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ARTICLE

Accent the positive: An investigation into five-year-olds' implicit attitudes towards different regional accents

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Abstract
Regional accent biases in 27 Essex five-year-olds are investigated. This study is the first to analyse implicit language attitudes by measuring children's neural activity (event-related potentials) while they take part in an Implicit Association Test. Both measures find a preference towards the prestigious accent, Standard Southern British English (SSBE), which is associated with cleverness (CLEVER). A late positive potential in the brain data for the association of the familiar, low-prestige Essex accent with CLEVER suggests the children also have a positive association with their home accent. The association between the less familiar, low-prestige Yorkshire accent and either CLEVER or NOT-CLEVER depends on the measure. Differences in the results are found relating to the children's accent exposure; those with a more heterogenous group of caretakers show more positive bias towards all three accents overall. Consequences for modelling the development of language attitudes are discussed.

Keywords: implicit attitudes; accent bias; children's perception; regional variation; event-related potentials

1. Introduction

'Accentism' refers to the negative associations and social judgements that are made based on a person's accent or language use, which can in turn lead to discrimination or unequal outcomes. Such associations can be investigated through the study of language attitudes. Studies with adult participants have found that negative language attitudes towards particular speaker groups may be implicit and may not manifest as explicit attitudes (McKenzie & Carrie, 2018). Explicit language attitudes are conscious expressions of opinion, and therefore their measurement relies upon candid responses to questions such as 'how friendly do think the speaker sounds?' On the other hand, implicit attitudes are more deeply embedded and unconscious, relying on measurements, which capture their automaticity. Currently, no studies have investigated at what stage implicit language attitudes form in childhood. The current project bridges this gap by investigating whether implicit language attitudes towards regional accents are already present in children

starting primary school. We evaluate implicit attitudes in the form of unconscious bias through two methods, measuring five-year-old children's neural activity (using event-related potentials, ERPs) while they take part in an adapted Implicit Association Test (IAT).

1.1. Evaluations of regional accent variation in Britain

A number of studies investigating language attitudes in Britain since the 1970s have found a consistent hierarchy in the ranking of regional accents according to social status dimensions such as prestige (Giles, 1970; Bishop, Coupland, & Garrett, 2005; Coupland & Bishop, 2007; Sharma et al., 2022). Regional varieties in Britain are often evaluated negatively in comparison to Received Pronunciation (RP), which, as the accepted standard English accent in England[1], surpasses others on measures of prestige. The term 'standard English' itself derives from the level of prestige associated with the variety and the speakers who use it and does not entail any linguistic superiority. Urban accents associated with working-class, industrial roots such as Birmingham, Liverpool, and Cockney are consistently ranked least favourably on measures of prestige, as are ethnic minority varieties such as Indian and Afro-Caribbean accents (Sharma et al., 2022). Such accents are often labelled as "non-standard," again based on value judgements about the speakers. Sharma et al. (2022) find that the regional, non-standard Essex accent is ranked among the lowest on both measures of prestige and pleasantness. Cole (2021) explores the roots of the present-day Essex accent, which has evolved to include features from Cockney due to the relocation of working-class East Londoners to Essex (in the east of England, to the north of London) during the twentieth century. In a study focusing on language attitudes in Southeast England, Cole (2022) found that, across this region, East London and Essex were most associated with perceived unintelligence and speaking incorrectly in comparison to other parts of the Southeast.

While regional varieties in Britain are ranked lower than standard varieties on status ratings relating to prestige and competence (indexed by traits such as being intelligent or successful), some move up the hierarchy when ranked according to social attractiveness measures such as pleasantness or solidarity measures such as perceived friendliness. For example, West Country accents (southwest England) are consistently ranked higher on social attractiveness measures compared to measures of prestige (Bishop et al., 2005; Coupland & Bishop, 2007; Sharma et al., 2022). This demonstrates how an accent can become stereotyped in more than one way; speakers from the West Country are associated with a negative rural stereotype as uneducated and backward (Britain, 2017) as well as a positive stereotype as friendly and comedic (Dann, 2019). In a similar way, despite being negatively evaluated on scales of prestige, within Britain the regional, non-standard Yorkshire accent (north of England) has been found to be associated with attributes such as sincerity, reliability, and friendliness (Cooper, 2013; Hiraga, 2005; Strongman & Woosley, 1967). As part of their larger-scale project (Levon et al., 2020), Levon et al. (2021) carried out a verbal guise study in which ten young male speakers of five different accents (two speakers per accent) read the same ten scripted responses to interview questions. British participants were then asked to judge the hirability of candidates to become trainee solicitors. Overall, the results found that speakers with

[1]But not in Scotland where Scottish Standard English is the accepted national standard variety (cf. Stuart-Smith, 1999).

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General Northern English accents (a cross-regional standard variety used by middle-class speakers in the north of England, cf. Watt, 2002) and Urban West Yorkshire English accents, along with the RP speakers, were perceived most favourably as hireable candidates. This was in comparison to the speakers of southern, working-class, and multiethnic varieties who were judged more harshly. While this finding could reflect a recent increase in positive attitudes towards northern varieties among younger people in England more generally (McKenzie & Carrie, 2018), the particular stereotype around the plain-speaking authenticity of Yorkshire folk (as represented in the Yorkshire-based internet services company Plusnet's advertising campaign: 'good honest broadband from Yorkshire' (Plusnet Broadband, 2011)) draws on long-standing social values associated with Yorkshire speakers (Cooper, 2013).

Another important finding from accent rating surveys with adults in Britain is that participants are consistently found to rank 'accent identical to own' highly on both status and solidarity measures, indicating an in-group preference for their own variety (Bishop et al., 2005; Coupland & Bishop, 2007; Sharma et al., 2022). While this could stem from the familiarity preference found in childhood (as discussed below), Sharma et al. (2022) find that it is South Eastern English respondents who are more likely to rate 'accent identical to own' highly in terms of prestige. This suggests that participants from the Southeast in England are possibly aware that they speak a standard-like variety themselves and therefore, by judging 'accent identical to own,' they are indirectly evaluating the British standard variety known as Standard Southern British English (SSBE). The effects of an ingroup identity on language attitudes are found in studies outside of Britain and demonstrate the different ways in which status and solidarity traits may manifest for different speech communities. McKenzie (2010) finds that Japanese L2 learners of English rate heavily accented Japanese English higher for social attractiveness but both standard and non-standard native English varieties higher for competence.

Despite some of the positive associations with a number of regional accents, the stigma around having a strong regional accent is still persistent and pervasive in Britain, and there are countless stories of accentism in the news and encountered by speakers of regional varieties up and down the country (cf. Schmid et al., 2020 and The Accentism Project (https://accentism.org)). The associations between certain accents and particular characteristics have developed into strongly held stereotypes, which are prevalent in the media, including children's films and television programmes (Lippi-Green, 2012). In this case, it is unsurprising that children pick up on accent differences and the ideology of the standard variety from a young age.

1.2. Development of language attitudes

In studies of language attitudes, it has generally been found that older participants (from middle age upwards) afford the most prestige to standard English, while younger informants (15–24 years old) tend to provide higher ratings to regional, urban accents (Bishop et al., 2005; Coupland & Bishop, 2007;Levon et al., 2021 ; Sharma et al., 2022). These consistent findings have been attributed to stable patterns that indicate perception changes across the lifespan (Levon et al., 2021; Sharma et al., 2022). A vital missing piece of this account of lifespan change, however, is at what point these attitudes develop in the first place and whether they stem from early childhood.

