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Brief article

Parent or community: Where do 20-month-olds exposed to two accents acquire their representation of words?

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ABSTRACT

The recognition of familiar words was evaluated in 20-month-old children raised in a rhotic accent environment to parents that had either rhotic or non-rhotic accents. Using an Intermodal Preferential Looking task children were presented with familiar objects (e.g. 'bird') named in their rhotic or non-rhotic form. Children were only able to identify familiar words pronounced in a rhotic accent, irrespective of their parents' accent. This suggests that it is the local community rather than parental input that determines accent preference in the early stages of acquisition. Consequences for the architecture of the early lexicon and for models of word learning are discussed.

1. Introduction

As adults we have developed a robust language-specific word recognition device that can ignore most of the indexical sources of variation[1] in speech, allowing us to recognise the word "bottle" spoken by a speaker from Boston or London. The traditional view is that indexical variation is normalised prior to access to an abstract-entry lexicon (McClelland & Elman, 1986; Norris, 1994; Pallier, Colomé, & Sebastián-Gallés, 2001; but see Goldinger, 1996; McLennan & Luce, 2005). However, infants tend to over-rely on surface forms in early lexical or speech processing (Jusczyk, Pisoni, & Mullennix, 1992; Schmale, Cristià, Seidl, & Johnson, 2010; Singh, 2008), perhaps because orthogonal indexical variability assists them when building abstract phonological categories (Mattock, Polka, Rvachew, & Krehm, 2010; Rost & McMurray, 2009; Singh, 2008).

With this reliance on surface representations, we ask how early and regular exposure to within-language indexical variability inherent in regional accents affects children's representation of speech. Specifically, we examine whether bi-accentual children, raised in a speech environment with more than one variety of their maternal language, display the same phonological constancy for accent variants as their mono-accentual peers. One possibility is that the increased indexical variability resulting from their exposure to different regional accents may allow earlier acquisition of language-specific categories. An alternative viewpoint would be to consider bi-accentualism as a very specific form of bilingualism (Albareda-Castellot, Pons, & Sebastián-Gallés, 2011) in which children receive identical syntactic and morphological forms, but divergent phonology and prosody. By analogy such children might also develop distinct phonological representations for each accent, as bilinguals come to learn two labels for each word (Paradis, 2001). In this case we might expect them to show a preference to the form corresponding to the most

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[1] Variation due to gender, speaker voice, emotions, speech rate and accents (Pisoni & Remez, 2005).

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frequently encountered accent, just as the amount of exposure to each language predicts bilingual children's corresponding vocabulary development (Pearson, Fernandez, Lewedeg, & Oller, 1997). Another possibility is that bi-accentual children process accent variants in a similar fashion to bilingual processing of cognates. Ramon-Casas, Swingley, Sebastián-Gallés, and Bosch (2009) presented toddlers with modifications of Spanish–Catalan cognates involving a vowel contrast only used in Catalan. Monolingual Catalan toddlers were sensitive to this change, reflecting their learning of language-specific categories (Werker & Tees, 1984). However, bilingual Catalan-Spanish toddlers failed to distinguish it, suggesting that the phonological forms of these cognate words were conflated in memory (Ramon-Casas et al., 2009, p. 21). Given bi-accentual children's inherently high exposure to between-accent cognates it may be possible that the phonological representations of these words might be also underspecified, meaning that children could fail to notice the difference between accents in familiar words.

To examine how bi-accentual children represent accent variants in their emerging lexicon we tested 20-month-old children raised in the West Country of England. All of these children had early and continuous exposure to a regional accent differentiated from most other British English accents by its rhoticity (Trudgill, 2004). This is typified by the insertion of [r] after some vowels (Ladefoged, 2001), such that 'farm' is produced with a tense r-coloured vowel. Mono-accentual children were raised by parents who also spoke with the rhotic accent, whereas bi-accentual children had at least one parent who spoke with a non-rhotic accent. Using an Intermodal Preferential Looking (IPL) task (Swingley & Aslin, 2000), we presented both groups of children with pairs of pictures depicting familiar objects, one of which was named using either its rhotic or non-rhotic form.

