The Effect of Accent Exposure on Social Cognition and Language Acquisition in Early Childhood

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy

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Abstract

It is common in many parts of the world for children to grow up in linguistically diverse communities. Despite this, developmental psychologists have only recently begun to examine the impact of language variation (i.e., hearing multiple languages and accents) on children. In this thesis, I examine aspects of the social and linguistic development of children living in one of the most culturally and linguistically diverse regions in the world (i.e., the Greater Toronto Area). In Chapter 2, I examine how exposure to accent variation shapes children’s friendship preferences. My findings suggest that despite having regular accent exposure, children living in diverse communities show strong social preferences for peers that speak with the locally dominant accent. However, the strength of children’s preferences seems to be modulated by their exposure to accented speakers in everyday life. In Chapter 3, I consider how linguistic diversity could impact infant’s ability to tell apart languages. My results suggest that although 5-month-olds can tell when an L1 bilingual speaker switches from English to Spanish, they have difficulty distinguishing Spanish and Spanish-accented English samples produced by a L2 English speaker. Finally, in Chapter 4, I examine how brief exposure to speakers with different types of accents
can influence speech production. More specifically, I examine children and adult’s imitation of model speakers from their own linguistic community and different linguistic communities. Contrary to previous work, I found no evidence that children imitate model speakers more strongly than adults. However, my results suggest that imitation can be influenced by both the accent of the model speaker and the test methodology. In combination, the three studies reported in this thesis advance our understanding of how accent exposure influences children’s speech perception and social behavior, and highlight the importance of considering real-world accent variation in models of social and linguistic development.
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“If we knew what it was we were doing, it would not be called research, would it?”

- Albert Einstein
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Chapter 1
General Introduction

1 Introduction

In the past 50 years, we have learned a great deal about children’s early social and linguistic development. Infants begin acquiring the sound structure of their native language even before they are born (Moon, Cooper, & Fifer, 1993) and by the time they reach their first birthday, infants have developed sophisticated abilities to read social information in the faces and voices of others (Kinzler, Dupoux, & Spelke, 2007; Mumme, Fernald, & Herrera, 2009; Paquette-Smith & Johnson, 2016; Vaish & Striano, 2004). Indeed, children’s social and linguistic development appear to be related. For example, infants who are more skilled in following the social eye gaze of others tend to develop more advanced linguistic abilities by the age of two (Brooks & Meltzoff, 2008).

Although there is growing evidence that children’s social and linguistic development are linked, one area that has been largely ignored by developmental psychologists, until recently, is the role that exposure to accent variation plays in both of these domains. In classic developmental research, the accent of the speaker who produced stimuli (or the accent of the children who participated in the study) was typically not even reported in methods section (e.g., Fernald, Pinto, Swingley, Weinberg, & McRoberts, 1998; Kuhl & Meltzoff, 1982; Werker & Tees, 1984 for examples). Although, developmental psychologists have until very recently largely ignored accent variation in studies of social behaviour and speech processing, sociolinguists have been aware of the interesting relationship between accents and behaviour for quite some time (Howard Giles, Coupland, & Coupland, 1991; Howard Giles, Taylor, &
Bourhis, 1973; Labov, 1963, 1972). Sociolinguistic case studies have suggested that people can shift their dialect depending on the characteristics of the interlocutor (Bell, 1984; Bourhis & Giles, 1977; Chambers, 1992; Labov, 1972). For example, Canadian children who relocated to England, reported sounding more ‘Canadian’ when they interacted with a Canadian-accented experimenter compared to when they interacted with their British-accented peers (Chambers, 1992). Despite the implications for developmental research, accent variation has not been on the radar of mainstream developmental psychologists until recently.

In recent years, a growing number of studies have demonstrated that children are highly sensitive to accent information. For example, preschoolers seem to rely heavily on accent–based cues to make social decisions (Kinzler et al., 2007; Kinzler, Shutts, DeJesus, & Spelke, 2009; Kinzler & Spelke, 2011). Similarly, research in language acquisition has also shown that the presence of an unfamiliar accent can be quite disruptive to children’s early word recognition (Best, Tyler, Gooding, Orlando, & Quann, 2009; Mulak, Best, Tyler, Kitamura, & Irwin, 2013; van Heugten & Johnson, 2014). Despite the evidence that children are aware of the accents speakers use, and initially struggle to understand foreign-accented speakers they encounter for the first time in the lab, very little is known about the accent processing abilities of children who are regularly exposed to accent variation. Indeed, much of the work that I will review in this chapter has focused primarily on children with relatively homogeneous accent and language input. However, as time goes on, the field has become increasingly more aware that focusing on less diverse, WEIRD (i.e., Western, educated, industrialized, rich and democratic) populations can skew our view of early development (see Henrich, Heine, & Norenzayan, 2010; Nielsen, Haun, Kärtner, & Legare, 2017 for a discussion). As such, the field is beginning to place a greater emphasis on studying the behaviour of children living in more culturally and linguistically diverse regions of the world.
In this thesis, I investigate how variation in children’s linguistic environment impacts their development. To do this, I examine the social and linguistic behaviour of children growing up in the Greater Toronto Area, one of the most culturally and linguistically diverse regions of the world (Statistics Canada, 2011). Although, most of the literature to date has focused on children with relatively homogeneous language input, this work suggests that even brief exposure to different-accented speakers can impact speech processing and social behaviour. In the remainder of this chapter, I will summarize the existing literature on how infants and children process and interpret accent information from birth to early childhood. I will begin by discussing infants’ early sensitivity to accents and languages, and their use of linguistically based categories to divide and interpret their language input (Section 2). Then, in Section 3, I will discuss how children learn to contend with unfamiliar-accented speech in toddlerhood. More specifically, I will describe how and when 1- and 2-year-olds begin to recognize familiar words when they are produced in unfamiliar accents. In Section 4, I will consider how some of the features of accented speech (i.e., processing difficulties, social stigma) may contribute to the development of social preferences for native-accented speakers in the preschool years. Finally in Section 5, I will consider how variation in children’s linguistic environment (e.g., multilingual, multi-accent) could impact early language acquisition and social behavior at various stages of development. I will conclude this chapter with an outline of my research objectives and the experiments that will be presented in this dissertation.

2 Infancy: categorization of speech input into accent- and language-based groups

From birth, infants have already begun to categorize their linguistic input by language. For example, English-learning newborns prefer to listen to English (a familiar stress-timed language) over Spanish (an unfamiliar syllable-timed language; Moon et al., 1993; Nazzi, Bertoncini, &
Mehler, 1998). As infants become more attuned to the sound structure of their native language, they begin to differentiate their native language and accent from other rhythmically-similar languages and accents (Butler, Floccia, Goslin, & Panneton, 2011; Kitamura, Panneton, & Best, 2013; Nazzi, Jusczyk, & Johnson, 2000). For example, 5-month-old American English learning infants can tell apart their own regional dialect of English (i.e., American English) from another regional dialect of English (i.e., British English; Nazzi et al., 2000). Although, infants’ ability to tell apart languages and accents improves over the first few months of life, some research has indicated that infants’ preference for their own regional dialect may decrease at around 9-months of age (Kitamura et al., 2013; Phan & Houston, 2009). While it may seem surprising to observe a decline in sensitivity to regional accent differences, it has been argued that this decline could reflect the development of language constancy, which is a more advanced understanding that accents are simply variants of the child’s native language rather than completely different languages (Kitamura et al., 2013).

In addition to learning to tell apart accents and languages, as infants age, they are thought to begin to use these accent and language-based categories to divide their social world (Bigler & Liben, 2007; Liberman, Woodward, & Kinzler, 2017b). By 6 months of age, infants can distinguish speakers based on their accent, and will selectively direct their attention towards speakers who speak with a native-accent over speakers who speak with a non-native accent (Kinzler et al., 2007). Just a few months later in development, infants begin using the languages people speak to guide their social behavior. For example, 10- to 12-month-olds show preferences for toys, food and music endorsed by speakers of their native language over toys, food and music endorsed by speakers of a foreign language (Kinzler et al., 2007; Marno et al., 2016; Shutts, Kinzler, McKee, & Spelke, 2009; Soley & Sebastian-galles, 2015).
Although proponents of a socially-based account of preferences have argued that infants are using the language a person speaks to infer their social characteristics (Kinzler & Liberman, 2017; Liberman, Woodward, & Kinzler, 2017a; Liberman, Woodward, Sullivan, & Kinzler, 2016), others have argued that infants’ preferences could be explained by simple, low-level associations between familiar languages and objects, food or people (see Haith, 1998; Scarf, Imuta, Colombo, & Hayne, 2012 for a discussion). Even though there is still considerable debate over the cause(s) of infants’ preferences, a growing number of studies support the notion that infants’ judgments are socially driven. For instance, studies of infants’ looking behaviour suggest that they expect two speakers of the same language to affiliate and share similar food preferences and are surprised when they do not (as is evidenced by longer looking times; Liberman et al., 2017a, 2016). The fact that infants are able to make inferences about speakers who speak a different language than they do supports the idea that infants are categorizing those speakers, rather than simply making associations between familiar languages and positive attributes. Although, it is possible to argue that there could be low-level explanations for looking time studies, by the time children reach school-age, there is strong evidence to suggest that children’s language-based preferences are social driven (Kinzler et al., 2007, 2009).

In recent years, the field has made substantial gains in its understanding of how infants divide their linguistic input on the basis of accent and language categories. Research in this area suggests that over the first 6 months of life, infants become increasingly more skilled in identifying their native language and accent (Butler et al., 2011; Kitamura et al., 2013; Nazzi et al., 2000) and by the end of the first year, infants have begun to use linguistic categories to make predictions about the social characteristics of the people they encounter (Kinzler et al., 2007; Liberman et al., 2017a, 2016; Marno et al., 2016; Shutts et al., 2009; Soley & Sebastian-galles, 2015). As infants’ ability to speak and understand their native language improves over the
second year of life (Fernald, Perfors, & Marchman, 2006; Fernald et al., 1998), accent information can have a substantial impact on their comprehension of the speaker. In the next section, we will discuss how toddler’s ability to interpret accented speech develops over the first few years of life.

3 Toddlerhood: coping with accent variation in spoken word recognition

Accent variation can impact the ability to process and understand speech. Although 1-year-olds are quite skilled in recognizing familiar words when they are spoken in their local community accent (Hallé & Boysson-Bardies, 1994; Swingley, 2005; van Heugten & Johnson, 2014), infants often struggle to recognize familiar words when they are produced in an unfamiliar accent (Best et al., 2009; Mulak et al., 2013; van Heugten & Johnson, 2014). In the following section, we will discuss when and how toddlers learn to cope with accented speech over the first two years of life.

One of the first steps towards being able to understand accented speech is learning to ignore non-contrastive accent variation in the production of words. Infants must learn that, for example, the sound pattern (or word form) ‘shark’ produced by a Canadian speaker is the same as the word form ‘shark’ when it is produced by an Australian speaker, despite the fact that (to a Canadian speaker) the latter may sound more like ‘shock’ than ‘shark’.

To assess this ability in the lab, infants have been familiarized to a pair of novel word forms (e.g., candle, hamlet) in a one accent. Then, in the test phase infants listen to sentences spoken in a different accent. Some of these sentences contain the familiarized word forms (e.g., “The candle in the kitchen was almost melted”) and some do not (e.g., Your kingdom is in a faraway place). If infants can recognize the newly learned word forms across accents, then they will orient longer to hear the sentences that contain familiar word forms over sentences that contain unfamiliar word forms.
While 9-month-old American English learning infants have difficulty recognizing a newly-learned word form when it is produced in a different accent, by 12 months of age, English learning infants’ word form representations seem to be abstract enough to cope with some types of accent variation. For example, when 12-month-olds are familiarized to a novel word form in American-accented English, they are able to recognize the same word form when it is heard in Canadian-accented English (Schmale, Cristià, Seidl, & Johnson, 2010; Schmale & Seidl, 2009). Although, the studies described above typically switch dialects between the familiarization and test phase, infants under 8 months of age also struggle to recognize familiar words forms when both the familiarization and test phase are produced in an unfamiliar accent (Nazzi, Mersad, Sundara, Iakimova, & Polka, 2014). For example, Parisian-French learning infants have difficulty recognizing familiar word forms when both the familiarization and test phase are produced by a Canadian-French speaker (Nazzi et al., 2014).

Even though infants can generalize a newly-learned word form across accents, 12-month-olds still have difficulty understanding and recognizing known words (e.g., mommy, baby) when they are produced in an unfamiliar accent (Best et al., 2009; Mulak et al., 2013; van Heugten & Johnson, 2014; van Heugten, Paquette-Smith, Krieger, & Johnson, in press). One way to examine infants’ ability to recognize familiar words is to present them with lists of familiar (i.e., daddy, bottle, diaper, mommy) and nonsense words (i.e., koddy, dimma, dapper, mitty). When the stimuli are presented in a familiar accent, infants will look longer (or prefer) to hear the familiar over the nonsense word list. However, when the stimuli are presented in an unfamiliar accent, young infants show no preferences (or no difference in their looking times) to hear the familiar over the nonsense words (see Johnson & Zamuner, 2010; Zamuner & Johnson, 2011 for detailed description of the methodology). Although age estimates can vary slightly, infants do not typically recognize familiar words when they are spoken in an unfamiliar accent until around
19 months of age (Best et al., 2009; Mulak et al., 2013; van Heugten & Johnson, 2014; van Heugten et al., in press). However, there is some evidence that younger infants can be successful at this task, if they are given brief exposure to the speaker prior to completing the word recognition task (van Heugten & Johnson, 2014) or if they have an exceptionally high vocabulary (Best et al., 2009; Mulak et al., 2013).

Although there is clear evidence that children’s ability to understand accented speakers improves with age (and exposure), there is still considerable debate over ‘what’ children are actually doing to cope with this variation. Some have argued that children’s adaptation to an unfamiliar accent may be phonologically specific (van Heugten & Johnson, 2014; White & Aslin, 2011). Indeed studies in which children are trained on one particular phoneme shift (i.e., where a speaker pronounces the vowel [a] as in dog as [æ] as in dag) then children will look at the ‘bottle’ when they hear the speaker produce ‘battle’ (which is the same vowel shift) but not when the speaker produces the word ‘bittle’ (which is a different vowel shift). Thus indicating that when children ‘adapt’ to a novel accent, they may have learned that the speaker produces particular phonemes differently and have adjusted their interpretation of those specific sounds accordingly. Alternatively, it has been argued that children may be simply expanding their notion of what is an acceptable pronunciation of a word. Proponents of the ‘general expansion’ account of accommodation argue that even exposing children to variability in a different domain (i.e., watching a non-verbal video of a diverse group of people) can help infants to better adapt to a novel accent. Thus instead of accommodation being specific, here, children are just more willing to accept greater variability in their pronunciations of words after having been exposed to some form of variation whether it’s linguistically relevant or not (Schmale, Seidl, & Cristia, 2015; see however Potter & Saffran, 2017 for evidence that not all exposure facilitates adaptation). Finally, it is also possible that similar to adults, children may be using some combination of these two
strategies to cope with accent variation (see Baese-Berk, Bradlow, & Wright, 2013; Cooper & Bradlow, 2016 for examples in adults). Children may rely on a phonologically specific strategy, in some situations and a less sophisticated generally expansion strategy in others. However, more work is needed to see if children are indeed using both strategies flexibly or if there are age-related changes in the types of strategies that children are using to adapt to novel accents.

Although there are marked improvements in children’s ability to cope with accented speech over the first two years of life, accented speech can still hinder comprehension in older children and adults (Bent, 2014; Nathan, Wells, & Donlan, 1998). In more demanding tasks, where children are asked to define the words they hear, 4- to 7-year-olds have difficulty comprehending the words produced by unfamiliar regional-accented speakers (Nathan et al., 1998). Similarly, even adult speech processing can be hindered, at least initially, by the presence of a foreign accent (see Cristia et al., 2012 for a review). As we will discuss in the next section, these difficulties in comprehensibility and processing may play an important role in shaping children’s social preferences.

4 Early childhood: the use of accent information to socially evaluate speakers

By the time children reach school age, they have become quite skilled in using accent information to socially evaluate others (Kinzler et al., 2007, 2009). By their fifth birthday, children have developed strong social preferences for people who speak their native language with the locally dominant accent (DeJesus, Hwang, Dautel, & Kinzler, 2017; Kinzler & DeJesus, 2013; Kinzler et al., 2007, 2009; Souza, Byers-Heinlein, & Poulin-Dubois, 2013). For example, American English speaking children will choose to be friends with other American-accented children over children that speak with a non-native (e.g., French) accent (Kinzler et al., 2007,
In addition to showing preferences for speakers that share a common linguistic background, children are also able to use accent-based categories to make fairly complex inferences about a speaker’s characteristics. For example, by 3- to 5-years of age, children can infer that two people that speak with the same regional accent are likely to live in the same geographic location (Weatherhead, White, & Friedman, 2016) and share similar cultural norms (i.e., live in the same style of house and wear similar clothing; Hirschfeld & Gelman, 1997; Wagner, Clopper, & Pate, 2014).

