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Children's comprehension of unfamiliar regional accents: a preliminary investigation*

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ABSTRACT

The effect of regional accent on children's processing of speech is a theoretically and practically important aspect of phonological development that has been little researched. 48 children from London, aged four and seven years old, were tested on their ability to repeat and define single words presented in their own accent and in a Glaswegian accent. Results showed that word comprehension was significantly reduced in the Glaswegian condition and that four-year-olds performed less successfully than seven-year-olds. Both groups made similar numbers of lexical misidentifications, but the younger children were more likely to fail to access any word at all. On the repetition task, the younger children showed a different pattern of errors to the older children, their productions being apparently more influenced by the phonetics of the Glaswegian stimuli. It is suggested that such phonetic responses are related to the younger children's failure to map the unfamiliar accent onto their own phonological representations. It is proposed that the lexical misidentifications, common to both age groups, are more likely to be induced by lack of context. The paper concludes with discussion of implications of these findings for our understanding of how children develop the ability to process unfamiliar regional accents.

INTRODUCTION

One aspect of young children's ability to acquire new languages with ease is that they can quickly become proficient in the accent of the new language (Long, 1993). This ability to acquire a new accent also manifests within the

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child's native language (Trudgill, 1986): children display a remarkable capability to adjust to the segmental and non-segmental features of different accents. Research hitherto has focused on the child's output, studying the forms used in spontaneous or elicited production by children who have moved from one dialect area to another. These studies have identified the child's age, length of exposure to the new dialect or accent, the relation between the two dialect systems, and the types of linguistic feature involved, as factors that determine the extent to which long-term accommodation to, or permanent acquisition of, the new accent take place (Chambers, 1992). However, little attention has been given to the question of how children develop the ability to comprehend unfamiliar accents – accents which the child may never have cause to reproduce in their own speech output. This is a skill that seems to be shared to a greater or lesser extent by virtually all adult speakers, and as such is an important aspect of sociolinguistic competence.

The accents of a language bear a stable and stateable relationship to each other and various classifications have been proposed (cf. Wells, 1982; Bailey & Gorlach, 1982). Wells (1982), taking a phonemic approach, emphasizes the commonality of the underlying phonemic representations of language varieties, with differences accounted for by descriptive rules. He lists four principal ways that accents differ at a segmental level. First, accents differ in their phonetic realization, that is, in the phonetic detail of the way a phoneme is realized. For instance, in the accent of Glasgow, the vowel in *game* is realized as [e] but in London accents as [ɛɪ]. Although they have no systemic linguistic consequences, these differences are important in the characterization of an accent. Secondly, accents can differ at a structural level in their phonotactic distribution, that is, in the environments in which particular phonemes occur. For example, the phonotactic distribution of /r/ in English differs according to whether the accent, like Glaswegian, is rhotic (in which case it appears in a wide variety of phonetic contexts) or, like the London accent, non-rhotic (in which case it is excluded from pre-consonantal and absolute-final environments). Thirdly, accents differ in their phoneme systems: the number or identity of phonemes that are used. For example, in Glaswegian there is only phoneme /ʏ/ used in the words *boot* and *foot* while in most English accents there are two, /u/ and /ʊ/. Lastly, accents differ in their lexical distribution. Different accents select different phonemes for the lexical representation of particular words. An example of this is the different realization of words like *bath* in southern and northern accents in England, which respectively use /ɑ/ and /æ/, even though each accent displays a phonological opposition using these two items elsewhere, e.g. *cat* vs. *cart*.

That adults are able to process accent variation is attested by evidence that adult listeners are easily able to identify utterances spoken by speakers whose first language is not English (Munro & Derwing, 1995). Foreign accented speech may affect intelligibility (Tajima, Port & Dalby, 1997), particularly if

there is limited contextual information (Suenobu, Kanzaki & Yamane, 1992), though Munro, Flege & MacKay (1996) found that a speaker's intelligibility is not necessarily related to the perceived strength of the foreign accent. Such findings suggest that adults have effective mechanisms for the successful processing of accent-related variation, provided sufficient contextual information is available.

However, Labov (1989), reporting experimental and naturalistic studies of American adults' comprehension of non-native dialects, concluded that the role of context was exaggerated, and that listeners could easily be led astray by a phonetic form from another dialect particularly when it overlapped with a different phoneme in their own dialect. For example, in a gating experiment, listeners invariably heard the historically recent ('advanced') Chicago pronunciation of *socks* [sæks] as *sacks* when the word was presented in isolation in the Chicago form. This was true both of listeners from other cities (Philadelphia, Birmingham) and of listeners from Chicago. Additional context was progressively introduced, first in what Labov calls the 'phrase' condition, *You had to wear socks*, and then in the 'sentence' condition, *You had to wear socks. No sandals*. Under the phrase condition, the non-Chicago listeners still found it extremely difficult, identifying *socks* less than 20% of the time, while Chicago listeners had improved to 40%. In the sentence condition, correct identification increased considerably, but still only to 60% for the non-Chicago listeners: even when the lexical item *sandals* was presented in the context, the remaining 40% of non-Chicago listeners persisted in hearing the target word as something that did not make semantic or pragmatic sense. According to Labov (p. 185):

> 'We must conclude that for some listeners, under some circumstances, an aberrant phonetic form may completely block access to other sources of information relevant to the interpretation of the sentence as a whole.'

Flege (1992) has made a psycholinguistic proposal as to how the listener might process forms that differ from those in his/her own speech. Flege suggests that a 'tolerance region' is formed around each prototype of a phonetic element, which allows the listener to detect divergences from phonetic norms as distortions or foreignness. For example, the vowel in *bear* is realized in London as [ɛː] but in Glaswegian as [eɪ]. As a consequence of the markedly closer quality of the Glaswegian vowel, Glaswegian tokens of *bear*, [beɪ], can sound quite similar to London tokens of *beer*, [biə]. Glaswegian *bear* may then be heard by the unsuspecting London listener as *beer* since, in the absence of contextual information, the listener does not know which word to go for. According to Flege's model, such lexical misidentification would arise from the overlapping of the tolerance regions for two different prototype phonetic elements in the London speaker's system, which could be represented phonemically as /ɛə/ and /iə/. In

everyday interaction, context might resolve the ambiguity, though this assumption has to be tempered in the light of Labov's findings reported above. Such contextual information might be semantic and/or grammatical (*Is there any__in the fridge?*); or phonetic – if the prior and succeeding talk is in a Glaswegian accent, for example.

