DYNAMIC VARIATION IN 'PANJABI-ENGLISH': ANALYSIS OF F1 & F2 TRAJECTORIES FOR FACE /eɪ/ AND GOAT /əʊ/

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ABSTRACT

The vowels FACE /eɪ/ and GOAT /əʊ/ [33] have been reported as characteristic of British English contact varieties. FACE has been found to have a lower F1 and a higher F2. For GOAT, a lower F1 but varying F2 have been reported. The vowels also have shorter trajectories or monophthongal realisations [4, 7, 26, 29, 34].

The current paper considers dynamic data from 'Panjabi-' and 'Anglo-'English speakers in Bradford and Leicester. Within locations, speakers of Panjabi-English have significantly lower F1 values across trajectories for both vowels. F2 for Panjabi-English speakers is higher for FACE, and lower for GOAT.

Although the two Panjabi-English communities share a heritage language, cultural and linguistic differences between the two mean this may not be an adequate explanation of the similarities observed. Instead, the results are considered in relation to consistencies with previous research which may provide evidence for the development of a supra-regional contact variety.

Keywords: Acoustics; dynamic vowel analysis; language contact; Panjabi-English; Sociophonetics.

1. BACKGROUND

The impact of language contact on the native English spoken in the UK is of growing interest to sociolinguists. Variation in the English of London, Manchester and Birmingham has been attributed to high levels of multilingualism and contact between communities in each location [5, 6, 14]. In Manchester and London, both varieties have been reported to have closer and fronter realisations of FACE, with GOAT being close but backed and both vowels having shorter trajectories than the 'traditional' diphthongs in the area [4, 7].

Research into Asian-English varieties has identified a number of characteristic features [10, 11, 15, 17, 18, 22, 23, 27, 31]. Stuart-Smith et al [29] comment on closer and fronter realisations of both FACE and GOAT in Glasgow Asian speakers compared to realisations by Glasgow non-Asian speakers. All speakers had monophthongal realisations of both vowels. In Southall, London, Sharma [26] characterises monophthongal FACE and GOAT as features of Indian English, with Asian speakers using these alongside British English diphthongal variants. Monophthongs were most common in interactions between Asian speakers.

In the current context, 'Panjabi-English' (PE) refers to the native English variety spoken by second-generation, British born, individuals who have at least one parent who is a first-generation migrant from the Panjab region and is a native Panjabi speaker. Speakers of PE may not be fluent speakers of Panjabi, although all PE participants here have some knowledge of the language. In contrast, 'Anglo-English' (AE) speakers are those who have no heritage language other than English, with both parents and grandparents being born in the UK.

According to the UK census [21], Bradford and Leicester both have sizeable Panjabi main language populations (4% and 2.4%, respectively) and both cities have large Indian and Pakistani communities (23% and 31%, respectively). Bradford is located in West Yorkshire, and Leicester in the East Midlands. The linguistic differences between Leicester AE and Bradford AE mean that any similarities between the PE spoken in each location could be considered in relation to language contact and the influence of the shared heritage language, Panjabi.

Bradford AE traditionally has monophthongal FACE and GOAT, with qualities of [ɛː] [12] and [ɔ̈ː] [32], respectively. Leicester AE in contrast, has wide diphthongal variants with qualities [ɐi] and [əʉ] [12]. Previous research into Bradford PE looked at vowel midpoints and, considering realisations of females, observed significantly closer realisations of FACE and GOAT from PE speakers [34]. Through using dynamic vowel data, a better consideration of differences across the trajectory can be made [30].

2. METHODS

Analysis of reading passage data from forty-six speakers is included. Participants were aged between 19 and 47. Age is considered as a continuous variable in the analysis. Male and female PE and AE

speakers from each location are included with the breakdown per cell illustrated in Table 1.

Table 1. Breakdown of participants included.

	Bradford	Leicester	**Totals**
Female PE	10	8	**18**
Male PE	8	8	**16**
Female AE	5	4	**9**
Male AE	2	1	**3**
Total	**25**	**21**	**46**

Fewer AE speakers were interviewed during fieldwork as the primary interest is in the relationship between PE in the two locations.

The reading passage 'Fern's Star Turn' was used. The passage takes two to three minutes to complete and includes a great number of consonantal variables and all of Wells' keywords [33] with the exception of commA. All interviews were recorded with a Zoom H4n Handy recorder and each participant wore a Beyerdynamic TG H54c neck worn microphone. Recordings were made at a 16 bit 44.1 kHz sampling rate.