Children rely so heavily on accent information initially, that they can, in some cases, ignore other more relevant information about the speaker. For instance, one study found that 3-years-olds will choose to learn the names of novel objects from native speakers that labeled familiar objects incorrectly, over non-native speakers that labeled familiar objects correctly (Corriveau, Kinzler, & Harris, 2013). However, as they grow older, children may become less rigid in their use of (and/or re-rank the weighting of) accent information. By 4-years of age, children will choose to accept labels from non-native speakers who have been previously accurate, over native speakers who have been previously inaccurate (Corriveau et al., 2013). Although children begin to use accent information more flexibly as they age, biases against non-native speakers can be observed throughout the life span. Even adults evaluate non-native speakers as being less socially desirable, intelligent and trustworthy than native-accented speakers (Bresnahan, Ohashi, Nebashi, Liu, & Shearman, 2002; Fuertes, Gottdiener, Martin, Gilbert, & Giles, 2012; Fuertes, Potere, & Ramirez, 2002).

Over the last 10- to 15- years, research has examined the role that accents play in children’s speech processing and social behaviour. It has been established that children’s ability to tell apart and comprehend accented speech improves with age. Research has also
demonstrated that children develop strong social preferences for speakers who speak their native language with the locally dominant accent. Although the field has made substantial gains towards understanding how children with relatively homogeneous accent exposure learn to categorize, comprehend, and interpret accent information, very little is known about the accent processing abilities of children who are regularly exposed to other accents or variants of their native language.

5 The impact of exposure to linguistic diversity on speech processing and social behaviour

Thus far, I have described how children process and interpret accent information at various stages in their development. However, much of the research I have discussed so far has not considered how variation in children’s linguistic environment could influence their speech perception and social behaviour. Most of these studies do not even report details about the accent exposure of the participants in their methods section. However, we may be inaccurate in assuming that children growing up in linguistically diverse environments process accent information in the same way as children who have had more uniform input (see Henrich, Heine, & Norenzayan, 2010b; Nielsen et al., 2017 for a discussion). In fact, the little work that has been done with more diverse populations, especially bilingual children, indicates that exposure to linguistic diversity does influence aspects of speech processing and social behaviour (Souza et al., 2013; Werker & Byers-Heinlein, 2008). In the following section, I now turn to discuss the small but emerging literature on how children from diverse environments categorize, interpret and make social decisions based on accent information.

Children’s linguistic environment can be diverse in a number of ways. While some children may be exposed to more than one language (i.e. they have bilingual or multilingual
input), other children might hear other accents or variants of those languages (i.e., they have multi-accent input). Over the last 10 years, the field has made substantial gains in its understanding of how children’s language input impacts their development. Differences in the way monolingual and bilingual children process speech can be seen early on. For example, instead of showing preferences for just one language, bilingual infants show preferences for both their native languages from birth (Byers-Heinlein, Burns, & Werker, 2010). Although bilingual infants can differ systematically from monolingual infants in how they behave in laboratory language tasks (Byers-Heinlein, 2014), they seem to be just as able to tell apart native (L1) language samples as monolingual infants (Bosch & Sebastián-Gallés, 1997, 2001; Byers-Heinlein, 2014; Byers-Heinlein et al., 2010). In addition to examining how bilingual infants learn to parse their input by language, there is also a lot of work looking at the vocabulary development of children growing up in multilingual settings (see Werker & Byers-Heinlein, 2008 for a review). Research in this area suggests that bilingual infants acquire language at much the same rate as monolinguals and have a similar vocabulary size (combined across their two languages; Pearson, Fernández, & Oller, 1993). However, the strategies that bilingual children are using to learn words can differ (Byers-Heinlein, Chen, & Xu, 2014). Despite the interesting differences we see in the development of children hearing multiple languages, the field has only begun to investigate differences in the development of children who are exposed to different accents or variants of those languages. Indeed, there has been very little work looking at how bilingual development may differ depending on whether children are exposed to L1 or L2 speakers.

Although few studies have examined how children growing up in bi-accented or multi-accented homes process speech, there is some indication that exposure to accent variation could impact children’s accent categorization abilities. Indeed, adults who have had greater variability
in their accent exposure tend to be more skilled in telling apart and categorizing accents (Clopper & Pisoni, 2004). Although, the categorization abilities of children living in diverse communities has not been examined directly, some work has indicated that children who are exposed to more than one dialect of English at home may be better at accent categorization tasks than children from mono-dialectal homes (Floccia, Butler, Girard, & Goslin, 2009).

In addition to refining categorization abilities, there is small but growing body of evidence to suggest that regular exposure to accents could also alter children’s early word learning. For instance, 12- and 18-month-old children who are regularly exposed to accented caregivers do not show the same preferences to listen to familiar words over nonsense words (spoken in the local community accent), as children who have more homogeneous exposure (van Heugten & Johnson, 2017). Similarly, other work has found that 24-month-olds with greater accent exposure are slower to recognize familiar words in the community accent, however these differences seem to dissipate by the time the child reaches 34 months of age (Buckler, Oczak-Arsic, Siddiqui, & Johnson, 2017).

Although there is some indication that children with regular accent exposure may be processing speech differently, the details of how their processing abilities differ are not well understood. The impact of exposure might vary depending on the type of accent exposure the child is receiving (i.e., regional vs. non-native accents) as well as how uniform that exposure is. Some work has suggested that children may adapt to having variable input by developing less specified representations of words. Indeed, 20-month-olds who are exposed to multiple dialects seem to be less sensitive to mispronunciations than children exposed to a single dialect (Durrant, Delle Luche, Cattani, & Floccia, 2015). However, these differences dissipate by the time they reach their second birthday. In fact, other work has suggested that children who are exposed to
different (regional) dialects might actually store the phonological contrasts used in both dialects in memory and can flexibly switch between those two representations depending on the accent of the speaker (van der Feest & Johnson, 2016).

In addition to influencing speech processing, exposure may also play a role in shaping children’s social behaviour. The results from one study indicated that monolingual English-learning infants growing up in linguistically diverse communities were more likely to learn from Spanish speakers (and imitated their use of a novel object) compared to infants that lived in less diverse neighborhoods (Howard, Carrazza, & Woodward, 2014). Although no work has directly considered how growing up in a multi-accent community might influence children’s friendship preferences, work on intergroup contact in adults has suggested that greater contact with out-group members might lead to greater acceptance (Allport, 1954; Dovidio, Gaertner, & Kawakami, 2003; Pettigrew, 1997; Pettigrew & Tropp, 2006). This raises the possibility that children who have greater contact with accented out-group members may be less prejudiced against members of those groups. However, simply being exposed to some type of linguistic diversity does not seem to automatically lead to greater acceptance of all out-group members. Even though bilingual children are more accepting of speakers who speak one of their native languages (Byers-Heinlein, Behrend, Said, Girgis, & Poulin-Dubois, 2017), they still show strong biases against speakers who speak those languages with a foreign accent (DeJesus et al., 2017; Souza et al., 2013). This may suggest that the specific type of linguistic diversity that children are exposed to could play a greater role in children’s group preferences than simply being exposed to variation more generally (see Chapter 2 for a discussion).

Taken together, the few studies that have examined development in diverse populations of children underscore the importance of considering the linguistic communities that our
participants grow up in. The research discussed above provides clear evidence that the accent and language variation children are exposed to could influence the way that they process speech and make social decisions. From the adult literature, there is an indication that accent exposure refines our ability to categorize accents (Clopper & Pisoni, 2004) and in the childhood years exposure to accented speakers seems to modify toddlers’ representations of words (Buckler et al., 2017; Durrant et al., 2015; van der Feest & Johnson, 2016; van Heugten & Johnson, 2017). Given the differences we see in these populations, there is a real need to examine how well previous work (with relatively homogenous populations) generalizes to children with greater variation in their exposure.

6 The current thesis

In this thesis, I consider how exposure to linguistic diversity impacts aspects of children’s social behaviour and language development. Previous work has suggested that children (with relatively homogeneous exposure) show strong preferences for speakers that speak with the locally-dominant accent (Kinzel et al., 2007, 2009). In Chapter 2, I investigate how well those findings generalize to a population of children with greater diversity in their accent exposure. To do this, I examine the accent-based friendship preferences of a group of 5-year-olds growing up in the Greater Toronto Area. Also, I examine whether the strength of children’s preferences varies depending on the accent of the speaker (i.e., whether the out-group members speaks with a regional or a non-native accent) and the amount of exposure children have to accented speakers in everyday life.

In Chapter 3, I consider how accent exposure might affect infant’s early speech perception. More specifically, I examine the possibility that exposure to a non-native variants of
English might complicate infants’ initial ability to sort their input according to language. Previous work has suggested that (at least initially) infants rely quite heavily on rhythmic cues in order to be able to tell apart languages (Nazzi et al., 2000). However in multilingual settings, infants often encounter speakers who learned one or more of their languages later in life and may carry over the timing (or rhythm) from their native language (L1) in their second language (L2) (White & Mattys, 2007). In this study, I ask whether infants can tell when a single heavily-accented speaker switches between two rhythmically distinct languages? Or do infants have difficulty tracking which language this person is speaking?

Finally, in Chapter 4, I investigate how exposure to accented speakers might influence children’s speech productions. I examine whether children will spontaneously imitate the productions of model speakers that speak with the same accent as they do (i.e., Canadian-accented English) or a different accent (i.e., Australian or Chinese-accented English). Given work suggesting that children’s productions may be more malleable than adults (Nielsen, 2014), I also examine whether there are age differences in children and adult’s imitation of accented speakers.

Although classic work in developmental psychology has often failed to consider how children’s early linguistic environment impacts their speech perception and social behaviour, recent research strongly suggests that exposure to variation in accents and languages matters. Taken together, this thesis advances our understanding of children’s social and linguistic development by considering development in a broader array of environments. This work represents a novel approach to development, by examining how diverse populations of children use and interpret accent information in the speech signal.
Chapter 2
The impact of everyday accent exposure on children’s sociolinguistic evaluation of peers

1 Introduction

Language use is a salient cue to group identity (Fuertes et al., 2012). Upon hearing a single sentence spoken by a novel speaker both children and adults can identify speakers that ‘talk like them,’ that is, those that speak their native language with the same regional accent (Clopper & Pisoni, 2004; Girard, Floccia, & Goslin, 2008). Adults tend to perceive individuals that share a common linguistic background (termed ‘in-group’ members) as being more socially desirable, intelligent, and trustworthy than individuals that speak with a foreign accent (e.g., Bresnahan et al., 2002; Cargile & Giles, 1997; Fuertes et al., 2012; Gluszek & Dovidio, 2010; Lindemann, 2003, 2005). Although these biases are well studied in adults, very little is known about where these biases come from and when they appear in development.

Research has shown that children as young as 5 years of age prefer to be friends with peers that ‘speak like them,’ indicating that these sociolinguistic biases likely emerge early in development (Kinzler et al., 2007, 2009). However, developmental studies examining sociolinguistic biases in children are limited in number, and typically collapse across any individual variation in the populations they test. This not only leads to questions about the generalizability of these findings, but also leaves many questions unexplored regarding how environmental factors might modulate children’s friendship preferences (an area that has been studied much more extensively in the adult literature; see Pettigrew & Tropp, 2006 for a review). In the current study, we take a different approach to address these issues by examining the
accent-based friendship preferences of children growing up in a linguistically diverse community.

The developmental precursors of accent-based social preferences are thought to have their roots in early infancy. By 5 months of age, infants can perceptually distinguish their own regional accent from other variants of their native language (Butler et al., 2011; Nazzi et al., 2000; see however Paquette-Smith & Johnson, 2015). By the time infants are 6 months of age, they will direct their attention towards linguistic in-group members that speak their native language with a familiar accent over out-group members that speak with an unfamiliar accent (Kinzler et al., 2007). These early attentional biases for in-group members of the same racial or linguistic group appear to be driven by familiarity (Anzures et al., 2012, 2013; Bar-Haim, Ziv, Lamy, & Hodes, 2006; Kelly et al., 2008). For example, infants growing up in Australia that are regularly exposed to Australian and American English (through the media) show preferences for both Australian and American-accented English (Kitamura et al., 2013). Thus, infants who are exposed to multiple accents in their input may initially show preferences for accents that are familiar, though not dominant, in their region.

Although infants will direct their attention towards people who speak their native language with a familiar accent, a listening preference does not necessarily indicate a social preference (see Haith, 1998 for a discussion). It is not until the preschool years that we see clear evidence of accent-based friendship preferences (Kinzler et al., 2007, 2009; Souza et al., 2013). A number of studies have examined the friendship preferences of children with relatively homogeneous accent exposure. In these studies, monolingual American-English speaking 5-year-olds are typically presented with two images of peers on a screen, one peer speaks English with a native (e.g., American) accent and the other peer speaks English with a non-native (e.g., French)
accent. When asked ‘who they would like to be friends with’, monolingual American-English speaking children reliably chose to be friends with other American-accented children over children that spoke English with a foreign French accent (Kinzler et al., 2007, 2009). These accent-based group preferences are so robust that accent can even take precedence over racial cues to group membership (Kinzler et al., 2009). Although there is strong evidence that children make social decisions based on accent information, the factors that drive the development of these preferences are not well understood. Why do American children prefer to be friends with other American-accented children over children who speak with a French accent? Is it because American children are less familiar with French accents? Or do they have greater difficulty understanding French-accented English? Or is it because the non-native-accented children are less fluent and native speakers are biased against this disfluency?

Much of what we know about the factors that influence group formation is based on work with adults. For example, we know that variability in the amount of exposure that adults have to out-group members can impact the strength of their in-group biases (Pettigrew & Tropp, 2006). According to the Intergroup Contact Theory (Allport, 1954), adults that have greater contact with out-group members, such as individuals that belong to a different racial, linguistic, or social groups, actually show less bias against members of those groups. These effects are so robust that simply facilitating friendships between individuals from different racial groups in a laboratory setting can lead participants to report a more positive view of racial out-group members (Page-Gould, Mendoza-Denton, & Tropp, 2008; also see Aboud, Mendelson, & Purdy, 2003; Crystal, Killen, & Ruck, 2008; Rutland, Cameron, Bennett, & Ferrell, 2005 for a discussion of intergroup contact effects in children). However, it should be noted that the nature of the contact matters. The positive effects of contact are most often seen when the cross-group interaction is meaningful (i.e., in the context of a friendship) and sustained over a longer period of time. In
fact, brief unstructured cross-race interactions can actually have the opposite effect, leading to greater anxiety and physiological arousal (see MacInnis & Page-Gould, 2015 for a review).

Although the effect of intergroup contact has been tested quite extensively in adults (especially in relation to racial biases; Pettigrew, 1997; Pettigrew & Tropp, 2006) there is much less work examining the factors that amplify and attenuate accent-based group preferences in the childhood years. This is a particularly important issue to address from a developmental perspective because like other biases, biases against accented out-group members are thought to develop early and become more entrenched and less malleable with age (Abrams & Killen, 2014).

Although it was not specifically designed to explain accent-based preferences, the Developmental Intergroup Theory (DIT) provides a useful framework to outline the potential mechanisms that generally contribute to the development of biases (Bigler & Liben, 2007). According to the model, environmental and cognitive factors influence three key processes that lead to group bias. In the first process, children “establish the psychological salience of person attributes.” To do this, children use input from their environment to establish which dimensions they can use to meaningfully group people. Children’s selection of dimensions is driven by the perceptual salience of the groups, as well as how important the dimension is in a given context. In the second process, children categorize the individuals they encounter based on the psychologically salient dimensions they have identified. The categorization of others depends on the child’s individual cognitive skill in grouping others as well as their experience with individuals from those groups (i.e., the number of exemplars they have encountered). Finally, in the last process children develop stereotypes and prejudices about the group members they have
identified. Here internal biases as well as exposure to external stereotypes work together to shape the nature of children’s group biases.

There are a number of studies that have empirically tested aspects of the DIT model. For example, the role of environmental factors, such as the size and salience of groups, has been examined using experimental designs in which children are randomly assigned to belong to one of two artificially created groups (e.g., blue shirts vs. yellow shirts; see Bigler & Liben, 2007 for a review). Children are more likely to show biases in situations where the groups are visually marked (i.e., by colored shirts) and adults explicitly label the groups (Bigler, Brown, & Markell, 2001). The proportional size of the groups also makes a difference, with children showing greater prejudice towards minority rather than majority groups (Brown & Bigler, 2002). From these studies, we can conclude that the perceptual salience of the groups and their size influence the formation of group biases. Although environmental factors (like group size and salience) clearly impact group formation, there is very little work examining how fluid aspects of group dynamics, like intergroup contact, influence children’s social preferences.

Previous work has often controlled for children’s prior experiences by randomly assigning them to novel social groups (i.e., blue shirts vs. yellow shirts). However, in the real world there can be substantial variability in the amount of everyday contact that children have with out-group members. One might predict that contact with linguistic out-group members, in particular, could have a substantial impact on the strength of children’s accent-based group preferences. However, developmental studies of friendship preferences typically do not capitalize on this naturally existing variation, rather, most studies have minimized the impact of this variation by examining the language-based friendship preferences of relatively homogenous populations of children (e.g., English-speaking Caucasian children in upper-middle-class
neighborhoods in the United States). Although these studies have allowed us to identify the importance of early language experience on the development of group preferences, the populations tested are not well-suited to examine the impact that intergroup contact has on the strength and malleability of these biases.

The goal of the current study is to examine the formation of accent-based peer preferences in 5- and 6-year-old children growing up in a linguistically diverse community - the Greater Toronto Area (GTA). The GTA is heralded as being one of the most culturally and linguistically diverse regions in the world. There are over 140 different languages and dialects spoken in Toronto and over half of the population was born outside of Canada (Statistics Canada, 2011). Thus, although the amount and type of accent exposure can vary greatly between children, on average children living in the GTA routinely experience greater accent diversity than children visiting university labs in other major North American cities. By testing children in the GTA, with greater average accent exposure, as well as by looking at how individual differences in accent exposure affect children’s friendship preferences, we can begin to examine the impact that accent exposure (both amount and type) have on the development of children’s peer preferences.