The IPL task has been used extensively to examine the level of phonetic detail in children's early words by comparing looking times for correctly versus incorrectly named objects (Bailey & Plunkett, 2002; Fernald, Zangl, Portillo, & Marchman, 2008). With this task monolinguals from the age of 14 months can detect minimal changes in familiar words (Mani & Plunkett, 2007; Mani & Plunkett, 2008) with sensitivity to graded phonological changes (White & Morgan, 2008), suggesting continuity in lexical representations (Saffran & Graf Estes, 2006). This procedure has also been used to examine word recognition with unfamiliar accented labels. Phonological constancy can be achieved at 18–20 months when the task is made easier by adding linguistic/communicative information (Mulak, Best, Tyler, Kitamura, & Bundgaard-Nielsen, 2010), removing the pictorial referents (Best, Tyler, Gooding, Orlando, & Quann, 2009), or providing brief exposure to the unfamiliar accent (White & Aslin, 2011).

The results of previous IPL studies (e.g. Mulak et al., 2010) suggest that mono-accentual children will not display recognition for words unless they are spoken in their familiar rhotic accent. If life-long wider exposure to phonetic/phonological variability enhances bi-accentual children's learning of phonological categories (Mattock et al., 2010) this group should display earlier phonological constancy than the mono-accentual group. Therefore, when compared to those tested by White and Aslin (2011) our bi-accentual children should provide the most favourable situation for the demonstration of phonological constancy across accents, which should lead to the recognition of target words across both accents. However, if bi-accentual children learn distinct representations for each accent, in a similar fashion to bilinguals, they should show a preference for the most frequently encountered variant (e.g. Pearson et al., 1997). To test for this possibility the bi-accentual children's amount of exposure to each accent will be evaluated and tested for correlation with their performance in the IPL task. If valid, the recognition of the target word should be better when named in the most frequent accent. Finally, if bi-accentual children behave like bilinguals faced with cognate words (Ramon-Casas et al., 2009), they might treat both accent variants as perceptually equivalent.

2. Method

2.1. Participants

Thirty-six children born and raised in the South–West of England (including 18 girls) were successfully tested (mean age 19 months, 27 days; STD 19 days). The data of four additional children were excluded for agitation (1) and experimenter error (3). Their parents' accent and the amount of exposure to each accent was ascertained via a background questionnaire focusing on the time spent in a local nursery/childminder, and time spent with each parent (Cattani et al., submitted for publication). The rhoticity of the parents' accent was also evaluated through analyses of their production of words (e.g. mirror; Ladefoged, 2001), recorded (over the phone for most fathers) and analysed by a trained native listener blind to their accentual origins. If both spoke with a rhotic accent the children were categorised as mono-accentual (18 children, including seven girls), and as bi-accentual if one or more parent spoke with a non-rhotic accent (18 children, including 11 girls; Table 1). Parents filled in the Oxford CDI (Hamilton, Plunkett, & Schafer, 2000), with no significant difference ($t(25) < 1$, Cohen's $d = .17$) between the scores of the mono- (55.5%) and bi-accentual (59.8%) groups. Parents' reporting also indicated that children were believed to understand 83% (SD 8%) of the experimental words.

2.2. Stimuli

Twelve test words with a rhotic/non-rhotic accent contrast (e.g. 'arm') were selected from the OCDI along with 12 paired distracters, with the addition of 14 control words and four training items with no rhotic ambiguity (e.g. 'foot'; Table 2). Corresponding colour pictures judged as being good exemplars of these words by the experimenters were also selected.

Four female speakers recorded the test words, two of whom had local rhotic accents and two non-rhotic accents (RP, i.e. British English as spoken in the media). The duration, pitch, amplitude, and formant distributions for each

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Table 1
Accent featured by the parents of the 18 children in the mono-accentual group (left) and the bi-accentual group (right). In the bi-accentual group, children with non-rhotic parents are listed first (NR only) and children with one non-rhotic parent only are listed below (Mixed). For the latter, the parent with a rhotic accent is in bold. "Neutral" refers to a Received Pronunciation (RP) or standard British English accent. These labels have been given by parents themselves, and the rhoticity (or the absence of) in their accent has been further attested by their reading aloud of a list of words and an analysis of their recordings by a trained native listener (see the stimuli section).

