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Perception and awareness of accents in young children

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This study examines children's metaphonological awareness for accent-related information in connected speech. In the first experiment, 5- to 6-year-old French-speaking children were asked to discriminate between Southern and Northern accented French in a sentence categorization task. It was found that these children were not able to reliably distinguish between these native variations of their own language, but were able to distinguish between their own accent and a strong foreign accent in Experiment 2. These findings were also replicated using a speaker discrimination task in Experiment 3, where children were asked to detect pairs of speakers sharing the same accent amongst speaker pairs with different accents. Whilst these experiments have shown that 5- to 6-year-old children do not use non-familiar regional accents as a discriminatory cue, they are able to perceive the differences between accents, as demonstrated in the AX task used in Experiment 4. The factors underlying the relative lack of awareness for a regional accent as opposed to a foreign accent in childhood are discussed, especially regarding the amount of exposure and the learnability of both types of accents.

The current literature on the development of phonological awareness (e.g. Gombert, 1992; Hakes, 1980) provides prolific evidence that language development is characterized by a growing explicit knowledge of phonological information. This metaphonological ability provides the capacity to identify the phonological components within linguistic units and intentionally manipulate them (Gombert, 1992, p. 15), requiring access to the abstract functional properties of language. Perhaps the best example of the utility of this ability can be found in the development of literacy, where there is a strong relation between the development of metaphonological knowledge and later performance in reading and writing (e.g. Bryant, Bradley, McLean, & Crossland, 1989; Goswami & Bryant, 1990).

According to Content (1985), the appearance of metaphonological ability only becomes evident from the age of 5–6 years, with most of the data focusing upon

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children's abilities in manipulating small linguistic units, such as rhymes (Content, Morais, Kolinsky, Bertelson, & Alegria, 1986; Goikoetxea, 2005; Lenel & Cantor, 1981; Smith & Tager-Flusberg, 1982), syllables (Fox & Routh, 1975; Goikoetxea, 2005; Liberman, Shankweiler, Fischer, & Carter, 1974; Rosner & Simons, 1971), or phonemes (Calfee, Lindamood, & Lindamood, 1973; Content *et al.*, 1986; Fox & Routh, 1975; Goetry, Urbain, Morais, & Kolinsky, 2005; Goikoetxea, 2005; Hakes, 1980; Liberman *et al.*, 1974; Treiman, 1985). Another avenue of research has been directed towards metalinguistic awareness of indexical information, related to age, gender, accent and emotion. Spence, Rollins, and Jerger (2002) showed that from the age of 3, children are able to use indexical information to identify familiar cartoon characters by their voice, building upon an earlier ability to learn about familiar caregiver voices from birth (DeCasper & Fifer, 1980). Morton and Trehub (2001) revealed gradual developmental changes in the ability to use acoustic correlates of emotion in speech; whereas 4-year olds mostly focus on content, older children and adults are more likely to rely on emotion-related indexical information.

One important aspect of indexical variability that has largely been overlooked in psycholinguistic research is that related to accents, especially the developmental implications of this source of variability (but see Nathan, Wells, & Donlan, 1998). Contrastively, sociolinguists have produced extensive descriptions of natural variations arising from social, ethnic, or regional characteristics, and the consequences of these variations upon social stereotypes in various situations (e.g. Linn & Pichè, 1982; Luhman, 1990; also see Mugglestone, 2003). In this psycholinguistic study, we examine children's perception and use of accent-related information found in connected speech, with a view to extending our understanding of the development of metalinguistic awareness of indexical information.

It is already well established that children are able to acquire new dialects when moved from one region to another, with proficiency generally inversely related to age. For example, Trudgill (1986) found that 7-year-old twins had both acquired Australian vowels within 6 months of their arrival from the UK, even though they displayed different patterns of acquisition. Similarly, Chambers (1992) examined accent production in six 7- to 15-year-old Canadian English-speaking youngsters when moved to southern England. He found that all the children acquired new dialectal features, although the younger children were more likely to acquire the more complex phonological features than their older siblings. Payne (1980) also found that older American adolescents acquired a Philadelphian accent after moving to that area, but could not acquire more complex phonological rules.

It is only relatively recently that researchers have begun to explore the origins of children's superior dialectal learning ability. Using the headturn preference procedure (see also Kitamura, Panneton, Notley, & Best, 2006; Phan & Houston, 2006), Nazzi, Jusczyk, and Johnson (2000) revealed that 5-month-old American infants were capable of discriminating between British and American English, suggesting that suprasegmental and/or prosodic representations were sufficiently detailed at this age as to allow discrimination of two native language varieties.

In older children, Nathan *et al.* (1998) reported a developmental shift in the ability to detect regional accent-related features. Using a word repetition and definition task, 4- and 7-year-old children were tested using words produced in their native London accent (e.g. « Church » produced as /tʃɜːʔtʃ/) and a Glaswegian regional accent (e.g. /tʃʌɹʔtʃ/). Children's responses were divided into two categories of interest: a phonological response, when the child repeated and defined the given word correctly in his/her own regional accent, and a phonetic response, when the Glaswegian version of the word was repeated exactly as such, with or without an exact definition. Interestingly, 4-year olds gave many more phonetic responses than 7-year olds (44% vs. 5%), whereas 7-year olds gave more phonological responses than 4-year olds (70% vs. 37%). According to the authors, phonetic responses provide early indicators of accommodation, a process by which speakers adjust their speech to that of a partner who speaks a different regional accent, in order to increase mutual intelligibility (e.g. Trudgill, 1986). This process would require sensitivity to phonetic information, an ability known to undergo particular development in infancy and early childhood (e.g. Werker & Yeung, 2005). Therefore, enhanced phonetic sensitivity at 4 years might lead to enhanced accommodation, which in turn would lead to an enhanced ability to learn a new regional accent.

However, we suggest another possible interpretation of these results. As the words were always presented in isolation, the only information that the participant could use to identify the targets was provided by his/her lexical knowledge, with additional inferences drawn from the speaker's lexicon. Success in this paradigm would require a readiness to assume that the signal is not 'correct', and thus interpretation would require modification. At 4 years of age, children may simply assume the relevancy of the speaker's production in its unmodified form, and so search for a potential candidate within their own lexicon. That is, they would not attempt to infer the speaker's communicative intention by considering potential changes in the word form, simply because they would be unable to conceive of potential 'errors' in the speaker's productions. This interpretation is favoured by the analyses of the definitions provided by the 4-year-old children when they give a phonetic response. In only 16% of cases, did they respond with the right meaning of the word, and in 23% of the cases, they gave a definition of an incorrect but phonologically related word (defining the Glaswegian version of 'church' as 'when you put your hand on something', i.e. 'touch'). The remaining 61% of the cases were classified as new definitions (30%, unrelated, made-up definition) or no definition at all (31%). These results give a clear indication that guesswork was the major strategy at that age, whereas at 7 years old, children might be aware of the possible discrepancy between the incoming sequences and their own representations and correct the form appropriately.

In sum, Nathan *et al.*'s study (1998) clearly indicates a developmental process in the ability to interpret regional accent-related information between the ages of 4 and 7. Younger children's inability to modify the incoming accented word forms could be attributed to their incapacity to question the distortion of the incoming input, because of their lack of metalinguistic awareness for this type of information, and/or because of their inability to conceive of speakers' possible 'erroneous' productions. This explanation is in line with the idea that children only start to develop a theory of mind around that age, allowing them to represent other people's beliefs and knowledge as being potentially different from their own (e.g. Wimmer & Perner, 1983). It is also worth noting that in this context the emergence of a theory of mind has been shown to correlate with the development of metalinguistic abilities (Farrar, Ashwell, & Maag, 2005).

To examine children's awareness of regional accents in connected speech, we tested a group of 5- to 6-year-old French children in Experiment 1 using a regional accent categorization task. This specific age group was selected as, at this stage of development, the children should have acquired a metalinguistic awareness for small linguistic units (Content, 1985). In addition, at this age, the participants should have also acquired a primitive concept of country (e.g. Barrett & Short, 1992; Piaget & Weil, 1951) and knowledge that people from different cultures can speak a different language (Hirschfeld & Gelman, 1997), both of which will help in their grasp of the concept of accents required in our task. Finally, justification for the choice of a categorization task is motivated by the requirement of the use of information, one step higher in the scale of awareness than discrimination (Karmiloff-Smith, 1992).