There is increasing consensus that the ability to discriminate between and/or group together speakers based on their accent begins at a young age (Beck, 2014; Jones et al.,

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2017; Kaiser & Kasberger, 2018; McCullough et al., 2019). In Britain, research has found that children as young as three years old show signs of being able to categorise speakers based on their accent (Jeffries, 2019), and in Canada, preschoolers have been shown to be sensitive to accent strength and distinctness from their home accent (Weatherhead, Friedman & White, 2019). These abilities progress with age and exposure to variation and are dependent on the distinctiveness and familiarity of the accents in question (Beck, 2014; Dossey et al., 2020; Floccia et al., 2009; Jeffries, 2022; Kaiser & Kasberger, 2018). Recognising and categorising accent differences is an essential developmental stage for children in the refinement of their speech perception system as they learn to abstract over variation in order to extract meaning from speech (Best, Tyler, Gooding, Orlando, & Tang, 2009). Accommodation to linguistic variation is therefore critical to children's communicative development as well as having important social implications. Accent categorisation as a cognitive strategy helps children to understand their social world and provides an important step in their sociolinguistic development. The next step, of particular interest in the current study, is the progression from the ability to categorise speakers to the development of social evaluations that children then attach to members of these accent categories.

Studies with young infants find an early preference for familiar speakers, starting with the voice of their mother (DeCasper & Fifer, 1980; Purhonen et al., 2005). This preference expands to familiar speaker groups as they encounter more voices, and at five months old, infants are found to show a preference for speakers with a familiar accent over unfamiliar regional accents (Butler et al., 2011). Again, this highlights an important stage of children's developing speech perception as they react to the variation that they encounter by honing in on what is already familiar to them. As children mature, a shift in preference is often found, driven by the social learning that forms the next stage of their sociolinguistic development. In particular, children who are part of standard language cultures, where the language they speak is believed to exist in a standardised variety (Milroy, 2001), have been found to develop a preference for a standard variety over a local, regional variety by five to six years old (Barbu et al., 2013; Day, 1980) and seven to eight years old (Cremona & Bates, 1977; Kaiser & Kasberger, 2021). These studies focused on children's preference for speakers in terms of 'correctness,' asking questions such as 'who spoke better?' This change in preference is likely due, at least in part, to these children starting school, where they are introduced to the notion of a prestigious standard variety, which they are taught to use and study in the classroom and which initiates the process of an implementation of the standard language ideology (cf. Milroy, 2001).

How the association of accent and prestige manifests for children at this early school age depends on the cultural and sociolinguistic context of their environment. Using a different method for tapping into children's development of accent evaluations, this time focusing on association, Starr et al. (2017) carried out an occupation judgement task with children in Singapore, a country home to many transnational migrants. The results found that children from five years old matched speakers to socially stratified occupations based on their accent (e.g. Australian English = teacher and Filipino English = helper) even when this was not reflected in the local labour market (e.g. Northern China-accented English = helper). The authors' interpretation of this finding is that the children are relying upon the associated prestige of the speaker's accent in their assigning of occupation so that speakers of low-status varieties in general (e.g. Northern China-accented English) are assigned to low-status occupations (such as helper), even without any lived experience of this being the case.

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The point at which children begin to evaluate speakers explicitly on their accent appears to come later in childhood. Research in this area has focused on children's evaluations of speakers using similar methods to studies with adult listeners. These methods include the matched-guise technique, in which one speaker is heard producing the same passage but using different accents (Giles et al., 1983), and the verbal-guise technique, in which different speakers with different accents are heard producing the same spoken passage (McCullough et al., 2019; Nesdale & Rooney, 1996). Such studies have found that children's evaluations are in line with adult-like stereotypes by around ten years old. In particular, by this age, children are able to express positive prestige evaluations of people who speak the standard variety. Positive solidarity ratings of regional varieties, again in line with adult-like stereotypes, have also been evidenced among children this age. Kinzler and DeJesus (2013) found that nine- to ten-year-olds in the U.S. evaluated Northern-accented American English speakers (which the authors equate with Standard American English speakers) as sounding 'smarter' while Southern-accented American English speakers as sounding 'nicer.' The five- to six-year-old children taking part in the same study did not express such stereotyped associations. In line with the studies mentioned above (Cremona & Bates, 1977; Day, 1980 and Kaiser & Kasberger, 2021), this demonstrates a progression from a preference for a speaker with a familiar accent into a positive evaluation of the standard variety as children acquire wider knowledge of the social meaning of variation.

In their study of accent perception across the lifespan, McCullough et al. (2019) looked at attitudes towards four regional varieties in the U.S. and found that while some accents were rated by four- to five-year-olds in a similar way to adults, children's status ratings were only fully adult-like by age 12. They found that solidarity ratings were more variable, however, they attribute this to the tendency for such ratings (such as friendliness and likeability) to be more subjective, relating to individuals as part of interpersonal interactions. The results of their large-scale study involving 240 participants ranging from four to 75 years old found that a number of factors played a role in attitude formation, including geographical knowledge, exposure to variation, cultural knowledge and general cognitive, and conceptual development (McCullough et al., 2019).

What seems clear is that children's attitudes towards speakers with different accents are intimately bound up with their developing realisation of the social meaning embedded in linguistic variation, often related to a growing awareness of a national standard variety and in line with adult-like stereotypes.

1.3. Implicit attitudes

Missing from previous studies is a focus on children's development of implicit attitudes towards regional accents. Importantly, implicit attitudes may have longer-lasting effects (McKenzie & Carrie, 2018) and have been shown to be a better predictor of behaviour than explicit attitudes (Pantos, 2019). Implicit attitudes are likely to be acquired in childhood through habitual reinforcement and therefore less prone to change than explicit attitudes (Wilson, Lindsey, & Schooler, 2000). Therefore, implicit attitudes become a vital area for researching the development of language attitudes more generally and investigating the potential divergence of the explicit from the implicit.

In the field of linguistics, implicit attitudes are often used to refer to attitudes below the level of consciousness as investigated in experiments such as matched guise tests (Rosseel & Grondelaers, 2019:2). However, these methods still rely on explicit questioning and

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introspection on behalf of the participants, and therefore, in social cognition research, such tasks are not classified as implicit measures. In fact, implicitness itself is a controversial topic in such research, and different attitude-formation models propose that implicitness refers to different things (see McKenzie & McNeill, 2022 for a thorough account). Those who work in the implicit memory tradition relate implicitness/explicitness to unconsciousness/consciousness and so implicit attitudes can be linked to a lack of awareness (Pantos, 2019).

The IAT (Greenwald et al., 1998) has become one popular way to measure implicit attitudes in social psychology, such as bias based on race, sexual orientation, or gender. Linguists have also recently started employing such techniques, and the IAT has been run in studies with adults in order to investigate the link between sociolinguistic variables and social categories and a preference for standard over regional varieties (Babel, 2010; Campbell-Kibler, 2012; Llamas et al., 2016; McKenzie & Carrie, 2018; Rosseel et al., 2018). The IAT measures implicit social attitudes by calculating how quickly participants identify a target concept (e.g. a northern accent or a southern accent) when it is categorised with a positive compared to a negative attribute (e.g. 'friendly' or 'unfriendly'), to uncover which pairing is more strongly embedded in memory. In the IAT, it is both the method and the attitude that are implicit, and the test uncovers a comparative measure between the two concepts based upon the premise that participants are unaware of the implicit attitudes they hold, which are inaccessible to introspection. McKenzie and Carrie's (2018) study looked specifically at how participants' implicit attitudes towards northern and southern English speech related to their explicit ratings of these accents. They found a divergence between explicit and implicit attitudes; while the IAT found that participants demonstrated an implicit bias towards southern varieties, participants' explicit ratings showed an overall preference for northern varieties. Given that southern varieties in England are associated with the standard variety (SSBE), which holds an overt prestige for speakers throughout the country, the authors interpret this difference in attitudes as a change in progress, with the implicit attitudes representing the more longstanding and embedded attitudes, while the explicit attitudes present the change that is occurring. As McKenzie and Carrie (2018):830) highlight, from the results of their study it therefore appears key to investigate implicit biases in order 'to help account for the persistence of deeply embedded linguistic prejudice.'

