GENDER, ACCENT FEATURES AND VOICING IN PANJABI-ENGLISH BILINGUAL CHILDREN

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Abstract

Results are reported of an investigation into the presence of Panjabi accent features in the English of ten-year-old bilingual children as perceived by 45 phonetically-trained listeners. The male bilingual children were rated as exhibiting more Panjabi influence than the females, a result confirmed by close auditory analysis and narrow phonetic transcription which pinpointed postalveolar articulation of alveolar stops and associated backing of open vowels as the features that most differentiated the boys from the girls. However, the amount of Panjabi influence in the realisation of English voiced stops as measured instrumentally showed no gender effect, although voiced stops in both languages were realised with a greater allophonic range than was found in the two control groups.

1. Introduction

In Heselwood & McChrystal (1999) we reported the results of an acoustic investigation into voicing in Panjabi stops in Bradford. The main finding was that while speakers over the age of about 25 realised voiced stops with prevoicing as is expected for Panjabi, younger speakers are much less predictable with respect to this feature. In our data some of them prevoiced their voiced stops all or most of the time, others rarely or never, and yet others varied more or less 50-50 between prevoiced and devoiced realisations. A vocal tract effect was evident whereby prevoicing was more likely to be maintained in stops with places of articulation further from the glottis.

The present study is concerned to explore the relationship between accent features and voicing behaviour in the pronunciation of English by the ten-year-old subjects in that study. For information about the subjects' social background, see Heselwood & McChrystal (1999: 49-50).

2. The research question

The focus of this investigation is on the extent to which each bilingual child is auditorally identifiable as a non-monolingual speaker of English by phonetically-trained listeners, and whether this correlates with

1. the speaker's gender (the independent variable)
2. the speaker's pattern of voicing of English stops
3. the speaker's pattern of voicing of Panjabi stops
4. the presence of non-monolingual BE (British English) accent features as confirmed by close auditory analysis.

Because voiced stops in Panjabi are typically realised with prevoicing (Heselwood & McChrystal, 1999) while those in English typically are not (Ladefoged & Maddieson, 1996:50), we wanted to see whether those speakers rated as having a relatively obvious non-BE accent when speaking English would also exhibit a relatively high incidence of prevoicing in realisations of both Panjabi and English voiced stops. Conversely, we wanted to see if those judged not to have much of a non-BE accent would tend not to prevoice voiced stops in either language.

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3. Data collection

The 19 speakers who formed Group D in Heselwood & McChrystal (1999)[1] were recorded producing eight English words twice each in a single-word picture elicitation task. Words beginning with each of the English stop phonemes /p, b, t, d, tʃ, dʒ, k, g/ were chosen (see Appendix 1 for the list of words) in order to measure the voice onset times (VOTs). All 19 speakers were bilingual in Panjabi and English with Panjabi as their L1[2], and all had attended English-medium school in Bradford since the age of 5. The group comprised 10 males and 9 females. Ten age-matched monolingual English-speaking children – 5 males and 5 females – from the same local school as the bilinguals[3] were recorded in the same task to act as a control group for the production of English stops.

Each speaker was recorded onto analogue tape in an empty classroom using a headset microphone and a Sony Professional audio cassette recorder. During sessions for the collection of the English words only English was spoken.

Data collected from the same bilingual subjects in the Heselwood & McChrystal (1999) study were used for crosslinguistic comparison of VOT behaviour; only Panjabi was spoken during those sessions. To provide quantified VOT norms for the realisation of Panjabi stops, data collected in that same study from older speakers were used. These older speakers therefore function as a control group for the production of Panjabi stops.

4. Data analysis

Three kinds of analysis were carried out:

1. accent judgement for rating the degree to which overt non-English accent features were perceived to be present
2. close auditory analysis for identifying and quantifying specific accent features for each speaker
3. acoustic analysis for measuring VOT.

4.1 Accent judgement

The first set of elicited words from each of the twenty nine speakers (19 bilingual Panjabi-English and 10 monolingual English) were randomised onto a single analogue audio cassette tape. Forty five phonetically-trained listeners were asked to listen to the tape twice and twice only. They were instructed on the second listening to rate each speaker on a four-point scale according to the presence of accent features not associated with monolingual varieties of British English (and therefore not associated with monolingual Bradford English). The scale points were as follows:

1. No non-English influence evident
2. Non-English influence detectable but not obvious
3. Non-English influence fairly obvious
4. Non-English influence very obvious.

They were also asked to note in general the non-English features they had perceived. They were not asked to do this for each word or each speaker separately as this might

[1] They have been given the same initials in this study so that comparisons can be made.
[2] It has not been possible to get an accurate picture regarding simultaneous vs consecutive bilingualism in our subjects or to discover their patterns of language usage in the home.
[3] One male control was from a different school but spoke with the same local variety of English.

have encouraged them to listen more often than the twice stipulated in the instructions.

All respondents were either staff or students in departments of British universities where linguistics and/or phonetics are taught. None of them spoke Panjabi, but knowledge of and proficiency in other languages were not controlled for, nor were all respondents L1 speakers of English. Listening conditions were not stipulated, e.g. free-field *vs* headphones. The point of the auditory analysis was to see how salient the non-English accent features were to the listeners without benefit of repeated exposure and therefore without opportunity for lengthy phonetic analysis. They were specifically asked to "give a judgement that reflects your general impression of the speaker's accent". Phonetically-trained listeners were chosen rather than phonetically naïve ones so that respondents could identify particular accent features using unambiguous phonetic terminology.

4.2 Close auditory analysis

All the English words produced by the bilingual speakers on the accent judgement tape were perceptually analysed and transcribed by the first author using IPA conventions without knowing their gender. A selection was checked by the second author for transcription agreement. The occurrence in the transcriptional record of the following accent features not associated with monolingual Bradford English was noted for each speaker (the number in brackets is the number of opportunities for the feature to occur in one speaker's transcribed data):

- Clear allophones of /l/ in syllable codas (2)
- Postalveolar/retroflex articulation of /t/, /d/ and /n/ (9)
- Backed articulation of /a/ and /a /[4] (5)
- An epenthetic vowel as the nucleus of the second syllable in *candle* and *garden* markedly more front than is found in monolingual English speakers (2)
- Postvocalic /r/ (2)
- Tense FOOT vowel in *pull* (1)
- Deaspirated voiceless plosives (3)

These were totalled to give each speaker an accent feature score out of a possible maximum of 24; speakers were then ranked by that score.

The purpose of this was to see if careful auditory analysis gave the same kind of picture regarding the presence of accent features as was given by the listeners; i.e. would 'general impressions' and careful auditory analysis converge on the same set of judgements.

4.3 Instrumental VOT analysis

The recordings were digitised on a Kay DSP5500 Sonagraph and displayed in synchronised spectrographic and waveform windows for VOT measurement. Realisations of target voiced stops were categorised into those which showed a voicing lead of at least 20ms prior to release (Laver, 1994: 349) (labelled 'prevoiced') and those which did not (labelled 'devoiced'). All tokens were measured to obtain a VOT value in milliseconds.

[4] Vowel length is phonemic in this pair in West Yorkshire (Wells, 1982: 364)

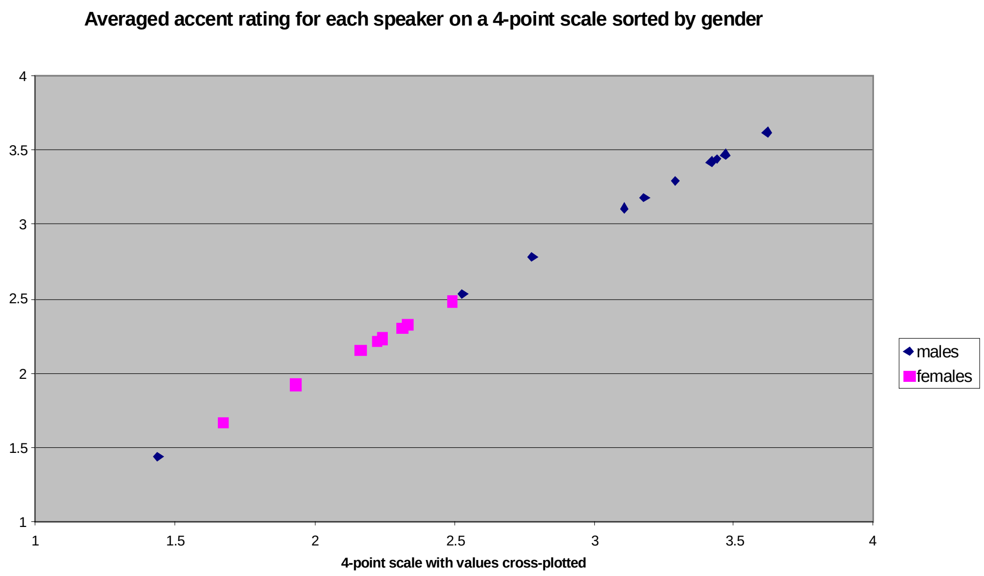
5. Results

5.1 Results of the accent judgement

All listeners correctly identified the 10 monolingual speakers by giving them a rating of 1 (= no non-English accent features detectable). Any listener that had rated one or more of these speakers higher than that would have had his/her responses excluded from the study on grounds of unreliability.