EXPERIMENT 1

In this experiment, we used a go/no-go categorization paradigm to investigate children's awareness of the difference between their own regional accent and that originating from another region. Children between 5 and 6 years old were presented with sentences uttered by four speakers, two from their own native region of Besançon in the east of France and two from the region of Toulouse in the south of France. During a training phase, all children were presented with sentences uttered in the two accents with instructions to group the speakers into two pairs. After training, the children were split between Regional accent and Voice groups. In the first group, speakers were paired according to accent, and the children were instructed to make a judgment based upon the regional accent of the speakers, detecting either the home or unfamiliar regional accent. In the Voice group, speakers were paired *across* accents, that is, a speaker with the home accent was paired with a speaker with the regional accent. In this group, the children were asked to categorize speakers across regional differences simply using voice-related idiosyncratic information.

To a certain extent, this experiment relied upon implicit learning. During the training phase, children were presented with a voice associated to a particular group colour, a home-accented voice with an orange character and a Toulouse speaker with a blue character for example. From their training examples, the children were expected to infer the nature of the discriminative cues between blue and orange groups of speakers. In the Regional accent group, the criterion for grouping the speakers was their common accent, whilst in the Voice group there was an arbitrary matching of two speakers, one speaker from Toulouse with one speaker from Besançon. We hypothesize that if the children are aware of the difference between regional accents, then we should find that performance in the Regional accent group should be superior to that of the Voice group. In this case, regional accent should provide a salient discriminative cue, providing a more effective basis for the construction of perceptual categories than the idiosyncratic differences between individual speaker's voices.

Participants

Thirty-seven children were tested in this experiment, with three participants rejected due to experimental errors, leaving 34 children between the ages of 5;5 and 6;5 years (mean of 5;11 months, 21 girls and 13 boys). The remaining children were randomly assigned to either the Regional accent group, containing 18 participants (including 12 girls), or the Voice group, with 16 participants (including 9 girls). In the Regional accent group, the children were evenly split between two conditions; in the first, the children were asked to detect their home regional accent (H), and in the second, they had to detect the unfamiliar regional accent (U). Children in the Voice group were also split between two conditions, the first having to detect a category of speaker consisting of one of the unfamiliar and one of the home speakers (V1), whilst in the other condition the children had to detect a category containing a different unfamiliar and home speaker (V2).

All children attended '*grande section de maternelle*', corresponding to the Reception Year in the UK. They had no recorded auditory problem and were all monolingual native French speakers. Along with active consent, the parents of the children were asked to complete a questionnaire detailing their residence over the past years. If the family had spent a significant period of time outside of the region since the child's birth (more than the usual holiday periods), they were excluded from the study.

Stimuli

All sentences used in this experiment were semantically concrete, and based on simple syntactic frames, with 0–1 level of embedding, such as '*La soupe de ma grand-mère est bien meilleure quand elle rajoute une carotte*' ('My grandmother's soup is much tastier when she adds a carrot'). Home regional accent speakers were both 22-year-old females and native to the Franche-Comté area. The unfamiliar regional accent speakers were 33- and 35-year-old females and native to the Toulouse area.

Each of the speakers produced four training sentences containing between 13 and 18 syllables, and 10 test sentences containing between 17 and 19 syllables. The mean duration of test sentences produced by the home regional accent speakers was 2,961 ms ($SD = 213$ ms) and 2,487 ms ($SD = 192$ ms), with durations of 2,913 ms ($SD = 229$ ms) and 2,616 ms ($SD = 206$ ms) for the unfamiliar regional accent speakers. These 40 sentences were then split into two blocks, with an equal distribution of sentences produced by the four speakers within each block. The order of the sentences presented within each block was randomized for each participant.

Regional accents

Phonologists and linguists agree on a perceptual boundary between northern, including the 'standard' Parisian regional accent (see Tranel, 1987, for a description) conveyed by the media, and southern regional accents (Carton, Rossi, Autesserre, & Leon, 1983; Hintze, Pooley, & Judge, 2001). This also corresponds to the boundary between the regional accents of Oïl in the north, east, west, and south-central areas, and the regional accents of Oc, which cover the south part of France. In all three experiments, the 'home' regional accent refers to that of the Franche-Comté region in the north-east of France, a regional accent from the Oïl family of regional accents. The 'unfamiliar' regional accent is that of the Toulouse area in the south-east of France, and belongs to the Oc family.

The Franche-Comté 'home' accent is typified by a number of differences to the (standard) Parisian accent (described in Tranel, 1987), including the closure and lengthening of vowels in closed syllables (that normally should be open and short: 'neige', *snow*, produced as /neːʒ/ instead of /nɛʒ/), and the opening of vowels when they are in word-final position (normally should be close: 'pot', *tin*, produced as /pɔ/ instead of /po/). There is also a tendency for /r/ and some voiced occlusives to be unvoiced ('encore', *again*, produced as /ɑ̃koʀ̥/ instead of /ɑ̃kɔʀ/). Also, whilst Parisian speakers would tend to lengthen the last syllable of a word, speakers from the Franche-Comté region will use stress in diverse syllabic positions ('maison', *house*, produced with a first long syllable and second short, instead of the reverse pattern; Konopczynski, 1979; Rittaud-Hutinet, 2001).

As described in Carton *et al.* (1983), the Toulouse area accent is typified by the consistent closure of /e/ and /o/ ('avais', *had*, produced as /ave/ instead of /avɛ/; 'cordes', *strings*, produced as /koʀd/ instead of /kɔʀd/), the systematic production of schwa ('uniquement', *only*, produced as /ynikəmɑ̃/ instead of /ynikmɑ̃/; although it is not produced in front of a vowel). Consonant gemination can be observed in certain cases ('dans le circuit', *in the circuit*, produced as /dɑ̃lləsiʀkɥi/ instead of /dɑ̃ləsiʀkɥi/). The usually back 'a' vowel is produced as a front vowel, nasal vowels are produced with nasal consonant elements ('aucun', *none*, produced as /okœœ̃N/ instead of /okœ̃/), some intervocalic consonant clusters are simplified (/gz/ becomes /z/), and /r/ is devoiced when it appears in word-final position, or rounding in other positions. Finally, the consistent group stress found on the final syllable of utterances in other accents will move if the final word ends in a schwa (in 'le ver de terre', *the worm*, the accent is carried by the two syllables of 'terre', /tɛʀə/).

Procedure

Each child was tested individually in a quiet room at school after active consent had been collected from their parents. The experiment was introduced as a game: the experimenter had recorded two teams of teachers on the computer, the blue team and the orange team. But the computer had been naughty and had mixed everything up. The child was told that they belonged to the blue team, for example, and that their task was to find the blue teachers. The child was told that some examples would be given at the beginning, but that later they would have to do it themselves.

Stimuli were presented over headphones, and the experiment was controlled by E-prime on a PC laptop. The training phase was divided into two parts. During the first part, children were presented with a set of 16 sentences, each of which was displayed together with a picture of a blue or an orange cartoon character for 6 seconds. Depending on the group or condition, the child become accustomed to those characters typifying the different categories of speaker, for example, an orange character for an unfamiliar accent and a blue for a home accent. During this first training phase, children were simply invited to listen carefully and pay attention to the associations between the speakers and the colour of the characters. Although sentences were presented in random order, the experimenter controlled the rate of inter-stimulus presentation and provided some feedback when necessary.

During the second training phase,[1] the same sentences were also repeated in a random order, but this time with none of the associated pictures. Children were instructed to press the red key on the E-prime Button Box with their favoured hand if they detected their specified category of speaker (depending upon their group and experimental condition), corresponding to a particular colour (blue or orange) of visual character, and make no response if the speaker belonged to the other category (the other colour). After each response, positive or negative feedback was presented for 3 seconds, consisting of a picture of a happy/sad cartoon character, together with a happy/sad jingle. The experimenter controlled the rate of stimuli

[1] *Data collected during the second phase of training could not be exploited as the experimenter generally had to direct the child in the task every two or three sentences. This provides a further indication of the relative difficulty of this task.*

presentation to encourage the child and re-explain the task if necessary. After all 16 sentences had been presented, the test phase began. Children were instructed to continue as before, but this time the experimenter did not provide any help, only controlling the rate of presentation. Forty new sentences were presented in random order, divided in two 20-sentence blocks. When the experiment was completed, children were congratulated and offered a small toy in thanks for their participation.