The IAT is not uncontroversial, and several studies have pointed out inconsistencies in the results and their interpretations (cf. Fiedler, Messner, & Bluemke, 2006). Gawronski (2009) summarises a number of issues with employing such implicit measures. These include the risk that such measures are still affected by participants' social desirability bias (to not appear racist or discriminatory in any particular way) and that the attitudes divulged may reflect wider cultural associations rather than any personal belief on behalf of the participant. Furthermore, Gawronski questions the unconscious nature of the attitudes, a supposition, which is hard to evidence. Following on from the concerns related to implicit measures such as the IAT, Rosseel and Grondelaers (2019) advocate for the progression of new techniques to investigate language attitudes, taking inspiration from other fields of study.

One way to address some of the concerns with how the results of a behavioural measure such as the IAT can be interpreted is to include direct measures of cognitive processing, such as elecrophysiological measures of brain activity, which can capture automatic processes the brain engages in below the level of conscious introspection. ERP studies have been coupled with IAT studies to explore a number of domains, including emotional valence, race, and sexual orientation (see Healy et al., 2015 for review). For example, Williams and Themanson's (2011) study on gay-straight in-group biases

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included a synergy of two measures of implicit behaviour, measuring ERPs while participants were taking part in an IAT. Results from the IAT found a positive bias towards straight people as opposed to gay people with quicker reaction times when straight was paired with positive and gay paired with negative compared to the other way around. In the brain data, the authors report an N400 response, a characteristic brain response (cf. Kutas & Federmeier, 2011) indicating the processing of incongruent information, for 'incompatible' trials (e.g. gay paired with good). Another characteristic response, the late positive potential (LPP), was also found to be larger in compatible trials. The brain data thus indicates automatic responses to emotionally congruent pairings, which appear to correlate with behavioural IAT responses. Through this combination of methods, Williams and Themanson (2011):474) conclude that 'both semantic and affective properties of the stimuli seem to contribute to the stronger association of the compatible items' and therefore this combination of behavioural and elecrophysiological measures seems to unlock further potential for understanding how implicit attitudes manifest and are processed.

Although few sociolinguistic studies have utilised ERP methodology, the N400 response has been shown to be sensitive to mismatches between a speaker's accent and their use of particular linguistic features. For example, a non-standard feature produced by a speaker with a standard accent has been found to produce a larger N400 amplitude in listeners (Loudermilk, 2015). Such sociolinguistic studies have not been carried out with children, although EEG has been used successfully to investigate other aspects of linguistic processing in young children, including sensitivities to mispronunciations (e.g. Mani et al., 2012).

In addition, while the IAT has been run in sociolinguistic studies with adults, there are no such studies, to our knowledge, with children. IAT studies on race adapted for children have found that at age six, European American and White British children have already established implicit pro-White, anti-Black biases (Baron & Banaji, 2006; Rutland et al., 2005). Cvencek et al. (2011)) have also been able to uncover implicit gender biases among four-year-olds by running an adapted IAT, which they label the Preschool IAT (PSIAT) and which uses images rather than category labels. The current project uses this combination of methods, adapting IAT and EEG measures of sociolinguistic processing for use with five-year-old children, with the aim of understanding the potential appearance of linguistic biases at this formative age.

1.4. The current study

Previous literature has demonstrated that children develop linguistic categorisation skills throughout the preschool and early school years and that they express explicit preferences relating to the standard and other implicit biases from around the age of five years. We therefore consider this a pivotal age for an investigation of children's implicit attitudes.

The current study investigates implicit attitudes towards SSBE compared to two non-standard regional accents, Essex (a local, regional accent) and Yorkshire (a non-local, regional accent), among five-year-olds in Colchester, North Essex. Due to previous findings from studies with adults that find a particular association between the Essex accent and unintelligence, we focus on the association of these accents with intelligence as a measure of prestige rather than a social attractiveness measure such as friendliness. SSBE has been found to be consistently ranked higher than Essex and Yorkshire on measures of prestige (Sharma et al., 2022), and the Essex accent is associated with being unintelligent (Cole, 2021).

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The research questions addressed are:

(1) Is there evidence of implicit social judgements towards speakers with regional accents among five-year-olds using (a) a behavioural measure (the IAT) and (b) an electrophysiological measure (ERP responses)?
(2) Do five-year-old children show an implicit positive bias on a measure of prestige (intelligence) towards a standard accent (SSBE) compared to (a) their local regional accent (Essex) and (b) a non-local, regional accent (Yorkshire)?

Based on the findings from previous research, including children's preference for the standard variety developing around the age of five, we expect that if the measures employed do pick up on implicit bias among the children, this bias will indicate a positive association with SSBE compared to both the Essex and Yorkshire accents on the measure of intelligence. Due to the particular stigmatisation of the Essex accent in Britain, there is a possibility that children may have picked up on the negative associations with their local accent; however, there is also the possibility that as a familiar accent to them, they will still show a preference for their own local accent. The children may have a negative association with the non-standard Yorkshire accent, but there is also the possibility that the associated 'friendliness' of the Yorkshire is already present in the attitudes of the children and that this positive association overrides the lack of prestige associated with the accent. As such, rather than differentiating between intelligence and friendliness, they may show a positive association with the Yorkshire accent, as represented by the positive 'clever' character.

2. Methods

2.1. Participants

29 monolingual five-year-old children (mean = 5;5, range = 4;5 – 6;5, SD = 0;5) from the local Colchester area in North Essex were recruited through existing links and advertising on social media. Caretakers were asked to report on their child's linguistic exposure (in terms of languages used in the home, foreign languages studied at school, and contact with caretakers or close family members from other regions of England), as well as the number of siblings and where those siblings were born. Additional background information was gathered about their caretaker's socioeconomic class (via occupational title and educational attainment), region of birth, and length of residence in Colchester. Background information revealed most of the children to be from middle-class backgrounds, with only two children having caretakers employed in traditionally working-class occupations. Two children were excluded from further analysis on account of (1) not having at least one caretaker born in Essex and (2) not speaking English as the primary language at home. The remaining 27 participants had no reported history with ear infections or hearing difficulties or any known neurological or behavioural issues.

2.2. IAT assumptions

This experiment follows the basic design of the PSIAT (Cvencek et al., 2011), in which children are trained to match a central picture with one of two smaller pictures located on the left- and right-hand sides of the screen (see Figure 1 for an example). In the original PSIAT study, the two pictures used are the iconic happy and sad faces. The PSIAT test

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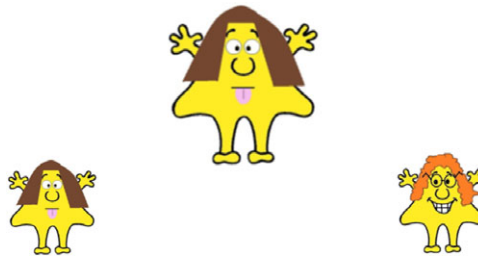

Figure 1. Image from the experiment showing the screen layout, here with Zoggy on the left and in the centre and Ziggy on the right.

measures the difference in matching speed observed when children have to match either the happy face or the sad face following the presentation of an image, which is either congruent in emotional valency (i.e. a pleasant item like a *flower* or an unpleasant item like an *insect*). The assumption, which underlies the PSIAT is that seeing a pleasant picture of a flower will prime the happy response, resulting in faster matching of the happy face than the sad face, and with the opposite prediction for the unpleasant *insect* image, with faster responses expected for the sad face compared to the happy face.

