Social Mobility and Phonetic Change in South African Indian English: Retroflexion and GOOSE-Fronting in Potchefstroom and Mohadin

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Abstract

This paper examines linguistic variation in South African Indian English (SAIE) as part of a broader effort to document and digitally preserve marginalised voices in post-apartheid South Africa. Focusing on Potchefstroom and the historically segregated township of Mohadin, the study investigates two key phonetic variables: retroflexion and the GOOSE vowel. The analysis is based on 32 speakers stratified by age, gender, and social class. Data were collected through Labovian sociolinguistic interviews and analysed using PRAAT and RStudio. Welch's t-tests and conditional inference trees (ctrees) were used to explore how inter-ethnolinguistic mobility, gender, and social class shape phonetic variation. Results reveal significant sociophonetic shifts, with younger speakers and women in Potchefstroom leading a move towards more standardised English pronunciations, while older women in Mohadin maintain traditional speech patterns. By combining rigorous quantitative sociophonetics with digital analytical tools, this research highlights the potential of Digital Humanities to document and amplify marginalised linguistic identities. It contributes to ongoing discussions on decolonising knowledge by foregrounding under-researched communities and demonstrating how digitally archived linguistic data can inform inclusive and culturally grounded models of language change and variation.

1 Introduction

The relationship between language, identity, and social change makes sociophonetics an important area of study for Digital Humanities (DH) in post-apartheid South Africa (Lafon and Mongezi, 2019; Mahlangu and Dlamini, 2019; Bianco et al., 2025). Language variation reflects cultural identity and social mobility, offering valuable insights into marginalised communities whose voices are often excluded from mainstream research and archives (Lafon and Mongezi, 2019; Mahlangu and Dlamini, 2019). Within the field of World Englishes, South African Indian English (SAIE) has been recognised as a nativised variety shaped by historical segregation, multilingualism, and inter-ethnic mobility (Mesthrie, 2010). Yet most studies focus on metropolitan areas such as Durban and Cape Town, leaving semi-urban and rural communities underrepresented.

Potchefstroom and its historically designated township, Mohadin, present a unique site for exploring the social dynamics of linguistic change. Historically established under apartheid residential policies, Mohadin served as a segregated Indian township where cultural traditions and conservative speech forms persisted despite increasing contact with mainstream South African English (SAE) (Rooy, 2009; Jimenez, 2023).

This paper examines sociophonetic variation in SAIE across these two communities, focusing on retroflexion of /t/ and /d/ and GOOSE-fronting. Using PRAAT and RStudio for acoustic and statistical analysis, the study applies quantitative sociophonetic methods, including Welch's t-tests and conditional inference trees (ctrees), to investigate how gender, age, and social class shape variation. Findings show that younger speakers and women in Potchefstroom lead a shift towards more standardized pronunciations, while older women in Mohadin retain traditional forms, reflecting broader cultural and social dynamics.

By combining digital analysis with sociolinguistic theory, this research highlights the potential of DH to document marginalised voices and contribute to decolonising knowledge. Creating digital records of these under-researched speech communities provides not only linguistic insights but also a framework for inclusive and culturally grounded DH projects in Southern Africa (Lafon and Mongezi, 2019).

2 Related Work

The relationship between language variation and social factors such as ethnicity, age, gender, social class, and place has been extensively discussed in sociolinguistics and provides the foundation for understanding marginalized voices in post-apartheid South Africa. Foundational studies in variationist sociolinguistics, beginning with Labov's early work on Martha's Vineyard (Labov, 1963), demonstrated that social factors strongly influence linguistic change and that women and younger speakers often lead innovations (Labov, 1990; Tagliamonte, 2012). These findings are echoed in more recent longitudinal and apparent-time studies showing that linguistic change is socially stratified and often driven by middle-class speakers in semi-urban and urban contexts (Labov, 2001; Trudgill, 1974).