Results

A hit was defined as a 'yes' response when the correct regional accent or voice was identified. A false alarm occurred when a response was given for an inappropriate regional accent or voice. In the Regional accent group, 63.3% of responses during the test phase were hits, with 55.0% false alarms. In the Voice group, mean hit rates and false alarms were 70.3% and 62.2% (see Table 1).

Separate measures of sensitivity (A') and bias (B''_D) were computed using signal detection analysis. Sensitivity A' was used because it does not rely on the strict assumptions of normality and equal variance of signal and noise distributions that are associated with d', a more popular measure of signal detection (Grier, 1971). Besides, the A' measure, which varies between 0 and 1, can be computed for extreme values. A maximum value of 1.0 is obtained when the participant gives 100% of correct hits and 0 false alarms, and a value of 0.5 indicates chance performance.

Response bias was measured using B''_D, which is independent from A', and ranges from -1 to 1. Negative values indicate a liberal response bias and positive values indicate a conservative bias (Donaldson, 1992).

An ANOVA with groups and conditions (detect H vs. R accent in the Regional accent group, and detect V1 vs. V2 set of voices in the Voice group) was conducted on A' and bias separately. The mean A' and B''_D values in each group are shown in Table 1. Mean A' was 0.58 in the Regional accent group and 0.56 in the Voice group, values that were not significantly different ($F(1, 30) < 1$, $\eta_p^2 = .005$, observed power = .07). Mean B''_D was -0.32 in the Regional accent group and -0.54 in the Voice group, showing a similar liberal bias in both cases (tendency to answer yes, significant in both groups, $t(17) = 3.16$, $p = .006$; $t(15) = 6.05$, $p < .001$; $F(1, 30) = 2.42$, $p = .13$, $\eta_p^2 = .07$, observed power = .33). These analyses suggest that children were unable to effectively categorize the test sentences by either voice or regional accent, and that there was no significant performance difference between these categories of stimuli. Comparisons of individual successes and failures across the groups yielded similar results.

In the Regional accent group, there was no significant difference between the sensitivity of H (mean $A' = 0.57$) or R (mean $A' = 0.59$) detection ($F(1, 16) < 1$, $\eta_p^2 = .005$, observed power = .06) with similar liberal bias levels (mean bias in H = -0.45; mean bias in R = -0.20; $F(1, 16) = 1.52$, $\eta_p^2 = .09$, observed power = .21). Similarly, in the Voice group, there were no significant differences in either sensitivity (V1: $A' = 0.62$, V2: $A' = 0.50$; $F(1, 14) = 2.17$, $p = .16$, $\eta_p^2 = .13$, observed power = .28) or bias (V1: $B''_D = -0.53$, V2: $B''_D = -0.55$; $F(1, 14) < 1$, $\eta_p^2 = .001$, observed power = .05) between the two sets of voices. Therefore, no significant difference could be found between the test conditions of either the Voice or the Regional accent groups.

Analyses of the distribution of correct hits and false-alarms rates as a function of speaker showed that each speaker elicited similar proportions of correct hits and false

Table 1. Pooled distribution of responses in the Regional accent and Voice groups of Experiment 1, and the Foreign accent and Voice groups of Experiment 2. Responses are categorized as correct hits, total 'yes' responses, false alarms, and total 'no' responses. Mean values of A' and B''_D are displayed in each experiment for each group, together with their *SDs*

		Correct hits	Total 'yes' responses	% Correct hits	False alarms	Total 'no' responses	% False alarms	Mean A'	*SD*	Mean B''_D	*SD*
Exp 1	Regional accent group	228	360	63.3	198	360	55.0	0.58	0.13	−0.32	0.44
	Voice group	225	320	70.3	199	320	62.2	0.56	0.17	−0.54	0.36
Exp 2	Foreign accent group	384	500	76.8	194	500	38.8	0.72	0.25	−0.28	0.65
	Voice group	215	400	53.8	223	400	55.7	0.48	0.13	−0.16	0.57

alarms (distribution of responses as a function of speakers in the Regional accent group: $\chi^2(9) = 5.39$, $p = .8$ and in the Voice group: $\chi^2(9) = 3.07$).

Discussion of Experiment 1

This first experiment indicates that 5- to 6-year-old French children are unable to use regional accent-related information to categorize sentences. However, before discussing the implications of these findings relevant to the development of regional accent processing, we first address possible methodological causes for this null result. One possible explanation is that the task used in this experiment is too complex, or that there may be some flaw in the selection of stimuli leading to a lack of salient information. To test whether the experimental procedure and stimuli were valid, at least from an adult perspective, we repeated the experiment with six French-speaking adult participants from various regions of France (mean age 34, from 28 to 53), split between the Regional accent and Voice groups. We found that in adult participants, the mean A' was 0.97 in the Regional accent group (from 0.94 to 0.99) and 0.78 in the Voice group (from 0.70 to 0.84). These results show that adults can accurately categorize stimuli based upon either regional accent or voice in this experiment, with increased performance in the Regional accent group indicating the use of abstract representations based upon regional information (see also Clopper & Pisoni, 2006; Williams, Garrett, & Coupland, 1999).

Adult performance in this task would suggest that the children's failure to categorize sentences based on regional accents is unlikely to be due to the lack of salient regional accent-related linguistic cues, nor to problems inherent in the procedure. However, these findings do not allow us to rule out the possibility that the 5–6 year olds were unable to understand the procedure, possibly due a delay in the development of executive function necessary to perform this task (i.e. Zelazo, 2004). This consideration must also be weighted by the assumption that the presentation of examples during training should have been sufficient for the children to discover the categorization cues for themselves, which may have been difficult to achieve at this age range. To address these concerns, a second experiment was conducted which tested whether children could succeed in a similar task when presented with a more salient contrast.

EXPERIMENT 2

The experimental procedure used in this experiment is highly similar to that of Experiment 1; however, instead of comparing home and unfamiliar regional accents, children compared their home regional accent and a foreign accent. Using non-fluent native English speakers to produce foreign-accented sentences, who had learnt French late in life, we hypothesize that children would be more likely to categorize this variety of 'distorted' speech as being different from their own home variety.

Participants

Forty-five children were tested (mean age: 5;3, range: 4;6–6;2, 25 girls and 20 boys). Twenty-five children were randomly assigned to the Foreign accent group (including 12 girls) and 20 to the Voice group (including 13 girls). In the Foreign accent group, 12 were asked to detect the home accent (H) and 13 to detect the foreign accent (F). In the

Voice group, 10 children were assigned to the detection of the first set of voices, V1 (first speaker from H and first speaker from F) and the other 10 to the detection of the other set V2 (second speaker from H and second speaker from F). Children were selected using the same criteria used in the previous experiment, but were slightly younger because they belonged to classes containing a mix of children from 2 school years.

Procedure

The procedure was identical to that used in Experiment 1, except that the regional accent was replaced by the foreign accent. In addition, the duration of the second training phase was reduced from 16 to 10 sentences as, previously noted in Experiment 1, the long duration of the training phase resulted in decreased motivation.

Stimuli

The set of home accent sentences was the same as that used in Experiment 1, except that only five of the eight training sentences were used in this experiment. Foreign-accented sentences were produced by two female native British speakers (aged 19 and 20) originating from South London and resident in the home accent region up to the 2 years prior to this study. These speakers were second language learners of French, and were chosen for their strong foreign accent in that language, as attested by the sentence duration of their utterances as well as perceptual reports from naïve listeners and trained phoneticians. These speakers produced eight training sentences, between eight and nine syllables long, with a mean duration of 2,499 ms (2,431 ms for the first speaker and 2,467 ms for the second). They also produced 10 test sentences each, between 17 and 19 syllables long, with a mean duration of 4,993 ms for the first speaker ($SD = 197$ ms) and 4,963 ms for the second ($SD = 505$ ms).

Results

Children in the Foreign accent group were much more accurate than those in the Voice group. The mean percentage of correct hits and false alarms was 76.8% and 38.8% in the Foreign accent group, compared with 53.8% and 55.7% in the Voice group (see Table 1). An ANOVA with groups and conditions (detect H vs. F accent in the Foreign group, or detect V1 vs. V2 set of speakers in the Voice group) as between-participant factors was conducted on A' and bias separately. Mean A' was significantly higher in the Foreign accent group than in the Voice group (0.72 vs. 0.48; $F(1, 41) = 19.91$, $p < .001$, $\eta_p^2 = .33$, observed power = .99), whereas bias B''_D was similarly liberal in both groups[2] (-0.28 vs. -0.16; $F(1, 38) < 1$, $\eta_p^2 = .008$, observed power = .08). Comparisons of individual successes and failures across groups yielded similar results.