In our adapted version, we use audio examples of the relevant accents in place of the *insect* or *flower* images and two characters representing 'cleverness' and 'non-cleverness'[2] in place of the happy and sad faces. To ensure that children were aware of the associations of our two characters, they were shown a short video to introduce them. In the video, the character of Ziggy was labelled as *very clever*, as evidenced by the fact that Ziggy "reads very well," "writes very well," "speaks very well," and "always gets the answers right." They were then introduced to Zoggy, who was labelled as *not very clever*, as Zoggy "can't read very well," "can't write very well," "doesn't speak very well," and "always gets the answers wrong." The story was read by a female speaker of West Coast American English so as to not prime the children with any of the target accents.

In each trial, participants heard an audio recording, which played with a centrally presented distractor image (balanced between a green circle, green square, blue circle, and blue square). After the audio finished playing, the participants were presented with either Ziggy or Zoggy in the centre of the screen. They then had to press a button to indicate if the central image matched the image on the left or the right (Figure 1). There were thus four possible pairings: a standard accent with an image representing CLEVER, a standard accent with an image representing NOT-CLEVER, a non-standard accent with an image representing CLEVER, and a non-standard accent with an image representing NOT-CLEVER. Our assumption was that standard/CLEVER and non-standard/NOT-CLEVER would represent congruent pairings where the accent and picture have similar biases, and standard/NOT-CLEVER and non-standard/CLEVER would be incongruent, where the accent and picture have opposing biases.

To verify these assumptions, we piloted the experiment on 14 Essex-based participants aged 17–18. In the pilot, EEG data was not collected, but reaction time data showed responses to congruent conditions were faster than incongruent conditions for all three accents. This pilot study suggested our IAT experimental design was robust, and that our

[2]We used the terms "clever" and "not clever" as opposed to the synonyms "intelligent" and "unintelligent" (used in studies with adults) as they are more likely to be familiar to five-year-old children.

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findings were consistent with predictions relating to adolescents' and adults' bias against regional accents. We then extended the paradigm to five-year-old children.

2.3. Experimental design

The experiment was structured into two paired comparison sets: Yorkshire-SSBE and Essex-SSBE, such that in each comparison set participants only heard one of the non-standard accents. Within each comparison, trials were split into two blocks, one of which had the matching CLEVER image on the left and the other of which displayed the matching CLEVER image on the right. Before the first block, there was a training round in order to familiarise the participants with the experiment and the position of Ziggy and Zoggy on the screen. To make the task easier for our young participants, the first two blocks used the same positions for CLEVER and NOT-CLEVER. Following this, the positions of the images were reversed, and there was another training round to familiarise them with this change before completing the final two blocks. Each of the training blocks consisted of six trials, which were balanced for speaker and congruency. The audio recordings for the training rounds were distinct to the stimuli used in the experimental rounds and included the STRUT[3] and BATH vowels in the final carrier words in the sentence, as these are linguistic variables known to vary between Yorkshire and Essex accents.

Each experimental block consisted of 32 trials (16 of the non-standard accent and 16 SSBE). The order of the trials within each block was balanced for speaker, sentence, linguistic variable, and congruency. Comparison order (whether participants heard Essex-SSBE or Yorkshire-SSBE blocks first) and image placement (whether the CLEVER image was on the right or left in the first blocks) were counterbalanced across participants.

2.4. Linguistic stimuli

Stimuli were produced by six female speakers with two from each of our accents of focus: Essex, Yorkshire, and SSBE. The speakers were all aged 18–29 years old (M=22.3, S.D.=3.8). Young female voices were chosen as previous work by Cole (2021) looking at attitudes towards speakers in the Southeast found that young female speakers were less likely to be perceived as intelligent compared to young male speakers. The stimuli consisted of eight distinct sentences for both the Yorkshire-SSBE and the Essex-SSBE comparisons. The eight sentences in the Yorkshire-SSBE comparisons were all produced by the two Yorkshire and the two SSBE speakers. Similarly, the eight sentences in the Essex-SSBE comparison were all produced by the two Essex and the two SSBE speakers. This gave a total of 32 distinct productions that were used as speech stimuli in each of the Essex-SSBE and Yorkshire-SSBE comparisons.

The eight sentences in each of the two comparisons consisted of two different linguistic variables, which are key indicators of the Yorkshire or Essex accents. In the Yorkshire-SSBE comparison, the two linguistic variables were the production of the GOAT vowel as [o:] in Yorkshire and [əʊ] in SSBE and the production of the FACE vowel as [e:] in Yorkshire and [eɪ] in SSBE. In the Essex-SSBE comparison, the two linguistic variables were L-vocalisation (e.g. 'milk' pronounced [miok] in Essex vs. [mɪłk] in SSBE) and TH-

[3]References to linguistic variables come from Wells' lexical sets (Wells, 1982).

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fronting (e.g. 'thing' pronounced [fɪŋ] in Essex vs. [θɪŋ] in SSBE). For each sentence, the linguistic variable of interest was in the final word produced, e.g. "Let's walk along this ROAD," "I really want to PLAY." "They kicked the BALL" and "The ice is THIN," which represent, respectively, the GOAT vowel and the FACE vowel (Yorkshire-SSBE comparison) and L-vocalisation and TH-fronting (Essex-SSBE comparison). Each sentence was chosen to limit as much as possible any other highly salient linguistic features within each accent. The full list of sentences is included in the appendix.

2.5. Experiment procedure

The experiment took part in the EEG lab situated in the Department of Language and Linguistics at the University of Essex. The lab was set up with child-friendly equipment, including an adjustable-height desk and booster seat. Audio was presented via two free-field JBL Control One stereo speakers with pictures displayed on a 22-inch Iiyama ProLite LCD monitor approximately 30 inches from the seated child. Continuous EEG was collected via a 19-channel array of AgCl active electrodes in standard 10/20 positions, with two external electrodes placed on right and left mastoids. Data was sampled at 512 Hz and amplified via a Biosemi Active 2 amplifier. A caretaker was present in the room with the child while they took part but was encouraged not to distract the child by interacting with them. The experiment took around 30 minutes to complete, including EEG preparation and capping. After watching the video introducing them to Ziggy and Zoggy, participants were told that they were now going to take part in a matching task. The children were instructed to match the image of Ziggy or Zoggy that they saw in the centre of the screen with either the image on the left or the right at the bottom of the screen. They were shown which keys to press and told that they had some time to practise first. At the end of the experiment, children received a small toy, which they were able to choose from a toy box situated in the lab.

2.6. Data analysis

All statistical analyses were performed in R (version 4.3.1; R Core Team, 2023) using the lme4 (Bates et al., 2015), lmerTest (Kuznetsova et al., 2017), and emmeans (Lenth, 2023) packages to estimate linear mixed effects models, and resultant p-values were estimated with an alpha level of 0.05.

2.6.1 Reaction times

We conducted an analysis on reaction times to examine responses to the specific pairing of the cartoon characters, Ziggy and Zoggy, with the accents used (based on Greenwald, Nosek, & Banaji, 2003). Average response times were 1843.078 (SD = 1277.821) across all trials. Table 1 shows response times by character and accent pairing. For analysis, we removed responses 2 standard deviations above and below the mean and log-transformed the data.