The clear result obtained was that the male bilingual children were rated as having greater non-English influences in their pronunciation than the females. Fig.1 shows the ratings averaged for each of the 19 bilingual speakers with all the males except one having an average score of at least 2.5 out of 4, and all the females an average score of less than 2.5.

Figure 1. Accent rating by gender.



In order to assess the inter-rater agreement in the judgement of strength of accent the number of raters who assigned each point on the scale to each speaker was counted, and the modal value calculated as a percentage of all responses. Agreement was higher in the rating of the female speakers with, on average, the modal value accounting for 64% of responses in contrast to 50% in the raters' judgements of the male speakers (see Table 1).

This difference could, however, be due largely to respondents' differing interpretations of 'fairly obvious' and 'very obvious'. To smooth out this effect the second most frequent rating was combined with the modal value and this new second-order value was calculated as a percentage of all responses. In all cases the second most frequent value was an adjacent point on the rating scale. Inter-rater agreement calculated in this way averaged 87% in relation to the male speakers and 90% in relation to the female speakers.

Combining the most frequent and the second most frequent responses together derives a 3-point scale from the original 4-point scale. The new scale can be labelled as: 1. Mild Panjabi accent 2. Moderate Panjabi accent 3. Strong Panjabi accent.

Table 1. Distribution of rater responses across 4 scale-points for each speaker, with modal value for each speaker expressed as a percent.

SPEAKER	Rating =1	Rating =2	Rating =3	Rating =4	Modal rating value as % of responses
MALES					
AS	1	1	12	31	**69**
AY	0	5	20	20	**44**
MB	2	21	18	4	**47**
AM	3	13	20	9	**44**
AR	0	9	19	17	**42**
YN	0	5	15	25	**56**
SR	0	3	18	24	**53**
SM	25	20	0	0	**56**
NG	0	13	14	18	**40**
AJ	1	3	17	24	**53**
AVERAGE					**50**
FEMALES					
SN	6	22	12	5	**49**
AN	9	31	4	1	**69**
II	3	28	14	0	**62**
TK	2	30	10	3	**67**
AK	2	36	5	2	**80**
SI	9	28	6	2	**62**
ST	15	30	0	0	**67**
TG	0	25	18	2	**56**
ZA	2	30	13	0	**67**
AVERAGE					**64**

Table 2. Second order distribution of rater responses across 3 scale-points, with modal value (2^{nd} order) for each speaker expressed as a percent.

SPEAKER	Mild accent	Moderate accent	Relatively strong accent	Second order modal value as % of responses
MALES				
AS	1	1	43	**96**
AY	0	5	40	**89**
MB	2	39	4	**87**
AM	3	33	9	**73**
AR	0	9	36	**80**
YN	0	5	40	**89**
SR	0	3	42	**93**
SM	45	0	0	**100**
NG	0	13	32	**71**
AJ	1	3	41	**91**
AVERAGE				**87**
FEMALES				
SN	6	34	5	**76**
AN	40	4	1	**89**
II	3	42	0	**93**
TK	2	40	3	**89**
AK	2	41	2	**91**
SI	37	6	2	**82**
ST	45	0	0	**100**
TG	0	43	2	**96**
ZA	2	43	0	**96**
AVERAGE				**90**

Table 2 presents the results mapped onto this scale, and Fig.2 shows the assignment of speakers to the accent strength categories according to gender. While 70% of the males fall into the 'relatively strong Panjabi accent' category, none of the females appear here at all.

As well as simply rating the speakers for accent, listeners were asked which accent features they had been aware of (see Table 3).

Figure 2. Accent strength by gender

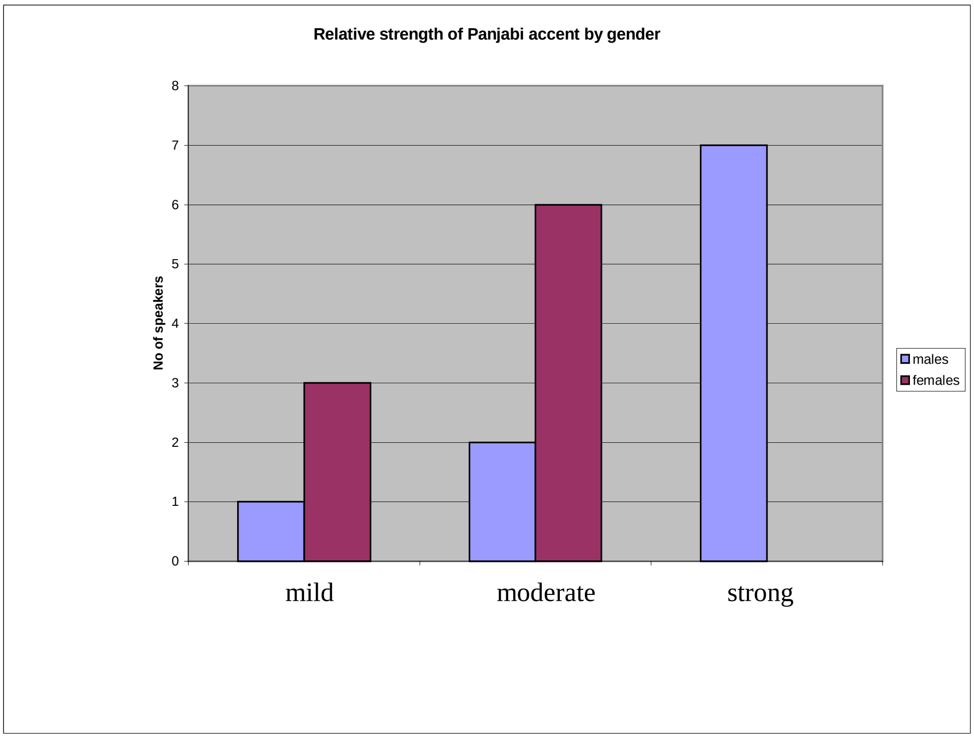


Table 3. Non-English accent features noted by listeners in accent rating task.

ACCENT FEATURE	No OF RESPONDENTS OUT OF 45
Retroflex/postalveolar articulation	27 (60.0%)
'Clear' /l/ allophone in coda positions	10 (22.2%)
Backed realisation of /a/ and /a /	9 (20%)
Deaspiration of /p, t/ and/or /k/	6 (13.3%)
Mid-front vowel insertion before syllabic /l/ and/or /n/	5 (11.1%)
Syllable-timed pronunciation	3 (6.7%)
Shortening of tense vowels	2 (4.4%)
Lengthening of lax vowels	2 (4.4%)
Post-vocalic /r/	1 (2.2%)
Dental articulations for /t/ and /d/	1 (2.2%)

5.2 Results of the close auditory analysis

Table 4 gives the accent feature score for each speaker listed in decreasing order; also given is each speaker's accent rating score multipied by 6 to express it as a score out of 24 for easier comparison, this being the maximum number of occurrences of accent features in each speaker's data-set. Gender is shown together with a number; in the figures below speakers are identified with this gender-number combination.

Table 4. Accent feature and accent rating scores.

SPEAKER	Feature score out of 24	Rating score out of 24	SPEAKER	Feature score out of 24	Rating score out of 24
NG *m9*	15	18.7	TK *f4*	10	13.7
SR *m7*	14	20.8	AN *f2*	10	13.4
AS *m1*	13	21.7	TG *f8*	8	14.9
AJ *m10*	13	20.5	SI *f6*	8	13.0
AY *m2*	12	19.7	AK *f5*	7	13.3
AM *m4*	11	16.7	II *f3*	7	11.6
ZA *f9*	11	13.4	ST *f7*	6	10.0
MB *m3*	10	15.2	SN *f1*	5	13.0
AR *m5*	10	19.1	SM *m8*	4	8.6
YN *m6*	10	20.6			

Postvocalic /r/ only occurred three times out of a possible 38, deaspiration only four times out of a possible 57, and FOOT-tensing (use of a tense vowel in *pull*) only once out of a possible 38 times. Fig.3 shows the percentage incidence of the remaining features by gender.