Within the Foreign accent group, the children were significantly more successful in detecting H than F, as shown by differences in A' (0.85 vs. 0.61; $F(1, 23) = 7.80$, $p = .01$, $\eta_p^2 = .25$, observed power = .76). Bias was equivalent in both conditions (-0.11 vs. -0.42; $F(1, 20) = 1.29$, $\eta_p^2 = .06$, observed power = .19). In the Voice group, the difference between the V1 and the V2 conditions was not significant with a

[2] *Bias could not be calculated for the three children in the* F *group who made no erroneous responses, as this would lead to a divide by zero error in the computation of* B''_D.

mean A' of, respectively, 0.51 and 0.45 ($F(1, 18) < 1$, $\eta_p^2 = .05$, observed power = .15) and a bias of 0.02 and −0.34 ($F(1, 18) = 2.22$, $\eta_p^2 = .11$, observed power = .29).

For the Foreign accent group, the distribution of correct hits and false-alarm rates was equivalent across the two speakers. However, in the Voice group, the detection of the second set of speakers was significantly easier than the first one ($\chi^2(9) = 22.35$, $p = .008$). Whilst this effect was not found in Experiment 1, which used the same H stimuli as this experiment, it is likely that this difference stems from the wider differences in the judgments required in the two experiments.

Comparison between the two experiments

The combined effects of experiments (1 and 2) and groups (Regional accent/Foreign accent and Voices) were examined, revealing that there was no main effect of experiment on A' ($F(1, 71) < 1$, $\eta_p^2 = .01$, observed power = .16) but there was a main effect of participant group ($F(1, 71) = 11.83$, $p < .001$, $\eta_p^2 = .14$, observed power = .92). A significant interaction between participant group and experiment was also found ($F(1, 71) = 8.47$, $p = .005$, $\eta_p^2 = .11$, observed power = .82) with further analyses revealing that there was no significant difference between the Voices groups between experiments ($F(1, 32) = 2.38$, $p = .13$, $\eta_p^2 = .07$, observed power = .32). However, children in the Regional accent group (Experiment 1) were significantly less accurate than those in the Foreign accent group (Experiment 2; $F(1, 39) = 6.71$, $p = .013$, $\eta_p^2 = .15$, observed power = .71). The same analyses carried out on bias were not significant. Mean A' for the two experiments are displayed in Figure 1.

Finally, in order to verify that the null result of Experiment 1, as opposed to the effect found in Experiment 2, could not be attributed to the relative small number of participants, we compared the overlap of the 95% confidence intervals for the group effect sizes in both experiments. In Experiment 1, the $CI_{95\%}$ for the effect size (.005) was −.084 to .125. In Experiment 2, the $CI_{95\%}$ for the effect size (.27) was .118 to .362.

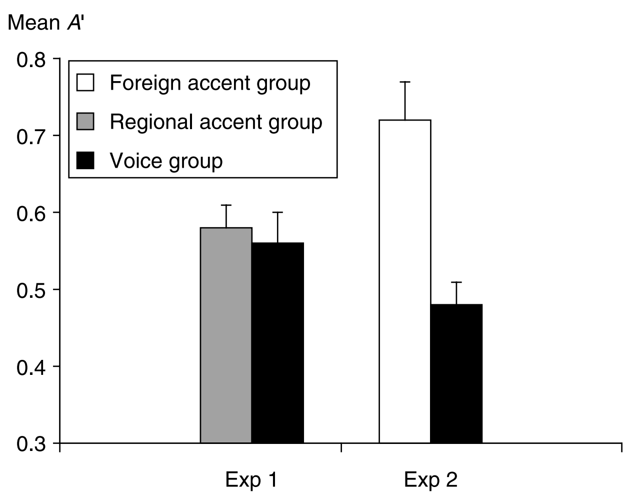

Figure 1. This chart displays the mean A' and standard errors for the Voice group (black) and Regional accent group (light grey) in Experiment 1 (two bars on the left), and for the Voice group (black) and Foreign accent group (white) in Experiment 2 (two bars on the right).

Given that the overlap between the two intervals was only 1.5%, and that the first CI entailed the value 0 whereas the second did not, it seems reasonable to conclude that the sample size was sufficient in both experiments to detect a potential effect.

Discussion of Experiment 2

Experiment 2 was designed to investigate whether 5- to 6-year olds could successfully categorize sentences using the foreign accent of the speaker as a discriminative cue. Not only did the children assigned to the Foreign accent group succeed in their task, but were also significantly more successful than those in the Voice group, where idiosyncratic information had to be used to distinguish the voices. This finding suggests that 5- to 6-year-old children are capable of taking advantage of foreign accent-related information to help them classify different voices. Additional indicators of children's awareness of the differences between their own accent and that of the foreign speakers were also evident in the debriefing sessions. In these sessions, the children commented that they had succeeded in the task because the accented voice was not a 'real voice' (*une vraie voix*) or that the foreign speakers 'spoke with a voice that is not very good' (*parlent d'une voix pas très bien*). One child gave an explanation based on an acoustic observation, by reporting that 'home speakers talked faster than foreigners' (*[H] parlent plus vite [que les F]*).

To provide a complete comparison with Experiment 1, six French-speaking adults (mean age 34, from 28 to 43) from the Franche-Comté region were tested in this experiment. Three were assigned to the Foreign accent group and three to the Voice group. Mean A' was 1.0 in the Foreign accent group (everyone had a perfect score) and 0.62 in the Voice group (from 0.40 to 0.89). As in the previous experiment, these results clearly show that stimuli were sufficiently perceptually distant to allow for categorization based on accent differences. The lower performance in the Voice group also suggests that adults were less efficient when they had to rely on idiosyncratic information to categorize speakers.

The comparison of the results of Experiments 1 and 2 reveals that the children were significantly more effective in classifying voices when distinguished by a foreign rather than a regional accent. This suggests that the null result seen in the previous experiment, where children were asked to distinguish between speakers with different regional accents, was not due to flawed methodology. Whether it shows that children are genuinely unable to *perceive* or *make use* of regional accent-related information in these conditions is an open question, one that will be addressed in Experiment 3.

EXPERIMENT 3

This experiment was designed to investigate whether children could perceive the difference between their own accent and that of speakers originating from another region or country. This was conducted using a go/no-go AX discrimination task in which children were presented with pairs of sentences produced by either the same speaker, or by two speakers sharing the same accent, or by two speakers with two different accents. On the contrary to the preceding experiments, in which children had to group speakers together, in this task they were simply asked to detect pairs of identical or different speakers. We hypothesized that if children are able to perceive the differences between accents, then they should be more accurate in discriminating speakers with different accents than those with the same accent. In a departure from the task used in the previous experiments, this task does not require an awareness of accent-related differences, simply the ability to encode accent-related information during perceptual processes.

Participants

Forty-four children were tested, but the data from five participants was rejected due to a refusal to participate (1), misunderstanding of the task (3), and loss of interest (1). The remaining 39 children were aged between 4;5 and 6;5 years (mean of 5;8 months, 22 girls and 17 boys). Of these children, 24 were randomly assigned to the Regional accent group (including 15 girls), who were presented with home and regional accents, and 15 to the Foreign accent group (including 7 girls), who were presented with home and foreign accents. Children were selected on the same criteria as in the previous experiments.

Stimuli

In this experiment, the material used in the previous experiments was extended to increase the number of stimuli. In the Regional accent group, 20 sentences produced by the four speakers (two from Besancon, two from Toulouse) were arranged in pairs, those produced by identical speakers (Identical condition), different speakers with the same accent (Same Accent condition), and different speakers with different accents (Different Accent condition). For each pair, the content of the two sentences were different, the only similarities being the speaker and/or the accent. In total, 80 pairs of sentences were presented to the participants of this group, 40 pairs for the Identical condition, 16 for the Same Accent condition, and 24 for the Different accent condition. This organization of stimuli meant that each individual sentence was repeated between 7 and 9 times, split equally between the first and second position of stimulus pairs.