The accuracy rate was 82.4% correct across all accent pairings, showing our participants were able to complete the basic task of matching the response key to the central picture. In looking at accent pairings, accuracy rates were all above 80% (81.1% for Essex, 82.9% for SSBE, and 83.0% for Yorkshire) and were not further analysed. All incorrect responses were removed from the RT analysis.

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Table 1. Average response times (in milliseconds) by cartoon character and accent pairing

Character	Ziggy (CLEVER)	Zoggy (NOT CLEVER)	
Accent			Mean (SD)
Essex	1924.23	1832.37	1878.25
	(1429.40)	(1213.49)	(1325.80)
SSBE	1796.04	1870.06	1833.05
	(1165.12)	(1293.45)	(1231.18)
Yorkshire	1756.40	1899.65	1827.95
	(1322.30)	(1317.16)	(1320.96)
Mean (SD)	1818.17	1867.98	1843.08
	(1276.03)	(1279.47)	(1277.82)

2.6.2 EEG data

EEG data was processed in Matlab (The MathWorks Inc. (2021) using the EEGlab (Delorme & Makeig, 2004), ICLabel (Pion-Tonachini et al., 2019), and ERPlab (Lopez-Calderon & Luck, 2014) plugins. During analysis, three subjects were removed due to EEG data quality issues (one subject had a faulty mastoid electrode, and two exhibited excessive movement during the experiment). For the remaining 24 subjects, raw EEG data was downsampled to 256Hz and bandpass filtered between 0.1–30Hz. Channels with line noise were spherically interpolated before blinks, and remaining channel noise artifacts were identified using ICA decomposition (Delorme et al., 2007) and removed after manual inspection. Data was re-referenced to linked mastoids and epoched between 200 and 1000 msec surrounding the onset of the critical images in the IAT procedure, with a prestimulus baseline of 200 msec. Remaining artifacts were rejected using a moving window peak-to-peak threshold of 480 μV on external ocular channels and scalp channels separately, resulting in a rejection rate of 1.7% across participants. Difference waves were calculated by subtracting responses to NOT-CLEVER from CLEVER for each of the accents. Mean amplitude was measured between 350–450 msec to capture a potential N400 response and 500–700 msec to capture a possible LPP.

3. Results

3.1. Reaction times

Log-transformed reaction times were estimated in a mixed-effects model with fixed effects of accent (Essex/SSBE/Yorkshire) and character (CLEVER/NOT-CLEVER), in addition to caretakers' places of birth (one Essex / both Essex), and the covariates of age and gender. Caretakers' birthplaces were included as an exploratory variable to account for potential differences in accent exposure among our participants, as approximately half of our participants (N = 11) had a primary caretaker who was born outside of Essex. A three-way interaction between our two variables of interest (accent and character) and caretakers' birthplace was included, along with two-way interactions between each of these variables. Simple coding was used for all categorical variables, with reference levels set to CLEVER, SSBE, and BothEssex, respectively. The model included random intercepts for participant and for each sentence.

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Results showed significant effects for age, with older participants responding more quickly than younger participants ($F(1,22.7) = 30.9$, $p < 0.001$). There were also significant interactions between character and accent ($F(2,2666.1) = 3.2$, $p = 0.04$) and between character and caretakers' place of birth ($F(1,2645.2) = 7.6$, $p < 0.01$), although the three-way interaction was not significant ($F(2,2645.2) = 1.4$, $p = 0.25$). For the full model table, please refer to Appendix B. Figure 2 shows that across accents, differences are mainly found in the responses to the NOT-CLEVER characters, where responses are nominally slower than responses for CLEVER in the SSBE and Yorkshire conditions, particularly for participants with only one caretaker from Essex, and faster in the Essex condition for participants with two Essex caretakers.

To explore these effects in more detail, we fit three follow-up models, one for each accent. Each sub-model is specified in the same manner as the omnibus model above, with the exception that accent is no longer an available factor. In all three models, age remains a highly significant factor (all *p*s < .0001) and will not be discussed further. For a full table of results for each model, see Appendix B.

For the SSBE model, we find no significant factors (all *p*s > 0.09), suggesting little discrimination across our participants between CLEVER and NOT-CLEVER pairings and no influence of caretakers' places of birth. However, for both Yorkshire and Essex models, we do find potential interactions between character and caretakers' places of birth (Yorkshire: $F(1,641.3) = 4.8$, p = 0.03; Essex: $F(1,628.9) = 3.6$, p = 0.06). Posthoc testing

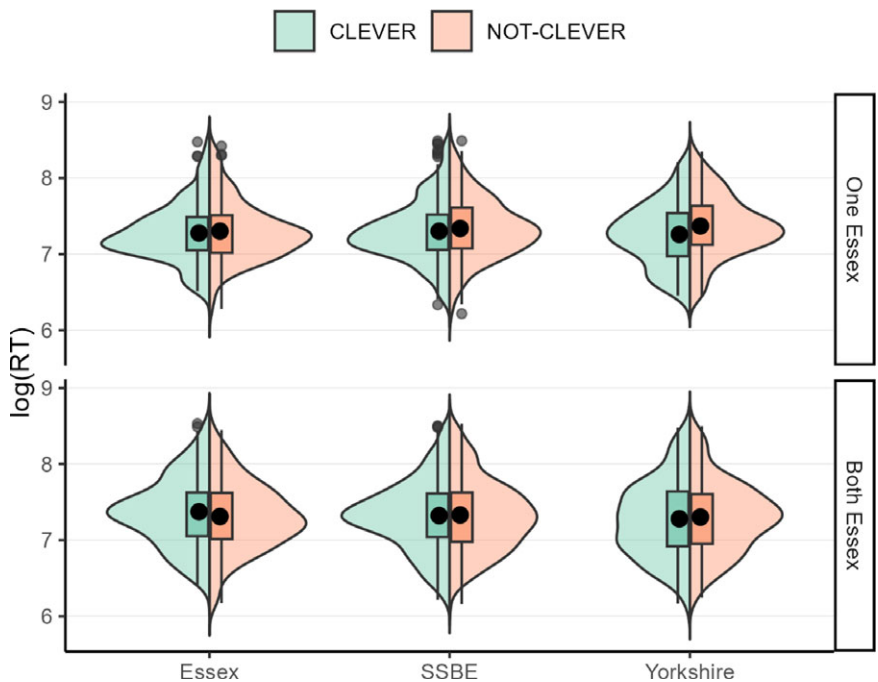

Figure 2. Split violin plot of log-transformed reaction times for Essex, SSBE, and Yorkshire accents paired with the CLEVER (green) and NOT-CLEVER (orange) characters. Response times are separated by caretaker status, with participants having one caretaker from Essex represented in the top panel (labelled 'One Essex') and participants with two caretakers from Essex represented in the bottom panel (labelled 'Both Essex'). Dots within the boxplots indicate the mean response in each condition and group.

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using estimated marginal means shows that in the Yorkshire condition, participants with a single Essex caretaker respond more slowly to NOT-CLEVER compared to CLEVER pictures (M=0.14, t(640.7) = 3.25, p < 0.001). Conversely, in the Essex condition, participants with both caretakers from Essex responded more slowly to the CLEVER compared to NOT-CLEVER pictures (M=0.07, t(635.3) = 1.96, p = 0.05). Taken together, this suggests that all participants treated pairings of CLEVER and NOT-CLEVER with the SSBE accent approximately equivalently, while in the Essex and Yorkshire conditions, caretaker background played a role. Specifically, these results support a bias towards pairing Yorkshire with CLEVER for children with exposure to multiple caretaker accents and a bias towards pairing Essex with NOT-CLEVER for children with Essex-only caretakers.