Audio files were forced-aligned using the HTK Hidden Markov toolkit and a variety specific dictionary [1][1]. The Formant Editor program was then used to extract F1-F3 trajectory values [28]. Using text grids created through the forced alignment, the program interfaces through Praat [3] and permits the manipulation of the LPC (linear predictive coding) output within an interval allowing for more accurate measurements to be taken. Interval boundaries were also corrected where necessary from the forced aligner's output. The user specifies the number of points to identify within an interval. In the current paper, eleven measurement points across the trajectory were used, consistent with previous research [9, 19, 20]. The values can then be exported into a .csv file along with additional metadata (e.g. preceding phone, speaker gender).

Twenty to twenty-five tokens per speaker were measured for both FACE and GOAT. In total, 1022 FACE, and 1179 GOAT tokens were included in the analysis. Further, five tokens of FLEECE, GOOSE and LOT were measured for each speaker as point vowels to enable normalisation. This was carried out in R using the NORM suite available through the *vowels* package using the modified Watt-Fabricius method [8, 13].

Separate mixed-effects linear regression models were run for F1 and F2 for both FACE and GOAT using the *lme4* and *lmerTest* packages in R [2, 16]. Fixed-effects were measurement point, gender, region, language background, and age. Interactions between measurement point and gender, measurement point and region, measurement point and age, measurement point and language background, language background and region, and a three way interaction of measurement point, language background and region were also included as fixed-effects. Speaker and word were included as random effects.

3. RESULTS

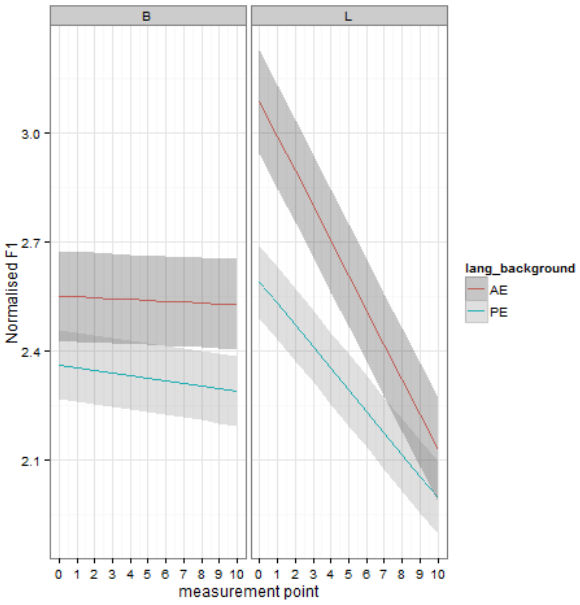
3.1 FACE

Results for FACE are presented below, with F1 and F2 being considered separately.

3.1.1 F1

Leicester speakers have significantly higher F1 values than Bradford speakers (t=6.02, p<.0001). Further, Leicester speakers show significantly more change across the trajectory than Bradford speakers with a falling F1 and a significant interaction between measurement point and region (t=-32, p<.0001). This is illustrated in the predictive interval plot in figure 1 including the results for females only. The figure highlights trajectory variation for each language background group within respective regions with shaded 95% confidence intervals bordering regression lines.

Figure 1. Trajectory variation in F1 for FACE from female speakers.



Also illustrated in figure 1 is the variation between PE and AE groups. PE speakers have significantly lower F1 values than AE speakers (t=-2.76, p=.008), this being maintained across the trajectory as confirmed by the significant interaction between measurement point and language background (t=-

2.28, p=.022). A significant interaction between language background and region highlights the greater difference between Leicester PE and AE groups (t=-2.96, p=.005). Leicester PE speakers have shorter trajectories than the Leicester AE speakers. This is illustrated in figure 1 above and reflected in a significant three way interaction between measurement point, language background and region (t=12.06, p<.0001).

For all speakers, decreasing age results in a significantly lower F1 (t=6.21, p<.0001), with an interaction between measurement point and age reflecting how this is maintained across the trajectory (t=-11.6, p<.0001). Males have a significantly higher F1 compared to females overall (t=2.902, p=.006), with a significant interaction between measurement point and gender indicative of the falling F1 and increased trajectory movement for males (t=-8.75, p<.0001).