	Mother	Father			Mother	Father
Mono-accentual	Plymouth	Plymouth	Bi-accentual	NR only	Neutral	neutral
(rhotic)	Plymouth	Plymouth		NR only	Neutral	Nottingham
	Plymouth	Plymouth		NR only	Neutral	Northern Irish
	Yorkshire	Somerset		NR only	Neutral	London
	Plymouth	Plymouth		NR only	Dorset	Dorset
	Cornwall	Devon		NR only	Somerset	Devon
	Devon	Gloucester		NR only	London	Birmingham
	Plymouth	Plymouth		NR only	South West	South West
	Plymouth	Plymouth		NR only	Suffolk	Suffolk
	Plymouth	Plymouth		Mixed	**Plymouth**	Lincoln
	Plymouth	Plymouth		Mixed	**Plymouth**	Yorkshire
	Plymouth	Plymouth		Mixed	South Wales	**Plymouth**
	Devon	(No father)		Mixed	**Plymouth**	Norfolk
	Plymouth	Plymouth		Mixed	**Plymouth**	Reading
	Plymouth	Plymouth		Mixed	**Devon**	Neutral
	Canada	Plymouth		Mixed	Australia	**Plymouth**
	Plymouth	Plymouth		Mixed	**Plymouth**	Neutral
	Devon	Devon		Mixed	**Plymouth**	Lancashire

Table 2
List of target-distracter stimulus pairs for training, test and control conditions. Note that for training and control pairs, each word could be equally the (named) target or the distracter.

	Target words	Distracters
Training	Boat	Ball
Training	Cake	Cow
Test	Arm	Eye
Test	Bear	Bath
Test	Bird	Bed
Test	Butterfly	Banana
Test	Car	Cup
Test	Chair	Chicken
Test	Door	Dog
Test	Finger	Foot
Test	Fork	Fish
Test	Hair	Hand
Test	Horse	Hat
Test	Tiger	Train
Control	Bowl	Book
Control	Brush	Bread
Control	Bunny	Bottle
Control	Bus	Bike
Control	Slide	Swing
Control	Spoon	Sock
Control	Tooth	Tongue

word were extracted using Praat (Boersma, 2001; Table 3), with each measure entered in separate repeated measures ANOVAs with the factors of accent (rhotic versus non-rhotic) and speaker (two per accent). The duration of the rhotic productions were longer than the non-rhotic ones (568.2 ms versus 531.3 ms, main effect of accent: $F(1, 11) = 6.1$, $p = .031$, $\eta^2 = .36$), with this difference also reflected in vowel duration (336.7 ms versus 308.5 ms, $F(1, 11) = 10.8$, $p = .007$, $\eta^2 = .50$), due to the inclusion of the trill characterising the post-vocalic approximant /r/ in rhotic speech. Also characterising rhoticity, the third (and fourth) formants were lower in rhotic than non-rhotic vowels (Hay & Maclagan, 2006; F3: 2390 Hz vs 2996 Hz, main effect of accent: $F(1, 11) = 120.4$, $p < .001$, $\eta^2 = .92$; F4: 3764 Hz vs 3994 Hz, $F(1, 11) = 37.3$, $p < .001$, $\eta^2 = .77$). Two additional female speakers with a non-rhotic accent (RP) recorded the control and training words.

2.3. Procedure

Children were presented with 21 pairs of images, one of which was the named target, the other an unnamed distracter. Two pairs were used for training, with the remaining 19 forming the experiment stimuli (12 test and seven control pairs, Table 2). Each child heard half of the target test objects named with a rhotic accent and half with a non-rhotic accent. Image pairs were presented in random order, with the presentation side of the target image counterbalanced across participants. Each 5000 ms trial consisted of a 2500 ms pre-naming phase followed by a

Table 3
Acoustic characteristics of the 12 test words produced by the four speakers: vowel duration and mean formant values (standard deviations presented in brackets).