3.2. ERPs

Visual inspection of ERP data shows the electrophysiological profile generated in response to the onset of visual stimuli, indicating children were attending to the pictures in the experiment. This visual evoked response is characterised by an early negativity followed by a positivity (i.e. an N170 and P3 response) and is followed by a further negative response in the N400 time window and a large positive peak around 700 msec in posterior electrode sites, indicative of an LPP. These responses are illustrated in Figure 3.

Mean amplitude of the difference between CLEVER and NOT-CLEVER conditions for each accent were entered into a linear mixed-effects model, with fixed effects of accent (Essex/SSBE/Yorkshire), caretakers' places of birth (one Essex / both Essex), age, and gender, including an interaction between accent and caretaker place of birth in line with the previous RT analysis. Simple coding was used for contrasts, with SSBE set as the reference level for accent and BothEssex as the reference for the caretaker's place of birth. Random intercepts were estimated for participant and for electrode site. N400 and LPP responses are each analysed separately below.

3.3. N400 window

Mean amplitude of difference waves in this window suggests discrepancies in responses based on accent-picture pairings. As illustrated in Figure 4, responses are overall more negative for NOT-CLEVER than for CLEVER in SSBE ($M = -1.93\mu V$), suggesting we do find an N400 response for the incongruent pairing of SSBE and NOT-CLEVER. An opposite effect is seen in Yorkshire, where we find an N400 response for CLEVER compared to NOT-CLEVER (M = 4.20μV). For Essex, little difference is observed in this window (M = 0.30μV); thus, no N400 is observed in pairing either CLEVER or NOT-CLEVER with the Essex accent. These observations are supported by results from our mixed-effects model, which show a main effect of accent condition (F(2,2371 = 69.3),

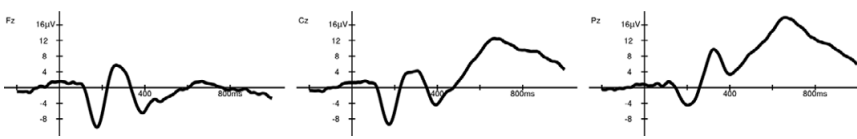

Figure 3. Mean amplitude of ERPs for all IAT conditions in frontal (Fz), central (Cz), and parietal (Pz) midline electrodes.

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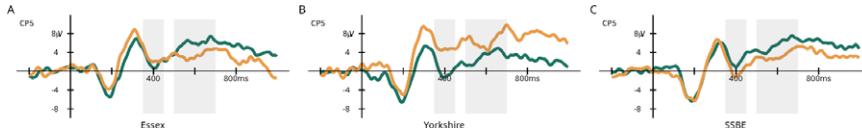

Figure 4. Mean amplitude of ERPs in site CP5 showing responses to CLEVER (green) and NOT-CLEVER (orange) pictures paired with an Essex accent (a), a Yorkshire accent (b), or an SSBE accent (c). Analysis windows for the N400 and LPP are marked out in grey.

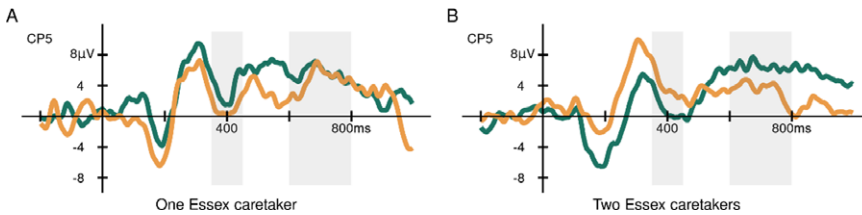

Figure 5. Mean amplitude of ERPs in site CP5 showing responses to Essex-CLEVER (green) and Essex-NOT-CLEVER (orange) for participants with one Essex caretaker (a, n=10) or two Essex caretakers (b, n=15). Analysis windows for the N400 and LPP are marked out in grey.

$p < 0.001$), with Yorkshire being more positive than Essex ($t(2340) = -8.43$, $p < 0.001$) and SSBE ($t(2340) = -11.33$, $p < 0.001$), and SSBE being more negative than Essex ($t(2340) = 2.90$, $p = 0.01$). However, a significant interaction between accent condition and caretakers' place of birth was also found ($F(2,2371) = 24.8$, $p < 0.001$), which posthoc testing with Tukey's test showed to be limited to responses to the Essex condition ($F(1,26.67) = 8.44$, $p = 0.007$; all other ps > 0.7). For the full model table, see Appendix B.

Further inspection of the Essex data by caretakers' places of birth showed a large divergence in responses between those with a single Essex caretaker and those with two Essex caretakers. While children whose caretakers are both from Essex show an N400 for the Essex-CLEVER pairing, children with only a single Essex caretaker do not. These responses are illustrated in Figure 5.

Taken together, this suggests that all participants exhibited a bias towards pairing SSBE with CLEVER and Yorkshire with NOT-CLEVER, as evident by comparatively smaller N400 responses in these conditions. For Essex, accent exposure again plays a role, with a bias towards pairing this accent with NOT-CLEVER for participants with Essex-only caretakers and with no discernible bias in either direction for those with exposure to multiple caretaker accents, echoing the distinction seen in the RT results above.

3.4. LPP window

Mean amplitudes in the LPP window show larger amplitude responses for CLEVER than for NOT-CLEVER in Essex ($M = 4.23\mu V$) and SSBE ($M = 1.22\mu V$), while the Yorkshire condition shows the opposite pattern, with a larger amplitude response for NOT-CLEVER than CLEVER ($M = 3.77\mu V$). Analysis of responses in this window parallels that of the N400 window, including a main effect of accent ($F(2,2371) = 105.2$, $p < 0.001$), with significantly larger amplitude responses in the Yorkshire condition compared to SSBE ($t(2340) = 5.47$, $p < 0.001$) and smaller amplitude responses in the Essex condition

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compared to SSBE ($t(2340) = -5.47$, $p = < 0.001$). The full model table is listed in Appendix B.

As before, a significant interaction between accent and caretakers' place of birth ($F(2,2371) = 28.2$, $p < 0.001$)) was also observed. While responses to SSBE and Yorkshire are similar across groups ($F(1,23.04) = 0.29$, $p = 0.60$; Yorkshire: $F(1,23.04) = 0.81$, $p = 0.37$), post-hoc testing finds a marginal difference in responses in the Essex condition ($F(1,23.04) = 3.46$, $p = 0.08$). In this case, participants with one Essex caretaker show larger amplitude LPP responses in the Essex condition (M=7.23μV) than those who have two Essex caretakers (M = 2.24μV).

In sum, the LPP data shows significantly more positive responses for the pairings of SSBE-CLEVER and Essex-CLEVER. Following the interpretation of the LPP as a marker of congruency by Williams and Themanson (2011), this suggests a bias in this direction for both groups of participants. For the Essex condition, we find larger positive responses in children with one Essex caretaker, although this comparison does not meet the threshold for statistical significance. It is noteworthy that this is the only data, which suggests any pairing of Essex-CLEVER, contrasting with the previously reported bias towards Essex-NOT-CLEVER in the RT and N400 data for those with Essex-only caretakers. For Yorkshire, the LPP data suggests a bias towards pairing Yorkshire with NOT-CLEVER, in line with the previously reported N400 data.

