

End of Award Report on ESRC project R000237417

FULL REPORT OF RESEARCH ACTIVITIES AND RESULTS

1. Background

The stimulus for the present study was the ESRC-funded project *Phonological Variation and Change in Contemporary Spoken British English* ([37], henceforth referred to as **PVC**). Focusing on the adult speech community of Newcastle upon Tyne, PVC revealed systematic patterns of variation in the realisation of certain vocalic and consonantal forms correlating with gender and age, and varying also across socio-economically disparate neighbourhoods [9]. One line of further inquiry which was strongly promoted by PVC was to understand how such patterns of variability come to be acquired by children in the same community.

In pursuing this question, a review of previous work yielded few clues. There was some evidence from sociolinguistic work that children show signs of mastering local variable forms at an early stage of development [43], but in general early child speech has received little attention from sociolinguists. Within the literature on developmental phonology researchers were converging on the view that, as a result of exposure to the ambient language during the first year of life, infants ‘tune in’ to the properties of their native language as part of the process of learning to reproduce the sound patterns of that language [24, 51]. While it is uncontroversial to state that children acquire an accent when they learn to speak, there were few accounts in the acquisition literature which shed light on what exactly this amounts to [30]. Overall, work on acquisition was notable for being predominantly focused on the acquisition of a stable set of contrasts (usually conceptualised phonemically but increasingly within other frameworks such as Optimality Theory). There has been much less focus on development of the detail of phonetic realisation and relatively little application of the techniques which would enable this to come to the fore. Likewise, work on child-directed speech (CDS) which is a key dimension in our understanding of phonological acquisition, has focused on many levels of, linguistic analysis, but with little attention paid to its segmental phonetic properties. Moreover, that work which has been done paints a rather inconsistent picture [3, 6, 48].

It was also striking that few links had been made between work in the sociolinguistic and developmental arenas (but see [4, 21, 42]), despite the potential for adding value to our understanding of phonological learning by bringing to bear insights from different theoretical traditions.

In this context we set out to investigate aspects of the phonological learning of children from Newcastle. Our aim was to track the path taken by children in learning variable phonetic forms in the accent to which they are exposed and as part of this to make a three-way comparison between the children’s performance, that of their immediate caregiver in CDS, and that of the broader speech community.

2. Objectives

Our study had three main objectives. We describe briefly here how these have been met. A fuller discussion of methods and findings is given in sections 3 and 4 below.

2.1 Objective 1: to characterise the relationship between sociophonetic features of child-directed speech (CDS) and those of the adult community norms.

Data were gathered from 40 mothers interacting with their children. A range of phonological variables known to be socially sensitive in the community were analysed quantitatively using auditory and acoustic techniques. Comparison was made between the CDS findings and those of inter-adult speech which had been yielded by the PVC project. Some significant differences were found, showing that segmental features may differ in speech directed to children. Variation in CDS was also found to correlate with the age and gender of the children being addressed. Data from a small number of adult males were also analysed, the results of which suggested men are less prone to modify their speech when addressing children. Overall CDS was not found to be less variable than adult-directed speech.

2.2 Objective 2: to trace the emergence of the phonetic features of the native accent, and the child's harnessing of those resources in the construction of a sociolinguistic identity.

A total of 96 recordings from 53 children aged between 2 and 4 years were gathered via both a cross-sectional and a longitudinal design. Children's productions of several variables were analysed in a range of phonological contexts, using a combination of acoustic and auditory methods. The effects of the children's age and gender, were examined with respect to the development of fine-grained articulatory patterns. Production of some variables was found to change over time, with older children matching more closely the patterns produced by adults. Cross-gender variation in production was not strongly marked in the data, even in the cases where such variation is found in adults' speech. One exception to this was found (see section 4.2.4).

2.3 Objective 3: to establish the relationship between patterns of variation observed in infants and what is known about variation within (a) the community at large, and (b) CDS.

Comparisons were made of the children's performance and the patterns found in both CDS and PVC, to identify the extent to which children's performance reflects characteristics of the adult samples. Results show correlations between mothers' and children's patterns in respect of a number of the variants studied.

3. Method

3.1 Fieldwork

Two parallel studies were undertaken, one cross-sectional and one longitudinal. The cross-sectional study had a sample design similar to that of PVC and focused on the same broadly 'working-class' community shown in PVC to be characterised by greater variation in realisation of the variables of interest.