1 Clear /l/ allophones In *candle* a non-velarised [l] occurred in 33 out of 38 tokens (86.8%). The quality of the [l] is much 'clearer' than the norm for realisations of /l/ in this context in West Yorkshire speech and tends to be palatalised. There is only a very slightly higher incidence among the males – 90% compared to 83.3% in the females.

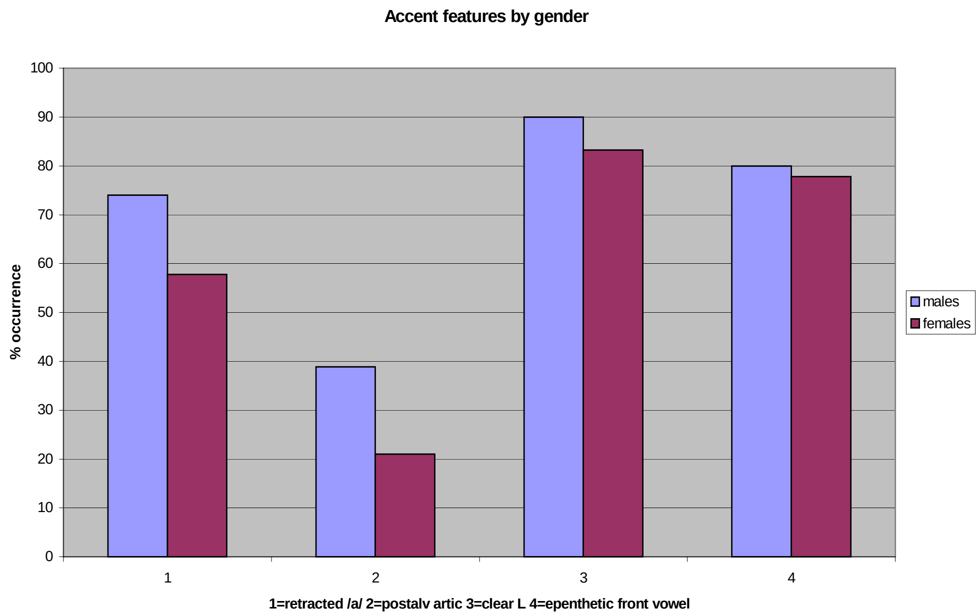
2. Epenthetic front vowel. In *candle* and *garden* a vowel of [ẹ], [ɛ̝] or [ə̝] quality occurred in 30 out of 38 tokens (78.9%). The quality of the vowel is very different from the mid-central schwa-type vowel found in monolingual English in these environments, being further forward in the vowel space. The quality before the clear [l] tended to be closer and more front than before the nasal, perhaps due to the palatalised quality in the lateral. Again, there is only a slightly higher incidence among males than females – 80% compared to 77.8%.

3. Postalveolar/retroflex articulation. The set of elicited words contained target alveolar stops as follows: /t/ x 3, /d/ x 3, /n/ x 3, TOTAL = 9

   The incidence of postalveolar/retroflex realisations was not totalled separately for the three phonemes, the result being 52 out of 171 tokens (30.4%). With this feature there was a much greater gender difference: among the boys the incidence was 35 out of 90 (38.9%) compared to 17 out of 81 (21%) for the girls.

4. Backed open vowels. There were five open vowels in the word-set: three short /a/ and two long /a /. The incidence of backed realisations was not totalled separately. The transcriptional record shows that 63 out of 95 tokens (66.3%) were quite noticeably backed more than is the case in monolingual West Yorkshire English. Again, there is a marked gender difference: 74% of the boys' realisations were backed, 57.8% of the girls'.

Figure 3. Incidence of accent features by gender.



5.3 Results of the instrumental analysis

The voicing patterns of the male and female bilingual speakers in realisations of the English voiced stops /b, d, dʒ, g/ were compared with each other and with the gender-matched controls. Each subject's pattern was also compared with his/her own pattern from the Panjabi data collected for the Heselwood & McChrystal (1999) study and with the patterns of the older (over 25yrs) speakers in that study. Each of these comparisons will be addressed in turn.

5.2.1 Comparison of male and female bilinguals' English voiced stops

The incidence of prevoicing in the English voiced stop data ranges from 0/8 to 8/8 among the boys, and from 1/8 to 8/8 among the girls. There is great variability from speaker to speaker and no real difference in the extent of variability in the two genders (see Fig.4). The average incidence of voicing among the boys is 4.1 out of 8 (51.3%); for the girls the figure is 4.4 out of 8 (55.6%).

5.2.2 Comparison of male bilinguals' and monolinguals' English voiced stops

Only one of the five monolingual males exhibited prevoicing. He prevoiced all eight tokens, which is unusual for English[5]. By contrast, nine of the ten bilingual

[5] Lisker & Abramson (1964: 395) found that one of their five English informants provided 95% of the prevoiced tokens, another provided 5%, and the others none. Docherty (1992) also notes that while few English speakers prevoice their voiced stops, those that do are quite consistent.

males prevoiced at least two tokens (see Fig.5). The average incidence of voicing in the two groups was 4.1 out of 8 (51.3%) for the bilingual males, 1.6 out of 8 (20%) for the monolingual males.

Figure 4. Bilinguals' prevoicing in English.

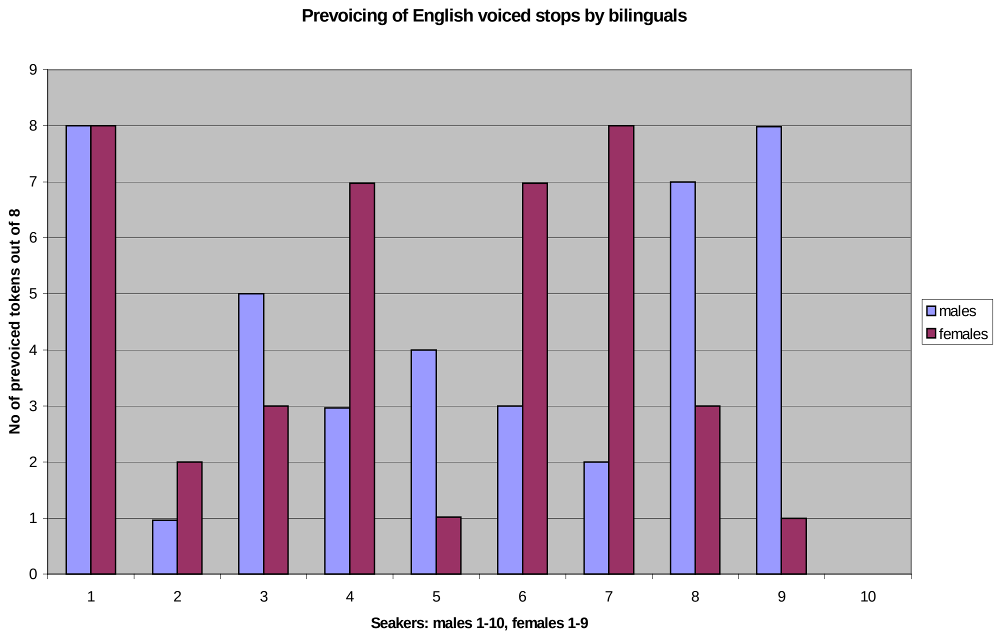
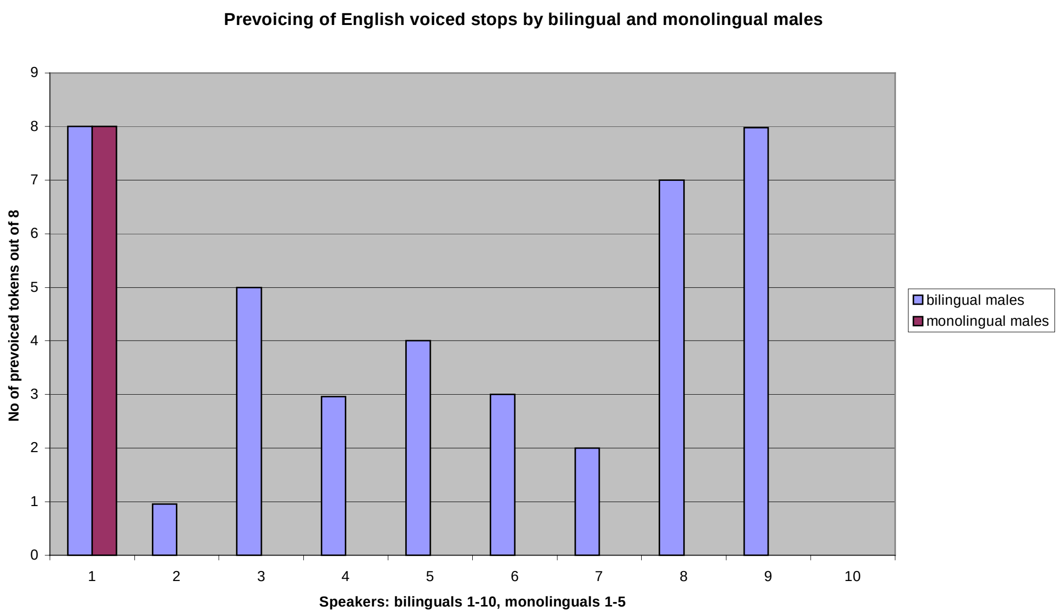