Developmentally, the tolerance region model suggests that overlaps of the kind described above will increase as the child is exposed to more overlapping phonetic tokens for different lexical items. This would then offer a psycholinguistic explanation for Labov's finding that a difficulty interpreting phonetic forms produced by speakers of other dialects is found in adults. However, this tendency would be counterbalanced developmentally by the child's increasing knowledge of lexis and grammar, and widening exposure to and recognition of unfamiliar accents; this would explain why adults do better with contextual information than without it. The developmental prediction would be that as they get older, children make more lexical identification errors – they go for the wrong word if there are two candidate words whose tolerance regions overlap. This is because, as their vocabulary grows, it will contain more words that are potentially confusable. On the other hand, younger children can be predicted to make more failures to identify any word at all: they have a smaller vocabulary, so have fewer words that the phonetic input might be mapped onto, but at the same time they are at least as likely to be led astray by the phonetic input as are adults or older children.

Data from both first and second language learning show that the age of acquisition of a new dialect or language is critical in predicting the degree to which the new accent is accommodated (Oyama, 1976; Williams, 1980; Payne, 1980; Chambers, 1992). Chambers (1992), in a study of a small group of Canadian children living in the South East of England, found that only the children who had arrived at aged seven and eleven, when studied two years later, had incorporated the SEE rule of low vowel demerger (differentiating the vowels in *Don* and *Dawn*, for example). The children who had arrived at an older age (11 and above) did not make this differentiation. Payne (1980) found similar results studying the acquisition of a Philadelphian dialect by in-migrants from New York and elsewhere: there was a relationship between how young her subjects were when they moved to a new area and how well they accommodated to the local accent. These output-based studies provide some grounds for hypothesizing that there may be age-related differences in children's input processing of unfamiliar accents. However, the child's chronological age on arrival in the new community is by no means the only factor at play: the studies by Payne and Chambers show that the length of time spent in the community, and the type of pronunciation difference or phonological rule involved, also play a crucial part in determining the extent to which the individual acquires the new accent. It is therefore very difficult,

on this evidence, to put precise chronological boundaries on a critical or optimal period for accent acquisition.

In order to understand how children learn to comprehend an unfamiliar accent, it is helpful to consider theories of the development of speech perception and word recognition, since such theories have to address the issue of how a listener learns to extract and decode meaning from a variable speech signal. While sources of variability also include incidental environmental conditions such as background noise, and idiosyncratic differences between speakers, our focus will be exclusively on the systematic variability that arises from differences in regional accent. Age-related differences in processing accent variation can be predicted from the research on children's speech perception. Studies have shown that speech perceptual skills are evident from a very young age (Eimas, Siqueland, Jusczyk & Vigorito, 1971; Werker, 1993) and that within the first year of life an infant's speech perceptual capacities have become attuned to the sound structure of the language they are exposed to, their mother tongue (Jusczyk, 1992). In this process of learning one's native language and acquiring its phonological contrasts, a loss of sensitivity occurs to contrasts that are nonnative early on in infancy (Werker & Tees, 1984; Burnham, 1986; Best, 1994). Another important ability that infants have acquired by the age of five to six months is that of vowel normalization, whereby an infant has learnt to ignore the differences in vowel production between speakers of different ages and sex (Kuhl, 1979).

Despite this evidence of the infant's speech perceptual abilities and early adjustments to the ambient language, there are differences in the way children and adults perceive and analyse speech input; further development is necessary before adult-like speech perception is attained. The developing perceptual system preserves very fine phonetic details of the talker's voice (Pisoni, 1993) allowing young children to accurately imitate and reproduce sound patterns heard in their native language learning environment (Studdert-Kennedy, 1983). The system must undergo refinement as relevant acoustic properties are integrated and irrelevant properties minimized. Nittrouer (1996) has characterized this as a 'developmental weighting shift,' whereby children assign different perceptual weights than adults. These are adjusted as children gain experience with their native language.

Burnham (1986) proposes that there are two main periods in which speech perception abilities may be lost to the child, the first is in infancy (6–12 months) and the second is between four and eight years of age. In the latter period, the loss of the ability to perceive phonetic contrasts that are phonemically irrelevant in the language the child is learning 'seems to be due to children's experience with particular contrasts and lack of experience with others' (Burnham 1986: 233). The kinds of contrast that Burnham reports being lost by English-learning children at this period include the difference

between implosive and voiced egressive stops, and the difference between prevoiced and non-prevoiced bilabial stops. He further suggests that the ability to perceive these contrasts recovers spontaneously after the age of eight years, or at least can be very easily taught. The sounds involved in the contrasts lost at this phase, while not present phonemically in the child's native language, are often present allophonically. Thus the child is using both sounds in his/her own speech, but is no longer able to hear the difference between them – presumably because they never appear contrastively in the language. However, it is just such slight phonetic differences that help to mark accents of the same language as distinct. We might therefore expect children of four years or younger to respond differently from older children (of seven or eight, for example), when presented with speech in an unfamiliar accent of their own language. Specifically, the younger children might be expected to show greater phonetic sensitivity to the input than older children.