Ethnicity plays a central role in structuring language variation, with ethnolects serving as crucial markers of cultural identity (Fishman, 1999; Hall and Bucholtz, 1995). Ethnolects such as African American Vernacular English (AAVE), Chicano English, and Singlish illustrate how language varieties encode cultural belonging and shared social experience (Labov, 1972; Fought, 2003; Gupta, 1994). Within postcolonial settings, ethnolects often emerge through processes of language contact, intermarriage, and multilingualism, reflecting both the maintenance of heritage identity and adaptation to dominant societal norms (Bourhis, 1977; O'Toole, 2018). South African Indian English (SAIE) is recognised as a nativised variety within the broader framework of World Englishes, shaped by a history of segregation, inter-ethnic mobility, and contact with other South African English varieties (Mesthrie, 2010, 2017). While research has focused on urban centres such as Durban and Cape Town, where inter-ethnolinguistic mobility has accelerated the deracialisation of phonetic variables such as the GOOSE vowel (Mesthrie, 2010), rural and semi-urban communities remain under-researched (Mahlangu and Dlamini, 2019). These communities often retain older phonological and phonetic features due to lower mobility and stronger intra-ethnic social networks, as shown in studies of rural Sepedi-English contact (Lafon and Mongezi, 2019). Examining SAIE in such settings provides insight into how post-apartheid mobility and social integration reshape previously ethnicised phonetic features.

The social factors influencing SAIE variation align with broader findings in sociophonetics. Ethnicity interacts with gender, age, and social class in complex ways, often producing socially meaningful phonetic variation. Labov's curvilinear hypothesis (Labov, 2001) and Trudgill's work on Norwich (Trudgill, 1974) show that linguistic innovations tend to originate in intermediate social classes, while older, more conservative speech forms persist in less mobile working-class and rural communities. Gender further intersects with these processes, as women have been documented as leading both "change from below" (vernacular innovations) and adopting prestigious forms in "change from above" (Labov, 1990; Tagliamonte, 2012). These findings are relevant to SAIE, where younger women in semi-urban contexts have been observed to favour more standardised South African English pronunciations, while older women maintain traditional forms associated with Indian identity. Age also plays a key role in phonetic change, as apparent-time studies consistently show younger speakers adopting innovative variants earlier (Eckert, 1998; Tagliamonte, 2012). In multilingual communities, intergenerational variation often signals language shift or levelling, as younger speakers align with prestige norms or broader regional variants. This is particularly significant in semi-urban South African communities where inter-ethnic contact has increased since the end of apartheid.

The rise of Digital Humanities (DH) has provided new tools for documenting and analysing such sociophonetic variation, especially in under-researched communities. Quantitative sociophonetics, combining acoustic analysis and statistical modelling, enables the systematic examination of fine-grained variation across social groups (Tagliamonte, 2012). PRAAT and RStudio have been widely adopted for such analysis, with Welch's t-tests suited for variance heterogeneity (Delacre et al., 2017) and conditional inference trees (ctrees) providing robust modelling of non-linear relationships between social and linguistic factors (Hothorn et al., 2006). In Southern Africa, DH methods have been applied to document variation in marginalised languages, such as vowel shifts in Zulu and code-switching in Sepedi-English bilinguals (Lafon and Mongezi, 2019; Mahlangu and Dlamini, 2019). These approaches align with calls to decolonise linguistic research by archiving marginalised varieties and making them accessible for future scholarship and community use (Antony

and Tramboo, 2023; Arifin and Dewi, 2023). SAIE, particularly in smaller semi-urban communities, represents a crucial gap in this digital documentation effort.

Building on this body of work, this study applies digital sociophonetic methods to investigate SAIE in Potchefstroom and Mohadin communities largely absent from existing research.

3 Methodology

This study investigates retroflexion and the GOOSE vowel in South African Indian English (SAIE) as spoken by the Indian community of Potchefstroom and Mohadin. The research adopts a sociophonetic approach, combining historical-sociolinguistic context with acoustic and statistical analysis to examine how **age, gender, and social class**, used as a proxy for place of residence, influences these linguistic variables.

3.1 Speech Community and Participants

The Indian community in Potchefstroom, historically segregated under Apartheid, is socioeconomically stratified across three main residential areas: *Mohadin* (conservative) and the *Town* (more liberal). A total of 32 participants were purposively sampled, balanced by **location, gender, and age**: 16 young adults (<25 years) and 16 older adults (>45 years) in each location. The age split reflects the contrast between speakers socialized during Apartheid and those exposed to post-Apartheid integrated schooling and prestige SAE norms.