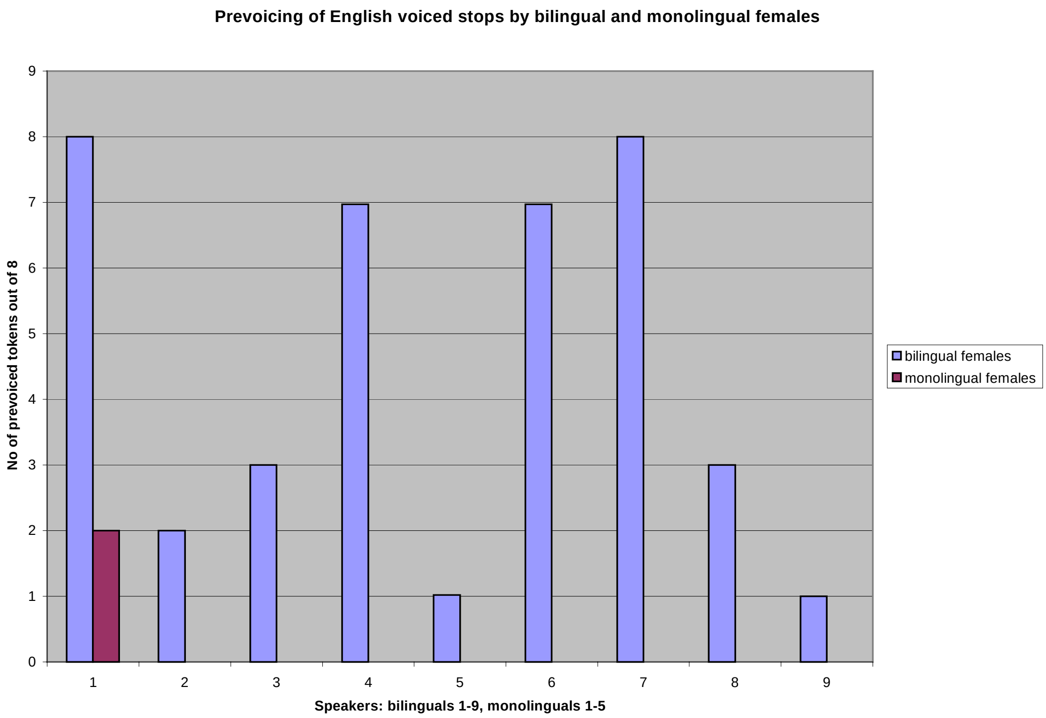
Figure 5. Prevoicing in English by males.



5.2.3 Comparison of female bilinguals' and monolinguals' English voiced stops

The contrast between bilinguals and monolinguals was even greater among the females. Only one monolingual speaker prevoiced any stops – one realisation of /b/ and one of /d/ - whereas all nine bilinguals prevoiced at least one token (see Fig.6). The average incidence of voicing in the two groups was 4.4 out of 8 (55.6%) for the bilinguals, 0.4 out of 8 (5.0%) for the monolinguals.

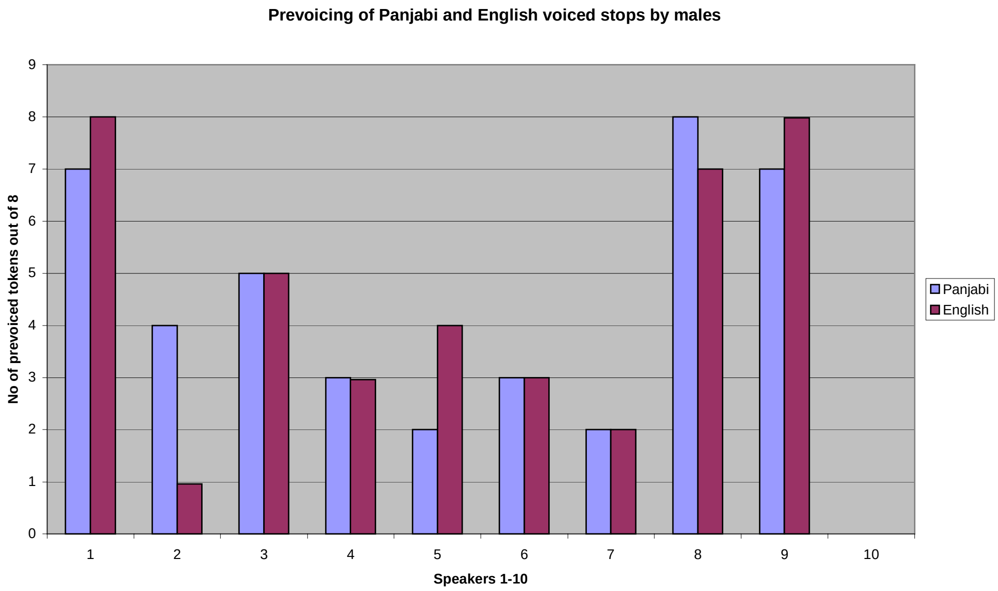
Figure 6. Prevoicing in English by females.



5.2.4 Comparison of male bilinguals' voiced stops in English and Panjabi

The results of this comparison show great variability within the group (see Fig.7). Speaker AS, for example, prevoices in both languages, speaker AJ produced no prevoiced tokens in either language. On average the incidence of voicing in the English data was, as we have seen, 4.1 out of 8 (51.3%); the incidence in the Panjabi data for these speakers was 4.3 out of 8 (53.8%).

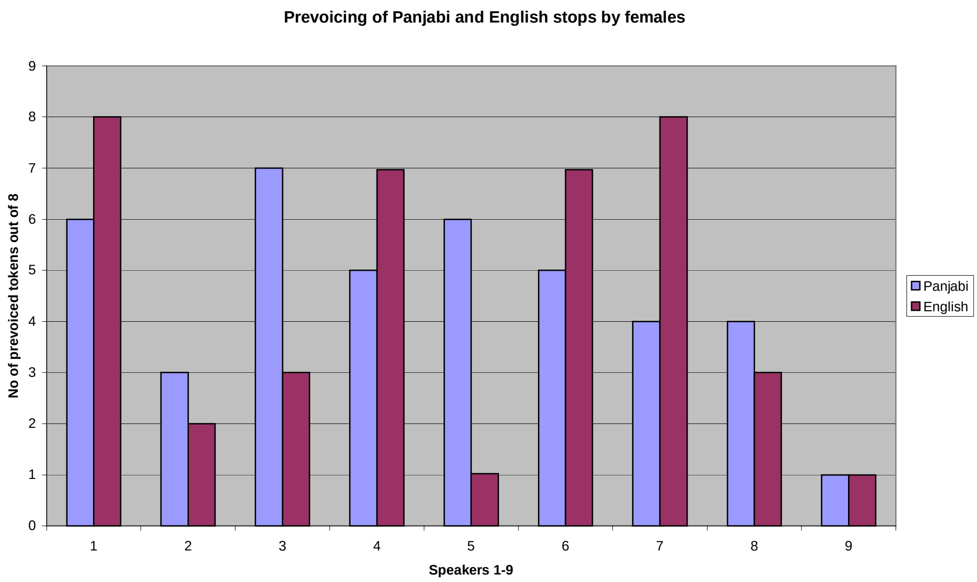
Figure 7. Males' prevoicing in Panjabi and English.



5.2.5 Comparison of female bilinguals' voiced stops in English and Panjabi

Again there is considerable variability (see Fig.8). Speakers SN, TK, SI and ST produced more prevoiced tokens in English, while speakers AN, II, AK, AY and TG produced more in Panjabi. The average incidence of voicing in the English data for these speakers was, as we have seen, 4.4 out of 8 (55.6%); in the Panjabi data it was 4.6 out of 8 (56.9%).