Data were gathered from neighbourhoods in the north and west of Newcastle, including Newbiggin Hall, Benwell and North Kenton. A range of methods was used to contact potential families: direct contact via health visitors, visits to toddler groups, and the 'friend-of-a-friend'

strategy which has been used successfully in sociolinguistic studies. Access to parents of potential subjects was unproblematic but as a result of the subject inclusion criteria (see below) and parental disinclination to participate, a number of potential subjects who were contacted did not ultimately take part.

The design of the cross-sectional sample was as follows (all ages \pm 1 month):

	age				
	2;0	2;6	3;0	3;6	4;0
males	4	4	4	4	4
females	4	4	4	4	4

This age-range was chosen on the basis that the level of phonological development typically achieved at 2;0 would probably be the earliest feasible starting point for addressing the research questions. Beyond 4;0 it was reasoned that it would be difficult to control for other sources of input, e.g. from the peer group and younger siblings. The sample size is designed to permit observation of the extent to which typical patterns emerge from each group of speakers and to permit statistically-informed inferences to be made.

The longitudinal study set out to track four male and four female infants bi-monthly over a two-year interval covering the same age-range. As the result of a higher than anticipated attrition rate during the project, combined with the difficulties in recruiting valid subjects referred to above, the final longitudinal sample consisted of three males and two females sampled over a two-year period. Further longitudinal data were obtained from two males and three females but without completing the full cycle of recordings. Parents were far less willing to commit to the longitudinal strand of this project than to the cross-sectional one. There were a range of factors underlying the attrition rate, including: moving out of the city, repeated failure to keep appointments, illness, and disrupted domestic circumstances resulting in a change of primary care-giver.

The inclusion criteria for the subjects in the study were as follows:

- both parents monolingual English speakers
- no referrals for speech and language therapy
- normal hearing and no recurrent otitis media
- full term pregnancy and otherwise normal development as reported by parents
- only child or eldest (to minimise impact of communication with siblings)
- parents main care-givers (i.e. no significant role for extended family, child-minders etc.).

For both strands of the study, the principal material collected was a sample of interaction between mother and child, mediated by the fieldworker. Typical interactional situations were playing with a toy or reading a book. Materials were chosen to elicit words containing the variables of interest. We were not prescriptive about the amount of material to be obtained from unscripted interaction with young infants, but the goal of each recording session was to obtain as much data as reasonably possible, with the focus/topic of the interaction geared by the fieldworker towards eliciting tokens of relevant variables. No attempt was made to manipulate infants' speech style. A word list produced by the parent was also recorded. Isolated words were also recorded from the child based on a confrontation naming task using a pictorial adaptation of the Dodd 25-word consistency test. Recordings were of variable duration but were most typically in the region of 45 minutes.

Recordings were made in as quiet surroundings as could be achieved at the subjects' homes, using radio lapel microphones and digital recording facilities. Given the domestic setting, it was not possible to control for a number of factors affecting the quality of the recording. This occasionally rendered entire sessions and portions of sessions unsuitable for analysis, but in the majority of instances, extraneous noise was well within the limits permitting reliable auditory and acoustic analysis. Where this was not the case the session was not included in the final corpus.

Recordings were made by a group of speech and language therapists, all with extensive experience in obtaining language samples from infants and their parents. All fieldworkers were trained in order to induct them to the aims of the study, the nature of the research protocol and the use of the equipment.

3.2 Analysis

Analysis of data made use of a combination of acoustic and auditory methods. This approach had been one of the innovative features of PVC, particularly in respect of consonant production. Several phonological variables were analysed. Both acoustic and auditory analysis were used to investigate (t), (p), (k) and Scottish Vowel Length Rule (SVLR). Auditory analysis alone was deemed appropriate for linking and intrusive (r), and the vowels of the FLEECE, GOAT, FACE, GOOSE, NURSE, PRICE and MOUTH lexical sets [54].

With the exception of (t), all variables were studied with reference to subsets of the full corpus. It was decided in the early stages of analysis to concentrate on (t), for several reasons: (i) the quantity of data demanded that we focused our efforts; (ii) (t) was much the most frequent variable, allowing more robust analysis; (iii) this was the most complex of the variables studied in PVC. (t) has therefore been analysed within all child recordings, in four contexts:

- (i) word-initial, e.g. *Teletubby*
- (ii) word-medial intersonorant, e.g. *water, bottle*
- (iii) word-final intersonorant, e.g. *hat on, get off*
- (iv) pre-pausal, e.g. *cat ##*

Auditory analysis centred on quantitative analysis of variants. In the case of (@), (t), (k) and SVLR, auditory transcriptions were also recorded but acoustic analysis was used both to register measurements of key parameters (e.g. vowel duration), and also to compile a detailed profile of the acoustic properties found in each token. For (t), (p) and (k) the acoustic analysis recorded the following:

- Word-initial: duration of voice onset time (VOT).
- In the other three contexts, the duration of any stop gap was measured. The acoustic profile for each token recorded the presence or absence of:
 - periodicity (reflecting voicing)
 - release burst (reflecting release of an oral closure)
 - pre-aspiration (the presence either of a period of high-frequency friction before the stop gap, or a breathy continuation of a vowel [S])
- 9 creaky phonation (the main correlate of 'glottal' variants [8]).
- In word-final intersonorant, the presence of [r]-like variants in 't-to-r' contexts ([9, 54]).