4. Discussion

In this study, we investigated whether five-year-old children showed evidence of implicit social judgements towards speakers with regional accents and, in particular, whether a positive bias towards the standard accent in comparison to familiar and unfamiliar regional accents would be evident. Across the different measurements of bias reported above, we find that, overall, our five-year-old Essex participants do show positive associations between SSBE and CLEVER, found in both reaction time and brain data. Results for the regional accents, however, were somewhat mixed. For the more unfamiliar regional accent, pairing Yorkshire and CLEVER showed evidence of some positive bias in terms of reaction time data but evoked a very different set of brain responses compared to the equivalent comparison in SSBE. The results for the associations with Essex and either CLEVER or NOT-CLEVER were also not as clear-cut as the results for SSBE. Only one of the measures (the LPP) suggested a positive bias towards Essex and CLEVER across all of the participants, while for those participants with Essex-only caretakers, the N400 and RT measures suggested a bias in the opposite direction. Particularly with the regional accents, there were other interesting findings related to whether the children have one or both caretakers from Essex, which emerged from our exploratory analysis of accent exposure. All of these findings are discussed at greater length below.

4.1. Own-accent bias?

A primary question in this study was whether our group of five-year-old children would show evidence of positive bias towards their own regional accent or whether there would be evidence showing a negative bias against the Essex accent, as has been observed in adults (Cole, 2021). Looking across the results for all participants, in the reaction time data, there is no significant difference in response times when pairing CLEVER or NOT-

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CLEVER with Essex. The brain data provides further evidence for this equivalency, with no evidence of an N400 being elicited for either the CLEVER or NOT-CLEVER pairing. However, a greater positivity in the LPP window is found when pairing Essex with CLEVER, which could point towards a positive association with Essex and CLEVER, as the LPP has been suggested as an index of attribute congruency in previous IAT+EEG work (Williams & Themanson, 2011.

Although these results only show a bias towards Essex in one measure, it's clear they contrast with the strong negative association with the Essex accent found in our piloting of the IAT with adolescents in Essex, as well as previous work investigating adults' explicit attitudes (Cole, 2021). One interpretation of this is that the children in our study may be showing an ongoing familiarity preference, as is found in perception studies from infancy (Butler et al., 2011; DeCasper & Fifer, 1980; Purhonen et al., 2005), where children prefer to listen to speakers with their own (or their mother's own) accent. We would therefore expect that testing older children would provide critical information about how long this persists, at what point children lose their own-accent preference, and how this manifests in their implicit vs. explicit attitudes. In addition, further work is needed to understand the relationships between accent exposure and attitudes, as we find discrepancies in the data between children who have both primary caretakers born in Essex compared to those children who have only one Essex caretaker, discussed at more length below.

4.2. Biases for SSBE and Yorkshire

When looking at the data from SSBE, we find an even stronger tendency towards a positive bias. This is evident in faster behavioural responses for SSBE and CLEVER, a larger N400 for SSBE and NOT-CLEVER pairings, and a greater positivity in the LPP window when pairing SSBE and CLEVER. This suggests that in this age group, there is a preference towards the standard, associating SSBE speakers with the attribute of cleverness. This accords with results from previous studies and our own pilot data with adolescents, which find a strong association between SSBE and cleverness. As with the Essex data, however, these differences are also modulated by the exposure to different accents the children are receiving from their caretakers.

The data for the other, more unfamiliar, regional accent, Yorkshire, is somewhat more complicated to interpret, as the findings are partially contradictory. While the Yorkshire accent is likely to be less familiar to our participants, we expect the children to adapt quickly to the accented speech (as found in speech perception studies; see Cristia et al., 2012 for a review). Furthermore, as five-year-old children have reached the stage of phonological constancy and are therefore able to abstract across different and unfamiliar accents in order to understand familiar words (Best et al., 2009), we do not expect a lack of familiarity with the Yorkshire accent to hamper their processing of the speech. Previous research has found that children show a developmental progression in categorising speakers by accent, starting with familiar accents and then grouping according to unfamiliar accents from around the age of five years (Jeffries, 2019, 2022). We therefore expect the children to be able to differentiate the accents, and our predictions were that children in this age group may start to associate the regional Yorkshire accent with NOT-CLEVER, in line with adult prestige ratings (Sharma et al., 2022), through exposure to these adult stereotypes. Indeed, our pilot data with adolescents found an association between Yorkshire and NOT-CLEVER in the IAT.

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Analysis of the reaction time data in the current study does not accord with this, however, as the Yorkshire-CLEVER pairings elicited faster reaction times than Yorkshire-NOT-CLEVER, suggesting a positive bias towards Yorkshire. On the other hand, we observe an N400 for the Yorkshire-CLEVER pairing and a late positive potential for Yorkshire-NOT-CLEVER, suggesting that in the brain data, there is a bias towards associating Yorkshire and NOT-CLEVER. Thus, overall, the association between Yorkshire and either CLEVER or NOT-CLEVER appears to depend on the measure used.

The association between the Yorkshire accent and CLEVER found in the reaction time data indicates a positive bias towards Yorkshire speakers. One possible explanation for these results may be in the subtleties of the associations between regional accents and positive attributes more generally. While adults in Britain have not been found to rate the Yorkshire accent positively on status dimensions such as intelligence, it is often evaluated positively on solidarity ratings, such as friendliness (Cooper, 2013; Hiraga, 2005; Strongman & Woosley, 1967). Therefore, the focus on intelligence in the current study may not be teasing apart the status and solidarity measures, which are found to work quite differently among children in studies of their explicit attitudes (McCullough et al., 2019). It may be that an overall, subjective, positive association with the Yorkshire accent based on solidarity is the overriding influence in the children's responses and that the negative status dimension for this accent, found in studies of explicit attitudes with adults (e.g. Sharma et al., 2022), has not appeared in the implicit attitudes of our participants (as McCullough et al. find for four- to five-year-olds' explicit attitudes).

If this is the case, however, it is intriguing that the brain data shows a bias in the opposite direction, with both the N400 and LPP responses pointing to an association with Yorkshire and NOT-CLEVER. This indicates that on some level, the unfamiliar and non-standard Yorkshire accent may have an associated negative bias for our five-year-old participants in line with status ratings from adults.

4.3. The role of accent exposure

Across all our data, we find that the strength of the bias measurements is dictated in large part by whether the participants in our study had a single caretaker from Essex or whether both of their primary caretakers are from Essex. For instance, caretaker status played a role in reaction times for SSBE and Yorkshire conditions, as well as in both the N400 and LPP measures for the Essex condition. In our analyses, we use this variable as a proxy for indicating which children are routinely exposed to greater accent variation.

For children with both caretakers from Essex, the N400 data shows this group is the only one that exhibits an N400 for the Essex-CLEVER pairing. On the other hand, children with only one Essex caretaker were less likely to exhibit either positive or negative bias towards Essex, with no difference in response speed for Essex-CLEVER or NOT-CLEVER pairings in the RT data. This group also showed more positive responses for the pairings of Essex-CLEVER in the LPP data. Children with one Essex caretaker were also more likely to show positive bias towards Yorkshire and SSBE, with significantly slower responses to NOT-CLEVER pictures for both Yorkshire and SSBE and significantly more positive responses for the pairings of SSBE-CLEVER in the LPP data.

Taken together, our data shows that the children with a more heterogenous group of caretakers showed more positive bias towards *all* of the accents in this study. This could be linked to their overall positive experience of being exposed to more linguistic variation,

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facilitating more tolerance of accent diversity. However, we acknowledge that this finding must be taken with some caution, as it resulted only from an exploratory analysis of caretaker place of birth, which happened to be relatively diverse, including regions such as London, Devon, and Ireland. More details of the individuals' experiences with accent variation would be needed to support this claim. Indeed, future studies should address exposure in more detail to better characterise the experience of the children and the degree to which having parents with heterogenous accents impacts on early stages of accent valuation.