3.1.2 F2

Leicester speakers have significantly higher F2 values than Bradford speakers (t=-2.32, p=.025). As with F1, Leicester speakers have more trajectory variation than Bradford speakers, with a rising F2 and a significant interaction between measurement point and region (t=18.26, p<0001). There is a significant difference between PE and AE speakers (t=3.82, p=.0004), with PE speakers having a higher F2 value which is consistent across the trajectory as shown by the significant interaction between measurement point and language background (t=-2.93, p=.003).

Increasing age results in a significantly lower F2 (t=-2.99, p=.004), with an interaction between measurement point and age highlighting this is consistent across the trajectory (t=8.99, p<.0001). A significant interaction between measurement point and gender (t=3.23, p=.001) reflects how females have higher F2 values at points throughout the trajectory, a difference not significant if considering gender as a main effect only.

All Leicester speakers retain a diphthongal realisation of FACE; [ɛi] for AE speakers but [ei] for PE speakers. All Bradford speakers retain a monophthongal realisation; [ɛː] for AE and the closer, fronter [eː] for PE speakers. Within each region, PE speakers have closer and fronter realisations, with PE speakers in Leicester having shorter F1 trajectories. Further, younger speakers, irrespective of language background, have closer realisations than older speakers. Males have more open and retracted realisations overall.

3.2 GOAT

Presented below are the results for GOAT, with F1 and F2 discussed separately.

3.2.1 F1

A significant main effect of region highlights that Leicester speakers have higher F1 values than Bradford speakers (t=4.88, p<.0001). Leicester speakers show more movement across the F1 trajectory than Bradford speakers, with a falling F1 and a significant interaction between measurement point and region (t=-21.44, p<.0001).

Overall, F1 is lower for PE speakers than AE speakers but there is no significant main effect for language background. A significant interaction between language background and region indicates the greater difference between PE and AE groups in Leicester (t=-2.4, p=.021). Again, Leicester PE speakers have shorter trajectories than Leicester AE speakers, this being reflected in a significant three way interaction between measurement point, language background and region (t=5.97, p<.0001).

Increasing age results in a significantly higher F1 value (t=3.78, p=.0005), something which is consistent across the trajectory as shown by the significant interaction between measurement point and age (t=-4.31, p<.0001). A significant interaction between measurement point and gender reflects the greater movement and the consistently higher F1 across the trajectory for males compared to females (t=3.01, p=.003).

3.2.2 F2

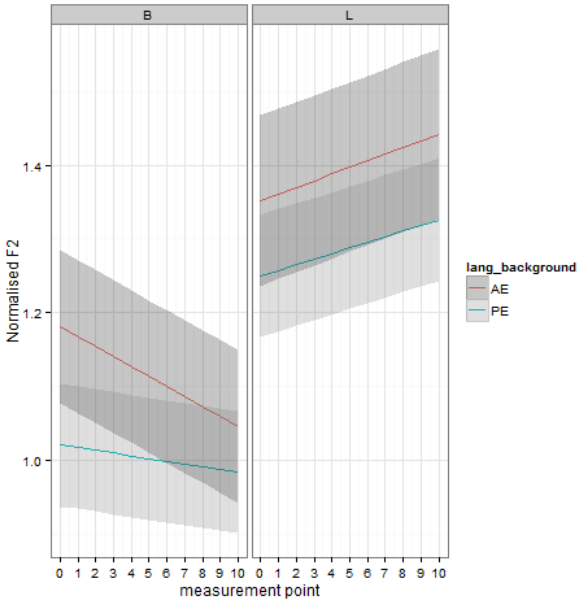
Leicester speakers have a significantly higher F2 than Bradford speakers (t=3.01, p=.004). A significant interaction between measurement point and region illustrates the different F2 trajectory patterns between Leicester and Bradford speakers (t=12.28, p<.0001). Leicester has a rising F2, Bradford a falling F2. The predictive interval plot for male speakers in figure 2 illustrates this.

A significant main effect of language background highlights that PE speakers have lower F2 values than AE speakers (t=-3.678, p=.0007). The significant interaction between measurement point and language background reflects the greater trajectory variation for AE than PE speakers (t= 7.01, p<.0001). Further a significant three-way interaction between measurement point, language background and region reflects the shorter Leicester PE trajectories relative to the AE trajectories (t=-5.289, p<.0001).

A significant interaction between measurement point and age (t=-8.71, p<.0001) reflects the

different trajectories for older and younger speakers, with a change from a falling to a rising F2 in younger speakers. A significant interaction between measurement point and gender reflects how a lower F2 for females compared to males is maintained across the trajectory despite both males and females having a falling F2 (t=-3.52, *p*=.0004).