Best (1994) has proposed a PERCEPTUAL ASSIMILATION MODEL to account for how non-native speech sounds are processed. Non-native phones become assimilated to a native phoneme category that the listener perceives to be most similar, even while he/she recognizes that there are discrepancies between them. This may happen either by two members of a non-native contrast being assimilated to two different categories or the two members both being assimilated to the same category. While this model has been proposed to test out hypotheses of how infants perceive non-native speech sounds, its scope could be extended to the child's processing of phones differing due to accent variation: when the realization of a Glaswegian item (e.g. [ɔ]) corresponds to two items in the London child's system (/ɔː/ and /ɒ/), the child has the option of assimilating the Glaswegian item into either of these phonological categories. Alternatively, assimilation may occur when the Glaswegian realization of the target phonological item overlaps with the London realization of a different phonological item. To return to an earlier example, the vowel in *bear* is realized in London as [ɛː] but in Glaswegian as [eɪ]. The Glaswegian vowel, with its closer quality, might be mapped by the unsuspecting London child onto the latter's vowel [iə]. This mechanism could form the developmental basis for the kinds of misidentification made by adults and reported by Labov (1989) – in this case, where an adult London listener hears Glaswegian *bear* as *beer*. The developmental prediction from this model would be that the young child assigns the vowel of the unfamiliar dialect (e.g. from Glaswegian *bear*) to one of his existing phonemic categories, e.g. /iə/. However, if the child does not yet have an appropriate lexical match in his vocabulary (e.g. *beer*) the child will fail to make a lexical identification. Thus it is predicted that the younger child will make more failures to identify any lexical item, whereas the older child will make more misidentifications.

A 'multiple trace model' (Hintzman, 1986; Jusczyk, 1997) allows traces of different phonetic tokens of a single item to be stored, so children's increasing exposure to language will increase the range of variation that they recognize and accept. According to this model, cases of realizational overlap between two phonemes in the unfamiliar accent could result from the listener having stored an insufficient range of different traces for the two phonemes in question. Thus, in our example, the London listener might recognize Glaswegian *bear* as *beer*, because he/she has not yet been exposed to [beɪ] tokens that are associated with *bear*; thus by default the listener assimilates the input to the phonetically closest item, i.e. [biə], and accesses its referent *beer*. Developmentally, the multiple-trace model suggests that with older children, there will be fewer realizational overlaps, fewer subsequent lexical misidentifications and also fewer failures to identify any lexical item at all. This is on the assumption that the older child will have had greater prior exposure to the unfamiliar accent and so will have had more opportunities to associate [eɪ] with /ɛə/ rather than /iə/.

In parallel with the refinement of speech perception, young children demonstrate remarkable abilities in acquiring vocabulary at a fast rate (Rice & Woodsmall, 1988) due to 'fast mapping' (Carey, 1978): a word's meaning can be understood in part on first exposure and is later refined and restructured. Despite the early manifestation of this skill, there still may be age-related qualitative differences in how vocabulary is accessed from the lexicon. Cole & Perfetti (1980) found that children were slower than adults at making a lexical interpretation of words containing mispronunciations, suggesting that children needed more information in order to recognize words.

To summarize, speech perception research indicates a progressive loss of sensitivity to non-native contrasts in the child and increased weighting in favour of the native language. This coincides with the development of effective mechanisms for lexical acquisition by 'fast-mapping'. At the same time, the growing child has to process an increasing amount of within-language phonetic variability, and developmental dialectological studies show that children are able to assimilate features of a new accent readily.

In the case of adults, we can pre-suppose an established phonological system (i.e. an acquired first language) which has been gradually refined through exposure to variation. However, the young child's developing system is by definition not yet stable. Infants have the potential to acquire any accent of any language to which they are exposed, but will go about it in a qualitatively different way to adults handling a new accent or language since the infant, unlike the adult, lacks fully-fledged pre-existing lexical and phonological systems to map the new data onto. Given the phonetic and phonological diversity of languages, the child's language learning mechanism has to be sensitive to a wide range of phonetic and potentially phonological

markers. It can therefore be hypothesized that a child will accommodate accent-related variation in speech input by making internal changes to their developing store of phonological representations. The aim of the experiment reported here is to begin to explore how this happens, by asking how children of different ages process accent variation for the purposes of lexical access. Two questions were addressed:

1. Is there an effect of age on single word comprehension when the accent of presentation is not that to which the child is exposed in his/her immediate linguistic environment?
2. Are there age-related developmental changes in the way in which children process and interpret words spoken in an unfamiliar accent?

METHOD

Design

Children were tested on two tasks, each involving matched lists of single word stimuli from two different accents of British English. A definition task was used to address the question of whether interference from accent might cause difficulty in accessing lexical representations and whether this might be more evident in younger children. A repetition task was used to test the hypothesis that younger children will find it more difficult than older children to repeat words accurately, in accordance with their own phonological system, when the words are presented in a different accent system to their own.

Two accents were selected: a London accent and a Glaswegian accent. On the continuum of London accents described by Wells (1986), our informant falls somewhere between London Regional Standard and Popular London. She does not use broad Cockney forms such as a monophthong for the vowel in *mouth*; nor a labiodental fricative at the end of that word. When reading a word list she does not use [ʔ] for intervocalic or final /t/, though this is occasionally evident in connected speech. On the other hand, she uses glottal closure invariably before final voiceless plosives. Apart from that, the London features of her accent are most evident in the vowels. These include: a relatively close vowel in words like *cat*; and at the beginning of the diphthong in *mouth*; a relatively back starting point for the diphthong in words like *night*; a long monophthong in *bear*; a fronter, often less rounded realization than is traditionally described for RP in words like *book*, and particularly in the second part of the diphthong in words like *rope* or *boat*. This last feature is a recent development characteristic of younger speakers in the south east of England.

One reason for choosing a Glaswegian accent was that it has a number of salient differences compared to the London accent. The accent used by our

Glaswegian informant accords closely to the description given by Wells (1982). Systemic differences include a lack of three pairwise phonological oppositions between distinctive monopthongs: [ʊ] and [uː] → [ʏ], [æ] and [ɑː] → [a], [ɒ] and [ɔː] → [ɔ]. The collapse of these contrasts includes the loss of both the vowel quality difference and the length difference found in the London accent.