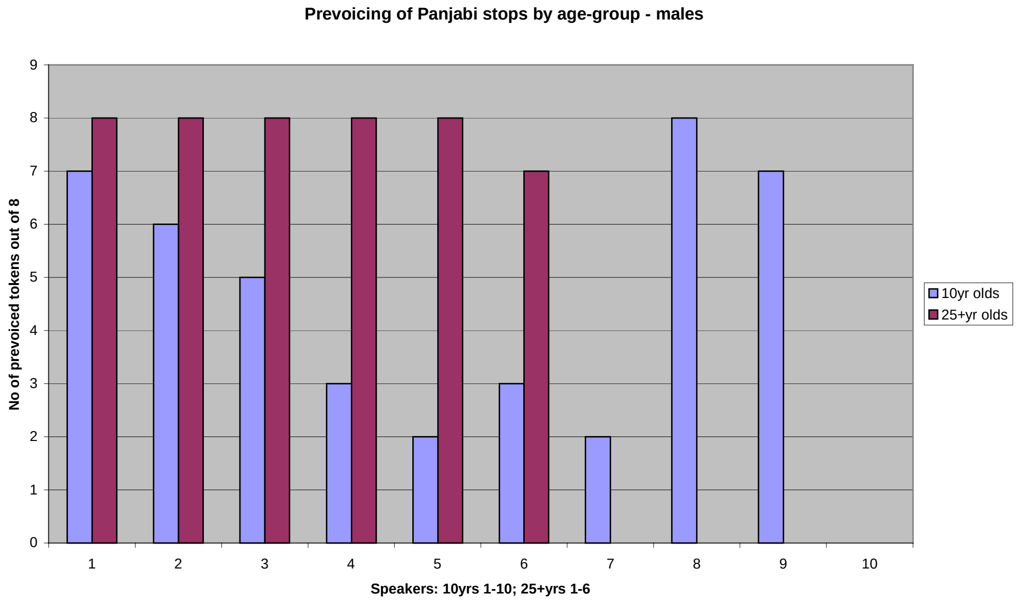
Figure 8. Females' prevoicing in Panjabi and English.



5.2.6 Comparison of male 10yr olds' and 25+yr olds' voiced stops in Panjabi

The older speakers are much more consistent than the younger ones with five out of the six speakers prevoicing all tokens and the remaining speaker voicing all but one token – a realisation of /dʒ/ (see Fig.9). The average incidence was 7.8 out of 8 (97.5%) for the 25+yrs group, compared to 4.3 (53.8%) for the 10yrs group.

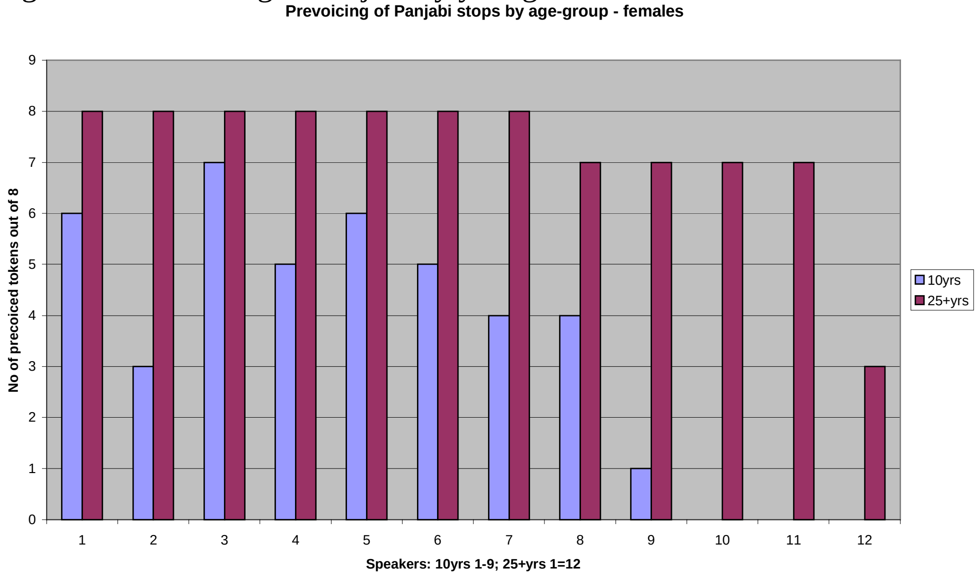
Figure 9. Prevoicing in Panjabi by younger and older males.



5.2.7 Comparison of female 10yr olds' and 25+yr olds' voiced stops in Panjabi

The results here are much the same as for the males, except that one speaker in the 25+yrs group only produced three prevoiced tokens (see Fig.10). The average incidence of prevoicing was 7.3 out of 8 (91.3%) for the 25+yrs group, compared to 4.6 (56.9%) for the 10yrs group.

Figure 10. Prevoicing in Panjabi by younger and older females.



6.0 Discussion of results

We will discuss first the results of the accent judgement task and then move on to the results of the close auditory analysis before finally considering the results of the instrumental investigation of voicing. We will then look at the implications of all the results together.

6.1 Discussion of accent judgement results

It is quite clear that listeners perceive the boys to have stronger Panjabi accents than the girls when speaking English, and that there is a high degree of inter-rater agreement about this. One male speaker, however, is notable for being an extreme exception. Male speaker SM has the lowest average accent rating of *all* the bilingual speakers, including the nine girls, with no listener rating him higher than 2 (= 'non-English influence detectable but not obvious') and twenty five listeners (56%) judging him to exhibit no non-English accent features whatsoever. Unfortunately we have no additional biographical information about the speakers that would enable us to seek a sociolinguistic explanation for this rather marked anomaly. In terms of voicing behaviour, however, SM is much more Panjabi-like than most of the other speakers, having high prevoicing scores in both languages – 8/8 in his Panjabi data, 7/8 in his English data.

By far the most commonly noted feature was retroflex/postalveolar articulation. This is not too surprising as Panjabi has a series of retroflex sounds. According to some accounts these may in fact vary in articulation between sublamino-prepalatal and apico-postalveolar (Catford, 1977: 152; Tolstaya, 1981: 8), but Bhatia has palatographic evidence that 'the point of articulation is way to the back of the hard palate' (Bhatia, 1993: 332) in at least some speakers. If we are justified in taking the backed articulation of /a/ and /a / as a coarticulatory effect of retroflexion (Laver, 1980: 50), then we can link backed open vowels and retroflex/postalveolar articulation together as a perceived accent feature, in which case 31 respondents (68.9%) reported it (five of the ones who noted this feature also listed retroflexion, two respondents explicitly linking these two features together). The obvious explanation is that this feature originates with the speakers' L1, and indeed it is a feature of so-called 'Indian English' (Wells, 1982: 628) which includes English as spoken in Pakistan.

Ten respondents listed the occurrence of a 'clear', i.e. non-velarised or palatalised, allophone of /l/ in syllable coda position, a context in which 'dark' or velarised allophones normally occur in English (Gimson, 1980: 200). Northern accents of English, which would include Bradford English, often have a realisation of /l/ in this context that sounds relatively clear (Wells, 1982: 370-71), but the quality of the [l] produced by the bilinguals was much clearer and more like that found in Irish and Scots accents. It is significant in this respect that none of the monolingual speakers were identified as exhibiting any non-English accent features which indicates that their /l/ realisations were not perceived to be as clear or palatalised as those of the bilinguals. Bhatia (1993) does not mention a velarised allophone of Panjabi /l/. It is therefore likely that this clear [l] is an L1 feature finding its way into the speakers' English. Wells (1982: 625) notes that '/l/ is clear in all positions' in Indian English.

Of the remaining features, dental articulations and post-vocalic /r/ are features of Panjabi; deaspiration could also be identified as a feature from Panjabi in that there are unaspirated as well as aspirated stops in that language. However, measurement of the speakers' VOTs for their realisations of English /p, t, k/ do not provide much evidence of deaspiration – they do not rerally differ from the VOTs of the monolingual speakers (see Table 5).

Table 5. Comparison of +ve VOTs in English voiceless stops by bilingual and monolingual 10yr olds. Values in milliseconds.

		Bilingual 10yr olds	Monolingual 10yr olds
/p/	Mean VOT	76	73
	VOT range	31-128	39-103
	SD	26	18
/t/	Mean VOT	62	89
	VOT range	28-147	50-153
	SD	26	32
/tʃ/	Mean VOT	80	85
	VOT range	37-139	56-114
	SD	27	17
/k/	Mean VOT	70	73
	VOT range	38-131	23-105
	SD	19	23

Insertion of mid-front [ɛ̞], [e̞] or [ə̞] before the /l/ of *candle* and the /n/ of *garden* can perhaps be taken together with syllable timing: there was only one other word of more than one syllable in the wordlist – *champion* – so it is reasonable to assume that it was the presence of these vowels that lead respondents to list syllable timing. No consonants are listed as syllabic in Panjabi by Bhatia (1993: 336), so again we can reasonably identify this vowel insertion as an L1 feature in L2 pronunciation. However, we should probably not regard it as a strategy to make English more syllable-timed as syllable-timing does not appear to be a feature of Panjabi. Bhatia describes Panjabi stress in terms not unlike the situation in English with stressed syllables distinguished from unstressed ones by length as well as pitch (Bhatia, 1993: 343). Rather, vowel insertion should be interpreted as a strategy to avoid syllabic lateral and nasal consonants. Quite what is responsible for the front quality of the vowel is not clear given that Panjabi has a mid-central unrounded vowel (Bhatia, 1993: 336) similar in quality to the schwa that sometimes occurs in these contexts in monolingual BE. The frontness may be a coarticulatory effect particularly of the /l/ which tends to palatalisation in the subjects' tokens.