All tokens were analysed where possible. For (t) this amounted to over 3,000 tokens in CDS, and over 7,500 from children. Where children produced immature articulations (such as [bɒkəl] for *bottle*), the form was transcribed as heard, and the acoustic profile was used to characterise in

detail the articulation. The rationale behind this policy was that unitary IPA transcriptions (such as [k]) are not always simple to provide, and where given they might be taken to indicate an ‘incorrect’ pronunciation even though the token may in fact contain appropriate elements (e.g. voicelessness and plosivity for [k]). Subsets of the data were analysed independently by two of the research team to corroborate results, yielding agreement in over 90% of cases. Consensus was reached in the remaining tokens, and the decisions taken were used to inform judgement in subsequent analysis.

Statistical support for the project was provided by Dr T. Chadwick of the Newcastle University Department of Statistics. Appropriate statistical procedures were used in order to investigate the significant relationships between the criteria1 phonetic properties in child performance/CDS and the independent variables of child age/gender and phonological context; these included the use of linear models and the identification of disjoint 95% confidence intervals for the proportion of use of the phonological variants for different subgroups of the whole population. All statistical analyses were designed to provide a conservative means of identifying differences and relationships between groups of speakers in the context of varying sample sizes from individual speakers and the between-speaker variability characteristic of child-speech.

The detailed results presented below are based mainly on the 40 children in the cross-sectional sample. Data from children recorded for the longitudinal study were also analysed, in the first instance to corroborate the findings of the cross-sectional study. The recordings of 40 mothers, again selected to reflect the cross-sectional design of the children’s study, were also analysed with respect to (t) variants. (One sample proved unsuitable for analysis, therefore comments are based on 39 mothers.) Comparison is also made with the PVC findings. Tables summarising the results are provided in *Annexe 2*.

4. Results

4.1 Child-directed speech

4.1.1 Word-medial intersonorant (t)

Adults in the PVC corpus were extremely consistent in using ‘glottals’ (acoustically characterised by full voicing with portions of creaky phonation [8]). In unscripted speech, the young working class women produced 87% glottals, with only 12% [t] (see Table 1). However, analysis of the mothers’ speech to the children revealed sharp differences: the proportion of [t] variants increases to 59%, with only 36% glottal. The mothers therefore used fewer characteristic local variants, preferring more standard-like forms. In order to corroborate this finding, supplementary data were collected from five further women from the same community, speaking in both CDS and unscripted ADS settings [41]. Extremely similar results were found, with the use of [t] greatly increased in CDS.

There was incidental evidence from our data that men did not modify to the same extent as women: a small amount of data from three men who were fortuitously present for part of a number of recording sessions showed that glottal forms were still favoured. This aspect remains a topic for future research, although the fact that men appeared to make less marked linguistic changes in CDS has been noted for other linguistic phenomena [49].

Interestingly, the variation in (t) production across adult- and child-directed speech parallels a style-shifting pattern found in the PVC data: in formal word-list readings, most women (but few

men) avoided the local glottal variants in favour of [t] [9]. Word-list readings by the mothers overwhelmingly showed the same effect.

Analysis of the CDS data furthermore showed differences in variant use related to the age and gender of the child. First, mothers of boys used significantly more glottals than did mothers of girls, who favoured [t] (Table 2). This apparent differentiation was more marked for the youngest children: CDS input to the youngest girls contained very high rates of [t] and low rates of glottals, while the youngest boys received higher proportions of glottals and fewer [t] variants. Input to older boys contained increasing rates of glottals, but with no statistically significant change. Speech to 'older girls, however, varied significantly, with [t] usage dropping in favour of glottals. Analysis of four mothers in the longitudinal corpus supported these findings, with all four reducing their proportion of [t] as their child's age increased.