3.2 Data Collection

Interviews followed a *Labovian sociolinguistic format* to elicit both careful and casual speech. Participants read a consent form and a word list (adapted from Wells 1982) containing target lexical items and engaged in conversational tasks about daily life (e.g., load-shedding). Recordings were captured using a **Zoom H4n Pro recorder** to ensure high-quality acoustic data. A total of 614 retroflex tokens (/t, d/) and 620 GOOSE vowel tokens were extracted for analysis.

3.3 Data Analysis

Acoustic analysis was conducted in **PRAAT**. *Voice Onset Time (VOT)* measured retroflexion, while *F2 frequencies* (normalized using the **Watt–Fabricius method**) (Watt and Fabricius, 2003) indexed GOOSE fronting. To control for anatomical differences, F2 was normalized per speaker, and tokens were categorized using (Mesthrie, 2010) W-F scale. Structural factors (e.g., preceding coronals, /j/-words, /l/ environments) were coded to capture phonological constraints. Quantitative analysis was carried out in **RStudio** using *Conditional Inference Trees (ctrees)* to identify the strongest social and linguistic predictors of variation, complemented by *Welch's t-tests* for group mean comparisons.

4 Results and Discussion

This section integrates the findings on retroflexion (measured via Voice Onset Time, VOT) and GOOSE-fronting (measured via normalized F2) in South African Indian English (SAIE) as spoken by the Indian community of Potchefstroom and Mohadin. By combining acoustic results with sociolinguistic interpretation, we highlight how age, gender, and social class influence language variation and potential change in this community.

4.1 Retroflexion: VOT in /d/ and /t/

4.1.1 Overall VOT Patterns

Voicing was the strongest predictor of VOT, with voiced /d/ showing significantly shorter VOTs (26 ms) than voiceless /t/ (38 ms; $t = -6.73$, $p < 0.001$), consistent with general English phonetics. As shown in Figure 1, stress further conditions /d/ production, while age is the main secondary factor for /t/. Gender and social class appear only in lower-level splits, indicating weaker effects. This hierarchy provides a broad overview of how linguistic and social factors interact, forming the basis for the detailed analyses that follow.

4.1.2 Stress and /d/

Stress significantly shaped VOT for /d/, with stressed syllables showing longer mean VOTs (34 ms) than unstressed syllables (24 ms; $t = -2.42$, $p = 0.018$). This suggests that stressed contexts involve clearer, more deliberate articulation (less retroflexion), whereas unstressed syllables preserve traditional retroflexed variants. Results illustrate narrower VOT ranges for unstressed contexts, indicating consistency in traditional articulation.

4.1.3 Gender and Social Class in /d/

Gender effects were most evident in unstressed syllables. Females articulated /d/ with shorter mean VOTs (22 ms) than males (28 ms; $p = 0.002$), indicating stronger retention of retroflexion. Social

class further refined this pattern: Mohadin females showed the shortest VOTs (19 ms), while Town females produced longer, less retroflexed /d/ (24 ms). Among males, the pattern reversed: Mohadin males produced significantly longer VOTs (35 ms) than Town males (21 ms; $p < 0.001$), reflecting accommodation to non-retroflexed variants in the more conservative Mohadin setting. These results challenge typical sociolinguistic trends where men retain traditional features, suggesting external social contact influences male speech norms.

Table 1: Mean VOT (ms) for /d/ in unstressed syllables by gender and social class

	Mohadin	Town	p-value
Females	19	24	$p = 0.026$
Males	35	21	$p < 0.001$

4.1.4 Age, Gender, and Social Class in /t/

For /t/, age was the primary determinant, with younger speakers ($\leq$25 years) showing significantly longer VOTs (42 ms) than older speakers ($\geq$45 years; 34 ms; $p = 0.002$). The longer VOTs among younger speakers reflect a shift away from retroflexion, while the shorter VOTs of older speakers indicate stronger retention of traditional retroflex. Social class had the greatest effect among older speakers, with Town speakers producing longer VOTs (42 ms) than Mohadin speakers (25 ms; $p < 0.001$). Gender further differentiated these patterns: in Town, older females showed the longest VOTs (50 ms) compared to males (33 ms), suggesting that women lead standardization. In Mohadin, older males produced longer VOTs (30 ms) than females (22 ms), indicating that Mohadin females remain the strongest conservators of retroflexed forms.