Based on previous work, it is difficult to make predictions about the precise impact exposure might have on children’s preferences, as accent exposure may simultaneously influence multiple aspects of group formation. According to the intergroup contact literature, having frequent, positive contact with out-group members might promote familiarity and increase social liking. However, frequent contact with out-group members may also refine children’s ability to identify and categorize accents. Indeed, there is evidence that adults who lived in three or more US states before the age of 19 are more skilled in identifying and categorizing American accents,
than adults who lived in a single state their entire life (Clopper & Pisoni, 2004). Thus it is possible that exposure may fine-tune children’s ability to identify members of their own group, which may lead to greater biases against out-group members. Given that exposure can simultaneously impact multiple aspects of decision making, it is possible that we could also observe a weak (or non-existent) impact of exposure in situations where these effects work in opposite directions.

In the current study, we capitalize on real-word variation in everyday accent exposure to test the hypothesis that accent exposure modulates children’s behavior in a friend selection task. In Experiments 1 and 2, children were asked to choose between familiar (Canadian) and unfamiliar (British or Korean) accented peers. Here we predict that children’s group preferences will be influenced by the amount of exposure they have to out-group members. That is, we predict that children with greater diversity in their everyday language input will behave differently in the friend selection task than children with less exposure to diversity. In Experiment 3, we explore the possibility that children’s ability to discriminate (or tell apart) accents from their own variant of English may have influenced their performance in Experiments 1 and 2.

2 Experiment 1

The goal of Experiment 1 is twofold. First, using a friendship selection task, we examine whether accent-based group preferences generalize to children living in a multi-accent community. In other words, do children with everyday exposure to accents demonstrate the strong accent-based in-group preferences seen in previous work? Or does exposure promote greater acceptance, and thus lead children to show weaker preferences for same-accented peers?
Second, we examine the possibility that real world variation in exposure to accents might modulate the strength and direction of these preferences.

To test this, 5-year-olds living in the GTA were asked to choose between British and Canadian-accented peers to be friends with. Since children in the GTA vary greatly in their exposure to accent variability, participants were grouped based on the amount of exposure (low, medium, high) they had to other variants of English (both non-native and regional). If growing up in a linguistically and culturally diverse community dampens children's bias against other-accented peers, then we may see little or no preference for Canadian over British English speaking peers in our sample. In addition, if the amount of exposure children have to out-group members in everyday life influences the strength of their group preferences, then children with lower exposure may behave differently in this friendship selection task than children with higher levels of exposure.

2.1 Method

2.1.1 Participants

Forty monolingual Canadian English speaking 5 and 6-year-olds (Mage = 68.73 months; range 60.20 - 71.70 months; 18 males, 22 females) from the GTA participated. Participants spoke English at least 90% of the time and had no history of diagnosed hearing or language impairments. Four additional children were excluded from the analysis, two because they had a strong side bias (i.e., they picked the child on the same side of the screen on all 8 trials) and two because there was not enough information provided for us to confidently classify them into one of the three accent groups.

2.1.2 Stimuli
The voices of eight elementary school children between the ages of 5 and 9 were recorded for use in this study. Four of the children (2 males and 2 females) grew up in the GTA and spoke with a Canadian accent. The other four children (2 males and 2 females) grew up in the South of England, and spoke Southern British English. Each child was recorded reciting eight semantically neutral sentences that were ten syllables in length (e.g., “Hands have five fingers and feet have five toes”). Sentences were modeled after the phrases used in Kinzler et al., 2009 (see Appendix A for the complete set of stimuli). Children were instructed to repeat each sentence after their parent until they were able to say it in a single, fluent utterance. Using Praat (Boersma & Weenink, 2011) the sentences were spliced into pairs and background noise was equalized across the stimuli set.

The visual stimuli consisted of 16 images of children. The images were matched based on gender and visual similarity. The image pairs were positioned side-by-side on a white background.

The auditory and visual stimuli were combined to create a total of 32 animated trials. In each trial, the image of one child was paired with the voice of a Canadian-accented speaker and the other image was paired with the voice of a British-accented speaker. At the beginning of the trial, the left image was highlighted by a green box and zoomed in and out while the participant heard a pair of sentences spoken by the first speaker. Once the passage finished, the right image was highlighted by a green box and zoomed in and out while the same pair of sentences was spoken by the second speaker. Note that the images and voices were always matched in gender, thus in each trial there were either two male speakers/images, or two female speakers/images.

2.1.3 Design
The experimental design was modeled after the friendship selection task used in Kinzler et al. (2007, 2009). The study design and experimental methodology were approved by the University of Toronto Research Ethics Board (Protocol # 31283, “The development of social evaluation abilities in children”). Children were randomly assigned to participate in one of four counterbalanced orders. Each order consisted of 8 trials and in each trial the child participant was asked to select whether they wanted to be friends with the Canadian or the British-accented child. Over the course of the experiment, each participant listened to all 8 voices (4 Canadian; 4 British) twice. However, each time a voice was heard it was accompanied by a different image and spoke different sentences. To eliminate any side biases, the British- and Canadian-accented children appeared an equal amount of times on the left and right sides of the screen. The order of the trials and the image that each speaker was paired with was counterbalanced across the 4 orders.

2.1.4 Procedure

Each child participant was presented with images of two peers on a screen (see Figure 1). One image in each pair spoke with a Canadian accent and the other with a British accent. To ensure that the experimenter or the parent could not bias the child’s responses, all auditory stimuli were presented to the child via headphones connected to the computer. At the start of each trial the experimenter said, “Here are two kids – let’s hear what they sound like.” Then the participant heard the voice of the child on the left side of the screen, followed by the voice of the child on the right side of the screen. While the voices played, a green box highlighted the image of the child who was speaking. The child participant could only listen to each voice once. After both voices had played, the experimenter asked the child, “Which one do you want to be friends with?” and the child was instructed to place a magnetic star above their choice. Once the child
had placed the star, the experimenter removed it and proceeded to the next trial. The entire procedure was videotaped for offline coding of the participant’s selections.

After the study, the experimenter completed a detailed language questionnaire (see Appendix B) with the parent that asked about the child’s exposure to different accents and variants of English. Based on the amount of exposure the child had to other accents or variants of English, children were classified into one of three groups. Children who had minimal daily accent exposure (i.e., the child did not interact with anyone that spoke with a non-Canadian accent on a weekly basis) were classified as ‘Low Exposure’. Children who had substantial lifetime exposure to accents on a daily basis (i.e., children who live with someone that speaks with a non-Canadian accent or have had consistent 40-hour/week contact with an accented speaker for at least 4 years of their life) were classified as ‘High Exposure’. Finally, children whose accent exposure fell somewhere in-between the other two groups were classified as having ‘Medium Exposure’. These children were not exposed to accents in the home, but parents reported that they had some routine contact with accented members of the community (i.e., daycare providers, school teachers, family members, or friends).
2.2 Results and Discussion

In each of the 8 trials, children selected between a Canadian and a British-accented speaker. Canadian selections were coded as 1 and British selections were coded as 0. An intercept-only logistic mixed effects model was implemented using the lme4 package in R 3.2.2 (Bates et al., 2015; R Development Core Team) to compare children’s selections to chance (.5). In line with previous work, 5-year-olds were more likely to choose to be friends with peers that spoke with the community accent (i.e., Canadian English) over peers that spoke with a different accent (i.e., British-accented English), $b = .39, SE = 0.14, z = 2.70, p = .007$. This demonstrates that even children with substantial variability in their accent exposure still show strong accent-

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1 For 2 out of the 32 trials the incorrect Canadian speaker was played. Although the trials were still a decision between a Canadian and a British speaker these two trials were removed from the analysis. If these trials are included the analysis looks the same, $b = 0.40, SE = 0.14, z = 2.85, p = 0.004$. 

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based in-group preferences. Moreover, these group-preferences were observed even though out-group members in this experiment spoke with a regional, opposed to a non-native, accent (see for Kinzler & DeJesus, 2013 for evidence that not all 5- to 6-year-olds show preferences for their regional accent).

To test our second prediction (i.e., that the strength of children’s preferences will be influenced by the amount of daily accent exposure), participants were divided into three groups (Low, Medium, High; see Procedure section for a detailed description of how children were grouped). Given that the sample was from the linguistically diverse GTA, very few children were classified as having ‘Low Exposure’ (7/40, 17.50%). As was expected, the majority of the children were classified as having ‘Medium Exposure’ (20/40; 50.00%) or ‘High Exposure’ (13/40, 32.50%). A logistic mixed effects regression model with accent group as a fixed effect and a random intercept per subject was implemented using the lme4 package in R (see Table 1). As accent group is an ordered categorical variable (i.e., low to high), we used reverse Helmert coding to investigate whether children with higher levels of exposure were more accepting than those with lower levels of exposure. Surprisingly, there was no relationship between accent exposure and the strength of children’s selections. Children with high exposure did not differ from those with low and medium exposure, $b = -0.12, SE = 0.32, z = -0.39, p = .697$ and children with medium exposure did not differ from those with low exposure, $b = 0.22, SE = 0.40, z = 0.55, p = .583$ (see Figure 2).
Table 1. LME model predicting children’s selections of the Canadian over the British-accented peers in Experiment 1. The model included Accent exposure group as a fixed effect and a random intercept per subject.

<table>
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<tr>
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<th>b</th>
<th>SE</th>
<th>z</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>0.35</td>
<td>0.16</td>
<td>2.256</td>
<td>0.02</td>
</tr>
<tr>
<td>Accent Exposure</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Low: Medium</td>
<td>0.22</td>
<td>0.40</td>
<td>0.55</td>
<td>0.583</td>
</tr>
<tr>
<td>Low + Medium: High</td>
<td>-0.12</td>
<td>0.32</td>
<td>-0.39</td>
<td>0.697</td>
</tr>
</tbody>
</table>

Figure 2. The average proportion of times 5-year-old Canadian-English learning children selected the Canadian-accented speaker over the British-accented speaker (in Experiment 1) by accent exposure (N = 40). Given the diversity in the population in the GTA very few children (n = 7) were classified as having low exposure. Most of the sample had either medium (n = 20) or high (n = 13) exposure.

Since we did not find evidence that the amount of accent exposure predicted preferences, a second logistic model was used to examine whether exposure to the specific accent in the study (British-English) influenced children’s preferences. About a quarter of the children (9/40, 22.50%) were reported to have at least occasional contact with someone that spoke with a British
accent. Although many of the children had some exposure to British accents through television (popular children’s TV shows include Thomas the Tank Engine and Peppa Pig), for the purposes of this analysis we only included children who had exposure to British people in real life. Here, we found that children who had at least occasional contact with a British-accented speaker (for example, children that see their British grandparents a couple times a year) ($M = .72, SD = .20$) were more likely to select the Canadian speaker than children with no British exposure ($M = .56, SD = .20$), $b = 0.77, SE = 0.35, z = 2.23, p = .026$. Thus, although we found no evidence that the amount of general accent exposure influenced children’s preferences, specific live exposure to British accents did. Interestingly, however, children who had British exposure were not more accepting of British peers, instead, they showed even stronger preferences for the Canadian-accented peers. We return to this point in the General Discussion.

Even though Canadian children showed social preferences for Canadian over British-accented children, the group preferences observed in this study were not as robust as the preferences seen in previous work. On average, Canadian children selected in-group members 59.33% of the time, whereas in Kinzler et al. (2009) American children selected American-accented peers almost 80% of the time. Similarly, if we compare effect sizes, our effect size is smaller ($d = .44$) than the effect size reported in previous work (e.g., Kinzler et al., 2009, $d = 1.47$).

Why might this be? Why was the preference we observed so much weaker than the preferences observed in earlier studies? There are a few plausible explanations. It may be the

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2 Note in order to compare effect sizes to previous work, instead of using a logistic mixed effects regression (which takes into account multiple trials per subject), we replicated the analysis used in previous work and compared children’s mean performance to chance using a one sample t-test, $M = .59, t(39) = 2.79, p = .008, d = 0.44$. 
case that having routine exposure to other accents or dialects of English may have led children living in the GTA to show weaker in-group preferences. In other words, although the amount of exposure (low, medium, high) did not predict acceptance, the results of the study as a whole may support the notion that simply living in a diverse, multi-accent community might breed acceptance. The second possibility is that the attenuated group preferences seen in Experiment 1 are driven by the fact that the out-group members in our study spoke with regional (British) accents, whereas the out-group members in previous work spoke with non-native (French) accents (Kinzler et al., 2009). Although no studies have directly compared regional and non-native accents, our findings align with work demonstrating that children’s preferences for regional accented speakers might be less robust (see Kinzler & DeJesus, 2013). There are a few reasons why children may evaluate regional and non-native-accented speakers differently. For example, foreign accents (i.e., French-accented English) tend to be more perceptible than regional accents (i.e., British or Australian; Floccia et al, 2009; Girard et al., 2008) and there can be differences in the fluency and comprehensibility of non-native compared to regional-accented speech (Bent, 2014).

In Experiment 2, we begin to address these issues by examining whether children growing up in the linguistically-diverse GTA will show a stronger bias against other-accented peers, when the other accent is a non-native (Korean) accent rather than a native (British) accent.

3 Experiment 2

In Experiment 1 we demonstrated that accent-based in-group preferences generalize to populations of children with greater diversity in their accent exposure. That is, children growing up in the GTA, a diverse multi-accent community, still demonstrate a reliable preference for peers that speak the locally dominant variant of English. Interestingly, however, the accent-based
in-group preferences seen in our sample were not as strong as the preferences seen in previous work (i.e., Kinzler et al., 2007, 2009). Here we consider two possible explanations for this. On the one hand, it may be that our sample showed weaker in-group preferences because they had more frequent exposure to accented speakers in everyday life (which fits with the predictions of the intergroup contact theory). On the other hand, it may be that children evaluate regional and non-native accents differently (e.g., due to potential differences in the salience of the accent, the fluency of the speaker, and/or the social stigma associated with the accent). In Experiment 2, we begin to tease apart these two alternative explanations by testing children’s preferences for Canadian versus non-native (Korean-accented English) peers. If having greater exposure to accented speakers leads children to be more accepting, then, as in Experiment 1, children should show weak in-group preferences for the Canadian over the Korean-accented out-group members. However, if children evaluate native (British English) and non-native (Korean English) accents differently, then we should replicate the strong in-group preferences seen in previous work (i.e., Kinzler et al., 2009).

3.1 Method

3.1.1 Participants

Thirty-two Canadian English speaking 5 and 6-year-olds \(M_{\text{age}} = 71.17 \text{ months}; \text{ range } 60.70 – 83.60 \text{ months; } 15 \text{ males, } 17 \text{ females} \) from the GTA participated in the experiment. As in Experiment 1, all children spoke English at least 90% of the time and had no history of diagnosed hearing or language impairments.
3.1.2 Stimuli, Design and Procedure

The stimuli, design and procedure were identical to Experiment 1 except that the voices of the British-accented children were replaced with Korean-accented children (2 males and 2 females) between the ages of 5 and 9.

3.2 Results and Discussion

As in Experiment 1, a logistic mixed effects regression model (LMER) with a random intercept per subject was used to compare children’s selections to chance (.5). Here children strongly chose to be friends with the Canadian over the Korean-accented peers, \( b = 2.53, SE = 0.41, z = 6.14, p < .001 \). Importantly, children’s preference for Canadian-accented in-group members in Experiment 2 was much stronger than it was in Experiment 1, \( b = 1.78, SE = 0.30, z = 5.89, p < .001 \) (see Figure 3). That is, children showed a stronger preference for the Canadian-accented in-group members when the out-group member was Korean-accented compared to when the out-group member was British-accented\(^4\).

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\(^3\) Selections in experiments 1 and 2 were compared using a logistic mixed effects regression model. Experiment (1 vs. 2) was simple coded and entered as a fixed effect. We also included a random intercept per subject.

\(^4\) At the end of the experiment, children were asked to indicate which language they thought the out-group members spoke. Majority of children (22/30, 73.33%) said they did not know or they thought that the out-group members spoke French.
Figure 3. The average proportion of times 5-year-old Canadian-English learning children selected the Canadian-accented speaker over the British-accented speaker (in Experiment 1) and the Canadian-accented speaker over the Korean-accented speaker (in Experiment 2).

As in Experiment 1, a logistic mixed effects regression model was conducted to examine the impact of daily accent exposure (low, medium, high) on children’s group preferences (See Table 2). In this sample, 4/32 (12.50%) children were classified as having ‘Low Exposure’, 19/32 (59.38%) were classified as having ‘Medium Exposure’ and 9/32 (28.13%) were classified as having ‘High Exposure’ (see Figure 4). Our results suggest that children with high exposure were less likely to select the Canadian-accented in-group members than children with low and medium exposure, $b = -1.77, SE = 0.78, z = -2.26, p = .024$. The effect of exposure seems to be limited to those with high exposure, as there were no differences between children with medium and low exposure, $b = -1.16, SE = 1.24, z = -0.94, p = .349$. These findings are consistent with the notion that long-term meaningful exposure to out-group members may lead to greater
acceptance (see MacInnis & Page-Gould, 2015; Pettigrew & Tropp, 2006 for a discussion).

Children with substantial everyday exposure to accented speakers were more likely to select accented out-group members as friends than children who had less exposure.

Table 2. LME model predicting children’s selections of the Canadian over the Korean-accented peers in Experiment 2. The model included Accent exposure group as a fixed effect and a random intercept per subject.