4.1.2 Word-final intersonorant (t)

Differences were also found on comparison of CDS with adult-to-adult data in word-final intersonorant context, although these were less marked than those outlined for word-medial position. In casual style the PVC adults used around 5% [t], with a range of voiced variants (creaky-voiced glottals, [ɾ d ɹ]) accounting for the majority of tokens. Around 33% of tokens involved creaky phonation. In the CDS data [t] was more frequent at 19%, with voiced variants totalling 56%, and 18% glottals. The variant [ɹ] was produced in 6.4% of potential instances. Individuals varied greatly, however, with some mothers making substantial use of [ɹ] and others none at all.

As with word-medial tokens there were effects for age and gender of child. These did not reach statistical significance, but the trends coincided with the effects found in medial contexts. That is, [t] was more common in speech to girls, while the non-standard local variants, [ɹ] and the glottals, were more frequent in speech to boys (Table 3). The use of [t] decreased in speech to older children, while glottals increased.

4.1.3 Pre-pausal (t)

Mothers' use of variants in pre-pausal positions also showed some differences compared with the PVC adults. Our interest centred on the pre-aspirated form [ʰt], which in PVC was very strongly associated with young women [8]. In the CDS data it was common, but variable across individuals. Glottal forms were also used but were variable across individuals and were in general rare, as was the case in the PVC data.

4.1.4 Vowels

In a series of experiments on various languages [24] it was found that the acoustic vowel space used in speech to babies was larger than that used in inter-adult speech. We replicated this analysis on a subset of the ESV mothers, but found no significant differences in CDS compared with ADS [50]. This finding may reflect the fact that the ESV children are substantially older than those in [24], and any modifications in vowel production to children may have ceased by age 2;0.

4.2 Children's production

4.2.1 Word-initial (t)

Over 90% of tokens were produced as voiceless aspirated stops, and with few exceptions these were alveolar. All but one of the children in the whole corpus had average VOT values greater than 25 ms, which is the generally agreed minimum value for aspirated stops [26]. This finding concurs with other studies which show that children can usually contrast initial voiced and voiceless stops by age 2 [33].

Our two youngest cohorts displayed more variability in both averages and standard deviations than the older groups, for whom the typical average was around 80 ms. This value is similar to those found in studies of adults [7, 23, 28]. Data from longitudinal subjects largely confirmed these patterns, with substantial intra-subject variability in VOT yielding to more stable and consistent values at later ages. For example, one longitudinal child had a very short average of 26.5 ms at age 2;0, but increased to 57-72 ms in subsequent recordings.

4.2.2 Word-medial intersonorant (t)

Table 4 summarises the overall quantification of acoustic features for all 40 children. The data are also shown divided into two subcategories, intervocalic and pre-/l/, since it was found in the PVC study that adults show differential variant usage in these two subcategories: a degree of variability was found for adults' pronunciations in intervocalic position, while pre-/l/ tokens were categorically realised by creaky phonation alone, yielding the auditory percept of [ʔ] [8].

The majority of tokens produced by the children were plain voiceless stops, as indicated by the high scores for voicelessness and release bursts and low scores for creak. The auditory transcriptions confirmed this, with 57% of tokens categorised as voiceless non-creaky stops. There was therefore some overlap with the variants typically used in word-initial position (mainly [t]). There was also, however, plenty of differentiation in phonetic forms used in medial position, with significant presence of both creak and pre-aspiration. Pre-aspiration was low compared with pre-pausal position (see below), but this feature was barely found at all in medial context in the PVC study. It was, however, present to a small extent in the mothers' speech, and has also been noted in recordings of Tyneside adolescents [1].

Overall there appeared to be some differentiation between intervocalic and pre-lateral tokens, with a higher use of creak and lower use of release bursts in the latter context. Although the overall number of pre-/l/ tokens was small, this pattern did mirror that found in PVC.

No significant differences were found in variant usage according to gender in medial context. However, differences did emerge with respect to age (Table 5). Older children used fewer voiceless stops than younger ones, with a fairly linear decline from the 2;6 cohort through to the 4;0 cohort. The youngest group proved an exception to this pattern, with a relatively low tally of voiceless stops, but this can be attributed to their relatively high number of immature articulations, which included many non-stop realisations. The opposite pattern was found for variants involving creak, which generally increased in correlation with the children's age. This evidence therefore suggests the older children approximated more closely to the patterns of variability which characterise adult speech. There was also evidence that the oldest children differentiated intervocalic from pre-/l/ contexts more sharply, using substantially fewer voiceless stops (22%) and more glottals (79%) before laterals.

4.2.3 Word-final intersonorant (t)

Voiceless variants, release bursts and pre-aspiration were all significantly less frequent than in word-medial context, although the proportion of glottal tokens was not significantly different (Table 6). In general, therefore, there was a reasonably well established pattern of differentiation between phonetic variants used in word-medial intersonorant positions, and those used in intersonorant positions interrupted by a word boundary.