Phonetic realizational differences include:

London	*Glaswegian*
[ɑɪ]	= [ʌi]
[əʊ]	= [o]
[æʊ]	= [ʌʏ]
[ɛɪ]	= [e]
[ɛː]	= [eɹ]
[ɜ̟ː]	= [ʌɹ]

As the last two items illustrate, the Glaswegian accent is rhotic: our speaker uses a postalveolar approximant following the vowel in words such as *bear*, *butter*, *dirt*, *fork*. This contrasts sharply with the London accent, where the postalveolar approximant is only found prevocalically. Other consonantal differences include the Glasgow speaker's use of a glottal stop without lingual closure, for the consonant at the end of words such as *hot* and *coat*, and in the middle of *butter*. This feature, though not evident in the word lists recorded from our London speaker, does occur in broader and less studied London speech, and so was not taken to be diagnostic of Glaswegian pronunciation in our experiment. One of the features common to both the Glasgow and the London accent, as represented by our informants, is the preglottalization of coda voiceless stops, in words such as *sock* and *rope*. In both accents, this is one of the features that serves to distinguish pairs such as *lock* and *log* or *rope* and *robe*, particularly as in both accents, the final stop consonant will be phonetically voiceless in both words of the pair. Examples of all the features discussed here can be found in the Appendix.

Participants

Two groups of children aged four and seven were selected. Each group had 24 children: age group 1 were in nursery and had a mean age of 4;02 (range from 3;10–4;07) and age group 2 were in year 2 and had a mean age of 7;01 (range 6;08–7;06). They were recruited from four nurseries/schools in North London. All were monolingual speakers of English and had no speech, language, hearing or learning difficulties (ascertained by teacher report). The children were speakers of a London accent that approximated well to the one used by the London informant who recorded the word lists. The researcher ascertained that the children selected had no sustained direct contact with the

experimental accent (Glaswegian), no immediate family members from Scotland and no extended periods spent in Scotland. There were equal numbers of boys and girls.

Four-year old children were selected because by this age, according to the usual criteria, children are assumed to have mastered the phonological systems of their own accent in terms of perception (Ingram, 1989). Thus by this stage we can be reasonably sure that any problems they might experience in relation to unfamiliar accents are unlikely to occur in relation to their own accent. As will be seen, this assumption was borne out in the present study, by the performance of the four-year-old children in the control condition, where they had to identify words spoken in their own accent. Furthermore, on the output side, four-year-old children are normally able to signal the large majority of phonological contrasts in their own accent. Thus any unusual pronunciations found when the children are asked to repeat the Glaswegian accent words in the experimental condition can be attributed to the unfamiliarity of the accent, rather than to the child's articulatory or phonological immaturity. Again, as will be seen, this assumption was borne out by the children's performance in the control condition, where they had few difficulties in accurately repeating the words presented in a London accent.

Seven-year-olds, like the younger age group, are still in the period where accommodation to new accents can be completed in a native-like form (Trudgill, 1986; Chambers, 1992). However, they have had three further years of exposure to speech input, and it is likely that this will include greater exposure to a wider range of unfamiliar accents. It can therefore be predicted that the seven-year-olds will have fewer problems understanding an 'exotic' accent than four-year-olds. Walley (1993) suggests changes in children's word recognition abilities at about this age, when phonemes become 'crystallized' i.e. there is a move to a more segmental approach.

Materials

Two word lists containing 20 words each were designed (see Appendix). Subjects received one word list presentation in the experimental accent (Glaswegian) and another word list in their own accent (London). Known differences between the accents were targeted so that there would be different realizations of the word when pronounced in the control condition to the experimental condition. Each list contained 10 high frequency words and 10 low frequency words, selected from Burroughs (1957). 'High frequency' words were selected from the first 500 most frequently used words of children aged between five and six and a half, 'low frequency' words were selected from the 500 next most frequently used words as recorded in Burroughs' study. The two lists were matched so that of the high frequency words, a word from one list shared similar phonetic features to its pair in the

other list, and similarly for low frequency words. The words were mainly one syllable in length, with some two syllable words. As far as was possible each word pair was phonetically matched to be consistent for a production in a London accent and in a Glaswegian accent; for example, if the target item were /ɛə/ its realization in the London accent as [ɛː] should occur in both words of the pair e.g. *pear* [pʰɛː] and *bear* [bɛː]. Similarly its realization in the Glaswegian accent should be phonetically consistent across the two words of the pair, in this case [eɪ], the two words being realized in Glaswegian as [pʰeɪ] and [beɪ] respectively.

Both lists were recorded in both accents. Half the subjects received List A in the London version and List B in the Glaswegian version; the other half received List A in the Glaswegian version and List B in the London version.

Procedure

Stimuli were pre-recorded on a Marantz Model CP430 with a Marantz microphone EM-8. They were played back to the subjects on a Panasonic Model RQ-2102. Subjects' responses were recorded using the Marantz CP430 and scored. Each list had two orders of presentation to control for any fatigue effect. The experiment took place in a quiet room. Three practice items were presented initially to accustom the child to the task.

Short extracts from two 'Mr Men' books (Hargreaves, 1971, 1976) were also pre-recorded, one by the London speaker, the other by the Glaswegian speaker and presented before the relevant word list.[1] These popular and entertaining stories written for young children served to habituate the subject to the voice and accent of the speaker. As noted earlier, exposure to an unfamiliar accent is an important aspect of the comprehension process, since it provides the opportunity for the listener to become familiar with the speaker's phonological system. Presenting single words without this opportunity would not be a test of the child's ability to comprehend and process a different phonological system; it would instead be testing the child's ability to interpret a series of exotic utterances. There is much cross speaker variation in the realization of phones. For example, one speaker's realization of a vowel's formant frequencies may overlap with a different speaker's realization due to differences in vocal tract size (Ryalls, 1996). It is thus important for the listener to become accustomed to an individual speaker's system and to make comparisons within the speaker's system. In order to control for cross speaker variation due to age or sex differences rather than accent differences two female speakers of a similar age had been selected.

[1] No words in either list appear in the 'Glasgow' Mr Man story. Although two words do appear in the 'London' story, it is felt that this would not have seriously affected the results given the large gap in performance between the London and the Glasgow conditions.