Accent	Speaker	Vowel duration (ms)	F1 (Hz)	F2 (Hz)	F3 (Hz)	F4 (Hz)
Non-rhotic	Speaker1	300.4 (103.0)	630.6 (159.8)	1647.8 (414.1)	2890.3 (142.8)	3885.9 (125.6)
	Speaker2	316.6 (125.5)	671.0 (158.0)	1612.2 (433.8)	3100.7 (166.1)	4102.7 (159.2)
Rhotic	Speaker3	322.0 (122.4)	611.6 (146.7)	1488.5 (273.8)	2304.6 (215.7)	3826.3 (173.5)
	Speaker4	351.5 (107.1)	752.7 (134.2)	1656.1 (332.2)	2474.5 (221.8)	3701.6 (120.8)

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2500 ms post-naming phase beginning with the onset of the target word in the carrier sentence "Look! *Target*". During both phases looking times were captured by cameras placed above each of the images, with video scoring completed offline by an experimenter unaware of the presented stimuli (software Look; Meints & Woodford, 2008). Each 40 ms duration frame (ignoring the first 367 m, see Swingley, Pinto, & Fernald, 1999) was coded for position (left, right, middle, or away). A second experimenter scored 10% of the videos independently, with an inter-experimenter agreement Intraclass Correlation Coefficient of 0.909 (Shrout & Fleiss, 1979).

3. Results

The difference in the proportion of total looking times (DPLT) towards the target picture during the pre- and the post-naming phase was analysed in an ANOVA with accent exposure (mono-accentual, bi-accentual) as a between-participant factor and word type (rhotic, non-rhotic, control) as a repeated measure. A significant main effect of word type was found ($F(2, 68) = 3.92$, $p = .024$, $n^2 = .103$), but no effect of accent background ($F(1, 34) = 2.11$, $p = .15$, $n^2 = .059$), nor any interaction between the two factors ($F(2, 68) = .19$, $p = .83$, $n^2 = .006$). The effect of word type was due to reduced looking times to the non-rhotic words when compared to both the rhotic words and the control words (Fig. 1). Paired comparisons showed that DPLT was larger for rhotic than non-rhotic words ($t(35) = 2.80$, $p = .008$, $d = 0.56$), larger for control than non-rhotic words ($t(35) = 2.04$, $p = .048$, $d = 0.49$), but not significantly different for rhotic and control words ($t(35) < 1$, $d = 0.12$). DPLT was also found to be significantly higher than 0 for rhotic words ($t(35) = 3.57$, $p = .001$, $d = .59$) and control words ($t(35) = 3.56$, $p = .001$, $d = .59$) but not for non-rhotic words ($t(35) < 1$, $d = .016$).

In the bi-accentual group, data from the accent exposure questionnaire were available for 15 children out of 18 (incomplete data for two and unreadable handwriting for one). The mean proportion of exposure to the non-rhotic accent was 73.2% (SD 22.4). Correlations between this measure and the DPLT for rhotic, non-rhotic and control words were not significant (rhotic: $r(15) = -.08$, $p = .77$; non-rhotic: $r(15) = .002$, $p = .99$; control: $r(15) = .18$, $p = .52$).

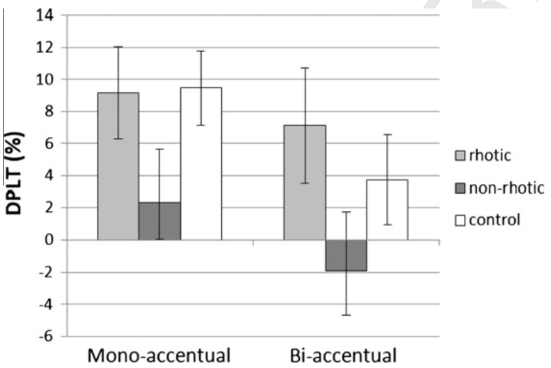

Fig. 1. Mean change in the proportion of looking times to the target over the distracter (post-naming phase – pre-naming phase; DPLT) for the mono-accentual group (left) and the bi-accentual group (right). Error bars are SEM.

4. Discussion

In an IPL paradigm 20-month-olds were only able to recognise words spoken in the rhotic accent of their community, irrespective of the accent spoken by their parents. This suggests that children's phonological representation of their language is determined by their immediate environment, rather than parental input or the overall frequency of exposure to each accent. This is the first demonstration of such an early socially driven influence on accent preference, complementing earlier reports that dialect acquisition in later childhood is often the result of integration within the local speech community rather than the family (Kerswill & Williams, 2000; Starks & Bayard, 2002; Tagliamonte & Molfenter, 2007). This might reflect the distributional statistics of phonetic cues (Maye, Werker, & Gerken, 2002) coupled with a bias favouring the weighting of cues from the community accent, leading to a preference for rhotic segments in tense vowels for both accent groups.[2] This is compatible with observations that children's mastery of phonological rules for the second dialect never becomes categorical, but differs according to the frequency of use of each variant (Starks & Bayard, 2002; Tagliamonte & Molfenter, 2007).