There was a similar organization of stimuli in the Foreign accent group, with a total of 56 sentence pairs presented, 28 in the Identical condition, 12 in the Same Accent, and 16 in the Different Accent. The total number of sentence pairs in this group is lower than the Regional accent group as a pilot study revealed that the increased duration of the foreign-accented sentences (almost twice the duration of regional accented sentences), and corresponding increase in the duration of the experiment, resulted in a high participant rejection rate due to loss of interest.

Eight additional sentence pairs were also prepared for training, four with identical speakers, two with different speakers with the same accent, and two with different accented speakers.

Procedure

The experiment was introduced as a game: the experimenter had recorded teachers on the computer and had arranged them in little ‘packets’. But the computer had been naughty and had mixed everything up. The child was told that their task was to listen to each of these packets and decide whether they were made up of the same teacher or not. They were told that some examples would be given at the beginning, but that later, they would have to do it by themselves.

During the training phase, children were presented with the set of eight training pairs of sentences, with instructions that after each pair they were to press a button with their favoured hand if the two speakers were the same, but not to press if they were not. Positive or negative feedback was presented after each response for 3 seconds, consisting of a picture of a happy/sad cartoon character. The experimenter controlled the rate of inter-stimulus presentation and provided feedback when necessary.

During the test phase, children were instructed to continue as before, but were not provided with any help, although the experimenter still controlled the rate of presentation. Eighty (in the Regional accent group) or 56 (in the Foreign accent group) pairs of sentences were presented in random order, divided in two equal length sentence blocks. Pairs were presented with an ISI of 1,500 ms, with no limit imposed on response latency.

Results

During the baseline block, 6.6% of all responses were missing (no responses within the 7.5 seconds of delay after the second sentence, corresponding to 'I don't know' responses) and 0.3% were anticipatory (given in the first 500 ms after the beginning of the second sentence).[3] During the test block, 5.2% of responses were missing and 1.0% were anticipatory.

Overall, children succeeded in the task of pairing identical speakers and discriminating different speakers, as attested by the high A' value of the entire group (mean $A' = 0.70$, $SD = 0.17$). Mean A' was significantly different from the 0.5 chance value ($t(38) = 7.64$, $p < .001$). Comparing groups using a between-participant ANOVA showed that A' was similar in the Regional accent and Foreign accent groups (mean of 0.72 vs. 0.68; $F(1, 37) < 1$) and Bias B''_D was similarly neutral in both groups (-0.15 vs. $-.007$; $F(1, 37) < 1$). These results indicate that children were equally successful in distinguishing female voices from one another, irrespective of the nature of the accents. The mean percentage of correct hits and false alarms was 70.0% and 38.4% in the Regional accent group, compared with 64.3% and 36.4% in the Foreign accent group (see Table 2).

However, when comparing the distribution of false alarms in the Same Accent and Different Accent conditions, a different pattern emerged. In the Regional accent group, children scored as many false alarms in the Same Accent condition as in the Different Accent condition (37.8% vs. 38.9%; $F(1, 23) < 1$). Contrastively, in the Foreign accent group, children made significantly fewer false alarms in the Different Accent condition (29.6%) than in the Same Accent condition (45.6%; $F(1, 14) = 8.71$, $p = .010$, $\eta_p^2 = .38$, observed power $= .78$), suggesting that only foreign accents served as a powerful discriminatory cue. The interaction between conditions (Same Accent vs. Different Accent) and groups (Regional accent vs. Foreign accent) was also significant ($F(1, 37) = 6.61$, $p = .014$, $\eta_p^2 = .15$, observed power $= .71$).

Further analyses were conducted to examine possible asymmetries in distinguishing speakers within each particular accent. Inspection of Table 2, which shows the distribution of correct hits and false alarms for each accent modality within each

[3] In the previous experiments, no misses were observed because there was no delay imposed on reaction times. The amount of anticipatory responses was negligible: only one reaction time less than 500 ms after the beginning of the sentence was observed in Experiment 1.

Table 2. For Experiment 3, this table displays the distribution of correct hits, total 'yes' responses, false alarms, and total 'no' responses as a function of groups (Regional accent and Foreign accent), condition (identical speakers, same accent speakers, and different accent speakers), and accent presented in the pairs (Home accent vs. Regional accent, or Home accent vs. Foreign accent)

	Correct hits	Total 'yes' responses	% Correct hits	False alarms	Total 'no' responses	% False alarms
Regional accent group condition						
Identical						
Home accent	348	480	72.5			
Regional accent	324	480	67.5			
Total	672	960	70.0			
Same accent						
Home accent				80	192	41.7
Regional accent				65	192	33.9
Total				145	384	37.8
Different accent						
Home accent first				104	288	36.1
Regional accent first				120	288	41.7
Total				224	576	38.9
Foreign accent group condition						
Identical						
Home accent	136	210	64.8			
Foreign accent	134	210	63.8			
Total	270	420	64.3			
Same accent						
Home accent				42	90	46.7
Foreign accent				40	90	44.4
Total				82	180	45.6
Different accent						
Home accent first				30	120	25.0
Foreign accent first				41	120	34.2
Total				71	240	29.6

condition, suggests that performance was similar for all pairs of identical speakers, irrespective of accent. Similarly, levels of performance when identifying different speaker pairs with the same accent were similar in the Home, Regional, and Foreign accent conditions. Systematic *post hoc t* tests comparing percentages of hit rates or false alarms between each accent, group, and condition were not significant, confirming these observations. For example, for the Foreign accent group tested in the Different accent modality, there was no significant difference in false alarms due to sentence presentation order ($t(46) < 1$), at 34.2% when the Foreign accent sentence was followed by a Home accent sentence, and 25.0% when the order was reversed.

Discussion of Experiment 3

This experiment was designed to investigate whether children were able to perceive the characteristics of the regional accent produced by the speakers used in the first experiment. For that purpose, a group of 5-year olds was asked to detect pairs of identical speakers amongst speakers that either had the same accent, or different regional or foreign accents. It was hypothesized that if they could perceive the unfamiliar accent-related cues, they could make use of this information to distinguish between speakers, resulting in fewer false alarms for these speaker pairs. This pattern of results was observed in the Foreign accent group, but not in the Regional accent group, replicating and extending the results of the previous experiments which showed that young children could perceive foreign-accented speech cues accurately enough to use them in either categorization (Exp 2) or speaker discrimination (Exp 3) tasks. Contrastively, young children do not appear to perceive, or make use of, the information carried by the regionally accented speech, as they failed to use this information in either task.

At this point, we are still left with the possibility that children might not be able to perceive any regional accented differences in the stimuli we used, rather than being unable to make use of these differences. Experiment 4 is designed to distinguish these two explanations via an investigation of simple accent discrimination in children using a classical forced-choice AX paradigm. If children are able to perceive regional accent-related information in speech, they should succeed in a discrimination task which contrasts their own home accent and another regional accent.

EXPERIMENT 4

To test 5-year-old children's perception of regional accents, an AX discrimination task was used to test their ability to distinguish their own home accent and that of another accent. Children's performance in the discrimination of regional accents was also compared to the discrimination of a foreign accent, designed to act as both a baseline and allow an evaluation of task difficulty.

Participants

Twenty-two children were tested in this experiment, with four rejected due to loss of interest at the beginning of the test block. The remaining 18 children were aged between 5;0 and 5;11 years (mean of 5;6 months, 7 girls and 11 boys) and selected on the same criteria as in the previous experiments.

Stimuli

The basic material used in this experiment was a subset of that used in Experiment 3, with the number of sentence pairs reduced to account for the within-participant design. Two blocks were constructed, a baseline block, contrasting home and foreign accents, and a test block, contrasting home and regional accents. In each block, sentences were arranged by pairs of speakers sharing an identical accent (Same Accent condition) and pairs of speakers with different accents (Different Accent condition). For each pair, the content of the two sentences was different, the only similarities being the speaker and/or the accent. The identity of the speaker producing the first and the second sentence of each pair was counterbalanced across all conditions. In the baseline block, this resulted in a list of 32 pairs of sentences, 16 within the Same Accent condition, and 16 within the Different Accent condition. In the test block, 40 pairs of sentences were presented, 24 in the Same Accent condition, and 16 in the Different Accent condition.

The order of the pairs presented within each block was randomized for each participant. Two training lists of eight pairs which were not included in the two main blocks were constituted. One list preceded the baseline block and the other preceded the test block. Each training list was made up of four pairs with the same accent and four pairs with a different accent.