The children produced 7% [ɾ]-like tokens, mostly as labial or labiodental approximants, [u]. What was particularly striking was that all examples occurred in the lexical set that is known to accommodate the variant [ɾ] in adult speech (*get off, put it* etc). The children therefore collectively displayed sensitivity to a variant pattern which is characterised by very tight lexical constraints.

With the exception of release bursts, where females outscored males, there was no evidence for gender differences in variant usage. There was again evidence that the performance of children differed as a function of age. Voiceless non-creaky stops accounted for 33% of tokens for the two youngest cohorts, but then decreased sharply to 15% or less in the three oldest groups. The decrease in voiceless stop variants was compensated for by an increase in voiced and/or creaky phones. This difference therefore suggests that the older children more closely matched the phonetic patterns produced by adults.

4.2.4 Pre-pausal (t)

In pre-pausal contexts (Table 7) the children used predominantly non-glottal stops, as is appropriate following the adult model. Pre-aspiration was well established, and was significantly more frequent here than in any other position, although this was variable across individuals. Overall, the variants used in pre-pausal position showed signs of marked differentiation from those used in other contexts.

An interesting age x gender interaction was found with respect to pre-aspiration. In the youngest three age groups boys and girls produced similar proportions of this feature overall. In the 3;6 cohort, however, the boys and girls showed significant divergence, with the girls outscoring the boys. At age 4;0 this trend was maintained but narrowly failed to reach significance. Given that pre-aspiration is strongly associated with women in Tyneside, this may offer evidence that appropriate gender-correlated sociolinguistic differentiation is taking place as the children approach 3;6 and beyond. Such a finding offers support to a similar claim made in relation to children from Philadelphia [43].

4.2.5 Other variables

Linking and intrusive (r) were analysed for 20 children. Both processes are rare in Tyneside English [14]. In the children's data relevant contexts were scarce, as anticipated from the adult recordings. Intrusive (r) was not found at all (from only 14 potential cases), while linking (r) was used in 21% of cases. These findings parallel those found for adults.

Acoustic and auditory profiling of (p) and (k) was carried out for six subjects. The range of variants observed was consistent with those observed for (t) (with the expected exception of 't-to-r' and use of plain glottal forms [9]).

SVLR was investigated for four children in light of previous studies which showed that its acquisition by Edinburgh children was closely dependent on its use by their parents [18]. With the ESV data this proved problematic for several reasons: the rarity of minimal pairs in the data, controlling for the overall variability in speech rate, and the fact that adults are also variable in

whether they demonstrate SVLR [36]. Only one of the four children showed evidence of having acquired SVLR [17]. Open syllable lengthening was also very apparent for all four children.

Seven vowel variables were transcribed for 12 children. It was found that with few exceptions the patterns of variation in the children's data matched closely with those found for young working class women in the PVC corpus [52]. Children therefore appeared to follow the model predominant among young women, in avoiding the markedly localised variants more readily apparent in male speech, showing instead an almost categorical preference for levelled forms which have a wider regional currency.

4.3 Comparison of children's and adults' (t) productions

Comparison of (t) patterns in word-medial and word-final intersonorant contexts yielded similar conclusions. Compared with PVC adults, children used fewer glottals and more [t]. However, when we take into account the sharp differences apparent between CDS and intra-adult speech, particularly in medial positions, the children's productions in fact bore close comparison with the input they received. In both CDS and the children's speech [t] was the most frequent variant, although it declined in favour of glottals as the children got older. In general, therefore, the children's productions seemed to correlate with the input from CDS. The fact that older children use more glottals may also reflect upon the relatively complex articulator-y control that must be mastered to articulate [d], as discussed in the nominated publication [16].

In word-final intersonorant position [ɾ]-like variants were found in similar measure in CDS and the children's data (6.4% to 6.8%). Although individuals vary markedly in their use of these variants, it may nonetheless be worthy of note that the child with the highest usage also has the mother with the highest use of [ɾ].

In pre-pausal context a significant correlation was found between mothers' and children's use of both pre-aspiration and glottals. That is, children who use a lot of pre-aspiration or glottals tend to have mothers who also use a lot of them, and vice versa.

4.4 Summary

Our results provide abundant evidence that the children have acquired a sharp sensitivity to the structural context within which a variable was located, producing different patterns of variable realisation across environments. Furthermore, the children were starting to produce sociophonetically sensitive patterns of phonological behaviour from the earliest age within our sample. In a number of cases a significant evolution of the pattern of variation over time across both genders was found, and in one case there was some incipient gender differentiation in the older children (Section 4.2.4). In both cases these changing patterns were related to the gradual increase in frequency of more localised variants. In CDS we found evidence of a lower usage of strongly localised variants but the effect of this is to render CDS more variable overall. Our results also suggest that there may be correlations between the performance of individual mother-child pairs. We also find some evidence that mothers vary the phonetic properties of CDS as a function of whether their child is male or female.