The story spoken in the London accent was presented first (with the accompanying pictures and text), followed by the 20 single words in the London accent (alternately List A or List B). The experimental condition, consisting of the second short story and the twenty words in the Glaswegian accent (alternately, List B or List A) then followed.

Two responses were required. First, for the repetition task, the child was asked to repeat the word, in response to the question 'what word do you think she is saying?' This formulation was designed to emphasize that a repetition rather than an imitation of the word was what was required. Wells (1995) highlights the difference in processing routes between a phonetic imitation task and a phonological repetition task of non-words: the former may involve a sub-lexical route and the latter a lexical route. This experiment, testing word comprehension, requires a lexical processing route and so the experimenter's wording is designed to guide the subject into processing the word phonologically and lexically rather than phonetically and imitatively.

The child was then requested to define the word he/she had said in order to find out whether or not the stimulus had been correctly accessed from the lexical store. A simple indication that the word had been understood was sufficient (pointing to the object in question, if this was possible, was acceptable). Probes were also used if the subject needed assistance (for example, 'what do you do with it?', 'where would you find this?')

Scoring of responses

Definitions. For the main analysis, a definition was scored as correct or incorrect, taken to indicate successful or unsuccessful/failed lexical access respectively. For example, 'some people go to marry' would be scored as a correct definition of *church* but 'eating' would be scored as incorrect. For the secondary analysis reported below, incorrect definitions were further subclassified as: (a) incorrect (but phonologically predictable) lexical access, where the child accessed the wrong word, but the word accessed was relatable to the phonetic form of the Glaswegian stimulus e.g. for the stimulus *bear*, a definition of *beer* is given: 'my dad drinks it'; (b) failed lexical access, where the child either offers no definition or else gives a definition of a lexical item that is completely unrelated phonetically to the Glaswegian stimulus (see example of *church* above).

Repetition responses. The following classification system was devised to record the repetition responses in the Glaswegian condition (examples are drawn from actual responses):

1. *A phonological repetition*. The child repeats the word according to his/her own phonological system i.e. in a London regional standard accent, and defines the word correctly. For example, *church*, Glaswegian stimulus [tʃʌɪʔtʃ], pronounced by the child as [tʃɜːʔtʃ] and defined as 'some people go to marry'.

2. *A phonetic response*. The child produces a phonetic realization that does not correspond to a word in the London accent. This realization may be more or less similar to the Glaswegian stimulus e.g. *church*, Glaswegian stimulus [tʃʌɹʔtʃ], realized as [tʃɒɹʔtʃ], or [tʃɔɹʔtʃ]. Various types of definition could be given: (i) a correct definition e.g. 'that's where you get married'; (ii) a definition of an incorrect but phonologically related word e.g. [tʃɔɹʔtʃ] defined as 'when you put your hand on something', i.e. *touch*; (iii) an unrelated, made up definition e.g. 'eating'; (iv) no definition.

3. *A lexical error repetition*. The child produces a lexical item in the London accent which has similar phonetic properties to the target word as it was produced in the Glaswegian accent, e.g. for *church*, Glaswegian stimulus [tʃʌɹʔtʃ], realized by the child as [tʰʌʔtʃ]. The child then gives a phonologically predictable definition: the definition is of a word that corresponds to the phonological characteristics of his repetition but is not the target word; in this case *touch*, defined as 'when you put your hand on something' (cf. (ii) in 2 above). This kind of definition will be termed a '*lexical error definition*'.

4. *No response*. The child does not repeat or define the stimulus.

Scoring was carried out by the first author, a phonetically-trained speech and language therapist. 10% of the children's responses were transcribed and scored blind by the second author, a trained phonetician with extensive experience of dialect and child transcription: he was presented with responses in random order and was not aware of what accent the stimulus for each response had been presented in. For both scorers, judgements as to which category a response should be assigned to were based on the description of the accent of the Glaswegian speaker who recorded the stimulus tape, and, in addition, on observation of the children's own London accent and that of the London speaker who recorded the stimulus tape. The features taken to be diagnostic of one accent or the other were principally vowel quality, vowel length and rhoticity. There was 90·9% agreement ($K = 0{\cdot}82$) between scorers on assignment to the response categories described above and 94·2% agreement ($K = 0{\cdot}75$) on whether or not the response conformed to a 'London' realization of the stimulus word.

RESULTS

Statistical analysis was carried out using number of correct definitions given as dependent variable. First, an analysis was carried out to determine whether the two word lists were well matched. Possible variation in performance according to list was examined as a function of age. Split-plot ANOVA of list (2) × age (2) revealed no main effect of list: $F(1, 46) = 0{\cdot}29$, $p = 0{\cdot}596$, a main effect of age, $F(1, 46) = 13{\cdot}58$, $p < 0{\cdot}001$, but no interaction between list and age, $F(1, 46) = 1{\cdot}84$, $p = 0{\cdot}182$. List A had a mean of 14·65 and a standard deviation of 4·42. List B had a mean of 14·4 and a standard

deviation of 4·09. Note that children experienced only one word list per accent; inspection of means suggests that variation in performance for each list as a function of accent was absolutely negligible (see Table 1). This

TABLE 1. *Means and standard deviations of list x accent*

	Glaswegian		London	
	Mean	S.D.	Mean	S.D.
List A	11·71	4·01	17·58	2·43
List B	11·17	3·09	17·63	1·69

indicates that the lists were phonetically and lexically well balanced: children were as likely to give a correct definition whether they received the Glaswegian version of List A or the Glaswegian version of List B.

A split plot ANOVA of age (2) × accent (2) showed that both independent variables produced significant main effects: accent: $F(1, 46) = 235{\cdot}47$, $p < 0{\cdot}001$ and age: $F(1, 46) = 101{\cdot}54$, $p < 0{\cdot}001$. Both age of subject and accent of presentation significantly affected how subjects performed. Mean scores show that older children performed better than younger children and that the Glaswegian accent produced lower scores than the London accent (Table 2).