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>SE</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>2.69</td>
<td>0.49</td>
<td>5.44</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Accent Exposure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low: Medium</td>
<td>-1.16</td>
<td>1.24</td>
<td>-0.94</td>
<td>0.349</td>
</tr>
<tr>
<td>Low + Medium: High</td>
<td>-1.77</td>
<td>0.78</td>
<td>-2.26</td>
<td>0.024</td>
</tr>
</tbody>
</table>

In Experiment 1, we found that children with specific exposure to British accents showed stronger in-group preferences. Ideally, we would have carried out an analogous analysis in the current study – asking whether specific exposure to Korean-accented speakers changed children’s peer selection behavior. However, in our sample, only 3 children had exposure to Korean-accented English in real life. Given the small sample, we could not analyze whether there were differences in the social preferences of those who had specific Korean-accent exposure and those that did not. However, we can speculate that given the overwhelming preference for Canadian-accented in-group members, specific Korean exposure may not be needed to reinforce children’s preferences for native (Canadian) vs. non-native-accented speakers.
Figure 4. The average proportion of times 5-year-old Canadian-English learning children selected the Canadian-accented speaker over the Korean-accented speaker (in Experiment 2) by accent exposure.

As a group, children in this experiment strongly selected the Canadian over the Korean-accented peers ($M = .88, SD = 0.16$). The effect size in this experiment was quite large ($d = 2.32$), even larger than the effect sizes seen in previous work (Kinzler et al., 2009, $d = 1.47$). Thus, the more plausible explanation for the small effect size seen in Experiment 1 may be that out-group members spoke with a regional instead of a non-native accent. But why did children in the GTA evaluate non-native accented speakers more harshly than they evaluated native-accented speakers? It is possible that children were sensitive to differences in the fluency and comprehensibility of the speakers. Or perhaps, given the close connection between Canada and

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5 In order to compare our findings to previous work, a t-test was conducted comparing the group mean to chance, $M = 0.88, t(31) = 13.12, p < .001, d = 2.32$. 
the UK (e.g., new immigrants to Canada are still asked to pledge allegiance to the Queen of England) children living in the GTA may have perceived the regional British accents (in particular) as being more socially prestigious than the non-native Korean accents. Or maybe, children simply had greater difficulty distinguishing the regional accents from their own variant of English. Indeed, in Experiment 1, children with occasional British exposure showed stronger in-group preferences, a finding that is consistent with the notion that occasional contact may refine children’s ability to distinguish British and Canadian accents. In our third and final experiment we explore this possibility by investigating whether there are differences in the discriminability of the specific accent stimuli used in Experiments 1 and 2.

Although it is possible to have a subtle non-native accent that is much less noticeable than a strong regional accent, distinct non-native accents (e.g., French-accented English spoken by a late learner of English or relatively novice child learner) are thought to be more perceptible than regional accents (e.g., British or Australian) (Floccia et al., 2009; Girard et al., 2008). Moreover, listeners can also differ in their individual ability to tell apart accents. Individuals who have experience encountering multiple exemplars of group members may be better able to categorize people into those groups (Clopper & Pisoni, 2004). It is possible that children from the GTA may, in general, be better at telling apart subtle differences in accents than children growing up in less diverse environments. In order to begin to investigate the underlying mechanisms that contribute to these preferences, in Experiment 3 we examine whether there are differences in children’s ability to discriminate the regional and non-native-accented stimuli used in Experiments 1 and 2.
4 Experiment 3

Taken together, Experiments 1 and 2 present clear evidence that Canadian English learning children from the GTA evaluated the non-native Korean-accented speakers in Experiment 2 differently than native British-accented speakers in Experiment 1. There are many reasons why children could have evaluated regional (British) and non-native (Korean) accented speakers differently. In Experiment 3, we explore the possibility that these differences may be at least partially driven by differences in the perceptual discriminability of the accents. To do this, we test Canadian children’s ability to distinguish between the British, Canadian and Korean-accented stimuli used in the first two experiments. We predict that, as in previous work, children will be better able to tell apart non-native accents from their own (Canadian) variant of English than other regional (British) accents. Additionally, children with greater daily exposure to accents may be more skilled at telling apart accents than children with less variation in their input.

4.1 Method

4.1.1 Participants

Twenty Canadian English speaking 5- and 6-year-olds (M_{age} = 69.34 months; range 61.40 – 72.1 months; 13 males, 7 females) from the GTA participated in the experiment. All children spoke English 90% of the time and had no history of diagnosed hearing or language impairments. Two children were excluded from this analysis due to failure to follow instructions.

4.1.2 Stimuli

The Canadian, British and Korean-accented stimuli from Experiments 1 & 2 were used as the auditory stimuli in Experiment 3. The visual stimuli consisted of two identical male or female silhouettes positioned side-by-side on a white background. When the participant touched an
image they would hear a child’s voice. While the passage was playing the image was highlighted with a green box. Similar to Experiments 1 & 2, the two voices were always matched in gender, thus in each trial there would be either two male speakers/images, or two female speakers/images.

4.1.3 Design

Each child was randomly assigned to participate in one of two counterbalanced orders of the experiment. Each order consisted of twelve trials, on each trial the child selected between a Canadian and a Korean-accented child, a Canadian and a British-accented child, or a British and a Korean-accented child. Within one order of the experiment, the British, Canadian and Korean-accented children appeared an equal amount of times on the left and right sides of the screen.

4.1.4 Procedure

The experiment was run using a touch-screen monitor. In each trial, the child was presented with two silhouettes (see Figure 5). They were instructed to tap the left image to hear the first voice. After the passage had completed, they were instructed to tap the right image to hear the second voice. The child could only listen to each voice once. All auditory stimuli were presented to the child via headphones, to ensure that the experimenter and the parent present in the room could not bias the child’s responses. After both voices had played, the experimenter asked the child “Who talks like you? Like they grew up here?” The child was instructed to drag their selection into the green box in the center of the screen and click next to continue. At the end of the study, the experimenter completed a detailed language questionnaire with the parent (see Appendix B).
Figure 5. Child participating in Experiment 3. In each of the 12 trials the child listened to pairs of speakers from Experiments 1 and 2 (i.e., the Canadian-accented, British-accented and Korean-accented speakers). After listening to both speakers the child was asked to drag the silhouette that talks like them into the green box in the center of the screen. After the child selected a silhouette the next trial was presented.

4.2 Results and Discussion

For each of the 12 trials children’s responses were scored as 1 (correct) or 0 (incorrect). In the ‘Canadian vs. British’ and ‘Canadian vs. Korean’ accent pairings, selecting the Canadian speaker was scored as a correct response. In the ‘British vs. Korean’ accent pair, although neither speaker truly “talks like them,” selecting the British speaker was denoted as a correct response based on the assumption that a regional accent would be perceived as more similar to Canadian English than a non-native accent. Overall, children were quite skilled in identifying which accent sounded “most” like them, demonstrating above chance performance for all three comparisons, $p < .009$ (see Figure 6). Children correctly selected the Canadian-accented speaker 85.00% ($SD = 22.06$) of the time when paired with the Korean speaker, and the British-accented speakers 81.25% ($SD = 19.66$) of the time when they were paired with the Korean-accented speakers. The
most difficult comparison was the Canadian vs. the British-accented speakers. Although children’s performance was still above chance, they only identified that the Canadian speakers sounded more like them 66.25% (SD = 26.00) of the time.

A logistic mixed effects regression model was used to investigate the impact of Trial Type (i.e., Canadian vs. British, Canadian vs. Korean and British vs. Korean) and daily Accent Exposure (high, medium, low) on children’s categorization abilities (see Table 3). Trial Type was simple coded to compare children’s performance on the Canadian vs. Korean and British vs. Korean conditions to the Canadian vs. British condition (treated as the Baseline). As in Experiments 1 and 2, Accent Exposure was reverse Helmert coded and a random intercept was included for subjects. The results suggested that there was no effect of Accent Exposure (all $z < 0.62, p > .538$). However, there was a significant effect of Trial Type, with children performing better on the British vs. Korean trials compared to the Canadian vs. British trials, $b = 0.91, SE = 0.40, z = 2.30, p = 0.022$ and the Canadian vs. Korean trials compared to the Canadian vs. British trials, $b = 1.21, SE = 0.42, z = 2.90, p = 0.004$. Since children that had at least occasional British Exposure (e.g., children who saw their British grandparents a couple times a year) were more likely to select Canadian over British peers in Experiment 1, we examined the impact of British exposure here too. In this sample, we find that the 7/20 (35.0%) of children who had at least occasional live contact with someone who speaks with a British accent showed a trend towards performing better on the Canadian vs. British trials than children with no British exposure, $b = 0.92, SE = 0.56, z = 1.65, p = 0.10$. Although based on a fairly small sample, these findings are in line with the idea that exposure may improve children’s categorization abilities.\(^6\)

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\(^6\) Similar to Experiment 2, very few (n = 1) children had exposure to Korean accents in real life. Thus we were unable to examine whether Korean-accent exposure improved categorization abilities.
Table 3. LME model predicting children’s categorization abilities in Experiment 3. The model included Trial Type and daily Accent Exposure group as fixed effects and a random intercept per subject.

<table>
<thead>
<tr>
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<th>b</th>
<th>SE</th>
<th>z</th>
<th>p</th>
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<tbody>
<tr>
<td>(Intercept)</td>
<td>1.49</td>
<td>0.30</td>
<td>4.951</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Trial Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>British vs Korean</td>
<td>0.91</td>
<td>0.40</td>
<td>2.30</td>
<td>0.022</td>
</tr>
<tr>
<td>Korean vs Canadian</td>
<td>1.21</td>
<td>0.42</td>
<td>2.90</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>Accent Exposure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low: Medium</td>
<td>0.39</td>
<td>0.63</td>
<td>0.62</td>
<td>0.538</td>
</tr>
<tr>
<td>Low + Medium: High</td>
<td>0.35</td>
<td>0.68</td>
<td>0.52</td>
<td>0.605</td>
</tr>
</tbody>
</table>

Figure 6. In Experiment 3 children were asked to select which speaker “talks like you, like they grew up here?”. The figure illustrates the average proportion of times Canadian children selected the Canadian-accented speakers as sounding ‘more like them’ than the British-accented speakers,
the British-accented speakers as sounding ‘more like them’ than the Korean-accented speakers and the Canadian-accented speakers as sounding ‘more like them’ than the Korean-accented.

Taken together, the results of Experiment 3 suggest that the perceptual salience of the accent group may play a role in children’s evaluation of accented speakers. Children had the greatest difficulty distinguishing British-accented English from their own Canadian variant of English. This suggests that the strong social preferences for native over non-native speakers in Experiment 2 may be at least in part driven by the perceptual distinctiveness of Canadian and Korean-accented English.

Contrary to our predictions, our three-way classification analysis did not provide any evidence that children with higher levels of exposure to accents are better at telling apart the accents used in this study. Nonetheless, similar to Experiment 1, there was some indication that children who had specific exposure to British English were better able to distinguish Canadian from British accents. Taken together with Experiment 1, these findings align nicely with adult work suggesting that specific exposure may have a greater impact on categorization abilities than general exposure (Clopper & Pisoni, 2004).

Although we did not see an effect of the amount of accent exposure (low, medium, high) on children’s ability to tell apart accents, these findings still leave open the possibility that having everyday exposure to accents might have generally improved children’s performance on this task. Indeed, the 5 to 6-year-olds in our sample (75% of which had either medium or high exposure), seemed to perform better than the 5- to 6-year-olds tested in previous studies (Wagner et al., 2014). Although it is difficult to compare directly, as Wagner et al., (2014) used a different discrimination task, the 5- to 6-year-olds in their study (who as a group were reported to have minimal accent exposure) were unable to tell apart their own variant of English (American) from a different regional variant (i.e., British English). They were also unable to tell apart an
unfamiliar regional accent (British English) from a non-native accent (Indian-accented English). In contrast, the children in our study performed above chance in both of these accent comparisons. Although it is difficult to ascertain how much of the group’s performance was driven by the subset of children who had occasional British exposure, one could speculate that children with greater diversity in terms of their accent input may also generally demonstrate greater categorization abilities than children growing up in less diverse language environments. One useful way to test this hypothesis would be to directly compare the categorization abilities of children living in linguistically diverse regions (like Toronto) to the categorization abilities of children living in less diverse regions.

5 General Discussion

Previous work has suggested that children (like adults) can rapidly identify and show social preferences for speakers who share a common linguistic background. In the current study, we examined the impact of accent exposure and accent type on the strength and direction of these preferences. We found that, as a group, even children with greater diversity in their accent exposure still show strong social preferences for peers that speak with the locally dominant accent. However, the strength of children’s preferences was modulated by both the accent of the speaker (regional vs. nonnative) and their exposure to accented out-group members in everyday life.

One of the goals of this study was to examine whether everyday accent exposure would make children more accepting of accented peers. Although our findings suggest that exposure certainly influences preferences, the relationship between exposure and acceptance is complex. When out-group members spoke with a British accent, children who had occasional contact with
British speakers showed stronger preferences for in-group members compared to children that had no British exposure. In contrast, when out-group members spoke with a Korean accent, children with high daily accent exposure in general (not specifically to Korean accents) were more accepting of the Korean-accented out-group members than children with low and medium exposure. These findings suggest that it is not simply the case that exposure leads to liking (or disliking), rather exposure seems to have a multi-directional effect on preferences. When accents are difficult to distinguish, as is the case with Canadian and British English, having occasional exposure to speakers who speak British English might have helped children to better identify their Canadian accented in-group members. Similar to Clopper & Pisoni (2004), we propose that children’s experience has refined their ability to categorize accents, giving them a heightened sensitivity to who belongs in their in-group and who does not. Note that exposure to accents does not necessarily modify the strength of children’s biases per se; children with and without British exposure may be equally biased against out-group members. However, those with exposure to British accents may simply be better at distinguishing the groups than children without this prior exposure. Indeed, the findings of Experiment 3 seem to support this hypothesis, as children with British exposure tended to be more skilled in distinguishing Canadian from British-accented English. We do not see the same effect when out-group members spoke with an easily detectable accent (like in Experiment 2), where most children were readily able to identify which of the speakers belongs to their in-group. In this situation, our findings align with work suggesting that intergroup contact reduces group biases (e.g., biases against people of other races and people with disabilities) in the childhood years (Aboud et al., 2003; Crystal et al., 2008; Maras & Brown, 2000; McGlothlin & Killen, 2006).

Our findings also highlight the need to take a more nuanced approach to quantify accent exposure. We know from research with adults that contact is more likely to lead to acceptance in
situations in which partners share common goals and high quality cross-group friendships are forged (MacInnis & Page-Gould, 2015; Pettigrew & Tropp, 2006). It may be the case that only in situations where children have high quality, meaningful relationships with accented out-group members, that exposure leads them to be more accepting. Although contact quality is far more difficult to assess, it may be important in future research to differentiate between children that have relatively superficial contact with out-group members compared to children that have formed close bonds with accented-speakers. Not only might the quality of the interaction with out-group members matter, but the match between their real life experiences (e.g., having a Korean-accented friend) and the type of out-group members they encounter in the lab, may also influence how well their experiences generalize to the friend selection task. For example, having exposure to Hindi-accented grandparents might be less influential in shaping children’s preferences for Korean-accented peers than being friends with a Korean-accented child at school.

This is the first study to take a closer look at how individual variation in the child’s accent input influences the development of group preferences. Our results suggest that there is not one simple factor that guides children’s friendship preferences, rather, multiple factors, including the accent of the speaker and children’s unique language exposure interact to shape preferences. Taken together, our findings highlight the need to consider how individual variation in language exposure and perceptual discrimination abilities interact to determine group preferences across development.
Chapter 3
The impact of L1 versus L2 input on infants’ ability to tell apart languages in their environment

1 Introduction

In a multilingual environment it is important for infants to be able to tell apart the languages they hear. Otherwise, it would be difficult for infants to learn the phonological structure of each individual language. Although research suggests that infants’ language discrimination abilities are initially limited to differentiating languages from different rhythmic classes (e.g., stress-timed English and syllable-timed Spanish; Nazzi et al., 1998), this situation changes rapidly. By 5-months of age, infants can discriminate their native language from any other language, even if it is rhythmically similar (e.g., Spanish-learning infants can discriminate Spanish and Catalan; Bosch & Sebastián-gallés, 2001) and English-learning infants can discriminate English and Dutch (Nazzi et al., 2000). However, at 5 months of age, infants still have difficulty differentiating between two unfamiliar rhythmically-similar languages. For example, 5-month-old English learners have difficulty distinguishing between syllable-timed Spanish and syllable-timed Italian (Nazzi et al., 2000). The fact that 5-month-olds can only tell apart two unfamiliar languages if they are rhythmically-distinct highlights the importance of rhythm in defining infants’ early language discrimination abilities.

Interestingly, most infant language discrimination work to date has focused on monolingual children. Moreover, the language samples that monolingual children have been asked to discriminate between have always been produced by native speakers of each language. But in the real world, children often hear multiple languages, and encounter a mixture of native
and non-native variants of these languages. Thus, our current understanding of how children tell apart languages may not be entirely ecologically valid. That is, the language discrimination abilities of infants that have been documented in the lab may not accurately reflect how children raised in multilingual settings come to distinguish between the languages in their environment.