4.5 Discussion of results

4.5.1 CDS

It is well known that features of intonation, syntax, speech rate and vocabulary may be modified in speech addressed to children [49]. Very few studies have analysed segmental variability, and their results have been conflicting. The lack of consistency may reflect the fact that the effects vary according to a range of factors, including the age of the child [6].

Our consonantal data clearly show that segmental features may differ from those found in inter-adult speech, and that these vary with the age of the child. In part these age-related differences may stem from differences in the discourse styles which dominate the recordings. Interaction with younger children typically involves a lot of single word utterances, including object naming. Interaction with older children increasingly contains more fluent conversation. The greater use of [t] to young children may therefore result from slower, more careful speech. However, it is intriguing that the use of (t) variants appears to vary also in relation to the gender of the child. It is perhaps not surprising to find adults' behaviour varying in this way, given what is known about other types of linguistic and non-linguistic activity [53], but our results suggest gender-correlated behaviour can be found even at the level of fine-grained phonetic realisation.

The segmental differences found in CDS present us with a paradox when it comes to interpreting the effect these modifications may have on the input the children receive. Some investigators [24] have interpreted their findings as indicative of a strategy by the mothers to increase the acoustic differences between phonologically contrastive elements of their language. Presumably this would provide the children with more robust opportunities to differentiate phonological units perceptually, and thus would provide, to borrow Snow's, terms, 'a simpler, cleaner corpus from which to learn language' [49: 180].

On the one hand this hypothesis receives support from our data. The increase in [t] variants leads to greater phonetic consistency across contexts, since word-initial (t) is also invariably realised as [t]. On the other hand, if we focus solely on the word-medial contexts, then the mothers' modifications actually lead to an *increase* in variability in proportional terms. In inter-adult speech the local glottal forms are used extremely consistently, whereas in CDS children are presented with alternative variants in relatively large measures.

Clearly, more research must be carried out to assess this paradox. However, our findings for (t) suggest that the role of CDS is not restricted to facilitating the learning of contrastive phonological units; it may also help children master the phonetic skills which underpin sociolinguistic identity in their speech community. The gender-correlated patterns in (t) usage, and the apparently different behaviour of women and men in CDS suggest that segmental variability within CDS may present the children with direct opportunities to learn the indexical values of sociolinguistically meaningful forms (cf. [40] with respect to grammatical learning).

4.5.2 Phonological variation and change

It has frequently been shown that women lead in the propagation of sound change. Labov [25] has linked this fact to the dominant role women typically play in child-raising, arguing that variable features dominant in women's speech have the best chance of being transmitted to the next generation. Various aspects of our findings lend support to Labov's hypothesis: (i) the close links between children's productions and CDS; (ii) the adoption of vowel variants with wide regional currency in preference to markedly local forms more typical of male speech; (iii) the high degree

of pre-aspiration by the children, showing that they have adopted a phonetic pattern predominantly associated with females.

Previous work has also shown that the peer group is a very important influence on the development of linguistic heterogeneity [10, 21, 22]. Peer influence typically leads children to diverge from the family model, often via a marked acceleration in usage of local vernacular forms. It would be rewarding for future work to track the development of Tyneside children as they enter school, to observe their transition from the family model into peer-dominated linguistic settings [cf. 1,211].

4.5.3 Phonological acquisition

Within the child language literature there have been numerous criticisms of assumptions that acquisitional targets are stable and invariant [2, 11]. The abundant variability found in child speech has often been attributed to imperfect learning, physical production constraints, random factors, and/or the operation of universal phonological rules (e.g. [31]). While such factors may indeed play a part in explaining variability, our data offer evidence that variability in child speech is linked to variability in adult speech. That is, children's variability is in part structured, and moreover it is structured in line with the input they receive. Our findings therefore offer support to other studies which show evidence for detailed learning, based on specific aspects of input, of features in other areas of the grammar [49]. The child's task in acquiring phonology cannot therefore be adequately described as the learning of a language-specific set of contrasts. The task is in fact much more complicated. Assessing that task demands an understanding of the parameters and constraints on variability in the ambient dialect, as was possible in this study by virtue of the PVC corpus.