TABLE 2. *Means and standard deviations of factors age and accent*

	London accent		Glaswegian accent	
	Mean	S.D.	Mean	S.D.
Age Group 1	16·38	2·22	8·67	2·46
Age Group 2	18·83	0·82	14·21	1·91

Age interacted significantly with accent at $F(1, 46) = 14{\cdot}72$, $p < 0{\cdot}001$. This interaction shows that, while both age groups perform better with a London accent, the older children's scores in both accents increase and there is less disparity between the two accents. T-tests confirm that there are significant differences of performance between accents for both age groups (age group 1, $t(1, 23) = 11{\cdot}25$, $p < 0{\cdot}001$; age group 2, $t(1, 23) = 11$, $p < 0{\cdot}001$). However, scores for the older children's performance in the control accent are subject to a ceiling effect, with a mean score of 18·8 out of a possible 20 and a standard deviation of 0·82. Scores for the older age group in the London accent condition may then have been affected by the restrictions of the design, and not reflect a true distribution of scores. If anything, the results may thus underestimate the difference between the age groups.

TABLE 3. *Percent of repetition responses by age* ($N = 480$ *per age group*)

Error type	Age 1 (%)	Age 2 (%)
Phonological repetition	37·0	70
Lexical error repetition	18·0	24
Phonetic response	44·0	4·8
No response	1·5	0·6

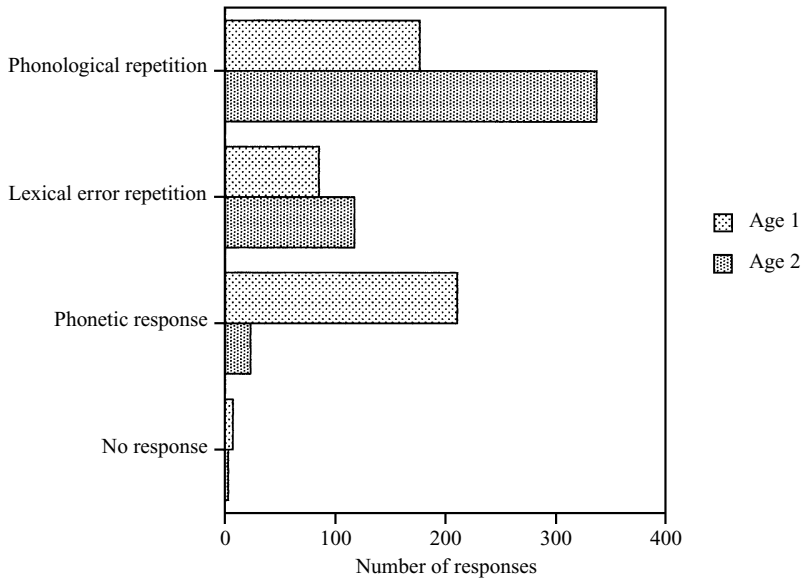

Fig. 1. Barchart showing distribution of response types by age.

In sum, these results indicate that accurate lexical access of words spoken in the Glaswegian accent improves between four- and seven-years of age.

In total, 46 % of responses for the Glaswegian condition were errors. The distribution of response types according to age is given in Table 3, and presented graphically in Figure 1.

Mann-Whitney tests found significant differences between the following parameters:

1. Number of phonetic responses of age group 1 and number of phonetic responses of age group 2, $N = 48$, $U = 876$, $p < 0{\cdot}001$. Age group 1 made significantly more phonetic responses.

2. Number of lexical error repetitions of age group 1 and the number of lexical error repetitions of age group 2, $N = 48$, $U = 490$, $p < 0{\cdot}05$. Age group 2 made significantly more lexical error repetitions.

The Wilcoxon's matched-pairs signed ranks test found significant differences between the following within subject parameters:

1. Number of lexical error repetitions of age group 1 and number of phonetic responses of age group 1, $N = 24$, $W = 325{\cdot}5$, $p < 0{\cdot}001$. Phonetic responses exceed lexical error repetitions in this group.

2. Number of lexical error repetitions of age group 2 and number of phonetic responses of age group 2, $N = 24$, $W = 292$, $p < 0{\cdot}001$. Lexical error repetitions exceed phonetic responses in this group.

These results show a distributional difference of error types according to age.

First, the number of phonetic responses decreases significantly, suggesting that the younger children are more susceptible than the older children to the phonetic characteristics of the Glaswegian stimuli. This notion will be considered further in the Discussion section.

Secondly, the number of lexical repetitions increases significantly with age. The increase in lexical repetitions should not, however, be taken to indicate a corresponding increase in lexical error definitions, i.e. in access of an incorrect but phonetically plausible lexical item. This is because the child might produce lexical error definitions, indicative of incorrect lexical access, not only following a lexical repetition, but also following a phonetic response. In fact, 23% of the phonetic responses of the four-year-olds were accompanied by lexical error definitions. A secondary analysis was therefore conducted to ascertain whether there was a real difference in the number of lexical error definitions between the two age groups. A Mann-Whitney test was carried out on difference in number of lexical error definitions between age group 1 and 2, including the lexical error definitions classified under phonetic responses as well as those classified under lexical error repetitions. No significant difference was found between the two age groups on this test ($N = 48$, $U = 549{\cdot}5$). This shows that while there is an increase in the incidence of lexical error repetitions, there was no significant developmental change in the number of incorrect lexical items accessed.

Error analysis

Different types of phonetic response occurred. Four-year-old children imitated some of the Glaswegian stimuli exactly, for instance, in response to *food*, Glaswegian realization: [fʏd], one child said [fʏd]; in response to *dirt*, Glaswegian realisation [dʌɹʔtʰ], one child said [dʌɹtʰ]. On other occasions, a child appeared to draw on vowels or consonants from their own (London) system e.g. *church*, Glaswegian pronunciation: [tʃʌɹʔtʃ], pronounced by the child as [tʃɔːʔtʃ]. Other types of phonetic response incorporate some apparent misperceptions e.g. *pudding*, Glaswegian realization [pʰʏdn], produced by the child as [kʰʊdɪn]; and *cooking*, Glaswegian realization [kʰʏkʏŋ], produced as [tʰʊtɪn]. Some discrimination errors of a similar kind were also evident in

the control condition (London accent) e.g. *pear* repeated as [hɛː], i.e. *hair* (or *hare*).