Figure 2. Trajectory variation in F2 for GOAT from male speakers.



Overall, GOAT mirrors the patterns observed for FACE. Diphthongs are present in Leicester for all speakers, with PE speakers having a realisation of [əʉ] in contrast to the AE [əʏ]. Bradford speakers retain a monophthongal realisation, PE speakers having [oː], AE speakers having a more open and fronted [ɔ̈ː].

With respect to GOAT fronting, region is a better predictor than language background, with all Leicester speakers fronting more than all Bradford speakers. Younger speakers have closer realisations overall with fronting trajectories. Females have shorter, closer and more retracted trajectories compared to the males overall.

4. DISCUSSION

The results for FACE are consistent with the patterns observed for other contact varieties, with a closer and fronter realisation for PE speakers. Leicester PE speakers also have shorter trajectories than the AE speakers [4, 7, 26, 29, 34].

For GOAT, a closer but more retracted realisation is observed for PE speakers with Leicester PE speakers again showing shorter trajectories. This contrasts with the findings of [29] in Glasgow Asian, but is consistent with [4, 7] and their comments on retracted GOAT in Multicultural London English (MLE) and Multicultural Manchester English (MME), respectively.

Modern Standard Panjabi contains the peripheral mid, front unrounded /e/ and mid, back rounded /o/ [25]. It is possible that the variation observed here is evidence of transfer through contact with Panjabi. However, this would not account for the consistencies observed with MLE and MME.

Moreover, the PE communities in Bradford and Leicester are quite different. The Bradford PE community has origins in Pakistan, and all members are Muslim. The Leicester PE community has origins in India, and all members are Sikh. Panjabi plays a different role within each community and, linguistically, Panjabi is known to vary greatly across the Panjab [24, 25]. Consequently, the consistencies observed between the two PE communities, and more widely across the UK, are of even greater interest.

The closer realisations and shorter trajectories of FACE and GOAT are also present among the younger members of the community, suggesting that, although language background differences are currently present, the non-standard variation observed is spreading to the wider community within each region.

Initial findings suggest an interesting gender relationship, with men in the current study having more open realisations and longer trajectories than females. Further fieldwork will be undertaken before this pattern is more fully considered, due to the low number of male AE speakers currently included.

5. CONCLUSION

The variation between PE and AE groups is likely to reflect speakers navigating complex individual and group identities interacting with ethnicity, religion and cultural practices. However, the reason why similar features are present in contact varieties across the UK is still little understood. It is important to look beyond the shared heritage language as an explanation for the consistencies, although it would be premature to dismiss it entirely. Instead, a supra-regional contact variety appears to be developing. Additional reasons for this shared variation are still to be properly explored.

6. REFERENCES

[1] *http://htk.eng.cam.ac.uk/*.
[2] Bates D., Maechler M., Bolker B., Walker S. 2014. *lme4: Linear mixed-effects models using Eigen and S4*, in *R package version 1.1-7*: http://CRAN.R-project.org/package=lme4.