Our findings offer partial support for previous claims made by variationists on language acquisition. For example, Chambers [5] suggests 'sociolinguistic competence' is learned at the same time as 'linguistic competence'. While this is clearly true in general, the learning process is gradual. Our data show that some local variable forms take longer to learn than others. Moreover, the general lack of gender differentiation among our children suggests that mastery of the social values of variable forms is not yet complete (although there 'maybe some evidence of divergence with pre-aspiration). However, it is also clear that aspects of detailed phonetic realisation are indeed learned from a relatively early stage of development. This includes reflexes of 'complex rules' [2, 42], such as the lexically-restricted [ɹ] variant of(t).

The fact that detailed phonetic information is learned from the start of the acquisition process suggests that such information may contribute to the construction of knowledge about the contrastive phonological system. Some phonological models, such as Optimality Theory, assume single invariant input (i.e. underlying) forms. It is not clear on what basis the input form is learned at the initial stage, particularly where surface forms in the ambient community are very variable. By contrast, emergent models of acquisition propose that early lexical representations are holistic in nature (e.g. [27, 46]; multiple trace models offer similar resources e.g. [19,201). Once a critical mass of forms has been acquired, holistic representations may be reconstructed to include reference to divisible and pet-mutable units such as segments. It has been argued that segmental awareness is not complete until perhaps as late as 7 years [32, 34, 35, 39, 51]. If such a model is valid, it would follow from our data that some aspects of 'sociolinguistic' information may in fact be learned prior to the stage at which lexical representations are reorganised to reflect abstract phonological structure. That is, if children begin by learning holistic representations of words based on their linguistic input, some of those representations are bound to include phonetic information which has social-indexical value among the adult community. There is also likely to

be a bias towards forms that are heard most often, which for many children means the forms produced by younger women. We therefore conclude that it is problematic to view the acquisition of contrastive phonology as separate from the accent-specific variation which is important for the construction of a sociolinguistic identity.

We might argue further that variability plays positive roles in acquisition, despite the fact it has usually been treated as dysfunctional (e.g. [31]). Recent work in speech perception has identified a functional role for variability in second language learning. It has been shown that the task of learning L2 phonological categories is improved by exposure to multiple voices [29]. The variability aids learners in constructing robust phonological categories by making them more aware of parameters of variation. This in turn aids in accurate speech production, and further enables them to extend their perceptual strategies to new speakers. It is likely that first language acquirers may benefit from variability in similar ways. Moreover, early learning of abrupt phonetic alternatives within the store of particular lexical representations may serve to highlight the location of sublexical phonological units. The child learning a word such as what with various final portions according to context ([t^h ɪ h^t ?]) may therefore be presented with useful information that a divisible unit is located towards the final third of the representations (see further [15]).

Finally, our data offer support to views that phonological learning may differ from person to person [12, 38, 47]. Since much is learned on the basis of input, and input differs from case to case, the construction of phonological knowledge is likely in part to follow an idiosyncratic path. The resultant differences across individuals may for the most part be trivial in detail. However, such a possibility raises intriguing issues for phonological models which rely on highly abstract and invariant units.

5. Activities

Members of the research team have been extremely active in disseminating the results of the project in oral presentations, including invited sessions, at conferences in the UK, continental Europe and North America. Audiences in child language, phonology, phonetics and sociolinguistics have been targeted. Invited seminars have also been given at several UK institutions. A full list of presentations is appended to this report. Docherty, Foulkes and Watt have also participated in research postgraduate training workshops, discussing aspects of the methodology and findings of the project.

6. Outputs

A full list of completed publications is annexed to this report. Publications in progress are listed in section 2a of the report form.

7. Impacts

There are already signs that researchers in the UK and North America are acknowledging the significance of the project. For example, reference [15] is cited in [44], a state-of-the-art review article. Investigators have also been invited to deliver plenary presentations (NWAV 2001, ICPHS 2003), and to participate in special sessions on child phonology (Manchester 2002). A number of graduate students are involved in research which has been influenced by this project (two at Leeds, one at Newcastle).

8. Future research priorities

One priority is to continue to exploit the very large corpus of data which has been gathered in the present project, in order to ascertain the extent to which our findings on (t) are paralleled by other variables, particularly those known to be gender-sensitive in the adult community.

A second priority is to gather further data to test the generality of aspects of our findings (acknowledging that care must be taken in extrapolating from a limited sample of data to a child's whole linguistic experience [49]):

- from other urban communities
- from larger samples of Tyneside children in particular age cohorts and from socially-differentiated neighbourhoods
- from adult males in child-directed speech mode
- from women interacting with both male and female children
- from children between the ages of 4 and 8 to assess the impact of the peer group on patterns of phonological variability.