Procedure

The experiment was introduced as a game: the experimenter had travelled across France to record teachers on the computer and had arranged them in little 'packets', each packet corresponding to a town. But the computer had been naughty and had mixed everything up. The child was told that his/her task was to listen to each of these packets and decide whether they consisted of teachers belonging to the same packet or town. They were told that some examples would be given at the beginning, but that later, they would have to do it themselves.

During the first training phase, children were presented with a set of eight pairs of sentences contrasting home and foreign accents, and told that they had to press a red button with their favourite hand if the speakers belonged to the same packet, or the blue button if they did not. Positive or negative feedback was presented after each response for 3 seconds, consisting of a happy/sad cartoon character. The experimenter controlled the rate of inter-stimulus presentation, and provided some feedback when necessary, but stimulus presentation order was randomized for each of the participants. Pairs were presented with an ISI of 1,500 ms, with a maximum 7.5-second response latency after the presentation of the second sentence.

This procedure continued with the presentation of the 32 sentences of the baseline block, except that the experimenter no longer provided any help to the children. After the baseline block, the child was congratulated and told that they had done so well that they were going to play game that was a bit more difficult. The experimenter then presented a second training block of eight sentences contrasting home and regional accents, which was then followed by the test block of 40 pairs of sentences.

Results

During the baseline block, 13.9% of all responses were either misses or anticipatory (from 0 to 34.4%) compared with 12.4% during the test block (from 0 to 20.0%). Misses correspond to 'I don't know' responses, and anticipations refer to responses triggered less than 500 ms after the beginning of a sentence.

A' and bias B''_D were computed on the proportion of correct hits and false alarms for 'same accent' responses: a hit was recorded if children correctly recognized a similar accent in the Same Accent pairs, and a false alarm if they incorrectly identified a similar accent in a Different Accent pair. During the baseline block, children succeeded in the task of detecting pairs of identical accents and pairs of different accents, as attested by the high A' value of the entire group (mean $A' = 0.68$, $SD = 0.22$). Mean A' was significantly different from the 0.5 chance value ($t(17) = 3.47, p = .003$) and mean bias B''_D (mean $= -0.11$, $SD = 0.49$) was not different from the neutral value 0 ($t(17) < 1$). This indicates that overall, children had no difficulty discriminating the foreign and the home accents, replicating the findings from Experiments 2 and 3.

During the test block, however, mean A' dropped to a mean of 0.57 ($SD = 0.19$), a value not significantly different from the 0.5 chance value ($t(17) = 1.65$). Bias also dropped to -0.34 ($SD = 0.50$), which was significantly different from the neutral 0 value ($t(17) = -2.90$, $p = .01$). There was also a significantly different A' between baseline and test blocks ($F(1, 17) = 4.44$, $p = .050$, $\eta_p^2 = .21$, observed power $= .51$) but not bias ($F(1, 17) = 3.54$, $p = .08$, $\eta_p^2 = .17$, observed power $= .43$), which suggests that children failed to discriminate the difference between the home and the regional accents. However, a closer inspection of individual data suggests otherwise. It would appear that success or failure during baseline was a fair predictor of performance in the test block, attested by a significant correlation in A' between these blocks ($r = .49$, $p = .039$). To investigate this effect further, participants were ranked as a function of their A' score during the baseline and split in two equal size groups (nine participants in each group). It was found that A' in the low-performing group was 0.51 ($SD = 0.17$) for the baseline and 0.49 ($SD = 0.18$) for the test blocks, neither of which were significantly different from the chance value of 0.5 ($t(8) < 1$). Contrastively, the high performance group had an A' of 0.85 ($SD = 0.10$) during baseline and 0.66 ($SD = 0.17$) during the test block, both significantly different from the chance value 0.5 ($t(8) = 10.80$, $p < .001$; $t(8) = 2.95$, $p < .02$, respectively) indicating successful discrimination in the test block. However, it must be noted that for these children, performance during the test block was still lower than during baseline ($F(1, 8) = 9.56$, $p < .001$, $\eta_p^2 = .54$, observed power $= .77$).

Discussion of Experiment 4

Results from this forced-choice AX accent discrimination task show that the foreign versus home accent contrast is easier to process than the regional versus home accent contrast, extending the results of the previous experiments. It also shows that most children who succeed in discriminating the foreign and home accent contrast also succeed, albeit to a lesser extent, to discriminate regional and home accent sentences. This suggests that children's failure to use the regional accent information in a categorization task (Exp 1) or in the speaker discrimination task (Exp 3) was not due to children's inability to perceive the linguistic characteristics of this unfamiliar accent, but to a relative lack of awareness for this accent as opposed to the foreign one. In other words, the degree of awareness that children have developed for regional accents does not allow them to represent this information in functional perceptual categories.

One unexpected outcome of this experiment is that a great proportion of children failed during the baseline block, that is, when asked to distinguish their home accent from the foreign accent. This result contrasts with the previous experiments in which analyses of individual performances showed a higher success rate when presented with these two accents. This failure could be attributed to the difficulty of the task: contrary to Experiments 1 and 2, children were asked to make a decision on pairs of stimuli instead of single sentences, increasing short-term memory load. Also, in a departure from the method of Experiment 3 in which they were asked to decide whether a sentence pair was produced by the same speaker or not, in Experiment 4 they had to make an abstract choice for each speaker according to their possible geographical location and compare them to one another. This task presumably requires more attention and representational space than a simple voice comparison task.

GENERAL DISCUSSION

The aim of this study was to investigate children's perception and awareness for accent-related information in connected speech. Experiment 1 tested French-speaking 5- to 6-year-olds' ability to categorize sentences using regional accents as a discriminative cue, the results showing that they were unable to make use of the regional accent-related features to perform this task. Contrastively, in a similar paradigm, children in Experiment 2 succeeded in using foreign accent-related information to differentiate speakers. Experiment 3 replicated and extended these results by using what is a presumably simpler speaker discrimination task. Results from that experiment also showed that children could use the foreign-accented speech cues to detect pairs of different speakers, but were not able to rely upon regional accented speech cues. Finally, Experiment 4 explored children's abilities to perceive differences between accents using a forced-choice discrimination task. Results showed that when children understood the principle of the discrimination task, as attested by their success in discriminating foreign and home accents, they also performed significantly above chance when discriminating regional and home accents. Therefore, when taking all of the findings of this study into consideration, it would appear that by the age of 5, children are able to perceive differences between varieties of accents in their maternal language, but that they have a greater awareness for the characteristics of foreign-accented speech than for regionally accented speech.

Recent findings suggest a U-shaped curve in the ability to perceive regional variations of the maternal language between infancy and adulthood. Following Nazzi *et al.*'s (2000) demonstration of American English versus British English discrimination in 5-month-old American infants, Kitamura *et al.* (2006) reported that this ability might disappear between 6 and 8 months. In their study, Australian infants were shown to discriminate American English from Australian English at 3 months, but failed to do so at 6 months (see also Phan & Houston, 2006). Therefore, our finding that 5 year olds show more difficulty in perceiving and using regional accent information (relative to a foreign accent) might be related to these early perceptual changes.

However, there are also a number of other factors which could also explain this asymmetry. One factor that could cause 5-year-old children to display less awareness for a regional accent would be that children might be sensitive to the broader and less predictable differences that occur in foreign-accented speech relative to regionally accented speech.[4] Indeed, researchers in automatic speech recognition acknowledge that the between-speaker variability in a foreign accent is usually far more pronounced than within a regional accent (see Livescu & Glass, 2000), rendering increased difficulty in the potential transfer of learning from one speaker to another. This is because foreign accents embody many irrelevant variations that have no relation to the listener's maternal language, and also because foreign speakers will usually be forced to adapt their own output phonology to that of a non-native language, resulting in phonetic variations that are not known to the listener. In sum, children might be more sensitive to the broader differences that characterize foreign accents, than to the more fine-grained ones that define regional accents. Previous research has shown that phonemic categorization in childhood is more variable than in adulthood (e.g. Hazan & Barrett, 2000), suggesting that their representations are more flexible and tolerant to potential variations than those present in adults.