Perhaps the most interesting aspect of our findings is that even when 20-month-old children are routinely exposed to (at least) two accents, they only appear to treat the local community accent as providing the correct pronunciation for words. Words produced in the alternative accent are treated like mispronunciations, discarded as lexical candidates in the same manner as minimal changes to familiar words (Mani & Plunkett, 2007).

As bi-accentual children were clearly able to distinguish between the two accent variants, but recognise only one, it seems unlikely that their exposure to a wider phonological/phonetic variability enhances their acquisition of language-specific categories (Mattock et al., 2010). Likewise, this would also appear to rule out the hypothesised analogy to cognate processing in bilinguals, in which it was suggested that bi-accentual children would develop an underspecified phonological representation for accent variants, resulting in equivalent processing of both accents.

Rather, our findings clearly indicate that bi-accentual children have only a single canonical accent variant in their lexicon (that of their environment), similar to some cases of lifelong adult exposure to two accents (Sumner & Samuel, 2009). This would firmly ground the idea of phonological abstraction in the lexicon, and the continuity of its architecture over development. This unique phonological representation is compatible with abstract-entry models of lexical access (Pallier et al., 2001), but could also support the concept of special status for canonical forms in exemplar-based models (Ranbom & Connine, 2007).

[2] As suggested by a reviewer, rhotic tokens might be preferred because they provide greater disambiguation among words than non-rhotic ones.

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Models of early word development usually convey the idea of rich representations for early words, encapsulating both indexical information and phonetic detail (WRAPSA: Jusczyk, 1997; PRIMIR: Werker & Curtin, 2005; see also Thiessen & Yee, 2010). In PRIMIR, abstraction arises with language experience through the building of a phonemic space, based on statistical regularities computed over variable word forms. Given the richness of early lexical representations, it might be expected that bi-accentual children's early words would encompass sufficient accent-related information to allow them to recognise even the less familiar (or the less socially meaningful) accent variant. One possibility is that the children's failure to recognise non-rhotic versions of familiar words is the result of the processing level tapped by the IPL task. Indeed, in its original formulation, PRIMIR makes the explicit claim that if the task requires decisions about the identity of a familiar word, as in the IPL procedure, children will respond on the basis of the built-in phonemic system rather than by using phonetic detail or indexical information available at the word level (Werker & Curtin, p.219). If the phonemic representations used by the bi-accentual children at this stage of development include rhoticity in tense vowels for certain words, such as 'fork', a non-rhotic presentation of the word will necessarily fail to fully activate the corresponding word. In contrast, neighbours containing an r-free tense vowel such as 'hall' and 'bowl' could be activated, with this competition resulting in the recognition failure observed in our study. Thus, there still remains the possibility that bi-accentual children retain more indexical accent-related information at the word level than their mono-accentual peers (such as the knowledge that words can be produced rhotically or not) than that revealed by the IPL task. A potential alternative would be to test preference for rhotically versus non-rhotically words in a head turn paradigm (Jusczyk, Cutler, & Redanz, 1993). This might reveal a different behaviour in bi-accentual and mono-accentual children, as there may be less influence from phonemic processing stages on this task. In the recently bilingual-adapted version of PRIMIR, Curtin, Byers-Heinlein, and Werker (2011) have proposed an additional comparison–contrast mechanism to complement statistical regularities extraction, capable of capturing differences between the languages being learned and organise the representational spaces accordingly. In principle, such a mechanism could also explain why bi-accentual children were able to discriminate between accent variants. However, further research will be required to determine whether bi-accentual children learn to discriminate and separate their two language inputs in a similar manner to bilingual children (Werker & Byers-Heinlein, 2008), resulting in distinct production and perceptual systems later in life.

To conclude, the finding that bi-accentual 20-month-olds only appear to be familiar with words spoken in a single accent strongly suggests that canonical forms have special status in early word representations, grounding the development of an abstract lexicon. This also contributes to the on-going debate on the role of within-language variations on the construction of phonological categories (Rost & McMurray, 2009; Rost & McMurray, 2010) and generally, on the role of variation in the abstraction of category organization (Perry, Samuelson, Malloy, & Schiffer, 2010).

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