Overall, VOT analysis shows complex interactions of social factors: women in Mohadin remain conservative, whereas Town women adopt prestige variants; younger speakers across locations are leading the shift toward less retroflexion.

4.2 GOOSE-Fronting (F2 Analysis)

4.2.1 Allophone and Social Class Effects

Allophone was the strongest predictor of GOOSE-fronting. The /j/-preceding environment showed the highest F2 values (1.405 normalized), confirming established fronting contexts. Social class significantly influenced F2 only for allophone 'a' (/r/ and /l/ preceding GOOSE): Town speakers had higher F2 (0.917) than Mohadin speakers (0.824; $p = 0.01$), indicating greater fronting among Town residents (Figure 3).

Table 2: Normalized F2 for GOOSE allophone 'a' by social class

	Mohadin	Town
Mean F2	0.824	0.917

4.2.2 Age and Gender Effects

Neither age nor gender had a statistically significant effect on overall GOOSE-fronting, though Town females displayed slightly higher F2 values and more variability, suggesting greater exposure to prestige norms.

4.3 Discussion

These results confirm that **social class** and **place of residence** are the strongest sociophonetic predictors, shaping both retroflexion and vowel fronting. Mohadin retains conservative speech norms, especially among women, while Town speakers, particularly younger females, adopt more standard SAE-like features. Gender patterns are, however, sometimes reversed from typical sociolinguistic trends: men in Mohadin lead in adopting less retroflexed speech, likely due to greater external contact, whereas women maintain community-specific features. Age effects are most visible for /t/, where younger speakers lead phonetic change.

The findings align with Labovian principles of language change, but also highlight the unique dynamics of a multilingual post-apartheid setting, where mobility and exposure to diverse linguistic environments accelerate change in some groups while reinforcing conservatism in others.

5 Conclusion

This study examined linguistic variation in South African Indian English (SAIE) speakers in Potchefstroom and Mohadin, focusing on retroflexion through Voice Onset Time (VOT) and GOOSE-fronting through normalized F2 values. The findings reveal that social class, gender, and age significantly influence these phonetic features. Town speakers, particularly younger females, demonstrated longer VOTs and greater GOOSE-fronting, indicating a shift towards prestige or standard South African English norms. In contrast, Mohadin

speakers, especially older women, retained shorter VOTs and more conservative, retroflexed pronunciations. Mohadin males showed little resistance to phonetic change, with longer VOTs and reduced retroflexion, likely due to increased external social interaction and mobility. Social class emerged as a strong predictor of linguistic change, with Potchefstroom residents adopting features more aligned with socially mobile, integrated speech patterns. The results confirmed most hypotheses, showing that inter-ethnolinguistic mobility accelerates linguistic change, younger speakers lead in adopting innovative variants, and females generally spearhead vowel fronting. However, the reversal of some expected gender patterns for retroflexion challenges conventional sociolinguistic assumptions, highlighting the unique cultural and social dynamics of this community.

This research contributes to understanding language change in post-apartheid South Africa by documenting an under-researched community and demonstrating how identity, social integration, and place interact to shape linguistic behavior. It also illustrates a balance where traditional phonetic features persist in some groups while others shift toward prestige norms under the influence of social mobility and broader linguistic contact. Future studies should refine age-related analyses through narrower generational cohorts, apply advanced statistical modeling to assess outliers, and extend investigations to other South African Indian English communities to test generalizability. The findings underscore the importance of exploring smaller, socially stratified communities to build a nuanced understanding of sociolinguistic variation and change in multilingual contexts.

6 Limitations

This study contributes to Digital Humanities (DH) by applying computational sociophonetic methods, including PRAAT-based acoustic analysis, statistical modeling in R, and the Watt–Fabricius normalization suite, to document variation in an under-researched speech community. However, several limitations remain.