A phonetic response could be accompanied by any of the four different types of definition discussed under the section 'Scoring of responses': sometimes a child accessed a lexical item, correct or otherwise; on other occasions, no lexical access occurred. The percentages of these types of definitions within this category are shown in Table 4. Percentages are

TABLE 4. *Breakdown by per cent of type of definition accompanying phonetic response in age group 1*

Subtype of phonetic response	Percentage
Correct definition	16
Lexical error definition	23
New definition	30
No definition	31

reported for age group 1 as only 4·8% of age group 2's total responses constituted phonetic responses (i.e. these responses were produced on only 19 occasions).

Table 4 shows that a phonetic response is sometimes accompanied by access of a lexical item that is related to the phonetic features of the stimulus (39%), but on 61% of cases this does not happen. In the 39% of cases where lexical access is relatable to the input stimulus, access may be either accurate (16%) or inaccurate (23%). These results suggest that whatever they may be, the factors involved in inducing a phonetic response are relatively independent of the factors that lead to accurate lexical access.

DISCUSSION

As would be expected, the results show that children found it harder to understand words spoken in an unfamiliar accent than in their own accent. More interestingly, there were developmental differences in the extent of children's difficulties with an unfamiliar accent: the seven-year-old children made significantly fewer errors, overall, than the four-year-old children. This indicates that making sense of accents is something that improves with age, at least between four and seven, and answers in the affirmative the first of our research questions: 'Is there an effect of age on single word comprehension when the accent of presentation is not that to which the child is exposed in his/her immediate linguistic environment?' A simple explanation would be that this is due to greater exposure to accent differences, through television etc; but this 'more means better' account should not be pushed too far. The dialectological studies reviewed in the Introduction indicate that

when it comes to accommodating to a new accent in one's own speech, older children and adults are less successful than younger children, even though they may have just as much exposure to the new accent (Chambers, 1992). The factors underlying this developmental change will now be explored by addressing the second of our research questions: 'Are there age-related developmental changes in the way in which children process and interpret words spoken in an unfamiliar accent?'

Despite the age-related increase in the number of correct definitions that has just been discussed, there was no corresponding decrease in the number of incorrect lexical items accessed by the older children compared to the younger children. This means that the difference between the two groups in number of definitions correct is not made up of cases in which an incorrect but phonetically plausible lexical item was accessed. Rather, the difference between the two age groups is made up of 'phonetic' responses that are accompanied by no definition or by a completely unrelated definition – cases in which there is no phonetically-induced lexical access. Thus the difference between the two age groups lies not in the number of lexical misidentifications, but in the number of failures to identify any plausible lexical item at all.

We will first consider the finding that there is no age-related increase in lexical misidentifications. The propensity for unfamiliar phonetic forms to be perceived as familiar words is not confined to children, as is apparent by evidence of the misunderstandings between accent systems described by Labov (1989). Such lexical misidentifications, involving closely related phones, recall Best's Perceptual Assimilation Model, where a non-native (or exotic) phone can be assimilated to a similar native (or familiar) category, e.g. the Glaswegian realization of the diphthong /ɛə/ as [eɪ] was assimilated by some of the four-year-olds to the London diphthong /ɪə/ resulting in lexical errors *beer* and *beard*. The finding that there is no significant difference in number of lexical errors between four-year-olds and seven-year-olds, and the observation that such errors are also made by adults, suggests that the mechanisms responsible for this type of error are not developmental ones. This rules out lack of exposure to accents as a causative factor, since exposure can be expected to increase with age. Equally, it would seem to rule out immature phonological representations, since phonological representations are thought to become more precise as the child gets older (Walley, 1993). The finding thus fails to bear out one of the predictions that follow from Best's assimilation model and Flege's tolerance region model – that older children will make more misidentifications than younger children, because they have a bigger vocabulary and thus potentially more words onto which the input might erroneously be mapped. On the other hand, the finding that both age groups made a similar number of lexical misidentifications does not support the opposite prediction, either. This prediction, following from the

multiple trace model of Hintzman (1986), is that older children will make fewer lexical misidentifications because they have had more opportunities to associate the 'exotic' form with appropriate lexical items, and thus add more multiple traces to that phonetic item. Instead, it seems likely that the absence of developmental increase or decrease in number of lexical misidentifications is due to the absence of contextual information, as this is an external factor that may affect younger children, older children and adults equally, both in this test situation and in everyday interaction. This ties in with Labov's finding that for adults, context, particularly in the form of a full sentence containing both lexical and grammatical cues, on many occasions aids correct lexical identification of a word spoken in a different accent.

We now turn to the findings that the younger group made more phonetically based responses, and were much more likely to fail to access any (plausible) lexical item at all. The 'phonetic responses' formed a large proportion of the total responses made by the four-year-olds (44%), but were rare in the seven-year-olds (4·8%). In the four-year-old group, 61% of these phonetic responses were accompanied by absence of lexical access (i.e. no definition or a made-up definition – see Table 4). The difference between the performance of the two age groups calls for a developmental explanation.

Our results are consistent with the sociolinguistic literature on second language and dialect learning, according to which, the younger a child is the more likely they are to accommodate to the accent of the new language/dialect (Oyama, 1976; Payne, 1980; Williams, 1980). Phonetic responses in our experimental task, and particularly those responses that involved complete imitation of the Glaswegian stimulus, may be early indicators of accommodation, a process of identifying the salient features of the new accent, which requires sensitivity towards phonetic detail (Trudgill, 1986). The notion that younger children are more sensitive to phonetic detail was discussed in the Introduction. It is well established that in the course of the first year of life, infants lose the ability to distinguish between phonetic contrasts to which they are not exposed in the ambient language. More relevant for this study is Burnham's proposal (1986) that between the ages of four and eight there is a second phase of perceptual loss, in which children lose the ability to distinguish between other contrasts – ones which may be present allophonically in the language they are learning but are not contrastive in that language. The child thus has no experience of using the two sounds contrastively. This apparent decline in phonetic sensitivity parallels the decline we have found in the number of phonetically based error responses, between four-year-olds and seven-year-olds.