The need to consider real-world language input in language discrimination studies has not been entirely overlooked. A few studies have examined the language discrimination abilities of bilingual infants. In general, it appears that the language discrimination abilities of bilingually-raised children are largely unaffected by having multilingual input (Bosch & Sebastián-Gallés, 2001; Bosch & Sebastián-Gallés, 1997). However, there is some evidence that the rhythmic similarity of the languages that bilingual infants are learning can impact their ability to tag and sort the meaningful phonetic contrasts in each language. For example, some research suggests that infants learning two syllable-timed languages (i.e., Spanish and Catalan) have greater difficulty dealing with overlapping vowel distributions compared to infants learning languages from different rhythmic classes (i.e., Spanish and English) (Bosch & Sebastián-Gallés, 2003; Sundara & Scutellaro, 2011). Thus, rhythm has been suggested to play an important role in determining how infants will handle bilingual input.

Although research is beginning to investigate how bilingual infants tell apart languages, these studies all focus on bilingual infants’ ability to tell apart two unaccented variants. No studies have investigated infants’ ability to discriminate speech samples produced by speakers with strong non-native accents. We know that non-native speakers often carry over some of the timing from their native language into their second language (White & Mattys, 2007), which could make it more difficult for infants to discriminate between those languages. For example, if
an English learning infant hears L2 English spoken by a native Spanish speaker, will they be able
to tell that the speaker’s Spanish-accented English is English rather than Spanish?

Our first experiment addresses this question by testing English learning 5-month-olds’
ability to discriminate native Spanish from Spanish-accented English. We predict that to 5-
month-olds, Spanish-accented English will sound very much like Spanish.

2 Experiment 1

Previous studies have shown that young infants can use prosody to discriminate between two
rhythmically distinct languages. For example, English learners can discriminate between Spanish
and English because Spanish is syllable-timed and English is stress-timed. But no studies to date
have asked whether infants can distinguish between an unfamiliar language and a heavily
accented variant of a familiar language. This question is important because many children who
are being raised in multilingual settings routinely encounter non-native variants of their native
language(s).

In this experiment, we ask whether infants can distinguish between native Spanish and
Spanish-accented English. Using a variant of the Headturn Preference Procedure (Johnson &
Zamuner, 2010), infants were habituated to either three minutes of native Spanish or three
minutes of Spanish-accented English. A single native Spanish speaker who learned English late
in life produced all the habituation and test materials. In the test phase, we measured infants’
looking times to samples of the old (habituated) language and the new language. We predicted
that if infants can distinguish the speaker’s Spanish samples from her Spanish-accented English
samples then they should look longer to listen the new over the old (habituated) language.
Conversely, if infants are unable to detect a difference between the speaker’s Spanish and L2 English, then they should demonstrate no preference for the new over the old language samples at test.

2.1 Method

2.1.1 Participants

Thirty-two 4.5 to 5.5-month-old infants were tested (Range = 137 - 166 days, $M_{Age} = 154.22$ days; 16 males, 16 females). Infants heard English 90% of the time, and had virtually no (less than 1%) exposure to Spanish or Spanish-accented English. Thirteen infants were removed from the study due to fussiness (6), parental interference (4), experimenter error (1), and failure to orient to the lights (2).

![Diagram of the Headturn Preference Procedure](image)

*Figure 7. Diagram of the Headturn Preference Procedure*
2.1.2 Stimuli

The stimuli set consisted of 40 English and 40 Spanish sentences modeled after Nazzi et al., (1998). The entire set of 16 to 18 syllable sentences was recorded in adult-directed speech by a female L2 English speaker. The speaker learned Spanish from birth and began learning English as an adult. At the time of recording, the speaker had only recently arrived in Canada. Given that there may be fluency differences between the speakers’ L1 and L2, the speaker was allowed to practice until she could produce the L2 sentences fluently. The habituation passages were created by splicing together 20 sentences of one language with 250ms of silence between each sentence. The sets of 20 sentences were then repeated once to create different counterbalanced orders of the approximately 3-minute Spanish and English habituation phases. The test passages were created by splicing together groups of five sentences of the same language.

2.1.3 Design

Infants were randomly assigned to one of eight counterbalanced orders of the experiment. Half of the infants were habituated to 20 of the Spanish sentences and the other half were habituated to 20 of the Spanish-accented English sentences. The test phase consisted of 8 trials. Four of the trials contained previously unheard sentences from the old (habituated) language (5 sentences per trial) whereas the other four trials contained sentences from the new language. The order in which the recordings were presented as well as which recordings were selected to be played in the habituation and test phases was counterbalanced across children.

2.1.4 Procedure

Infants were habituated and tested using a modified single speaker variant of the Headturn Preference Procedure (Johnson & Zamuner, 2010) used in Nazzi et al., (2000) (see Figure 7). Infants sat on their parents lap in the center of a sound-attenuated booth. Parents were instructed
to wear headphones and listen to masking music to ensure that they could not bias their child’s responses. In the habituation phase, the auditory passage played continuously regardless of where the infant was looking. However, in order to familiarize infants with the experimental design and the location of the lights, the center and sidelights flashed depending on where the infant was looking. In the test phase, the presentation of the auditory stimuli and the flashing lights was contingent on the infant’s looking behaviour.

At the start of each trial, the blue light, positioned directly in front of the infant flashed. When the infant looked at the blue light then one of the red lights located 90 degrees to the infant’s left or right side began flashing. In the test phase, when the infant turned their head to look at one of the side lights, the passage began to play from a speaker located directly behind the light. If the infant looked away from the light for more than 2 seconds, the passage stopped and the next trial began. Looks away under 2 seconds were subtracted from the infant’s total looking time. An experimenter, located outside the booth, coded the infant’s looking behaviour online using a live video monitor.

### 2.2 Results and Discussion

The mean orientation time towards the old (habituated) and new language test trials was computed for each participant. The first two trials (one new and one old) were removed from the analysis as previous studies suggested that they can be unstable (van Heugten & Shi, 2010; Vouloumanos & Werker, 2004).

The results of a paired-samples t-test indicated that infants did not look longer to hear the new language ($M = 8.40, SD = 4.19$) compared to the old (habituated) language ($M = 7.96, SD = 5.05$), $t(31) = 0.65, p = .52$ (See Figure 8). This suggests that infants were unable to tell apart the L2 English speaker’s Spanish samples from her English samples. However, there could be a
number of alternative explanations for infants’ inability to distinguish between the Spanish and Spanish-accented English samples produced by the L2 English speaker. It may be that the experimental design was not sensitive enough to reveal infants’ abilities. In order to ensure that our paradigm is able to detect differences in the ability to discriminate languages, in our second experiment we tested whether infants were able to tell-apart language samples produced by an unaccented L1 bilingual speaker.

3 Experiment 2

In Experiment 2, we use the same procedure as Experiment 1 to examine whether infants could discriminate the English and Spanish language samples produced by a bilingual speaker. If infants are successful at this task then this is an indication that 5-month-olds are not struggling with the procedure in Experiment 1; rather it is the accent of the speaker that is impacting their ability to tell apart languages.

3.1 Method

3.1.1 Participants

Thirty-two 4.5 to 5.5-month-old infants were tested (Range = 143 – 169 days, $M_{\text{Age}} = 157.0$ days; 19 males, 13 females) in this experiment. All infants were exposed to at least 90% English at home, and had minimal (less than 1%) exposure to Spanish or Spanish-accented English. Nine infants were removed from the study due to fussiness (6) and failure to orient to the lights (3).
3.1.2 Stimuli

The same 40 English and 40 Spanish passages were recorded by a female English-Spanish bilingual who learned both languages from birth.

3.1.3 Design

The design was identical to Experiment 1 except for the use of a bilingual speaker instead of the L2 English speaker.

3.1.4 Procedure

The procedure was identical to Experiment 1.

3.2 Results and Discussion

As in Experiment 1, we computed the mean looking time to the old and the new language trials (excluding the first two trials; see Figure 8). The results of a paired-samples t-test indicated that infants exposed to the bilingual speaker could differentiate the new language samples ($M = 8.69$, $SD = 3.72$) from the old (habituated) language samples ($M = 7.46$, $SD = 3.81$), $t(31) = 2.83$, $p < .01$. Infants’ successful discrimination of Spanish and English in this experiment suggests that the lack of discrimination seen in Experiment 1 was not an artifact of the method, rather it is an indication that infants have difficulty differentiating language samples when they are produced by an accented L2 speaker.
In a multilingual society infants are often exposed to languages spoken by both native and non-native speakers. Although infants can use rhythm to tell apart languages, we have demonstrated in this series of experiments that language discrimination is more difficult when the speaker speaks with a non-native accent. This is the first study to examine language discrimination using non-native samples. Previous language discrimination studies have always tested discrimination using native speakers (or early bilinguals) of a language. These findings contribute to our understanding of how infants learn to discriminate languages in the face of real-world variability in accents and dialects.

Figure 8. Mean orientation times to the new language samples and old (habituated) language samples in Experiments 1 and 2. Error bars represent the standard error of the mean.

4 General Discussion

The ease with which infants can distinguish between the languages spoken in their
environment can impact how readily they acquire the phonological structure of their native tongue(s). In Experiment 1, English-learning infants had difficulty discriminating Spanish from Spanish-accented English. We know that infants readily distinguish between Spanish and English samples produced by native speakers (Nazzi et al., 1998) and by 5 months of age they can also discriminate their native language (in this case English) from any other language, regardless of rhythmic similarity (Nazzi et al., 2000). Our findings suggest that when exposed to an L2 English speaker, monolingual English infants perceived the speaker’s Spanish–accented English to be more Spanish- than English-like. This is presumably because the speaker spoke English with a Spanish rhythm. Thus, even though Spanish-accented English is a variant of English (their native language), infants perceived it like a foreign syllable-timed language. Hence, infants’ performance in Experiment 1 is reminiscent of studies where infants are asked to discriminate between two rhythmically-similar foreign languages (like Spanish and Italian) (Nazzi et al., 2000).

Although this is an indication that non-native accents can impact infants’ ability to discriminate languages, we acknowledge that L2 English speakers vary in how heavily they carry over the rhythm of their L1 into their L2. Here, we tested infants on a heavily-accented speaker. The outcome of the current study might have been different if the speaker’s accent was subtler. It is also possible that infants may be better at dealing with L2 accents if the speaker and the child share the same native language. For example, monolingual English-learning infants may be more able to discriminate accented language samples when they are spoken by a native English speaker whose L2 is English-accented compared to a foreign language speaker whose English is foreign-accented.

This is the first line of research to compare infants’ ability to discriminate language
samples from non-native accented and an unaccented speaker. Our initial findings from this experiment underscore the importance of considering real-world language variability in models of infant speech perception and have implications for infants growing up in bilingual language environments. Follow up work will test whether infants raised in bilingual environments might be more sensitive to language changes even when the speaker is accented.
Chapter 4
Phonetic convergence in children and adults: the influence of model talker accent

1 Introduction

When an individual comes into contact with a new linguistic community, over time their speech patterns (i.e., vowel space, voicing) can shift to sound more like the new community (Evans & Iverson, 2007; Munro, Derwing, & Flege, 1999; Pardo, Gibbons, Suppes, & Krauss, 2012; Sancier & Fowler, 1997; Smith, Durham, & Fortune, 2007). This phenomenon, referred to as phonetic accommodation (or convergence), is thought to explain some of the changes or shifts in the way a person speaks over time. For example, after spending a few years in university in Southern England, the vowels of Northern English speakers are reported to begin to sound more like the prestigious ‘Southern’ variant (Evans & Iverson, 2007). Although both children and adults are capable of accommodating to a new community accent, observational studies suggest that adults and children may do so to different degrees. For example, all else being equal, younger children appear to adapt faster and more fully to a novel community accent than adults (Chambers, 1992; Smith et al., 2007; Tagliamonte & Molfenter, 2007). In the current study, we examine how the age of the listener and the model speaker’s accent influence accommodation. To do this, we tested children and adults’ imitation of local-accented models and models that spoke with an unfamiliar accent.

Although language users have a tendency to imitate the way others in their environment speak, the amount that different language users accommodate to speakers in different situations varies greatly. Researchers are just beginning to understand the factors that determine when and
to what degree language users will accommodate to others in their environment. Some theories suggest that imitation may be driven largely by social factors (Giles, 1973; Giles et al., 1991; Giles & Ogay, 2007). Indeed, there is evidence that people will selectively converge their productions towards speakers they perceive to be socially desirable and will diverge their productions away from people that they wish to maintain their social distance from (Giles, 1973; Giles et al., 1991; Giles & Ogay, 2007). According to socially driven accounts of accommodation, a speaker’s sociolinguistic choices are like small ‘acts of identity’, signaling to others their group membership. For instance, after relocating to a new accent community, children who were more integrated into their classroom social network showed stronger accent accommodation, than children who were more socially isolated (Berthele, 2002).

Although observational studies support the notion that accommodation can be socially-mediated (Berthele, 2002; Pardo et al., 2012), other theories have argued that social interaction may not be necessary to elicit imitation. In this view, imitation occurs more or less automatically (Delvaux & Soquet, 2007; Goldinger, 1998). Simply hearing the productions of others primes those speech sounds for the listener and once primed, the listener then increases the frequency of their use (i.e., showing accommodation; Goldinger, 1998). The fact that imitation can be elicited in artificial laboratory tasks, where participants simply listen and repeat after a recording of a model speaker (Goldinger, 1998; Goldinger & Azuma, 2004; Nielsen, 2011, 2014; Shockley, Sabadini, & Fowler, 2004), is often used as evidence for automatic explanations of accommodation.

Although these studies seem to support the notion that imitation is automatic, they still leave open the possibility that imitation could be socially mediated since accents can be identified rapidly from single words and the accent of the speaker can trigger social evaluations.
As discussed in Chapter 2, even young children can use the accent of the speaker as a social cue. Given that young children show strong social preferences for in-group members that speak their native language with a native accent (Kinzler et al., 2007, 2009; Souza et al., 2013), it is possible that the social desirability of the model’s accent could influence imitation in the childhood years. Although we know that accents trigger social evaluations in children and adults, very few studies have examined the impact of the model speaker’s accent on accommodation in the lab.

Observations of accommodation in the real world suggest that not all accents are imitated equally. Certain accents, like regional-accents, and more prestigious variants, tend to show stronger accommodation (Evans & Iverson, 2007; Giles, 1973). For instance, children growing up in non-native English speaking homes rarely acquire their parent’s non-native accent. Instead, they learn to speak with the regional accent that is dominant in the community. Despite the impact of accent type (regional, nonnative) on real-world accommodation, the vast majority of laboratory studies have focused on imitation between speakers who speak the same dialect (Babel, 2012; Babel, McGuire, Walters, & Nicholls, 2014; Goldinger & Azuma, 2004; Nielsen, 2011, 2014, Pardo, 2006, 2013; Shockley et al., 2004). However, a comparison of imitation across different dialects could help tease apart social and automatic explanations of accommodation. If imitation is driven by social factors, then we might predict that people’s productions would converge towards model speakers that share a common linguistic background (i.e., their ‘in-group members’) and diverge their productions away from model speakers that belong to a different social group (i.e., their ‘out-group members’). In contrast, if imitation is largely automatic, then we should see equal imitation across speakers. In other words, imitation should not be socially selective or accent specific.
To date, only a few laboratory studies have investigated people’s imitation of speakers that speak with a different accent (Babel, 2010; Delvaux & Soquet, 2007; Kim, Horton, & Bradlow, 2011; Walker & Campbell-Kibler, 2015). From this work, there is some evidence that people will imitate models that speak with a different regional-accent (Babel, 2010; Delvaux & Soquet, 2007; Walker & Campbell-Kibler, 2015). For example, in one study after participants from New Zealand were exposed to an Australian model, they began to shift their vowels to sound more Australian (Babel, 2010). Interestingly, the degree of imitation that was observed in this study was related to the participant’s implicit attitudes towards Australians. Participants that viewed Australians more positively showed stronger imitation, than participants who viewed Australians more negatively (Babel, 2010). This supports the notion that accommodation may be socially-mediated, participants may have converged their productions more strongly towards model speakers they perceived to be socially desirable (Communicative Accommodation Theory; CAT; Giles & Ogay, 2007). Although there is some evidence that the vowels of regional speakers might be imitated (Babel, 2010; Delvaux & Soquet, 2007; Walker & Campbell-Kibler, 2015), not all studies have found evidence of imitation. For example, one study that examined imitation in spontaneous conversation, found that people did not imitate different regional or non-native accented speakers (Kim et al., 2011). Some researchers have even argued that dialectal differences can block imitation in situations where the productions of the model are outside of the speakers’ productive repertoire (Kim et al., 2011).

Taken together, previous work suggests that the accent of the speaker likely influences imitation. However, it is not clear how the type of accent the model speaks with (e.g., regional, nonnative) modifies the amount of imitation observed. Although the social desirability of accents might influence the degree to which we imitate (Babel, 2010), imitation may also be constrained by our ability to produce the speech sounds present in the other dialect (Kim et al., 2011). Thus,
one of the aims of the current study is to begin to systematically examine how regional and non-native accent variation influences imitation. To do this, we compare participant’s imitation of model speakers from the same accent community to model speakers that speak with a different regional and non-native accent.