As for vowel length, we are not able to speculate on the perceived 'non-English' vowel length reported by two respondents as descriptions of intrinsic and extrinsic vowel length and its relationship to vowel quality are not available for Mirpuri Panjabi.

It is safe to say, then, that in our sample of bilingual children the boys are perceived to exhibit more non-English features than the girls, that the features which presented most prominently to the listeners are associated with the kind of articulation used for the stops classed as retroflex in Panjabi, and that this and the other features are most easily explained as influences from Panjabi, the L1 of all the bilingual subjects.

6.2. Discussion of close auditory analysis results

The perception of features as reported by the listeners in the accent judgement task was, not surprisingly, largely confirmed by the transcriptional record. Discrepancies can perhaps mostly be put down to the fact that in the transcription differences of degree of a feature were not recorded, and it may be that degree of a feature had a significant impact on listeners' ratings.

Clear /l/ allophones in codas and epenthetic front vowels were the most frequently occurring, being absent in only one speaker. This was speaker SM; it will be remembered that he was rated as having the least non-BE accent of all the subjects. There was only a slightly higher incidence of these features in the boys' data compared to the girls'.

Postalveolar/retroflex articulation and open vowel backing occurred less frequently but showed a clear gender difference with boys exhibiting these features more than girls. Speaker SM's score for these features (4/14), however, was lower than for the other males who ranged between 6/14-11/14 and was at the lower end of the range of female scores (2/14-8/14). The transcriptional record shows he has the lowest incidence overall of the features listed above in section 4.2. which agrees with the listeners' rating of this speaker.

We can conclude that the judgements made under the conditions of the accent rating task, and the accent feature scores obtained through close auditory analysis, do indeed converge on the same general pattern regarding the distribution of accent features with respect to gender. In relation to the phonology of the words elicited, the picture seems to be that clear /l/ allophones in codas and fronted epenthetic vowels before potentially syllabic laterals and nasals mark the speaker as an L1 Panjabi speaker regardless of gender, while retroflex/postalveolar realisations of /t, d, n/ and backed realisations of /a/ and /a / tend to mark boys off from girls. It is possible that there is a general tendency for male Panjabi speakers to realise retroflex consonants in Panjabi with a greater degree of retroflexion than females (Bhatia, personal communication) although research evidence for this is so far lacking. If however it is the case, then the boys may be implementing this tendency in their realisation of English alveolar stops, i.e. grafting an L1 gender-marker onto L2. Preliminary spectrographic analysis of two of our speakers does point in this direction. Laver (1980:55) states that a lowered F4 in vowels is an acoustic consequence of a slightly retroflex setting, while more pronounced retroflexion causes a lowering of F3. Comparison of the third and fourth formant values for speakers SR (male) and SN (female) who had high and low accent scores respectively, reveals a gender difference in the predicted direction (Table 6). Values are taken from two tokens of the Panjabi word 'daal' (Arabic letter-name) and two of the English word 'dart' using a combined FFT and LPC setting on a Sensimetrics Speech Station II with the cursor positioned at the midpoint of the vowel's duration. Centre-frequency values are given to the nearest 5Hz. On average F4 is about 500Hz closer to F3 in the tokens from the male speaker with no discernible language effect.

Table 6.

Speaker	Word	F3	F4	F4-F3	Accent feature score	Accent rating
SR *m*	'daal'	3190	4255	1065	14/24	20.8/24
		3360	4195	835		
	'dart'	3220	4255	1035		
		3105	4365	1260		
	mean	**3220**	**4270**	**1050**		
SN *f*	'daal'	3275	4870	1595	5/24	13.0/24
		3050	4840	1790		
	'dart'	3500	5095	1595		
		3385	4675	1290		
	mean	**3305**	**4870**	**1570**		

6.3. Discussion of instrumental results

The most striking finding perhaps is that the 10yr old bilingual speakers as a group are different from their monolingual English peers and from their older community members with respect to the voicing of voiced stops in, respectively, English and Panjabi. Other researchers report similar findings with respect to other languages, e.g. Caramazza, Yeni-Komshian, Zurif & Carbone (1973) for Canadian French-Canadian English; Whitworth (this volume) for German-English; Khattab (this volume) for Arabic-English. Although prevoicing in English voiced stops has been observed in monolinguals (Docherty, 1992), in our data it occurs in only 15% of tokens (one monolingual prevoiced all his tokens but he is exceptional in the sample), but in the Panjabi data prevoicing in the 25+yrs control group is almost total – 93.9% of tokens display it. As was noted above, the 10yr-olds, male and female, are highly variable as a group in their voicing of voiced stops in both languages. Variation is sometimes in the direction one might expect, i.e. prevoicing more Panjabi tokens than English tokens (speakers AY (male), AN (female), II (female), AK (female), SM (male) and TG (female)), but is equally often in the contrary direction (speakers AS (male), AR (male), NG (male), SN (female), SI (female), ST (female) and TK (female); see figs 7 and 8). Whitworth (this volume) has also found this kind of contrariness in stop voicing and in contextually-determined vowel length in her German-English subjects. The quantity of data is insufficient to warrant generalisation of this particular tendency to the wider population, but the inter- and intra-speaker variation in both languages is quite clear. Developmental immaturity is unlikely to be responsible for this: control over the prevoiced/short lag/long lag phonetic distinctions should be complete well before 10 yrs (Zlatin & Koenigsknecht, 1976), and speakers between 16 and 22yrs from the same community have been found to exhibit a very similar pattern of devoicing of Panjabi voiced stops (Heselwood & McChrystal, 1999:57-9).

We have discussed the phonological implications of the devoicing of stops in Panjabi elsewhere (Heselwood & McChrystal, 1999) but it is worth pointing out here that the implications are different for the two languages: in Panjabi the difference between a prevoiced and a short lag stop correlates with a phonemic distinction whereas in English it does not. In this respect this study is different from most previous studies of VOT in bilinguals where only two phoneme categories are involved in both languages. Variability is therefore less hazardous for English than for

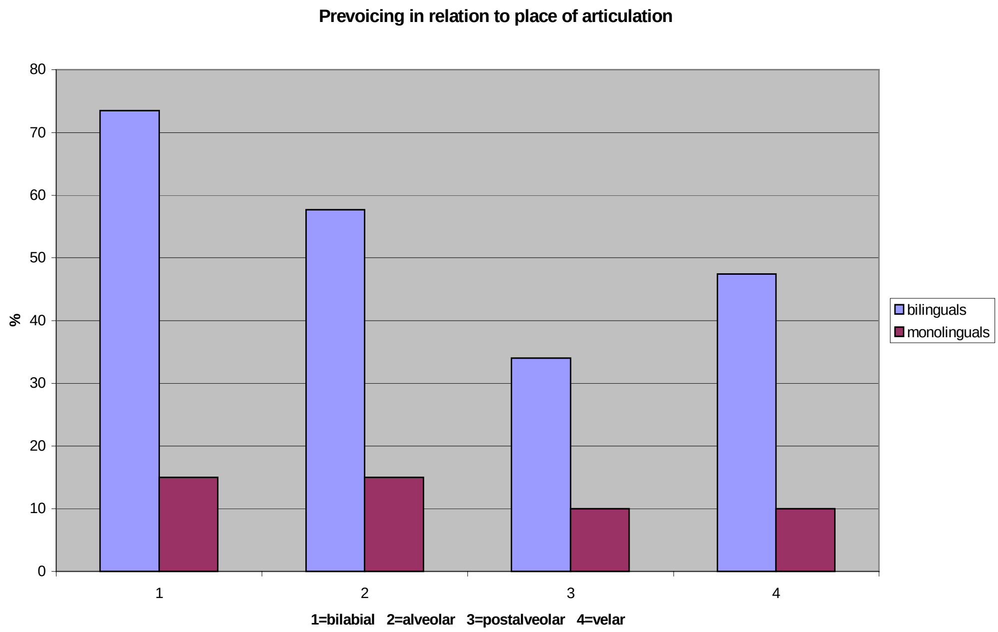
Panjabi, and could even be a consequence of influence from English such that the pattern of free variation with respect to lexical identity between prevoiced and short lag realisations that English can accommodate may have found its way into the Panjabi speech habits of these speakers.