First, the relatively small and localized sample restricts the generalizability of the findings, which contrasts with DH's emphasis on building large-scale, shareable linguistic datasets. Future work should expand the participant pool across different South African Indian English (SAIE) communities to enhance comparative and archival value.

Second, while this study integrates acoustic and statistical methods consistent with DH practices, its focus on only two phonetic variables (retroflexion and GOOSE-fronting) limits the breadth of sociophonetic insight. Incorporating additional features, such as intonation and vowel mergers, and including multimodal data would strengthen its utility for DH-based linguistic corpora and comparative cross-community analyses.

Finally, the cross-sectional design constrains the ability to track language change over time, which is important for DH goals of creating dynamic and temporal records of language variation. Longitudinal and multi-generational research would allow for a more robust integration of historical and real-time data, contributing to sustainable and reusable DH resources that archive marginalised voices in post-apartheid South Africa.

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A Appendix

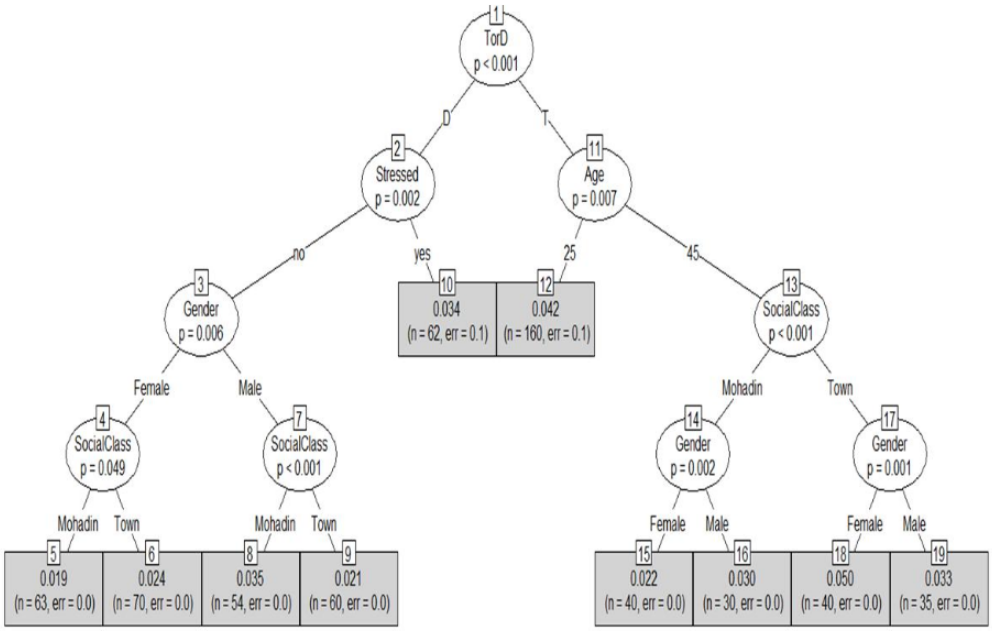

Figure 1: Conditional inference tree for VOT by voicing, stress, age, gender, and social class