9. Ethics

Ethical approval for the study was granted by the Newcastle University/Newcastle Health Authority Joint Ethics Committee and we have undertaken to maintain confidentiality and anonymity of the subjects. The tape recordings have been lodged at the Universities of York and Newcastle. They are not generally accessible but are available to *bona fide* scholars who will be required to maintain confidentiality and anonymity.

Annexe 1: References

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Annexe 2: Selected tables of results

Table 1. % occurrence of variants, word-medial position, adults

Corpus	[t]	creak	N
PVC young WC women, casual style	12.2	87.4	245
ESV mothers, CDS	59.1	36.0	570
ESV males, CDS	25.0	66.7	36
Parsons (2000), inter-adult speech	15.7	80.3	127
Parsons (2000), CDS	46.7	50.0	30

Table 2. % occurrence of variants, word-medial position, adults

	[t]	creak	N
mothers of boys	48.4	44.8	293
mothers of girls	69.3	27.7	277

Table 3: % occurrence of variants, word-final intersonorant position, adults

	[t]	creak	[ɹ]	N
mothers of boys	12.4	20.4	8.8	524
mothers of girls	23.8	15.7	4.1	604

Table 4. % occurrence of acoustic features, -word-medial position, 40 children

context	voiceless	burst	pre-aspiration	creak	N
V V	77.2	69.9	14.6	26.6	508
l	67.4	56.3	9.8	44.2	215
overall	74.3	65.8	13.1	31.8	723

Table 5. % variant use by age, word-medial position, 40 children

	2;0	2;6	3;0	3;6	4;0
voiceless stops, V V	52.4	80.2	61.2	56.8	46.2
voiceless stops, l	36.4	82.1	56.7	55.6	22.6
creak, V V	17.5	15.8	14.1	31.6	45.2
creak, l	45.5	16.1	40.0	40.7	79.3

Table 6. % occurrence of acoustic features, word-final intersonorant position, 40 children

context	voiceless	burst	pre-aspiration	creak	[ɹ]-like	N
V# V	49.0	47.0	2.0	38.2	-	249
t-to-r context	42.4	35.8	3.3	32.2	6.8	366

Table 7. % occurrence of acoustic features, pre-pausal position, 40 children

context	voiceless	burst	pre-aspiration	creak	N
overall	98.0	68.7	38.8	19.8	1,396

Annexe 3. Conference presentations

Presentations of findings of the study were made at the following meetings:

1999

- Child Phonology Conference, University of Wales, Bangor, July.
- 14th International Congress of Phonetic Sciences, University of California at Berkeley, San Francisco, August.

2000

- British Association of Academic Phoneticians, University of Glasgow, April.
- International Conference on Language Variation in Europe, Universitat Pompeu Fabra, Barcelona, July.
- VIEW (Variation is Everywhere) 2000, University of Essex, September.
- Symposium on Patterns of Speech Sounds in Unscripted Communication: Production-Perception-Phonology. Institute of Phonetics and Digital Speech Processing, Christian-Albrechts-University of Kiel, October [invited participation].
- NWAV (New Ways of Analysing Variation) 29, Michigan State University, October [2 presentations].

2001

- Sociolinguistics Symposium, University of the West of England, April.
- 3rd UK Language Variation Conference, University of York, July.
- Workshop on Early Phonological Acquisition, Carry-le-Rouet, October.
- NWAV (New Ways of Analysing Variation) 30, North Carolina State University, October [invited plenary panel participation].

2002 including forthcoming presentations

- British Association of Academic Phoneticians, University of Newcastle, March.
- 10th Manchester Phonology Conference, -Manchester, May [invited participation].
- 8th Conference on Laboratory Phonology, Yale University, June.
- 11th International Conference on Methods in Dialectology, University of Joensuu, Finland, August [2 presentations].

Invited seminars have also been given by members of the research team at the Universities of Aberdeen, Essex, Leeds and Sheffield.

Annexe 4: Publications derived from the project

- Docherty, G.J. & Foulkes, P. (2000) Speaker, speech and knowledge of sounds. In N. Burton-Roberts, P. Carr & G.J. Docherty (eds.) *Phonological Knowledge. Conceptual and Empirical Issues*. Oxford: Oxford University Press. pp. 105-129.
- Foulkes, P. (forthcoming 2002) Current trends in British sociophonetics. To appear in *University of Pennsylvania Working Papers in Linguistics* 8.
- Foulkes, P. & Docherty, G.J. (forthcoming 2002) Phonological variation in the English of England. To appear in D. Britain (ed.) *Language in the British Isles* (2nd edition). Cambridge: Cambridge University Press.
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