4.4. Consequences for modelling the development of language attitudes

Findings from the current study have illustrated interesting discrepancies in the results dependent on the different measures being evaluated. The inclusion of ERP responses as a measure of neural activity alongside the IAT behavioural responses allowed us to investigate implicit bias from different angles, and the differences we find may result from the relative automaticity of the measures. Both the N400 and LPP brain responses occur more than 1 second before the behavioural IAT responses. These quicker brain responses perhaps indicate an emotive reaction based on a more embedded attitude, whereas the slower IAT responses have had more time to be influenced by conscious reflection and may therefore not be reflecting a completely unconscious attitude (as posited by Gawronski, 2009). The largest discrepancy between these two measures in our own data surfaced in the Yorkshire accent comparison. For this data, this would indicate that the association with Yorkshire and NOT-CLEVER is the more embedded attitude, while the contradicting reaction time results associating Yorkshire and CLEVER could be influenced by further downstream reflective processes. McCullough et al.'s (2019) work suggests that children develop explicit attitudes in line with adult-like evaluations between the ages of four and twelve years old, and results from the current study begin to address the question of how implicit attitudes might fit into the overall picture of language attitude development.

For the five-year-olds in the current study, there is a positive association with SSBE and cleverness across the implicit measures and a positive association with the Essex accent and cleverness in the (LPP) brain data specifically. Building on this, a question for further work is whether children's implicit attitudes follow a similar trajectory to explicit attitudes, becoming more in line with adult-like stereotypes throughout early childhood and into adolescence. McKenzie and Carrie's (2018) work with adults finds that implicit and explicit attitudes don't necessarily correlate and that implicit attitudes are more deeply embedded and can have longer-lasting effects. Therefore, modelling the trajectory of both kinds of attitudes is a crucial focus for future research.

5. Limitations

The main limitation of this study is the small sample size of the population we were able to test, which confines the interpretations we are able to make. This specifically impacted our ability to use a traditional D-score-based analysis of the IAT responses due to the low number of subjects resulting in a lack of statistical power for these kinds of analyses. A behavioural-only version of the experiment presented here would facilitate the ability to test a larger sample and may provide additional evidence for the presence or absence of implicit associations with specific accents in children of this age. Additionally, due to

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limitations on the length of the experiment, the stimuli itself focused on specific linguistic variables, female voices, and one attitude type, further narrowing the scope of our analysis. While the current study has a narrow focus, this was essential for the inaugural running of these methods with children, and it is hoped that future work in this area will be able to expand on the breadth of these initial findings.

6. Conclusion

Overall, this study is the first to address children's implicit language attitudes and provides a vital first step for further work in this area. Our results find the appearance of implicit biases towards regional accent varieties at the age of five years among Essex children in the UK. An association with the prestigious SSBE accent and cleverness is found in the IAT data and the brain data, while the LPP brain data also reveals an association with the Essex accent and cleverness, suggesting the children have a positive association with their home accent. The association between the Yorkshire accent and cleverness depends on the measure used, with behavioural results in line with a positive bias but brain results patterning in the opposite direction. An exploratory analysis of caretaker place of birth illustrated differences in the overall results, which suggests more positive bias towards all three accents for children who have potentially encountered more regular exposure to accent variation. These findings uncover the multifaceted manifestation of implicit accent biases, which warrant thorough exploration in follow-on studies.

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Competing interests. The authors declare none

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Appendix A

Sentences used for audio stimuli

Essex-SSBE condition

- That blanket is *thick*
- The ice is *thin*
- The baby is *thirsty*
- I have a sore *thumb*
- They kicked the *ball*
- The tree is very *tall*
- The glass was *full*
- They rang the *bell*

Yorkshire-SSBE condition

- We should be in the *shade*
- I really want to *play*
- She said that I should *wait*
- It has been a good *day*
- I have a very sore *toe*
- Let's walk along this *road*
- Tell me when I should *go*
- There was a sheep and a *goat*

Appendix B

Model tables

Reaction time analysis – omnibus model

Term	*Sum sq*	*Mean sq*	*Num DF*	*Den DF*	*F*	*p-value*
accent	0.02	0.01	2	62.84	0.08	0.923
character	0.52	0.52	1	2665.65	4.40	0.036
caretaker-birthplace	0.01	0.01	1	22.93	0.05	0.832
age	3.64	3.64	1	22.69	30.89	<0.01
gender	0.41	0.41	1	22.91	3.49	0.075
accent × character	0.77	0.38	2	2666.07	3.25	0.039
accent × caretaker-birthplace	0.42	0.21	2	2641.15	1.78	0.168
character × caretaker-birthplace	0.90	0.90	1	2645.17	7.64	<0.01
accent × character × caretaker-birthplace	0.33	0.16	2	2645.31	1.39	0.249

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Reaction time analysis – SSBE sub model

term	*Sum sq*	*Mean sq*	*Num DF*	*Den DF*	*F*	*p-value*
character	0.29	0.29	1	1343.71	2.43	0.119
caretaker-birthplace	0.00	0.00	1	22.60	0.02	0.891
age	3.22	3.22	1	22.45	27.40	<0.001
gender	0.36	0.36	1	22.80	3.04	0.095
character x caretaker-birthplace	0.04	0.04	1	1326.99	0.35	0.557

Reaction time analysis – Yorkshire sub model

term	*Sum sq*	*Mean sq*	*Num DF*	*Den DF*	*F*	*p-value*
character	0.99	0.99	1	644.86	8.12	0.0045
caretaker-birthplace	0.01	0.01	1	22.44	0.09	0.7649
age	5.90	5.90	1	21.88	48.54	<0.001
gender	0.79	0.79	1	23.05	6.49	0.0180
character × caretaker-birthplace	0.58	0.58	1	641.25	4.77	0.0293

Reaction time analysis – Essex sub model

term	*Sum sq*	*Mean sq*	*Num DF*	*Den DF*	*F*	*p-value*
character	0.04	0.04	1	633.04	0.35	0.552
caretaker-birthplace	0.04	0.04	1	22.45	0.32	0.579
age	2.24	2.24	1	22.18	19.86	<0.001
gender	0.19	0.19	1	22.86	1.67	0.209
character × caretaker-birthplace	0.40	0.40	1	628.92	3.57	0.059

N400 analysis – omnibus model

term	*Sum sq*	*Mean sq*	*Num DF*	*Den DF*	*F*	*p-value*
accent	15724.38	7862.19	2	2371.00	69.25	<0.001
caretaker-birthplace	267.10	267.10	1	21.00	2.35	0.140
age	194.74	194.74	1	21.00	1.72	0.204
gender	891.03	891.03	1	21.00	7.85	0.011
accent × caretaker-birthplace	5633.73	2816.87	2	2371.00	24.81	<0.001

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LPP analysis – omnibus table

term	*Sum sq*	*Mean sq*	*Num DF*	*Den DF*	*F*	*p-value*
accent	31145.34	15572.67	2	2371.00	105.24	<0.001
caretaker-birthplace	38.50	38.50	1	21.00	0.26	0.615
age	249.61	249.61	1	21.00	1.69	0.208
gender	542.76	542.76	1	21.00	3.67	0.069
accent × caretaker-birthplace	8337.00	4168.50	2	2371.00	28.17	<0.001

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