The vocal tract effect on the incidence of prevoicing in Panjabi observed in Heselwood & McChrystal (1999: 57-8) is also evident in this study in both the bilingual and monolingual realisations of English voiced stops. There is an overall tendency for the incidence of prevoicing to decrease in stops with places of articulation closer to the glottis (fig.11), although the postalveolar affricate /dʒ/ appears particularly prone to devoicing, perhaps due to the need to sustain friction after the release.

There is only a slight suggestion in the results of a gender difference in voicing behaviour. As a group the girls exhibited 4.3% more voicing in the English voiced stops, and 3.1% more in the Panjabi voiced stops. Both groups showed slightly more voicing in Panjabi. More data are needed to confirm or disconfirm these trends.The possibility of gender differences in e.g. duration and/or amplitude of prevoicing may merit investigation given that very subtle differences have been found to have a systematic sociolinguistic correlation (Docherty & Foulkes, 1999: 71), although the high proportion of devoiced tokens in speakers of both genders makes it seem unlikely.

Intra-speaker variability seen in the 10yr old bilinguals' voicing of both English and Panjabi stops indicates a production behaviour that spans the phonetics of both languages and that must have come about from exposure to monolingual Bradford English outside the immediate community and to Panjabi and Panjabi-accented English within it. Influence from the voicing systems of two different languages is also reported for English-French bilinguals in Canada (Caramazza et al., 1973). When speaking English their VOT values were approximately midway between the values for monolingual English and monolingual French speakers, but when speaking French they were very close to monolingual French. The authors explain this as a function of the fact that French was their first language and conclude that 'interference appears to be unidirectional: from the first, perhaps stronger language to the second, perhaps weaker language' (Caramazza et al.: 427). It is problematic which language should be considered the stronger in our speakers, but the presence in their English of accent features originating from Panjabi would indicate that with regard to pronunciation Panjabi is the stronger. We would therefore have expected, in the light of Caramazza et al., to find hardly any devoicing of Panjabi stops and to find in their English data either short voice leads or shorter positive

Figure11



VOTs than those produced by the monolinguals. Regarding the first prediction, this was certainly not the case (see figs.7 and 8); regarding the second, only two tokens out of 152 showed a short voicing lead of less than 20ms (Laver, 1994: 349) and the means and ranges of positive VOT values are much too similar; where there are differences they are not consistently in the same direction (see Table 7).

Table 7. Comparison of +ve VOTs in English voiced stops by bilingual and monolingual 10yr olds. Values in milliseconds. (Excludes realisations with prevoicing).

		Bilingual 10yr olds	Monolingual 10yr olds
/b/	Mean VOT	19.2	14.5
	VOT range	0-44	5-31
	SD	6.6	7.2
/d/	Mean VOT	13.7	18
	VOT range	7-31	7-30
	SD	7.0	5.9
/dʒ/	Mean VOT	56.4	58.9
	VOT range	28-113	38-81
	SD	20.1	12.9
/g/	Mean VOT	30.8	19.8
	VOT range	5-47	11-28
	SD	9.9	4.4

We cannot explain the voicing behaviour in straightforward terms of L1 influence on L2 in the bilingual speakers; we may have to take the additional factor of language status into account (Bialystok, 1991: 1). Mirpuri Panjabi is a minority language in Bradford (also in other parts of the UK, e.g. Birmingham and Glasgow) surrounded by a monolingual variety of the majority language English, a situation not mirrored in the relationship between Canadian French and Canadian English. What we may be seeing here is an interaction between two contending forces: the force of the L1 and the force of the majority language. These younger generation bilingual children are not only sometimes realising Panjabi stops with the phonetics of English voicing as reported in Heselwood & McChrystal (1999: 60-61) but also the converse – sometimes realising English voiced stops with the phonetics of Panjabi voicing. It seems that in both production modes – English and Panjabi – most of our speakers appear to have two sets of motor-programmes available for activation. The idea that both languages are active during a bilingual's speech is of course not a new one (Sharwood Smith, 1991:17) but quite what determines which is activated at any given time may be impossible to ascertain; nothing identifiable changed during the course of the data elicitation other than the picture stimuli, and the same stimulus often produced a prevoiced token on one occasion and a devoiced token on the other. In fact this happened 20 times out of a possible 76 (26.3%) in the English mode and 25 times out of 76 (32.9%) in the Panjabi mode with the same speakers. Only two speakers out of the nineteen – AS (male) and SN (female) – never did this in either language. It is difficult to conclude that the observed voicing behaviour is anything other than random. None of the confounds identified by Grosjean (1998), for example, can easily be held responsible for the inter- or intra-speaker token-by-token variation.

It is also difficult to fit Watson's notion of a 'compromise' to our voicing data (Watson, 1991: 40-41). He suggests that bilinguals may develop a strategy for balancing on the one hand the need to be acceptable to each speech community and on the other the desire to minimise the processing complexity involved in operating two phonetic repertoires. As a result they would produce tokens for each language that differed less than the tokens of the two sets of monolingual speakers. Caramazza et al.'s (1973) subjects appear to do something of this nature as do sometimes the speakers reported in Khattab (this volume) and Whitworth (this volume). The speakers we are considering, however, vary between tokens that are no less distinct than those of the two control groups, i.e. prevoiced tokens indistinguishable from those produced by the older Panjabi speakers, and devoiced tokens indistinguishable from those of the 10yr-old English monolinguals. There is therefore no real evidence of a reduction of on-line processing load. Nor is there much evidence that they are trying to realise their voiced stops in a language-appropriate manner: while there is perhaps some evidence of this among the females, the males exhibit more language-*in*appropriate voicing than language-appropriate voicing which, in Panjabi, compromises the phonological opposition between voiced and voiceless phonemes.

But all is not necessarily hopelessly inexplicable. Their voicing behaviour can be reconciled with Watson's principle of processing economy if we regard these speakers as simply having one set of motor programmes for voiced stops that includes prevoiced and devoiced realisations and which is opposed to a set of long lag realisations. That is to say, they are not bothering to choose from that set with much regard for which language they happen to be speaking. The result is a much lower incidence of prevoiced Panjabi tokens than in the older control group, and a much higher incidence of prevoiced English tokens than in the English control group. Compare figs. 12a and 12b.

Fig. 12a. Bilingual speakers' use of VOT categories for realising stop phonemes in Panjabi and English.

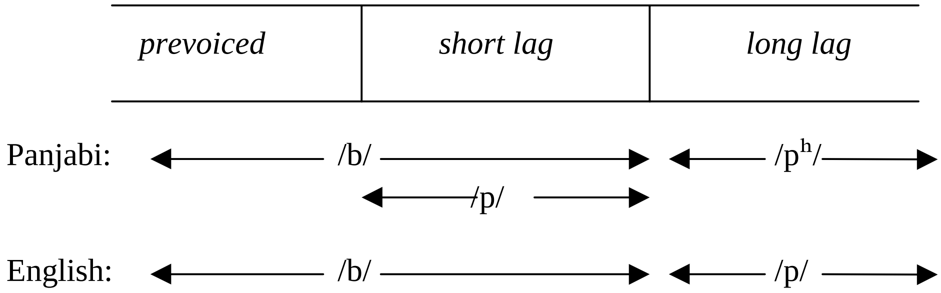
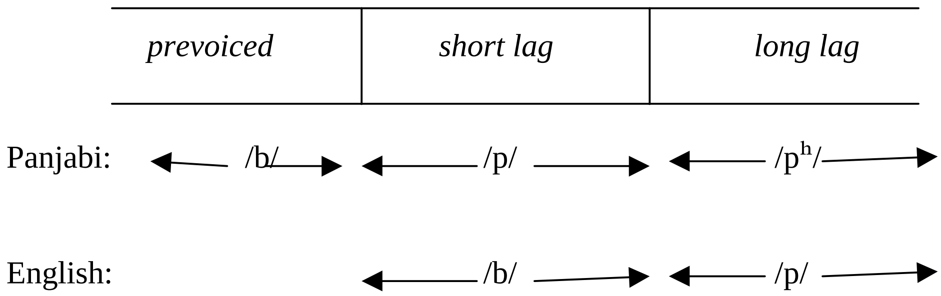


Fig. 12b. Control groups' use of VOT categories for realising stop phonemes in English and Panjabi.



In effect what they have done is add together the allophones of English voiced stops and the allophones of Panjabi voiced stops. Whether we should regard the result as a single large allophonic set which serves both languages, or two co-extensive allophonic sets, one for each language, is probably not an empirical question. The principle of economy of description favours the former view and we should accept it unless there are good theoretical reasons not to. Storage and on-line processing is simplified for the speaker if there is only one set of motor programmes to store and if choosing from the set in real time is unconstrained. This does not preclude the possibility of language-appropriate choices: constraints on the selection of a motor programme could be activated in certain circumstances but relaxed in others.