[3] Boersma, P., Weenink, D. 2013. *Praat: doing phonetics by computer (Version 5.3.45)* [Computer program]. Available from http://www.fon.hum.uva.nl/praat/
[4]Cheshire, J., Fox S., Kerswill P., Torgersen E. 2008. Ethnicity, friendship network and social practices as the motor of dialect change: Linguistic innovation in London. *Sociolinguistica*, 22. 1-23.
[5] Cheshire, J., Kerswill P., Fox S., Torgersen E. 2011. Contact, the feature pool and the speech community: The emergence of Multicultural London English. *Journal of Sociolinguistics*, 15(2). 151-196.
[6] Drummond, R. 2013. *Adolescent identity construction through Multicultural (Manchester) English*. Paper presented at UKLVC 9: University of Sheffield.
[7] Drummond, R. 2013. *Multicultural Manchester English: UKLVC9 presentation (personal communication)*. 15th September, Email.
[8] Flynn, N. 2011. Comparing vowel formant normalisation procedures. *York Papers in Linguistics*, 2(11). 1-28.
[9] Haddican, B., Foulkes P., Hughes V., Richards H. 2013. Interaction of social and linguistic constraints on two vowel changes in northern England. *Language Variation and Change*, 25. 371-403.
[10] Heselwood, B., McChrystal L. 2000. Gender, accent features and voicing in Panjabi-English bilingual children. *Leeds Working Papers in Linguistics and Phonetics*, 8. 45-70.
[11] Hirson, A., Sohail N. 2007. Variability of rhotics in Punjabi-English bilinguals. *Proc. 16th ICPhS*. Saarbrucken, 1501-1504.
[12] Hughes, A., Trudgill P., Watt D. 2012. *English Accents and Dialects: Fifth Edition*. London: Hodder Education.
[13] Kendall, T., Thomas E.R.. 2009-2014. *Vowels: Vowel Manipulation, Normalization, and Plotting in R. R package, version 1.2-1*: [Software Resource: http://ncslaap.lib.ncsu.edu/tools/norm/].
[14] Khan, A. 2006. *A Sociolinguistic Study of Birmingham English: language variation and change in a multiethnic British Community*. University of Lancaster: Unpublished PhD Thesis.
[15] Kirkham, S. 2011. The Acoustics of Coronal Stops in British Asian English. *Proc. 17th ICPhS*. Hong Kong, 1102-1105.
[16] Kuznetsova, A., Brockhoff, P. B., Christensen, R. H. B. 2014. *lmerTest: Tests in Linear Mixed Effects Models*, in *R package version 2.0-20*: http://CRAN.R-project.org/package=lmerTest.
[17] Lambert, K., Alam F., Stuart-Smith J. 2007. Investigating British Asian accents: studies from Glasgow. *Proc 16th ICPhS*. Saarbrücken, 1509-1512.
[18] McCarthy, K., Evans B.G., Mahon M. 2011. Detailing the Phonetic Environment: A Sociophonetic Study of the London Bengali Community. *Proc 17th ICPhS*. Hong Kong, 1354-1357.
[19] McDougall, K. 2006. Dynamic features of speech and the characterization of speakers: Toward a new approach using formant frequencies. *International Journal of Speech Language and the Law*, 13(1). 89-127.
[20] McDougall, K., Nolan F. 2007. Discrimination of speakers using the formant dynamics of /u:/ in British English. *Proc. 16th ICPhS*. Saarbrücken, 1825-1828.
[21] ONS. 2013. 2011 Census: Quick Statistics for England and Wales, March 2011. *Office for National Statistics*.
[22] Rathore, C. 2011. *East African Indians in Leicester, UK. Phonological variation across generations*. Paper presented at ISLE2: Boston.
[23] Rathore, C. 2011. *"I am more of an African than an Indian", East African Indian English in Leicester, UK*. Paper presented at ICLaVE 6: Freiburg.
[24] Shackle, C. 1979. Problems of classification in Pakistan Panjab. *Transactions of the Philological Society*, 191-210.
[25] Shackle, C. 2003. Panjabi. In: Cardona G., Jain D. (eds), *The Indo-Aryan Languages*,. Routledge: London. 581-621.
[26] Sharma, D. 2011. Style repertoire and social change in British Asian English. *Journal of Sociolinguistics*, 15(4). 464-493.
[27] Sharma, D., Sankaran L. 2011. Cognitive and social forces in dialect shift: Gradual change in London Asian speech. *Language Variation and Change*, 23(3). 399-429.
[28] Sóskuthy, M. 2014. *Formant Editor: Software for editing dynamic formant measurements (Version 0.8.2)*. [Software]. Available from https://github.com/soskuthy/formant_edit
[29] Stuart-Smith, J., Timmins C., Alam F. 2011. Hybridity and ethnic accents: A Sociophonetic analysis of 'Glaswasian'. *Language Variation - European Perspectives 3: Selected papers from ICLaVE 5*. Copenhagen: John Benjamins. 43-57
[30] Van der Harst, S., Van de Velde H., Hout V. 2014. Variation in Standard Dutch vowels: The impact of formant measurement methods on identifying the speaker's regional origin. *Language Variation and Change*, 26. 247-272.
[31] Verma, M., Firth S. 1995. Old Sounds and New Sounds: Bilinguals Learning ESL. In: Verma M., Corrigan K., Firth S., (eds). *Working with Bilingual Children: Good Practice in the Primary Classroom*, Multilingual Matters: Avon. 128-142.
[32] Watt, D., Tillotson J. 2001. A spectrographic analysis of vowel fronting in Bradford English. *English World Wide*, 22(2). 269-304.
[33] Wells, J.C. 1982, *Accents of English 1: An Introduction* . Vol. 1. Cambridge: Cambridge University Press.
[34] Wormald, J. 2014. Bradford Panjabi-English: the realisation of FACE and GOAT. *Proc. 1st Postgraduate and Academic Researchers in Linguistics at York (PARLAY) conference*, 1. 118-138.

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