Observational studies have suggested that listener age may also influence imitation. Studies that track accent change over time suggest that adults do not acquire a new regional accent as quickly and completely as young children (Chambers, 1992; Smith et al., 2007; Tagliamonte & Molfenter, 2007). However, only one study to date has directly compared children and adult’s imitation in a controlled laboratory setting (Nielsen, 2014). In this study, children and adults were asked to label a series of images twice, once before exposure to the model speaker and again after exposure. It was found that although both American children and adults’ post-exposure productions converged with the model, preschool and 3rd grade children showed stronger convergence than adults. This study is relevant to the current investigation for two reasons. First, the findings of Nielsen (2014) indicate that there may be age-related changes in children and adults’ imitation of model speakers. Second, it provides a methodology to test children using a structured laboratory task. However, given that this study only looked at the imitation of native speakers (i.e., speakers who speak the same dialect as the participants), it is not known whether the imitation of speakers with different (regional or non-native) accents would follow a similar trajectory.

In the current study, we address this gap in the literature by comparing children and adults’ imitation of model speakers with different accents. Similar to Nielsen (2014), we used an auditory naming task to measure participant’s imitation of model speakers. We compared participant’s imitation of models that spoke with the local (Canadian) accent to models that
spoke with a different accent. If imitation is automatic, then participants might imitate all models equally, regardless of their accent. In contrast, if imitation is socially driven then participants might imitate some accented models more than others. For example, participants may diverge their productions away from less socially desirable out-group members, and converge their productions towards models belong to the same linguistic in-group. Given evidence that children seem to acquire new regional dialects more fully than adults (Chambers, 1992; Smith et al., 2007; Tagliamonte & Molfenter, 2007), we also predict that there will be age differences in imitation between children and adults.

2 Experiment 1

Although we know that 5- and 6-year-old children show strong social preferences for people that speak with the community accent (see Chapter 2; Kinzler, Corriveau, & Harris, 2011; Kinzler et al., 2007; Kinzler et al, 2009; Paquette-Smith, Bucker, Choi & Johnson, submitted; Souza et al, 2013), no work has investigated how the model speaker’s accent influences children’s imitation. To examine this in Experiment 1 we used an auditory naming task to compare Canadian English learning 5- and 6-year-old’s imitation of Canadian English models to Australian-accented English models.

Similar to Nielsen (2014), we tested children’s imitation using a three phase auditory naming task. In the first phase, children were recorded producing the baseline word list (containing words beginning with /p/ and /k/). Then, in the exposure phase they listened to either the Canadian model or the Australian model produce a subset of the words beginning with /p/. As in previous work, the voice onset time (VOT) of the model’s productions were artificially lengthened to elicit imitation (Nielsen, 2014). Also, the word list contained exposed /p/ words (that were heard in the exposure phase), unexposed /p/ words, and words beginning with /k/. This
design allows us to examine how strongly VOT imitation generalizes across different segments (i.e., from /p/ to /k/) and across different words (i.e., to /p/ initial words that the participant was not exposed to). If children imitate the elongated VOTs of the model speakers, then we should observe an increase in the length of their post-exposure VOTs relative to their baseline VOTs.

As in previous work (Nielsen, 2014), we predict that children will imitate the elongated VOTs of models that speak with the local Canadian accent and this imitation will generalize across segments (i.e., from /p/ to /k/). However, given children’s differential social evaluations of accented speakers and the impact of social information on accommodation, we also predict that there might be differences in the degree to which participants imitate Canadian-accented in-group members compared to the Australian-accented out-group members.

2.1 Method

2.1.1 Participants

Thirty-two native Canadian English speaking children were tested in this experiment (Age range = 5.05 to 6.98 years, Mean age = 6.16 years; 16 females, 16 males). In order to participate in this study, children had to speak English at least 90% of the time and have no diagnosed speech, hearing or vision issues that could interfere with participation. Four additional children were excluded from the analysis due to technical issues in the running of the experiment (3), and a failure to follow instructions (1).

2.1.2 Design

The design of the experiment was modeled after Nielsen (2014). In the baseline and the post-exposure phases participants were asked to label a set of 59 images presented to them in a random order. In the exposure phase, participants were randomly assigned to one of four
conditions. Half of the children listened to the productions of the Canadian model whereas the other half listened to the productions of the Australian model. Children either listened to the words in List 1 (13 of the words beginning with /p/) or List 2 (the other 13 words beginning with /p/). The word list was repeated three times (for a total of 39 exposure tokens). Finally, in the post-exposure phase the child was asked to re-label the same set of 59 images from the baseline.

2.1.3 Stimuli
The production list consisted of 59 nouns commonly known by preschool-aged children (e.g., strawberry, keys, pants; see Appendix C for a complete list of stimuli). Twenty-six of the nouns began with /p/ (half of which they were exposed to in the exposure phase and half of which they were not), and 13 began with /k/. The remaining 20 nouns did not begin with a voiceless stop and were used as filler items.

**Auditory Stimuli.** To create the auditory stimuli for the exposure phase, the entire set of 26 /p/ tokens were recorded by three female speakers (a Canadian, an Australian and a Chinese-accented speaker). The recordings from the Chinese-accented speaker were set aside for use in Experiment 2. Both the Canadian and Australian speakers used in this experiment learned English as their first language. One speaker learned English in Canada and spoke with a Canadian accent and the other learned English in Australia and spoke English with an Australian accent. The auditory stimuli were recorded in an AIC sound-attenuated booth using a Zoom Pro Audio Recorder and a high-quality external Sennheiser MKE600 Shotgun microphone. Each word was recorded 2 to 3 times and the clearest, most natural sounding token from each speaker was selected for editing. With all else being equal, there was some bias to choose a token whose duration was similar to the average duration by all three speakers to minimize the amount of editing that needed to be done.
In order to control for inherent variability in VOT and word duration across the stimuli set, the duration of the Canadian, Australian and Chinese-accented tokens of the same word were equalized. So that, for example, the duration of the word ‘paint’ produced by the Australian speaker would be equal to the duration of the word ‘paint’ produced by the Canadian and the Chinese speakers. To do this, all three tokens of each word were adjusted to be equal to the mean duration (e.g., if the average duration of the word ‘paint’ across the 3 speakers was 611.05ms, then all 3 tokens of paint were either lengthened or shortened to be equal to 611.05ms).

Once the duration of each word was equalized, the VOT was measured for each token. Prior to any VOT manipulation, the mean VOT of the Canadian-accented stimuli set was 83.57ms (SD = 16.64), the Australian-accented set was 60.97 (SD=22.68) and the Chinese-accented set was 66.91 (SD=19.97). Due to the fact that participants may show greater imitation of longer VOTs, it was not possibly to simply add 50ms to each VOT (as some speakers would end up with a longer final VOTs than others). In order to make the VOT manipulation equal across the three speakers, the mean VOT for each word token was computed and then 50ms was added to that mean. For example, if the mean VOT for the word paint were 63ms, then the VOT for each speaker’s token of “paint” would be extended to 113ms. Across the entire stimuli set, the mean VOT after manipulation was 120.48ms (an increase of 50ms). Similar to previous work, VOTs were extended by copy-pasting the medial (stable) segments of the aspiration using Praat (Nielsen, 2014; Shockley et al., 2004). To prevent introducing any audible clicks or pops, all splicing was done at zero crossings. In about a third of cases, extending the medial portion of the aspiration sounded somewhat artificial. Similar to Nielsen (2011), for these tokens, we used the VOT from another token of the same word (produced by the same speaker) to extend the VOT. Importantly, after the VOT manipulation, the duration of the VOT of all three speakers was the identical for each word token.
**Visual Stimuli.** The visual stimuli consisted of 59 images of the 59 nouns used in the study (26 /p/ words, 13 /k/ words and 20 fillers). The images were placed on a white background and were presented to children on a 26-inch computer monitor.

The four conditions of the experiment were created using Articulate storyline, an experiment building software, which presented the stimuli from each of the three phases (baseline, exposure and post-exposure phase) in a random order. To create the four exposure phases, the recordings for half of the /p/ words (see Appendix C for a List 1 and 2) were presented alongside the images of those items. 500ms after each image appeared, the participant heard the assigned speaker’s token of the word followed by 1 second of silence. The word list was repeated three times to create an exposure phase that lasted approximately 1.5 minutes.

### 2.1.4 Procedure

For the duration of the procedure, the participant sat beside an experimenter in an AIC sound-attenuated booth. Participants sat approximately 15 inches away from a Sennheiser shotgun microphone, located just below the computer monitor. The microphone recorded the child’s productions at 66,000Hz into a Zoom H4N pro audio recorder. In the baseline phase, participants were instructed to say the isolated word for each of the pictures on the screen (i.e., without the addition of any articles like ‘a’ or ‘the’). After the child produced each word, the experimenter clicked to display the next image. If participants had difficulty labeling the image, the experimenter gave them a hint, but did not produce the words for them. If they still did not know the word after the hint then the experimenter moved onto the next trial. In the exposure phase, participants were told to sit quietly and listen while someone else said some of the words. The exposure stimuli were presented over high quality speakers to ensure that fine-grained phonetic
details were audible. Finally, in the post-exposure phase, participants were asked to label the baseline pictures a second time.

### 2.1.5 Data Analysis

The VOT of the participants’ productions were measured using AutoVOT, an automated VOT measurement software (Keshet, Sonderegger, & Knowles, 2014; Sonderegger & Keshet, 2012). Prior to analyzing this dataset, the AutoVOT algorithm was trained using 311 hand measured VOT tokens produced by 4 different speakers. All AutoVOT measurements were checked by a trained experimenter and adjusted by hand to correct for any obvious errors in measurement.

A total of 2,356 tokens (produced by 32 participants) were included in the analysis. An additional 140 tokens were excluded due to the participant producing an incorrect label (or no label) for the item (n = 126; e.g., producing hangaroo instead of kangaroo or nuts instead of peanuts), the presence of background noise (n = 8), or a production that contained a voiceless vowel following the VOT (which made the boundary between the aspiration and the vowel difficult to measure; n = 6).

The total word duration (excluding word initial VOT) was measured from the end of the /p/ or /k/ phoneme to the end of the word. For words that ended in a stop constant (i.e., cake, carrot, cat, coat, cup, kite, peacock, pig, pink, pocket) the end of the word was always marked at the end of the final vowel (as stop consonants are not consistently released).
2.1.6 Statistical Analysis

The statistical analysis was performed using a series of linear mixed effects models (Barr, Gann, & Pierce, 2011) which were implemented using the lme4 package of R 3.2.2 (Bates et al., 2015; R Development Core Team, 2015). The dependent variable (or outcome of interest), VOT duration, was modeled as a function of the Condition (Baseline, Post-exposure) and the Model’s Accent (Canadian-accented or Australian-accented). Given that VOT duration can vary as a function of word duration and segment type (i.e., the VOTs of /k/s are typically longer than /p/s) (Nielsen, 2011), Word duration and Segment Type (/p/ or /k/), were included as fixed effects in the model. All categorical independent variables were simple coded. For Condition, the Baseline phase was coded as the reference category in order to compare the VOT of participant’s Post-exposure productions to their Baseline. For the Model’s Accent, the Canadian speaker was coded as the reference category in order to compare the VOT of participants who heard the Australian
model to participants who heard the Canadian model. Importantly, since both the Condition (Baseline and Post-exposure) and Model’s Accent were entered into the model, we were not particularly interested in the main effect of the Model’s Accent but rather the interaction between Condition and Accent. In other words, we are interested in whether the difference between Baseline and post-exposure VOT varied depending on the accent of the model (Canadian or Australian). The interaction between Condition and Segment was also included as it is possible that certain segments (in particular the /p/ segments that the participants were exposed to) might show greater imitation than the /k/ segments that participants were not exposed to. For the random effects, we included random intercept and Condition slopes for participants, as well as, random intercept and Condition slopes for Items (words). For the fixed effects we report $b$, standard error, $t$-values, and $p$-values calculated using Satterthwaite approximations to degrees of freedom and implemented using the lmerTest package in R (Kuznetsova, Brockhoff, & Christensen, 2015).

2.2 Results and Discussion

In the LMER model (described above; see Table 4), we observed no main effect of Condition, $b = -1.87$, $SE = 2.00$, $t(32.1) = -0.94$, $p = 0.356$, indicating that as a group (N = 32) there was no change in VOT from the Baseline to the Post-exposure phase. There were, however, significant main effects of Word duration, Segment Type, and the Model’s Accent. As expected, word duration predicted VOT duration, $b = 0.03$, $SE = 0.00$, $t(910.8) = 5.85$, $p < 0.001$, and words beginning with /k/ had longer VOTs than words beginning with /p/, $b = 23.94$, $SE = 3.61$, $t(36.4) = 6.64$, $p < 0.001$. We also found that the VOT duration of the participants in the Australian condition tended to be shorter on average than in the Canadian condition, $b = -12.76$, $SE = 5.33$, $t(29.8) = -2.39$, $p = 0.023$. Although, the VOTs of children in the Australian condition were
shorter on average, this does not indicate that there were differences in the amount of imitation (from Baseline to Post-exposure). In order to examine whether children imitated the elongated VOTs more after listening to the Canadian compared to the Australian-accented speaker, we must examine the interaction between Condition and the Model’s Accent (see Figure 10). In this model, the interaction was not significant, indicating that there was no difference in children’s imitation of the two speakers, \( b = 3.73, SE = 3.93, t(29.9) = 0.95, p = 0.349 \). There was also no significant interaction between Condition and Segment (/p/ vs. /k/).

Table 4. Table of the fixed effects from the Experiment 1 LME model predicting VOT duration. The model included the following variables: Dependent variable = VOT duration; Fixed Effects = Condition * Model’s Accent + Condition * Segment Type + Word Duration; Random effects = (Condition |Subject)+(Condition| Word item)

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</tbody>
</table>
Overall, our results do not show evidence of imitation of either speaker. This is surprising given that the procedure and methodology used in our experiment were quite similar to Nielsen (2014). If anything, we should have seen evidence of imitation in the Canadian condition. However, there are some key differences in how children responded to our task, which might explain why we did not replicate Nielsen (2014). First, the average VOT of our participants’ baseline productions (in the Canadian condition) were substantially longer (M for /p/ = 79.86ms, M for /k/ = 99.27) than the Baseline VOTs reported in the Nielsen study (M = 60.24ms for /p/, M = 73.21 for /k/). In fact, the mean baseline VOT in our study was even longer than the mean Post-exposure VOT reported in Nielsen’s study (M = for /p/ = 71.12 and M = for /k/ = 84.28ms). This raises the possibility that the children in our sample might have hyper-articulated the words
in the baseline or just generally have longer VOTs (Yu, De Nil, & Pang, 2015). Either way, we might observe no evidence of imitation because our sample had very little room to increase their VOTs from baseline.

Alternatively, it may be the case that children do not consistently imitate the extended VOTs of speakers. Similar to previous work (Lowenstein & Nittouer, 2008; Yu et al., 2015), our data suggest that there is a lot of variability in preschoolers production of voiceless stops, which may make VOT imitation effects particularly difficult to replicate. Indeed, only one study (i.e., Nielsen, 2014), with a relatively small sample, has found evidence of VOT imitation in children. Thus, it is possible that similar to many of the findings in the imitation literature (see Pardo, 2013 for a discussion), this particular effect may be quite small or difficult to replicate, especially in a population that has relatively long, and variable VOT productions to begin with (Yu et al., 2015). Although only one study has found evidence of VOT imitation in children, there are quite a few studies that have (using a similar paradigm) demonstrated VOT imitation in adults (Goldinger, 1998; Goldinger & Azuma, 2004; Nielsen, 2011). In order to examine whether our paradigm is able to elicit VOT imitation, in Experiment 2, we test a group of adult participants using the same design.

3 Experiment 2

In Experiment 1, we tested children’s imitation of a Canadian and an Australian-accented model. It was predicted that if imitation were influenced by the model’s accent then children would imitate the elongated VOTs of the Canadian-accented in-group member more than the Australian accented out-group member. Surprisingly, however, we found no evidence of imitation for either model. Why might this be? Since only one study has examined imitation in children (Nielsen, 2014), it is possible that children do not consistently imitate the extended VOTs of speakers. At
the same time, however, it is also possible that some aspect of our stimuli or experimental design may have inhibited imitation. In Experiment 2, we examine whether imitation can be observed in adults when they are tested using the same stimuli and design as Experiment 1. Given previous work suggesting that adults will imitate elongated VOTs of speakers (Goldinger, 1998; Goldinger & Azuma, 2004; Nielsen, 2011), we predict that adults should lengthen their VOTs after exposure to the model.

In addition to testing a different population, in order to maximize the likelihood that we will detect differences in imitation between our different accented models, we added a condition in which participants were exposed to the productions of a non-native (i.e., Chinese-accented) model. Previous work has suggested that non-native speakers tend to be evaluated more negatively than regional-accented speakers (Dragojevic, Giles, Beck, & Tatum, 2017; Fuertes et al., 2012; Gluszek & Dovidio, 2010). Thus, if there are any socially driven differences in imitation across accents, then we might be more likely to observe these differences between the Canadian and the non-native Chinese-accented conditions.

As in Experiment 1, we predict that Canadian participants will systematically lengthen their VOTs after exposure to the elongated VOTs of the model. We also predict that if imitation is socially mediated then participants may respond differently to the Canadian-accented in-group member compared to the Chinese or Australian-accented out-group members.

### 3.1 Method

#### 3.1.1 Participants

Twenty adults were tested in each of the 3 conditions (60 adults total, Age range = 17- to 39-years; Mean age = 18.41; 53 females, 7 males). In order to participate in this study, participants
had to indicate that they learned English in North America before the age of 6 and report that English was their dominant language (currently spoken at least 80% of the time). Participants reported no diagnosed hearing or vision issues that could interfere with participating in the study. Eight additional adults were run but excluded from the analysis due to technical issues in the running of the experiment (7) and failure to follow instructions (1).