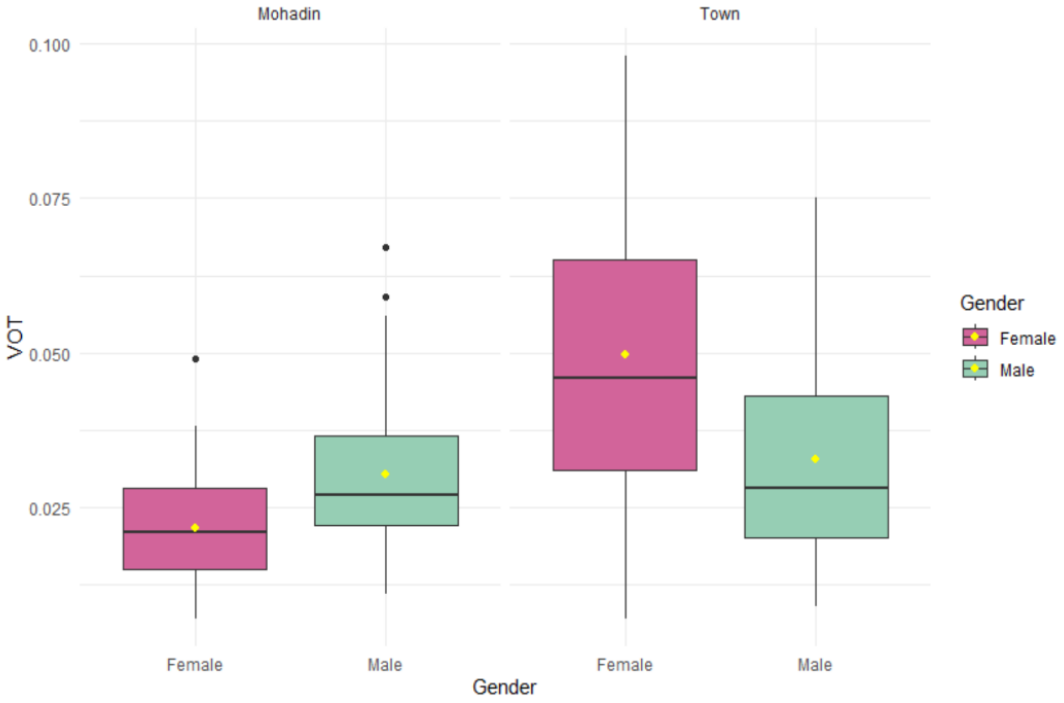

Figure 2: VOT by age, gender, and social class for /t/ (speakers aged 45+)

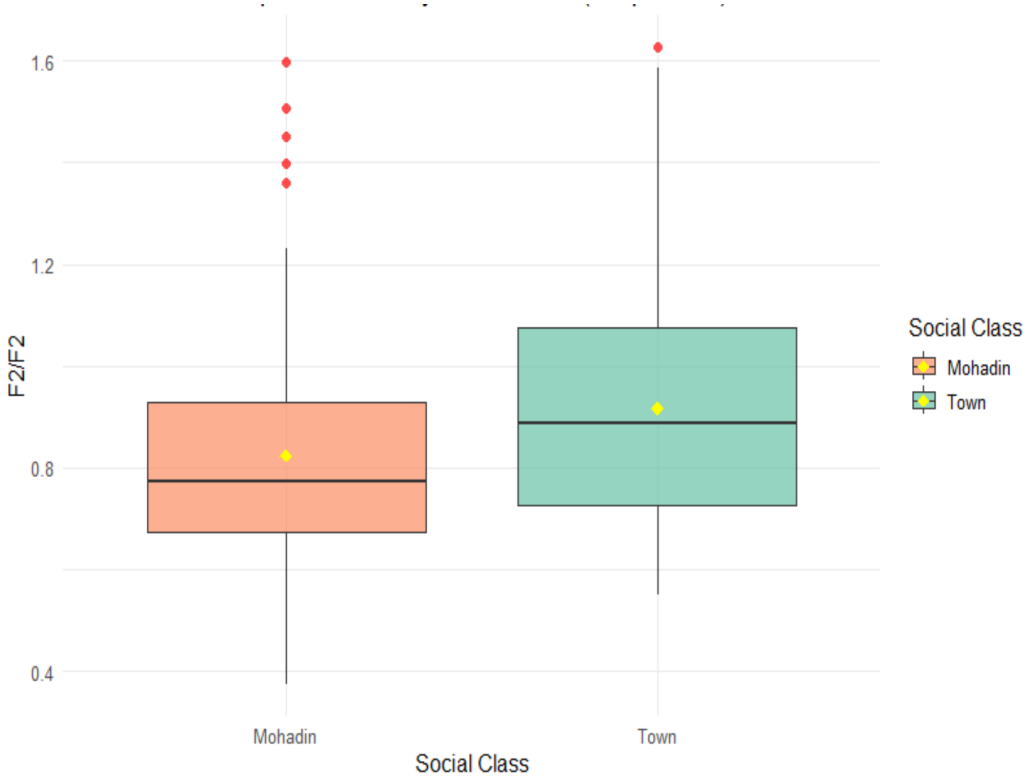

Figure 3: Normalized F2 for GOOSE by social class, age and gender