Finally, there is substantial evidence of the children in this study adopting strategies to maintain prevoicing which are not characteristic of voiced stop production in adult Panjabi speakers but which have been reported in immature speech in other languages (Macken & Barton, 1980; Allen, 1985; Khattab, this volume). Ohala (1997: 687) explains why voicing cannot continue for long while the vocal tract is constricted. When the pressure increase behind the stricture reaches the level of subglottal pressure, transglottal airflow ceases and voicing is impossible. Children, with shorter vocal tracts, will be unable to sustain voicing in this condition for as long as adults which may pronpt them to seek compensatory strategies if they are attempting to match the values of adult speech. Macken & Barton (1980) observed spirantisation of voiced stops by a 4yr-old Spanish-speaking child, while Allen (1985) reports three strategies employed by young French speakers: prenasalisation, prevocalisation with an oral vowel and prevocalisation with a nasalised vowel. The six speakers in that study were aged 1;9-2;8 but we have observed a similar range of strategies in our bilingual speakers aged ten years in both their languages. Regarding spirantisation, one speaker realised a Panjabi /b/ as [β] on one occasion, but nasality was much more prevalent. Several speakers produced what sounded like a homorganic nasal in some of their tokens spanning all four places of articulation. One or two speakers prevocalised a voiced stop but the vocalic segment was too brief to reliably tell whether or not it was nasalised. We have not quantified these observations as yet or attempted to correlate them with gender, but they appear to be quite common. Indeed, one speaker (AS male) prenasalised all eight of his English voiced stops and four of his Panjabi ones (see Spectrogram 1: production of English /bʊk/ with 83ms of prenasalisation, and Spectrogram 2: production of Panjabi /bʊɖe/ with 106ms of prenasalisation).

7.0 General discussion of all results.

Gender differences are apparent in accent rating and in accent feature scores but not in voicing of voiced stops. Because prevoicing is the norm for voiced stops in Panjabi but not for those in English it can be considered an accent feature on a par with the features listed in 4.2. above. However, as mentioned earlier, none of the listeners in the accent rating task listed prevoicing of stops as a feature they had perceived. It is interesting, therefore, that while there is a clear difference between males and females in English accent rating and accent feature scores there is no corresponding gender difference in their English or Panjabi voicing behaviour as measured instrumentally.

One possible explanation is that the boys are using Panjabi accent features to identify themselves as members of their community which for obvious historical reasons uses a variety of English strongly characterised by influences from Panjabi. Only accent features that are overt will serve this purpose. The girls, on the other hand, may be moving more towards the monolingual variety of English spoken outside the community by the majority population of Bradford. Research has shown females to be less conservative than males, and more open to linguistic influences from outside the immediate social group (Watt & Milroy, 1999: 41). It is boys rather than girls who tend to favour non-standard local pronunciations (Trudgill, 1983: 87). The reason usually given for this is that females prefer prestige forms moreso than males (Labov, 1990: 240). If we try to interpret our findings in these terms it leads to the conclusion that the girls regard more 'English-sounding' pronunciations as having greater prestige than 'Panjabi-sounding' pronunciations and are consequently adopting them when speaking English. The boys, on the other hand, appear more content to use the Panjabi-sounding pronunciations of English prevalent within the confines of their community.

Recent sociolinguistic research in the UK puts a slightly different slant on the gender issue. It has identified females as favouring supra-local variants over local ones regardless of their wider prestige value while males tend to stick to local forms (Watt & Milroy, 1999: 43; Mathisen, 1999: 122; Milroy, Milroy, Hartley & Walshaw, 1994) so perhaps we can account for the gender difference in accent by viewing monolingual Bradford English as a supra-local variety from the perspective of the local Mirpuri community. The reason there is no obvious gender difference in the incidence of prevoicing might be explained on the grounds that its low perceptual salience renders it less useful as a sociolinguistic marker of identity. If prevoicing is dissociated from other accent features then speaker SM's low accent rating and accent feature score but high prevoicing score in both languages could more easily be explained. This argument is not entirely convincing, however, when we consider that prevoicing is perceptually salient enough to serve as the phonetic basis of a phonemic opposition in Panjabi and many other languages, unless the children's level of sophistication is such that they know it isn't so perceptually salient to monolingual

Bradford English speakers. It has been shown, for example, that speakers decrease their sensitivity to phonetic distinctions that are not important in their language, including voicing distinctions of the kind found in the Indo-Aryan languages (Werker, Gilbert, Humphrey & Tees, 1981).

An alternative explanation could be sought in the suggestion alluded to above that the boys are using a more retroflex/postalveolar articulation than the girls, and consequently more coarticulatory vowel backing, in line with a possible gender difference prevalent in Panjabi and that this difference just so happens to be very noticeable to the non-Panjabi speakers who carried out the accent rating task and the transcriptions. That is to say, the perceived accent difference may be a consequence of a within-community 'phonetic sex-typing' (Kahn, 1975) rather than a difference in susceptibility to influences from outside the community. This would account for why there is no gender difference in the voicing and also no obvious gender difference in other accent features such as generalised use of clear allophones of /l/ and insertion of epenthetic front vowels. Further research is needed to see which way an explanation may lie.

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Appendix 1. Words elicited in the English picture-naming task

/p/	pull
/b/	book
/t/	tap
/d/	dart
/tʃ/	champion
/dʒ/	jet
/k/	candle
/g/	garden

Appendix 2. Raw VOT scores

Bilingual subjects' VOT values for English stops.

SPEAKER	/p/	/b/	/t/	/d/	/tʃ/	/dʒ/	/k/	/g/
AS *males*	86 69	-63 106	41 33	-101 -103	72 67	-56 -83	56 64	-161 -78
AY	34 50	23 -23	39 50	20 8	50 81	39 56	63 64	33 31
MB	56 50	14 -33	42 33	-48 -63	98 52	-30 -10	45 64	16 -56
AM	91 117	20 -66	83 56	22 -161	83 77	56 -15	84 52	49 -87
AR	55 31	-48 -60	39 28	-41 -5	75 102	59 53	45 38	16 -36
YN	98 97	-40 -33	83 43	11 13	84 37	51 54	75 90	13 -45
SR	66 42	23 -101	58 30	13 -78	48 69	48 64	72 48	38 38
SM	91 92	-136 -53	147 72	-126 -30	103 75	-28 40	81 56	-73 -55
NG	63 41	-100 -100	44 56	-94 -114	56 47	-48 -61	63 38	-71 -53
AJ	46 63	Pv pv	48 53	22 9	81 63	81 50	59 63	43 28
SN *females*	91 42	-61 -79	47 34	-38 -79	66 44	-- -46	56 95	-60 -43
AN	84 66	13 -40	63 53	-50 0	75 66	47 56	56 59	28 31
II	106 138	-96 -93	112 91	22 -80	128 134	97 72	131 106	44 44
TK	101 94	-86 -66	61 73	-79 -69	97 119	-74 -58	72 81	-71 0
AK	78 89	8 17	61 83	8 13	56 72	52 44	64 58	27 -60
SI	88 83	-109 -43	64 56	-33 -25	67 67	-43 -61	72 77	19 -58
ST	75 80	-95 -100	97 109	-43 -123	139 81	-63 -63	100 78	-108 -113
TG	70 128	-96 -68	55 55	-48 0	120 119	58 56	84 83	19 16
ZA	83 80	-53 19	75 77	17 18	127 89	64 80	86 78	30 47

Monolingual subjects' VOT values for English stops

SPEAKER	/p/	/b/	/t/	/d/	/tʃ/	/dʒ/	/k/	/g/
CT *males*	53 47	-114 -87	53 50	-46 -66	88 70	-60 -79	50 23	-53 -43
MP	61 70	11 13	116 81	19 13	114 92	52 58	84 84	25 19
NT	61 39	-15 -5	63 55	11 20	78 83	81 58	61 56	20 20
LI	97 73	22 31	147 116	16 17	73 66	56 42	80 105	23 16
JK ↓	78 76	9 6	105 113	23 27	92 91	72 75	66 63	16 17
RG *females*	92 94	-86 9	81 75	-76 30	78 84	67 59	102 100	20 19
LC	100 103	22 11	86 64	16 14	111 102	69 38	111 86	28 23
SJ	77 52	20 8	125 86	7 25	69 67	55 52	73 66	27 17
DF	70 66	5 17	50 63	16 16	69 56	44 44	42 45	11 16
KP ↓	67 78	17 17	153 100	14 22	106 113	80 58	81 72	23 16