3.1.2 Design, Stimuli and Procedure

The design, stimuli and procedure of the experiment were the identical to Experiment 1, except for the addition of the Chinese-accented exposure condition. The Chinese-accented model began learning English at age 7 in China, but moved to Canada as an adult and spoke English with a Chinese accent.

3.1.3 Data Analysis

Similar to Experiment 1, we measured the VOT duration of participant’s baseline and post-exposure /p/ and /k/ tokens using a combination of AutoVOT, (Keshet et al., 2014; Sonderegger & Keshet, 2012), and hand measurements. A total of 4659 tokens (produced by 60 participants) were included in this analysis. An additional 21 tokens were excluded due to following reasons: the participant provided an incorrect label (n = 9), the experimenter accidently produced the target word (n = 1), background noise (n = 9), or the production contained a voiceless vowel following the VOT (n = 2). As in Experiment 1, word duration was measured from the end of the /p/ or /k/ phoneme to the end of the word. For the words that ended in a stop consonant, word duration was measured at the end of the final vowel.

3.1.4 Statistical Analysis

The same LME model from Experiment 1 was used to analyze the data from Experiment 2. However, instead of having two model accents (Canadian and Australian), in Experiment 2 there
were three model accents (Canadian, Australian and Chinese-accented). Here, the Model’s accent was simple coded to compare VOT duration in the participants exposed to the Australian and Chinese-accented speakers to the participants exposed to the Canadian-accented speaker (reference group).

### 3.2 Results and Discussion

As in Experiment 1, there was no main effect of Condition, \( b = 0.43, SE = 0.92, t(62.5) = 0.47, p = 0.641 \) (see Table 5), indicating that as a group there was no change in VOT from the Baseline to the Post-exposure phase. Also, there was no main effect of the Model’s accent, meaning that compared to the participants that heard the Canadian speaker, the VOTs of the participants that heard the Australian and the Chinese speakers, were not significantly different. As expected, there was a significant main effect of Word Duration, with longer words having longer VOTs, \( b = .01, SE = 0.004, t(2116) = 3.01, p = 0.003 \). There was also a main effect of Segment Type with the VOTs of /k/’s being longer than /p/’s, \( b = 20.09, SE = 2.79, t(38.2) = 7.19, p < .001 \). Most importantly, there was a significant interaction between Condition and Model’s accent, with greater imitation occurring after exposure to the Canadian compared to the Chinese-accented model, \( b = -5.19, SE = 2.20, t(56.7) = -2.37, p = 0.021 \) (see Figure 11).
Table 5. Table of the fixed effects from the Experiment 2 LME model predicting VOT duration. The model included the following variables: Dependent variable = VOT duration; Fixed Effects = Condition * Model’s Accent + Condition * Segment + Word Duration; Random effects = (Condition | Subject)+(Condition | Word item)

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>0.43</td>
<td>0.92</td>
<td>0.47</td>
<td>0.641</td>
</tr>
<tr>
<td><strong>Model's Accent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian</td>
<td>-1.48</td>
<td>3.92</td>
<td>-0.38</td>
<td>0.707</td>
</tr>
<tr>
<td>Chinese</td>
<td>-1.70</td>
<td>3.92</td>
<td>-0.43</td>
<td>0.666</td>
</tr>
<tr>
<td><strong>Segment Type</strong></td>
<td>20.09</td>
<td>2.79</td>
<td>7.19</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Word Duration</strong></td>
<td>0.01</td>
<td>0.00</td>
<td>3.01</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Condition x Model’s Accent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition x Australian</td>
<td>-2.16</td>
<td>2.20</td>
<td>-0.98</td>
<td>0.329</td>
</tr>
<tr>
<td>Condition x Chinese</td>
<td>-5.19</td>
<td>2.20</td>
<td>-2.37</td>
<td>0.021</td>
</tr>
<tr>
<td><strong>Condition x Segment Type</strong></td>
<td>0.10</td>
<td>1.04</td>
<td>0.10</td>
<td>0.920</td>
</tr>
</tbody>
</table>

Figure 11. Adults’ mean VOT before and after exposure to the Canadian, Australian and Chinese- accented models in Experiment 2. Error bars represent the standard error of the mean.
Given the significant interaction between Condition and the Model’s Accent, two additional follow-up LMEs were run to examine whether there was a significant increase in VOT from the Baseline to the Post-exposure phase (i.e., a main effect of Condition) separately in the group that heard the Canadian-accented model and in the group that heard the Chinese-accented model (see Table 6 and Table 7). Both LMEs used the same structure of fixed and random effects described above. In the Canadian-accented LME, there was a marginally significant main effect of Condition, $b = 3.52$, $SE = 1.99$, $t(20.60) = 1.77$, $p = 0.092$, indicating that participants tended to increase their VOTs (compared to baseline) after being exposed to the Canadian-accented model. In the Chinese-accented group there was also a marginally significant main effect of Condition. However, instead of demonstrating lengthening in response to the model’s lengthened VOTs, participants tended to diverge their productions away from the model by shortening their VOTs, $b = -2.44$, $SE = 1.24$, $t(22.00) = -1.98$, $p = 0.061$. Thus the interaction between Condition and Model’s Accent seen in the omnibus LME was driven by the fact that the group that heard the Canadian-accented model tended to increase their VOTs after being exposed to the model’s elongated VOTs, whereas the group that heard the Chinese model tended to decrease the length of their VOTs after exposure.

Table 6. Table of the fixed effects for the subset of participants exposed to the Canadian-accented Model. The LME model included the following variables: Dependent variable = VOT duration; Fixed Effects = Condition * Segment + Word Duration; Random effects = (Condition |Subject)+(Condition| Word item)

<table>
<thead>
<tr>
<th></th>
<th>$b$</th>
<th>$SE$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>3.52</td>
<td>1.99</td>
<td>1.77</td>
<td>0.092</td>
</tr>
<tr>
<td><strong>Segment Type</strong></td>
<td>21.36</td>
<td>3.00</td>
<td>7.11</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Word Duration</strong></td>
<td>0.01</td>
<td>0.01</td>
<td>2.24</td>
<td>0.026</td>
</tr>
<tr>
<td><strong>Condition x Segment Type</strong></td>
<td>4.48</td>
<td>1.91</td>
<td>2.34</td>
<td>0.020</td>
</tr>
</tbody>
</table>
Table 7. Table of the fixed effects for subset of participants exposed to the Chinese-accented Model. The LME model included the following variables: Dependent variable = VOT duration; Fixed Effects = Condition * Segment + Word Duration; Random effects = (Condition | Subject)+(Condition | Word item)

<table>
<thead>
<tr>
<th>Participants Exposed to Chinese-accented Model</th>
<th>b</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>-2.44</td>
<td>1.24</td>
<td>-1.98</td>
<td>0.061</td>
</tr>
<tr>
<td>Segment Type</td>
<td>16.79</td>
<td>2.72</td>
<td>6.17</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Word Duration</td>
<td>0.00</td>
<td>0.01</td>
<td>-0.06</td>
<td>0.949</td>
</tr>
<tr>
<td>Condition x Segment Type</td>
<td>-2.03</td>
<td>1.74</td>
<td>-1.17</td>
<td>0.243</td>
</tr>
</tbody>
</table>

The results of Experiment 2 suggest that the accent of the model influenced the amount of imitation observed. Even though the VOTs of all three models were equal in duration, adults showed greater imitation of models that spoke with their regional (Canadian) accent compared to models that spoke with a non-native (Chinese) accent. These findings are consistent with the hypothesis that imitation is influenced by social factors. Proponents of the Communication Accommodation Theory might argue that participants converged their productions towards in-group models that they perceived to be socially desirable and diverged their productions away from out-group models that they perceived to be less socially desirable (because they spoke a non-native variant of English). Although these results could be consistent with social theories of accommodation (i.e., CAT), given the design of the experiment it is difficult to rule out the influence of non-social factors. For instance, it could also be the case that adults did not imitate the Australian and Chinese-accented models because some of their productions were outside the Canadian participant’s productive repertoire. According to Kim et al. (2011), imitation may be inhibited when the acoustic-phonetic distance between the productions of the model and the speaker is too large.

In addition to demonstrating that the type of accent influences the degree to which we imitate a speaker, our results also confirm that our experimental manipulation can successfully
elicit imitation in adults. This leads us to question why we did not see evidence of imitation in Experiment 1. Did methodological differences make our study less successful in eliciting imitation in children? Or is it simply that children do not consistently imitate the VOT of speakers? In order to address these issues, in Experiment 3, we modify the paradigm to maximize the likelihood of eliciting VOT imitation in children.

4 Experiment 3

In Experiment 2, we tested adults to explore possible explanations for why children did not imitate the models in Experiment 1 (i.e., is it that children imitate VOT inconsistently or did some aspect of our design inhibit imitation). We found that adults imitated the elongated VOTs of speakers, which suggests that our stimuli were sufficient to elicit imitation, at least in adults. In Experiment 3, we alter the paradigm to maximize the likelihood that we will be able to observe imitation in children.

We do this by making two major changes to the procedure. First, we added a Pre-baseline phase in order to decrease the likelihood that children would hyper-articulate the baseline tokens. Second, we replaced the ‘Exposure Phase’ with a ‘Shadowing Phase’. There is some evidence that having a shorter delay between the model’s productions and the participant’s productions tends to elicit greater imitation (Goldinger, 1998). Thus, instead of simply listening to the productions of the model speaker, participants were instructed to repeat each word immediately after the model’s production. We also tested a group of adults to compare imitation across the two age groups. We predict that children and adult’s imitation will be impacted by the model speaker’s accent. However, given previous work, we also predict that children will show greater imitation than adults.
4.1 Method

4.1.1 Participants
Thirty-two native Canadian English speaking children (Age range 5.03 to 6.92 years, Mean age = 5.79 years; 18 females, 14 males) and thirty-two Native English speaking adults (Age range 18-38, Mean age = 20.13 years; 24 females, 8 males) were tested in this experiment. As in Experiment 1, in order to participate in this experiment, children had to speak English at least 90% of the time. Adult participants had to indicate that they learned English in Canada before the age of 6 and report that English was their dominant language. Participants did not have any diagnosed speech, hearing or vision issues that could interfere with participating in the study. Four additional children were excluded from this analysis because they failed to complete the experiment (3), or follow the instructions (1). Two additional adults were excluded due to technical issues in the running of the experiment.

4.1.2 Design, Stimuli and Procedure
The design of Experiment 3 was similar to Experiment 1, except for two important changes. First, we added a Pre-baseline phase. In the Pre-baseline phase, participants were asked to label the entire set of 59 words once before proceeding to the Baseline phase. This phase was added to decrease children’s tendency to hyper-articulate the baseline tokens by familiarizing them with the items and giving them the opportunity to practice labeling them out loud.

The second modification to the procedure was to replace the Post-exposure phase with a Shadowing phase. The stimuli used in the Shadowing phase was identical to the Exposure phases used in Experiments 1 and 2 except, instead of being asked to “listen” to the model speaker’s productions, participants were instructed to directly “repeat” the words after the model. For
example, if the model produced the word “paint”, the participant would then repeat the word “paint” in the 1.5 s interval between each word.

4.1.3 Data Analysis
The VOT of the Shadowed and Baseline tokens were measured using AutoVOT (Keshet et al., 2014; Sonderegger & Keshet, 2012), and were adjusted by hand to correct for any obvious errors in measurement. A total of 3210 tokens (produced by 64 participants) were included in this analysis. An additional 118 tokens were excluded for the following reasons: the participant labeled the item incorrectly (or failed to produce an audible label; n = 29), there was an overlap between the participant’s productions and the Model’s productions (i.e., the participant produced the item at the same time as the model, or the end of the participant’s production overlapped with the model’s subsequent production, n = 67), there was background noise (n = 13), the VOT was followed by a voiceless vowel (n = 9)). As in Experiments 1 and 2, word duration was measured from the end of the /p/ phoneme to the end of the word.

4.1.4 Statistical Analysis
An LME model (Barr et al., 2011) was implemented using the lme4 package of R 3.2.2 (Bates et al., 2015; R Development Core Team, 2015). We modeled the dependent variable (VOT duration) as a function of Condition (Baseline, Shadowed production), the Accent of the model (Canadian-accented or Australian-accented), Word duration\textsuperscript{7}, Age Group (Children, Adults) and the 3-way interaction between Condition, the Model’s Accent and Age. Segment type was not included in this model, as all the words in the shadowed phase began with /p/ (i.e., there were no /k/ segments). We used the same structure of random effects from Experiments 1 and 2.

\textsuperscript{7} Note. Word Duration was rescaled by a factor of 10 to increase the LME model’s ability to fit the data
4.2 Results and Discussion

Unlike the first two experiments, in this experiment there was a significant main effect of Condition, $b = 10.28$, $SE = 1.45$, $t(47.3) = 7.08$, $p < .001$ (see Table 8). This indicates that participants systematically increased their VOTs after exposure to the Model’s productions. As expected, there was also a significant main effect of Word Duration, $b = 0.17$, $SE = 0.04$, $t(1118.7) = 3.94$, $p < .001$. Although there was a main effect of the Model’s Accent, there was no interaction between Condition and the Model’s Accent, meaning that participants imitated the elongated VOTs of both the Canadian and the Australian-accented models equally (see Figure 12), $b = 0.94$, $SE = 2.69$, $t(60.1) = 0.35$, $p = .728$. As expected, children produced significantly longer VOTs (in general) compared to adults, $b = -12.85$, $SE = 3.34$, $t(62) = -3.84$, $p < .001$. However, there were no 2-way or 3-way interactions between Age, Condition and the Model’s Accent (all $b < 3.47$, $p > .521$), which suggests that there were no age-related differences in the amount of imitation seen in children and adults. Indeed, when we rerun the model to examine whether there was a significant increase in VOT from Baseline to Shadowed Phase (i.e., a main effect of Condition) separately for each of the four groups of participants (see Table 9), we find evidence of imitation (i.e., a significant main effect of Condition), in both the children who heard the Canadian, $b = 8.88$, $SE = 2.98$, $t(15.12) = 2.98$, $p = .009$, and Australian-accented speakers, $b = 12.56$, $SE = 3.42$, $t(16.91) = 3.67$, $p = 0.002$, as well as the adults that heard the Canadian, $b = 11.80$, $SE = 2.55$, $t(16.9) = 4.63$, $p < .001$, and Australian-accented speakers, $b = 10.32$, $SE = 2.35$, $t(15.84) = 4.40$, $p < 0.001$. 
Table 8. Table of the fixed effects from the Experiment 4 LME model predicting VOT duration. The model included the following variables: Dependent variable = VOT duration; Fixed Effects = Condition * Model’s Accent * Age + Word Duration; Random effects = (Condition |Subject)+(Condition| Word item). Note: Word Duration was rescaled by a factor of 10 to increase the LME model’s ability to fit the data.

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>10.27</td>
<td>1.45</td>
<td>7.07</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Model’s Accent</strong></td>
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<td>3.30</td>
<td>-2.44</td>
<td>0.018</td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
<td>-12.85</td>
<td>3.34</td>
<td>-3.84</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Word Duration</strong></td>
<td>0.17</td>
<td>0.04</td>
<td>3.94</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Condition x Model's Accent</strong></td>
<td>0.94</td>
<td>2.69</td>
<td>0.35</td>
<td>0.728</td>
</tr>
<tr>
<td><strong>Condition x Age Group</strong></td>
<td>-0.54</td>
<td>2.70</td>
<td>-0.20</td>
<td>0.843</td>
</tr>
<tr>
<td><strong>Model's Accent x Age Group</strong></td>
<td>1.32</td>
<td>6.60</td>
<td>0.20</td>
<td>0.842</td>
</tr>
<tr>
<td><strong>Condition x Model's Accent x Age Group</strong></td>
<td>-3.48</td>
<td>5.39</td>
<td>-0.65</td>
<td>0.521</td>
</tr>
</tbody>
</table>

Table 9. Table of the fixed effects for the subset of child and adult participants exposed to the Canadian and Australian–accented Models. Each model included the following variables: Dependent variable = VOT duration; Fixed Effects = Condition + Word Duration; Random effects = (Condition |Subject)+(Condition| Word item).

**Children Exposed to Canadian-accented Model**

<table>
<thead>
<tr>
<th></th>
<th>b</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>8.88</td>
<td>2.98</td>
<td>2.98</td>
<td>0.009</td>
</tr>
<tr>
<td><strong>Word Duration</strong></td>
<td>0.03</td>
<td>0.01</td>
<td>3.76</td>
<td>&lt; 0.001</td>
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</table>

**Children Exposed to Australian-accented Model**

<table>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>12.56</td>
<td>3.42</td>
<td>3.67</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Word Duration</strong></td>
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<td>0.01</td>
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<td>0.740</td>
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</table>

**Adults Exposed to Canadian-accented Model**

<table>
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</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>11.80</td>
<td>2.55</td>
<td>4.63</td>
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</tr>
<tr>
<td><strong>Word Duration</strong></td>
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<td>0.01</td>
<td>-0.32</td>
<td>0.747</td>
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**Adults Exposed to Australian-accented Model**

<table>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>10.28</td>
<td>2.35</td>
<td>4.38</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Word Duration</strong></td>
<td>0.00</td>
<td>0.01</td>
<td>0.63</td>
<td>0.530</td>
</tr>
</tbody>
</table>
Figure 12. Mean VOT in Baseline compared to shadowed tokens in participants that heard the Canadian and Australian-accented Models in Experiment 3. The data from the child participants is presented on the left and adult participants on the right. Error bars represent the standard error of the mean.