Our finding that the four-year-old children seem to be more readily influenced by the phonetic information in the speech signal can be related to the process of vocabulary growth occurring during the age range under consideration. As the lexicon expands, there is necessarily some instability in

both inter- and intra-lexical structural associations (Walley, 1993). Indeed, this growth has been seen as the impetus for the restructuring of the lexicon with representations that are more detailed and segmental (Charles-Luce & Luce, 1990). The very occurrence of phonetic responses confirms that this phase is one of instability and potential change; it is only through the building up of 'multiple traces' (Hintzman, 1986) and of exposure to relevant input that language-specific representations become more detailed and more stable. Our proposal is that the younger children's sensitivity to exotic phonetics, during this period of developing precise phonological representations, results in poor ability to access those lexical representations that they already have stored, and which, as shown by the children's performance on the control condition, were specified adequately enough to allow stimuli presented in the child's own accent to be accessed. The extent to which the four-year-old children made phonetic response errors in addition to lexical repetition errors may be thus indicative of the relative imprecision of their phonological representations, itself due at least in part to a relative lack of exposure to language variation.

Their limited exposure to lexical items means that younger children are less likely to have built up fully established and detailed lexical and phonological representations (Carey, 1978; Nittrouer, 1996). In terms of Flege's 'tolerance region' model, as the younger children will also have had less experience in dealing with accent variation, they will not yet have established adequate tolerance regions around prototypes (Flege, 1992). The finding that the four-year-olds are more likely than the seven-year-olds to fail to identify any word at all thus accords with one of the predictions that follows from Flege's model (see Introduction). The same prediction is made by Best's Perceptual Assimilation Model, though for a different reason: the younger child has a smaller vocabulary, and so has fewer lexical items onto which the exotic input might be mapped. Our results support both models in this respect.

The differences in performance between the four-year-old children and the seven-year-old children when defining and repeating words presented in the unfamiliar Glaswegian accent can thus be linked to two developmental factors. The first is the younger children's greater phonetic sensitivity, evident from studies of infant and child speech perception and also in their reportedly superior ability to master the accents of new dialects or second languages. The second factor is the relative imprecision of the young child's developing phonological representations, due at least in part to the comparative lack of exposure to input from different accents and to the smaller size of the young child's lexicon.

CONCLUSION

The ability to process and understand a novel or unfamiliar accent of one's own language is an important part of the individual's linguistic and sociolinguistic competence. The ability to accommodate a new accent into one's own speech patterns may also be important for the individual moving into a different dialect community. The aim of this exploratory study has been to investigate how the skills involved in these aspects of communicative competence develop in children. The results suggest that the development of these abilities can be related to the developmental mechanisms responsible for the tuning of speech perception skills and for the filling out of phonological representations. At the same time, the child's developing skills have to be seen in relation to the behaviour of competent adults when faced with having to understand accents other than their own, the study of which is still in its infancy.

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APPENDIX

LIST A			LIST B		
Word	London	Glaswegian	Word	London	Glaswegian
High frequency			High frequency		
night	[nɑɪʔt]	[nʌiʔ]	*light*	[lɑɪʔtʰ]	[lʌiʔ]
pear	[pʰɛː]	[pʰeɹ]	*bear*	[b̥ɛ̝ː]	[b̥eɹ̝]
bird	[bɜ̟ːd̥]	[bʌɻd]	*girl*	[gɜːlʸ]	[gɪɾl]
book	[bʊ̈ʔkʰ]	[bʏʔkʰ]	*good*	[gʊd̥]	[gʏd̥]
coat	[kʰʌʊʔtʰ]	[kʰo̞ʔ]	*boat*	[b̥ʌʉ̟ʔtʰ]	[bo̞ʔ]
fork	[fɔ̟ːʔk]	[fɔɹʔk]	*walk*	[wɔːʔkʰ]	[wɔʔkʰ]
sock	[sɒʔkʰ]	[sɔʔkʰ]	*box*	[bɒʔks]	[bɔʔks]
mouse	[mæʊs]	[mʌ̟ʏs]	*mouth*	[mæʊθ]	[mʌ̟ʏθ]
hand	[hæ̞̃ːnd̥]	[hand̥]	*sand*	[sæ̞̃ːnd̥]	[saːnd̥]
skirt	[skɜ̟ːʔtʰ]	[skʌɹʔtʰ	*dirt*	[d̥ɜ̟ːʔtʰ]	[dʌɹʔtʰ]
Low frequency			Low frequency		
pudding	[pʰədɪŋ]	[pʰʏdn]	*cooking*	[kʰʏkʰɪŋ]	[kʰʏkʏŋ]
naughty	[nɔːtʰi]	[nɔʰte]	*butter*	[bɐ̟tʰɐ̟]	[bʌʔəɹ]
bite	[bɑɪʔtʰ]	[bʌɪʔ]	*kite*	[kʰɑɪʔtʰ]	[kʰʌ̟iʔ]
word	[wɜ̟ːd̥]	[wʌɻd]	*shirt*	[ʃɜ̟ːʔtʰ]	[ʃʌ̟ɹʔtʰ]
soap	[sʌɣʔpʰ]	[soʔpʰ]	*rope*	[ɹʌɣʔpʰ]	[ɻoʔpʰ]
food	[fəʉd̥]	[fʏd̥]	*boot*	[b̥ʉːʔtʰ]	[bʏʔ]
wave	[wɛɪʏ̞]	[weːʏ̞]	*game*	[gɐ̟ɪm]	[gem]
hot	[hɒʔtʰ]	[hɔʔ]	*fox*	[fɒʔks]	[fɔʔks]
nurse	[nɜ̟ːs]	[nʌɻs]	*church*	[tʃʲɜ̟ːʔtʃʲ]	[tʃʌɹʔtʃ]
bath	[b̥ɑː θ]	[b̥aːθ]	*path*	[pʰɑːθ]	[pʰaːθ]

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