetic categories /t/ and /d/. That is, increasing Glaswegian Identity increased assimilation in VOT in /t/ but was not associated with changes in VOT in /d/, whereas increasing Indian Identity decreased assimilation in VOT in /d/ but was not associated with changes in VOT in /t/. One explanation behind these asymmetrical effects of Glaswegian and Indian Identity on /t/ and /d/ VOT assimilation may be related to social indexicality (Mooney, 2019). In Glaswegian English, /t/ may carry stronger socio-indexical value as a salient feature of the local variety. Speakers with higher Glaswegian Identity might subconsciously adopt the Glaswegian-like VOT for /t/ to signal affiliation with the host community. This effect is in line with the broader idea of language as a social identity marker, where prominent phonetic features like VOT changes can signify group membership (Alam, 2015). In contrast, /d/ may be less socially marked in Glaswegian English and therefore less susceptible to assimilation based on Glaswegian Identity. For individuals with a stronger Indian identity, retaining Indian-like VOT in /d/ might be a way to assert cultural identity or maintain ties with their linguistic heritage. Speakers with strong Indian identity may consciously monitor their speech to align more closely with Indian English norms, particularly for /d/, which might be a less noticeable feature in Glaswegian English. This is evidence of identity-driven linguistic behavior, where speakers selectively retain features that reflect their social affiliations. It is also possible that language dominance, proficiency, or exposure could interact with identity in shaping the observed patterns. However, in this study, Indian Identity did not correlate with language dominance or proficiency. Instead, a strong negative correlation was found between Indian Identity and Length of Residence in Glasgow ($-.63$), suggesting that individuals with a longer stay in Glasgow reported lower Indian Identity scores. Based on this, it seems reasonable that the observed VOT patterns are more closely tied to identity maintenance than to proficiency-related effects.

Such differential effects of Identity across VOT in /t/ and /d/ might also be attributed to greater variability in VOT across /t/ and /d/ (Keating, 1984; Lisker & Abramson, 1964). The acoustic and articulatory properties of /t/ often show greater variability in VOT across languages than /d/, which has a shorter positive VOT by default and is closer to the phonetic boundary for voiced stops. This inherent salience of /t/ may make it a more adaptable feature for speakers with stronger Glaswegian identity, as it provides a larger perceptual space for adopting Glaswegian norms. The shorter VOT of /d/ in both Indian and Glaswegian English might make the transfer less perceptually noticeable and less likely to shift under socio-phonetic pressure. Consequently, individuals with a high Indian identity may retain their original /d/ VOT more strongly. Higher Glaswegian identity might reflect positive attitudes toward the Glaswegian accent, increasing motivation to adopt Glaswegian-like /t/. The lack of similar motivation for /d/ could stem from its lesser salience in the Glaswegian system or

lower perceived importance in identity signaling. Retention of Indian-like /d/ may be a subtle way for speakers to assert their cultural heritage without compromising communicative efficiency in Glaswegian English. This highlights the nuanced interplay between linguistic accommodation and identity preservation. These results indicate that cross-linguistic influence is not uniform across phonetic categories and is shaped by both external sociolinguistic factors and internal phonetic properties. Socially marked and phonetically salient categories in the host variety, such as /t/, might be more susceptible to transfer driven by host identity, while categories like /d/ that are less socially marked may be preserved in line with heritage identity.

Finally, while the current study investigated VOT as the phonetic parameter affected by the phenomenon of backward transfer, the place of articulation of /t/ and /d/ is another potential dimension that could be subject to cross-linguistic transfer and one that remains understudied in this context. As discussed earlier, in both Hindi and Indian English, /t/ and /d/ have a retroflex realization, whereas in Glaswegian English these stops have a denti-alveolar realization. Previous research has highlighted retroflexion as a distinguishing feature and known marker of Indian identity (Gargesh, 2008; Sailaja, 2012; Wiltshire & Harnsberger, 2006). Future research could explore whether, in addition to VOT, these Glasgow-Indians assimilate to the Glaswegian denti-alveolar realization of these stops, potentially using spectral moments as an acoustic measure (Alam, 2015). As pointed out by one anonymous reviewer, it is also possible that compared to these coronal stops, bilabial stops may show fewer identity-related effects due to their similarity in place of articulation across the native and host varieties. This reason makes /t/ and /d/ particularly interesting for studies on phonetic identity marking. While the present study did not examine backward transfer effects in place of articulation, this remains an important question for further investigation.

5. Conclusion

To the best of my knowledge, the present study contributes to the existing knowledge on cross-linguistic transfer in two novel ways.

First, by examining a situation of simultaneous bilingual and bidialectal contact, it provides an insight into and compares transfer across languages with transfer across dialects. Much previous research has found evidence of backward transfer in bilingual interactions and of L1 phonetic accommodation in short- as well as long-term bidialectal interactions and across different language pairs. However, previous research has rarely examined both these phenomena in the same speaker group. Furthermore, the combination of linguistic varieties examined in the present study (Glaswegian English, Indian English, Hindi) has scarcely been examined before and was very insightful in that it compared typologically similar (Glaswegian English and Indian English) and comparatively distant (Glaswegian English and Hindi) varieties. Second, this present study acknowledged and provided evidence that bilingualism is both a psycholinguistic *and* sociolinguistic phenomenon. It revealed that an immigrant's sense of self in the wider context is formative in shaping their linguistic output to indicate their affiliation to different social communities.

Now looking to the future, more evidence is needed to understand the nature of transfer in this situation of simultaneous bilingual and bidialectal contact, and compared to a cross-sectional study, a longitudinal study would be better suited to capturing such transfer processes taking place across time. The present study

contributed to the limited evidence suggesting the role of sociolinguistic predictors in affecting cross-linguistic influences and highlights the need for further research on the same.

Supplementary material. The supplementary material for this article can be found at <http://doi.org/10.1017/S136672892510014X>.

Data availability statement. The data and materials for this study are available on the Open Science Framework: <https://osf.io/7kpdt/>.

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Competing interests. The author declares no competing interests.

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