Taken together the results of Experiment 3 suggest that both children and adults will imitate the VOTs of a model speaker that speaks with a different regional accent in a direct shadowing task. Similar to previous work, we see stronger evidence of imitation overall when we used a direct shadowing task, compared to when we used a task with a delay (as in Experiment 1 and 2). Surprisingly, unlike Nielsen (2014), which found that children imitated more strongly than adults, we found similar levels of imitation in both age groups.
We also did not find any evidence of accent-based differences in imitation. Participants imitated the elongated VOTs of the Canadian and Australian speakers equally. This pattern of results could suggest that the imitation that occurs while shadowing is not strongly affected by the type of accent. It may be the case that shadowing promotes a more automatic imitation; whereas longer-term changes in production may be more heavily influenced by social factors like the in-group or out-group status of the model speaker.

5  General Discussion

This is the first study to compare children’s imitation of model speakers from their own linguistic community versus another linguistic community. Given that Canadian children showed strong social preferences for Canadian-accented peers in Chapter 2, in Experiment 1, we predicted that Canadian children would imitate the productions of Canadian-accented models more strongly than Australian-accented models. However, we found no evidence of imitation of either model. In order to investigate possible explanations for this, in Experiment 2 we tested a group of adults using the same paradigm. Not only did adults imitate the elongated VOTs of the Canadian-accented model, but their imitation was modulated by the model’s (regional or non-native) accent. In order to maximize the likelihood that children would imitate, in Experiment 3 we tested children and adults using a modified shadowing procedure. Interestingly, our results suggested that both age groups imitated the Canadian and Australian-accented models equally. Although we found no age differences in the amount of convergence, our results suggest that the demands of the task (immediate vs. delayed imitation) may play an important role in determining the type of imitation that is elicited.

One goal of this study was to investigate whether there were age-related changes in the imitation of familiar and unfamiliar accented speakers. Contrary to Nielsen (2014), when we
used an auditory naming task in Experiment 1, children did not appear to imitate any of the model speakers. It may be the case that the long baseline VOTs produced by children in our sample may have limited their ability to increase their VOTs after exposure. However, it is also possible that delayed VOT imitation might be quite unstable in young children. The design of our delayed task may simply be too complicated and taxing on children’s limited working memory capacity to elicit stable imitation effects (see Heath, 2017 for evidence that occupying working memory decreases VOT imitation in adults).

Although we did not see imitation in the delayed task (Experiment 1), children did imitate both speakers in the immediate shadowing task (Experiment 3). However, we still did not replicate the age differences in accommodation reported in Nielsen (2014). This is surprising given that real-world observations suggest that children tend to accommodate faster and more fully than adults (Chambers, 1992; Smith et al., 2007; Tagliamonte & Molfenter, 2007). However, we must consider the possibility that even though we did not observe age differences in VOT imitation, children may indeed show greater imitation of other features (like intonation, F1, vowel duration) compared to adults.

In recent years, a number of papers have stressed importance of using multiple measures to assess imitation (Pardo, 2013; Pardo, Jordan, Mallari, Scanlon, & Lewandowski, 2013). Here, we assessed imitation on a fine-grained phonetic level by measuring changes in VOT. However, we acknowledge that participants might also be simultaneously converging and diverging on other features (i.e., vowels, word duration), that were not assessed in this study. To examine this possibility, we have designed a follow-up study to assess imitation using a more ‘holistic’ measure of convergence. In this study, a second group of adult participants will listen to the participants’ recordings from Experiments 1 through 3. The new group of participants will be
asked to rate whether the Shadowed or Baseline productions of the original participants sounded more like the model production. If ‘global’ imitation is detectable, then the raters should perform better than chance (.5) in identifying the Post-exposure productions. Although we did not observe age differences in Experiments 1 to 3, it is possible that we may be able to detect differences using the rating task described above.

Our second question of interest was whether there are differences in the imitation of familiar and unfamiliar accented speakers. Although no laboratory studies have examined the imitation of accented speakers in children, a few studies have examined the imitation of accented speakers in adults. Some of these studies suggest that participants will imitate models that speak with a different regional accent (Babel, 2010; Walker & Campbell-Kibler, 2015). However, one study found no evidence that participants will imitate speakers that speak with different regional or non-native accents (Kim et al., 2011). In our study, we found that participants will imitate unfamiliar accented models, but their imitation varied depending on the task. When we used an immediate shadowing task (similar to the task used in Babel, 2010), both children and adults imitated the Canadian and Australian speakers equally. However, when we used a delayed shadowing task (closer to the spontaneous conversation method used in Kim, 2011), children failed to imitate any model speakers and adults only imitated the Canadian model. Our findings (in adults) seem to support the notion that imitation may be socially mediated. Adults might have converged their productions towards socially desirable in-group members and away from foreign-accented out-group members. That being said, it is difficult to rule out automatic explanations for these findings. It may also be the case that acoustic-phonetic differences between the speaker and model could have blocked adult’s imitation of the unfamiliar accented models. Although, it is difficult to tease apart social and automatic explanations of accommodation in the current study, a similar paradigm could be used to investigate how heavily
adults’ imitation is influenced by social information. For example, we could examine whether adults will imitate regional-accented speakers that are socially desirable but are acoustically dissimilar, over regional speakers that are less socially desirable, but acoustically more similar.

Although we find no evidence of age-related changes, our results suggest that imitation is influenced by both the accent of the speaker, as well as the type of task used to elicit imitation. In line with previous work (Goldinger, 1998), we found more consistent imitation when participants were asked to repeat after the model (immediate shadowing), compared to when participants re-named the entire word list in the Post-exposure phase (auditory naming). Although it is not considered in previous work, the differences observed across these two tasks could indicate that are different mechanisms underlying immediate and delayed imitation. Social factors (like group status) may play a greater role in delay productions; whereas shadowed productions might be more automatic (and driven by fine-grained acoustic-phonetic features). Indeed, Babel (2010) also found that social liking (measured using an Implicit Association Test) had a greater impact on whether the model’s vowel shifts were maintained in the post-exposure phase compared to whether the model’s vowels were imitated in the immediate shadowing block. If this is the case, then perhaps delayed shadowing tasks may be more representative of accent change over time.

We may shadow productions relatively automatically, but we might be more socially selective in terms of which productions will we integrate into our repertoire. In order to begin to examine whether the social group membership of speakers can have any impact on direct shadowing, we are currently examining whether children and adult participants will imitate the VOT of non-native Chinese-accented speaker in an immediate shadowing task. If participants do converge with non-native speakers, then this would further support the notion that direct shadowing may be less affected by the social characteristics of the speakers than delayed imitation tasks.
This is the first study to compare children and adult’s imitation of accented speakers. Although we do not see evidence that children imitate more than adults, the degree to which model speakers were imitated seemed to be influenced by the demands of the task and the accent of the speaker (at least in the case of adults). While the group status of the speaker affected productions in the (delayed) auditory naming task, there was no impact of accent type in the shadowing tasks. This raises the possibility that imitation may be less socially selective when shadowing is immediate. These findings highlight the importance of considering how factors like the group status of the speaker may be interacting with the demands of the task to influence the imitation we observe in the lab and in the real world.
Chapter 5
General Discussion

1 Summary of Findings

In this dissertation, I explored the effect of accent exposure on social cognition and language acquisition in early childhood. In each chapter, I examined the impact of accent exposure on a different aspect of children’s social and linguistic development. In Chapter 2, I examined the effect of everyday accent exposure on children’s friendship preferences. In Chapter 3, I investigated how accented speech might impact infants’ ability to sort their linguistic input by language. And finally, in Chapter 4, I explored how a model speaker’s accent might influence children’s phonetic imitation. My findings suggest that accent exposure plays a role in two of these domains, impacting children’s friendship preferences and their language discrimination abilities. This work also provides future suggestions for examining the role that accent exposure may play in speech production. Taken together, my dissertation highlights the importance of considering how the diverse communities that children live in might impact aspects of their development.

In Chapter 2, I demonstrated that despite having regular exposure to other accents or variants of English, children living in linguistically diverse communities still show strong social preferences for peers that speak with the local accent. However, the strength of children’s preferences was modified by the accent of the speaker as well as children’s exposure to accented out-group members in everyday life. In some cases, having substantial accent exposure (i.e. growing up with an accented parent or caregiver) seemed to make children more accepting of non-native speakers. However, in other circumstances exposure to a specific accent (i.e., British
English in Chapter 2 Experiments 1 and 3) may have increased bias, by refining children’s perceptual ability to identify and distinguish that accent from their own variant of English. This work provides a foundation for future work investigating the relationship between accent exposure and preferences. Indeed, individual variation in the quality and quantity of children’s exposure may play an important role in shaping their social behaviour.

In Chapter 3, I examined how the model speaker’s accent impacts infants’ ability to tell apart languages. Previous work has focused on language discrimination using native-accented speech samples. However, children in multilingual settings are often exposed to non-native speakers that might carry over some of the timing from their native language (L1) into their second language (L2; White & Mattys, 2007). In this study, I demonstrated that although monolingual 5-month-olds were able to discriminate Spanish from English speech samples produced by a bilingual L1 English speaker, they had difficulty telling apart Spanish and Spanish-accented English samples produced by an L2 English speaker. This work raises the possibility that infants growing up in multilingual settings might initially struggle to tell apart the languages they are hearing, if the speakers they are exposed to speak with non-native accents. However, it is possible that, given their experience with other accents and languages, bilingual infants may be more skilled in telling apart non-native speech samples than monolingual infants. It is also possible that, even though infants struggle in the lab, in the real world they may be able to use contextual or relational information (e.g., who is speaking, where the speech is occurring, and the ethnicity of the speaker; Kandhadai, Danielson, & Werker, 2014) to help them sort their input by language. For example, a bilingual infant may capitalize on the fact that at home their mother mostly speaks Spanish, but outside the home their mother speaks English with a Spanish accent. Future work is needed to examine these possibilities in the lab.
Finally, in Chapter 4, I examined the influence of brief accent exposure on children’s speech productions. Unlike previous work, which suggests that children show stronger imitation than adults (Nielsen, 2014), in Experiment 1, I found no evidence of VOT imitation in children. In order to explain these findings in Experiment 2, I tested a group of adults using the same methodology and stimuli. Here, adults showed evidence of imitation. In fact, adults seem to imitate selectively, converging their productions towards Canadian-accented speakers and diverging their productions away from non-native Chinese-accented speakers. In the last Experiment, using a modified paradigm, I found that adults and children imitated both the Canadian and Australian models equally, regardless of their accent. Contrary to my predictions, however, I found no evidence of age-related declines in accommodation. Although children and adults showed similar VOT imitation, it is possible that children may show greater imitation of other features (like vowels and intonation) than adults. In future work, I will begin to examine this possibility by measuring imitation using a more holistic rating task in addition to fine-grained phonetic measurements.

2 Future Directions

In the three lines of research reported in this thesis, I consider how exposure to accent variation influences aspects of children’s social and linguistic development. This work highlights the importance of examining how well previous findings generalize to populations with greater diversity in their linguistic input. However, it also raises some interesting questions about how individual variation in children’s accent exposure may influence aspects of their development. Indeed, there can be a lot of variation in the types of accents that children are exposed to (i.e. regional or non-native) as well as how heterogeneous that exposure is. In order to truly understand the relationship between exposure and behaviour, we need to take a closer look at
how individual differences in children’s exposure could shape the processing of accented speech. In the following section, I will discuss how the quality and quantity of accent exposure and the individual characteristics of the listener could influence children’s friendship preferences, categorization abilities and speech imitation.

Within a group of children with ‘high accent exposure’ there can be substantial variation in how uniform that exposure is. For example, some children are exposed to a variety of regional and non-native accented speakers on a daily basis, whereas other children have a lot of exposure to one accent (i.e., they hear Hindi-accented English spoken at home and in the community), but they have very little exposure to other accents. Given that exposure can breed acceptance (see Pettigrew & Tropp, 2006 for a review), one might predict that regular exposure to a single accent might make listeners more accepting of speakers from that community. However, there is some evidence that this may not be the case. One study of Korean-English bilingual children, found that even though Korean-accented English was familiar to them (i.e., most participants had parents that were born in South Korea), children still showed strong social preferences for American over Korean-accented English speakers (DeJesus et al., 2017). Given the findings from Chapter 2, one could speculate that exposure to a variety of different accents may be more beneficial in promoting acceptance than exposure to a single accent. For instance in Chapter 2, the children that were more accepting of the Korean-accented speakers had ‘high accent exposure’, but very few of those children were actually exposed to Korean English. Although speculative, the aforementioned relationship between the uniformity of accent exposure and social liking may also begin to explain why children (despite frequent exposure) do not acquire their parent’s non-native accented productions. In the future, it would be interesting to explore whether children that hear a variety of accents in their community might be more likely to shift their productions towards different-accented speakers than children with more uniform input.
Not only do we see variation in children’s accent exposure, there is also considerable individual variation in children’s ability to imitate, categorize and understand accented speech. Research with adults suggests that some people are more skilled in identifying and adapting to novel accents than others (Banks, Gowen, Munro, & Adank, 2015; Clopper & Pisoni, 2004; Janse & Adank, 2012). These individual differences in adaptation seem to be correlated with general cognitive abilities, like working memory and inhibitory control (Banks et al., 2015; Janse & Adank, 2012), as well as vocabulary knowledge (Banks et al., 2015). Cognitive abilities, like working memory, may also explain some of the individual differences we see in imitation (Heath, 2017). Indeed, when working memory is occupied, adults seem to show less imitation of fine-grained phonetic features like VOT (Heath, 2017). However, individual differences in imitation can also been attributed to personality traits like openness (Yu, Abrego-Collier, & Sonderegger, 2013).

These individual differences in children’s ability to process accented speech could have an impact on their social preferences. For example, adults tend to evaluate accented speakers more negatively in situations where those speakers are more difficult to comprehend (Dragojevic & Giles, 2016). Thus, it is possible that children who are less able to process accented speech might show greater social bias against accented individuals. For children who ‘adapt easily’, there may be less of a barrier to interacting with foreign-accented speakers.

Finally, there may be interesting bidirectional relationships between imitation, comprehension and social liking. Social liking predicts imitation, however imitating others also leads to greater comprehension and greater social liking (Adank, Hagoort, & Bekkering, 2010; Adank, Stewart, Connell, & Wood, 2013). In future work, it is important that we begin to take into account the complex and multi-faceted relationships between accent exposure and individual
differences in processing, by modeling these variables together. Models that investigate the role of accent exposure on linguistic processes and social behaviour should combine measurements of the quality and quality of exposure with measurements of how well individual children adapt to and process accented speech. Taking a more multifaceted approach, like this, could advance our understanding of what drives children’s linguistic and social behaviors.

3 Concluding Remarks

Taken together, the findings reported in this dissertation provide novel insight into how children’s linguistic environment might influence their friendship preferences, speech perception, and speech production. Each individual child comes into the lab with a unique set of linguistic experiences and there is value in attempting to identify how these experiences color the way in which they process and interpret accent stimuli presented to them in the lab and in the real world.
References


Appendices

**Appendix A:** Sentences used in Chapter 2

There are lots of animals at the zoo.

There are three meals: breakfast, lunch and dinner.

There are lots of big sailboats on the lake.

Hands have five fingers and feet have five toes.

You can see the moon and stars after dark.

There are seven colours in the rainbow.

The trees in the park are tall and leafy.

Planes fly in the sky high above the clouds.
Appendix B: Language interview used in Chapter 2.

1. How old were you (primary caregiver) when you first learned English?
2. How old were any other primary caregivers when they first learned English?
3. Where did you learn English? How would you describe the variant of English you speak (e.g. Southern Ontario, Australian, Singaporean etc…)?
4. Where did any other primary caregivers learn English? How would you describe the variant of English they speak (e.g. Southern Ontario, Australian, Singaporean etc…)?
5. Based on the above questions, what percentage of the time would you say your child hears English spoken by people who learned it in Ontario (or other Canadian provinces with no distinct dialects) as a first language?
6. What percentage of the time does your child hear other languages or variants of English?
7. Do you speak (or have you spoken in the past) any other languages besides English? When did you learn the language and in what context do you currently use it?
8. Do other primary caregivers speak (or have they spoken in the past) any other languages besides English? (If no for all primary caregivers, please skip to question number 11) When did they learn the language and in what context do they currently use it?
9. Do you consider English your dominant language? If not, please explain.
10. Do other primary caregivers consider English their dominant language? If not, please explain.
11. Are you raising your child bilingually? Please explain.
12. Do you expect English to be your child's only language? If not, do you expect it to be your child's dominant language?
13. Does your child attend school? How often? What is the dominant language at school? How long has the child been at this school for? How would you describe the variant of English that the primary teachers speak? (If there are variants other than Southern Ontario English, how long has the child been with this particular teacher for?)
14. What language(s) do your friends and family members who spend the most time with your child speak in your child's presence? How much time do they spend with your child?
15. Does your child listen to any Polish, British or Korean accented English? If yes, by whom (include TV shows)? Also, please explain how often/how many hours per week.

16. Do you travel often with your child to locations where Canadian English is not the dominant language/dialect? How much time do you spend in those locations?

17. Do you live in a neighborhood where a language besides Canadian English is the dominant language/dialect? Please explain.

18. Can you please confirm the percentage of Canadian English your child hears?
**Appendix C: Word list from Chapter 4**

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Copyright Acknowledgements

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Data from Chapter 4 will be submitted for publication as Paquette-Smith, M., Schertz, J., & Johnson, E.K.