A second possibility is that children lack the finer distinctions of geographical knowledge useful to the categorization and existence of regional accents, whilst knowledge of foreign countries, and other languages, is more salient. In order to construct a perceptual category for a given accent, it would certainly help to relate it to an identifiable geographical entity, which may not be possible in the case of regional accents. In contrast, Piaget and Weil (1951) showed that geographical knowledge of either their own country or other countries starts developing from about 5 or 6 years of age onwards, even if there is still much geographical confusion until puberty (e.g. Barrett & Farroni, 1996; Piaget & Weil, 1951). In addition, 5- to 6-year-old children possess some stereotypical ideas about other nations, as shown by Barrett and Short (1992), who studied British children's answers to questions about other European people. Children also usually begin to categorize themselves as members of their own national group from about the same age (e.g. Barrett, Riazanova, & Volovikova, 2001; Piaget & Weil, 1951).

Regarding metalinguistic knowledge about languages, Hirschfeld and Gelman (1997) have reported that children from the age of 3 are able to infer that people from a different culture would speak a different language, as shown in a series of picture/sound-matching task. Altogether, this shows that children at the age range examined in this study would possess some early concept of nation, even if fully specified representations might take longer to develop (e.g. Nugent, 1994; Piaget & Weil, 1951), together with the knowledge of foreign languages and, to a certain extent, within-language variation. It is possible that the concept of a different language, i.e. speakers using different words, is easier to acquire than the concept of a regional accent, which requires the understanding that someone from the same culture, speaking the same language, and using the same words might produce those words in a slightly different way.

A third factor that could explain the little awareness for regional accent when compared with foreign accent would be the reduced exposure to regional varieties before the age of 5, when compared with that of foreign accents. Clopper and Pisoni (2004) have reported that American adult listeners who had been exposed to a variety of regional accents were more likely to accurately categorize dialects spoken in geographically contiguous regions than less experienced listeners. However, both types of listeners were equally proficient in detecting differences in regional varieties.

[4] *This should not be taken as a generality; some expert foreign speakers might be more intelligible, and comprehensible, than speakers from another region.*

As Flege (1984) points out, accurate *identification* for a (foreign) accent might need more exposure, but simple *detection* is possible in non-experienced listeners, even in very short samples, such as syllables or segments. Therefore, even with minimal exposure, one would expect 5- to 6-year-old children to be able to detect an unusual variety of their native language.

However, findings (Clopper & Pisoni, 2004) that accent categorization accuracy in adults is related to the amount of prior exposure to accent diversity suggests another hypothesis. Thanks to television, most children in Britain have been more regularly exposed to non-native regional accents than French children, because it has been the BBC policy over the recent years to promote the use of a broad variety of English regional accents over mass media. In France, the prestige of the standard Parisian French is such that it is still by far the most predominant variety represented by the media. We could then suppose that English-speaking children would be more readily aware of regional accents than French-speaking children, at the same age. We recently tested a group of Plymouth (UK) 5- to 7-year-old children in a similar categorization task, involving Irish-accented, French-accented, and Plymouth-accented English. Results extend those obtained in the current study: English children also show a relative inability to use a regional accent to categorize sentences, whereas they are more successful in detecting and using the foreign accent (Floccia, Butler, & Metz, 2007). Even if this result suggests that the amount of exposure has no clear influence on the ability to develop metalinguistic awareness for accents (see also Evans & Iverson, 2004), further research will be necessary to expand upon this point, especially by focusing on the type of exposure within each child's family. Following studies on bilingualism it could be anticipated, that if anything, children from bi-regional backgrounds (e.g. hearing two varieties of English at home) should display more developed metaphonological abilities than those from mono-regional backgrounds (e.g. Bialystok, Majumder, & Martin, 2003).

A fourth factor accounting for, or perhaps a consequence arising from, the small awareness for regional accent when compared with foreign accent could be related to the learnability of accents. As mentioned in the introduction, children are excellent learners of regional accents until the start of puberty, usually acquiring the variety of regional accent spoken in their native peer community (e.g. Fischer, 1958; Kerswill & Williams, 2000; Starks, 2002). Contrastively, as pointed out by Chambers (2002), children born of immigrant, non-native speaking, parents, do not appear to learn the native language with their parent's foreign accent, as if children came equipped with an innate accent filter, which would prevent them from learning any 'foreign features' (p. 121–122). Such a claim would require substantiation (as stated by Chambers himself, p. 123), for example, whereas Chambers claims that non-native phonology is never learnt, it is possible that contact with native speakers refines the deviant phonological/phonetic representations learnt from non-native speakers. In any case, such a finding would still indicate that a foreign-accented sound system is not typically learned, or at least, not stable, contrary to that of a native regional accent.

Could the lack of awareness for a regional accent, as shown in our first experiment, facilitate its learning during childhood? Similarly, could children's awareness for a foreign accent, as seen in Experiment 2, restrain them from acquiring it? This question can be understood within the framework of the Fundamental Difference Hypothesis (Bley-Vroman, 1988). In its original form, this hypothesis states that adults, on the contrary to children, use problem-solving strategies when learning a second language because they can no longer rely upon innate mechanisms for implicit language acquisition. One of the keys to superior syntactic acquisition in childhood might be the progressive diminishing capacity for implicit learning of complex abstract systems due to maturational constraints (Bley-Vroman, 1988; DeKeyser, 2000, 2003; Johnson & Newport, 1989; but see Bialystok, 2002).

Whilst the FDH has been formulated and tested on the child's ability to acquire syntax, can it be extended to their learning of languages' sound systems? Could children's *capacities* for learning the sound system of a language or a regional accent lie in their *incapacity* to access this information explicitly? By extension, would their awareness for foreign accents relate to their (supposed) inability to learn them? Answering these questions is beyond the scope of the present study. For instance, it would be necessary to ascertain that the asymmetry between regional and foreign accent awareness, as displayed in our first and second experiments, is genuinely due to a fundamental difference in the cognitive or perceptual processing of regional and foreign accents. That is, that it is not simply due to the perceptual distance between the home regional accent, unfamiliar regional accent, and foreign accent samples. Foreign speakers were specifically selected for their strong English accents, contrary to that of the Toulouse speakers in the first experiment who had a moderate accent. However, as every phonetician, phonologist, or psycholinguist knows, it is nearly impossible to quantify the amount of accent within a given utterance, and even more difficult to compare perceptual scales used to evaluate accentedness. Similar numeric values for regional and foreign accents on perceptual scales may not reflect similar perceptual distances, but rather different endpoints.

The results of this study have highlighted that an understanding of the whole process of accent learning and normalization will require additional research. There is little doubt that the development of awareness and perception of regional and foreign accents is related to the development of long-term memory, familiarity, sociolinguistic knowledge, together with that of language-specific learning mechanisms. This study is an attempt to shed some light on to the cognitive processes underlying regional accent learning in the course of language development, as the study of the mechanisms underlying regional and foreign accent perception is still in its early stages.

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References

Barrett, M., & Farroni, T. (1996). English and Italian children's knowledge of European geography. *British Journal of Developmental Psychology*, *14*, 257–273.

Barrett, M., Riazanova, T., & Volovikova, M. (Eds.), (2001). *Development of national, ethnolinguistic and religious identities in children and adolescents*. Moscow: Institute of Psychology, Russian Academy of Sciences (IPRAS).

Barrett, M., & Short, J. (1992). Images of European people in a group of 5–10 year old English children. *British Journal of Developmental Psychology*, *10*, 339–363.

Bialystok, E. (2002). On the reliability of robustness: A reply to DeKeyser. *Studies in Second Language Acquisition*, *24*(3), 481–488.

Bialystok, E., Majumder, S., & Martin, M. M. (2003). Developing phonological awareness: Is there a bilingual advantage? *Applied Psycholinguistics*, *24*(1), 27–44.

Bley-Vroman, R. (1988). The fundamental character of foreign language learning. In W. Rutherford & M. Sharwood Smith (Eds.), *Grammar and second language teaching: A book of readings* (pp. 19–30). Rowley, MA: Newbury House.

Bryant, P. E., Bradley, L., MacLean, M., & Crossland, J. (1989). Nursery rhymes, phonological skills and reading. *Journal of Child Language*, *16*, 407–428.

Calfee, R. C., Lindamood, P., & Lindamood, C. (1973). Acoustic-phonetic skills and reading kindergarten through twelfth grade. *Journal of Educational Psychology*, *64*, 293–298.

Carton, F., Rossi, M., Autesserre, D., & Léon, P. (1983). *Les Accents du Français*. Paris: Hachette, De Bouche à Oreille.

Chambers, J. K. (1992). Regional accent acquisition. *Language*, *68*(4), 673–705.

Chambers, J. K. (2002). Dynamics of dialect convergence. *Journal of Sociolinguistics*, *6*, 117–130.

Clopper, C. G., & Pisoni, D. B. (2004). Homebodies and army brats: Some effects of early linguistic experience and residential history on dialect categorization. *Language Variation and Change*, *16*, 31–48.

Clopper, C. G., & Pisoni, D. B. (2006). Effects of region of origin and geographic mobility on perceptual dialect categorization. *Language Variation and Change*, *18*, 193–221.

Content, A. (1985). Le développement de l'habileté d'analyse phonétique de la parole. *L'Année Psychologique*, *85*, 555–572.

Content, A., Morais, J., Kolinsky, R., Bertelson, P., & Alegria, J. (1986). Explicit speech-segmentation ability and susceptibility to phonological similarity in short-term retention: No correlation. *Perceptual and Motor Skills*, *63*, 81–82.

DeCasper, A. J., & Fifer, W. P. (1980). Of human bonding: Newborns prefer their mothers' voices. *Science*, *208*, 1174–1176.

DeKeyser, R. (2000). The robustness of critical period effects in second language acquisition. *Studies in Second Language Acquisition*, *22*(4), 499–533.

DeKeyser, R. (2003). Implicit and explicit learning. In C. Doughty & M. Long (Eds.), *Handbook of second language acquisition* (pp. 313–348). Oxford: Blackwell.

Donaldson, W. (1992). Measuring recognition memory. *Journal of Experimental Psychology: General*, *121*(3), 275–277.

Evans, B. G., & Iverson, P. (2004). Vowel normalization for accent: An investigation of perceptual plasticity in young adults. Poster given at the *Acoustical Society of America 75th Anniversary Meeting*, New York, USA, May 2004.

Farrar, M. J., Ashwell, S., & Maag, L. (2005). The emergence of phonological awareness: Connections to language and theory of mind development. *First Language*, *25*, 157–172.

Fischer, J. L. (1958). Social influences on the choice of a linguistic variant. *Word*, *14*, 47–56.

Flege, J. (1984). The detection of French accent by American listeners. *Journal of the Acoustical Society of America*, *76*(3), 692–707.

Floccia, C., Butler, J., & Metz, J. (2007). Regional and foreign accent categorisation in British children from 5 to 7 years. Paper presented at the *30th Child Language Seminar*, University of Reading, 18–20 July 2007.

Fox, B., & Routh, D. K. (1975). Analysing spoken language into words, syllables and phonemes. A developmental study. *Journal of Psycholinguistic Research*, *4*, 331–342.

Goetry, V., Urbain, S., Morais, J., & Kolinsky, R. (2005). Paths to phonemic awareness in Japanese: Evidence from a training study. *Applied Psycholinguistics*, *26*(2), 285–309.

Goikoetxea, E. (2005). Levels of phonological awareness in preliterate and literate Spanish-speaking children. *Reading and Writing*, *18*, 51–79.

Gombert, J. E. (1992). *Metalinguistic development*. Chicago, IL: University of Chicago Press.

Goswami, U., & Bryant, P. E. (1990). *Phonological skills and learning to read*. Hillsdale, NJ: Erlbaum.

Grier, J. B. (1971). Nonparametric indexes for sensitivity and bias: Computing formulas. *Psychological Bulletin*, *75*, 424–429.

Hakes, D. T. (1980). *The development of metalinguistic abilities in children*. Berlin: Springer.
Hazan, V., & Barrett, S. (2000). The development of phonemic categorization in children aged 6–12. *Journal of Phonetics*, *28*, 377–396.
Hintze, M. -A., Pooley, T., & Judge, A. (2001). *French accents: Phonological and sociolinguistic perspectives*. London: CILT/AFLS.
Hirschfeld, L. A., & Gelman, S. A. (1997). What young children think about the relationship between language variation and social difference. *Cognitive Development*, *12*, 213–238.
Johnson, J. S., & Newport, E. L. (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology*, *21*, 60–99.
Karmiloff-Smith, A. (1992). *Beyond modularity.* Boston, MA: MIT Press.
Kerswill, P. E., & Williams, A. (2000). Creating a new town koine: Children and language change in Milton Keynes. *Language in Society*, *29*, 65–115.
Kitamura, C., Panneton, R., Notley, A., & Best, C. (2006). Aussie, Aussie, Aussie, Oi–Oi–Oi: Infants love an Australian accent. *Journal of the Acoustical Society of America*, *120*(5), 3135.
Konopczynski, G. (1979). Description phonétique et phonologique du français régional de Besançon. *Cahiers du CRELEF*, *4*, CRDP, 2–19.
Lenel, J. C., & Cantor, J. H. (1981). Rhyme recognition and phonemic perception in young children. *Journal of Psycholinguistic Research*, *10*, 57–67.
Liberman, I. Y., Shankweiler, D., Fischer, F. W., & Carter, B. (1974). Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology*, *18*, 201–212.
Linn, M. D., & Pichè, G. (1982). Black and white adolescent and preadolescent attitudes toward black English. *Research in the Teaching of English*, *16*, 53–69.
Livescu, K., & Glass, J. (2000) Lexical modelling of non-native speech for automatic speech recognition. Proceedings of *ICASSP*.
Luhman, R. (1990). Appalachian English stereotypes: Language attitudes in Kentucky. *Language in Society*, *19*, 331–348.
Morton, J. B., & Trehub, S. E. (2001). Children's understanding of emotion in speech. *Child Development*, *72*, 834–843.
Mugglestone, L. (2003). *Talking proper: The rise of accent as a social symbol*. Oxford: Oxford University Press.
Nathan, L., Wells, B., & Donlan, C. (1998). Children's comprehension of unfamiliar regional accents: A preliminary investigation. *Journal of Child Language*, *25*, 343–365.
Nazzi, T., Jusczyk, P. W., & Johnson, E. K. (2000). Language discrimination by English-learning 5-month-olds: Effects of rhythm and familiarity. *Journal of Memory and Language*, *43*, 1–19.
Nugent, J. K. (1994). The development of children's relationships with their country. *Children's Environments*, *11*(4), 26–41.
Payne, A. (1980). Factors controlling the acquisition of the Philadelphia dialect by out-of-state children. In W. Labov (Ed.), *Locating language in time and space* (pp. 143–178). New York: Academic Press.
Phan, J., & Houston, D. M. (2006). Infant dialect discrimination. Paper presented at the *Annual meeting of the XVth Biennial International Conference on Infant Studies*.
Piaget, J., & Weil, A. (1951). The development in children of the idea of the homeland and its relation with other countries. *International Social Science Bulletin*, *3*, 561–578.
Rittaud-Hutinet, C. (2001). Les français de Besançon: Systèmes phonologiques et énonciation. In M. -A. Hintze, T. Pooley, & A. Judge (Eds.), *French accents: Phonological and sociolinguistic perspectives* (pp. 97–127). London: CILT/AFLS.
Rosner, J., & Simons, D. P. (1971). The auditory analysis test: An initial report. *Journal of Learning Disabilities*, *4*, 384–392.
Smith, C. L., & Tager-Flusberg, H. (1982). Metalinguistic awareness and language development. *Journal of Experimental Child Psychology*, *34*, 449–468.
Spence, M. J., Rollins, P. R., & Jerger, S. (2002). Children's recognition of cartoon voices. *Journal of Speech, Language, and Hearing Research*, *45*, 214–222.

Starks, D. (2002). Individual variation in the acquisition of postvocalic /r/: Day care and sibling order as potential variables. *American Speech*, *77*(2), 184–194.
Tranel, B. (1987). *The sounds of French: An introduction*. Cambridge: Cambridge University Press.
Treiman, R. (1985). Onsets and rimes as units of spoken syllables: Evidence from children. *Journal of Experimental Child Psychology*, *39*, 161–181.
Trudgill, P. (1986). *Regional accents in contact*. Oxford: Basil Blackwell.
Werker, J. F., & Yeung, H. H. (2005). Infant speech perception bootstraps word learning. *Trends in Cognitive Science*, *9*(11), 519–527.
Williams, A., Garrett, P., & Coupland, N. (1999). Dialect recognition. In D. R. Preston (Ed.), *Handbook of perceptual dialectology* (pp. 345–358). Philadelphia, PA: John Benjamins.
Wimmer, H., & Perner, J. (1983). Beliefs about beliefs representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, *13*, 103–128.
Zelazo, P. D. (2004). The development of conscious control in childhood. *Trends in Cognitive Science*, *8*, 12–17.

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