Children's Competence with Listener Dependent Prosodic Modifications

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

A key component of communicative development is learning that different listeners are spoken to in different ways. Mature communicators not only adjust what they say when addressing children versus adults, for example, but they also adjust the manner in which they speak. The purpose of this dissertation is to explore school-aged children's knowledge about the kinds of adjustments that speakers make to their prosody depending on who their listener is. Prosodic aspects of speech are those which pertain to pitch, volume, and speech rate. Study 1 (Experiment A) explored the relative strength of prosody and semantic content in 5- to 10-year-old children's decisions about the intended listener of greetings. In incongruent conditions, in which the prosody of the greeting suggested one listener (i.e., either an infant or an adult) and the content another, 5- to 6-year-old children's choices indicated confusion about whom to choose, while 7- to 10-year-old children used prosody to choose the intended listener of the greeting. Experiment B showed that adults were similarly influenced by prosodic rather than content cues. In these ways, Study 1 highlighted older children and adults' associations of speaker prosody with particular types of listeners (even in the face of conflicting content cues). Relatedly, Study 2 explored the kinds of social and communication-related judgments that adults (Experiment C) and children (Experiment D) made about speakers and listeners when the speaker's prosody was appropriately tailored to her listener (i.e., child-directed prosody for a child) versus inappropriately tailored to her listener (i.e., adult-directed prosody for a child). When making

judgments about a range of socio-communicative qualities, Experiment C showed that adults considered whether the prosodic style was appropriate for the listener when assessing competence. In contrast, Experiment D showed that 7- to 10-year-old children did not penalize interlocutors when there was a prosodic mismatch between speaker and listener. Rather, children showed a strong preference for child-directed prosody generally, which extended throughout their competence ratings. Results from these two sets of studies have theoretical implications as well as implications for the remediation of social and communicative deficits.

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Introduction

In successful communication exchanges, speakers and listeners have to engage in communicative acts simultaneously as individuals, and as ensembles (Clark, 1996). Successfully engaging in this joint action of communication requires sensitivity to the needs of one's conversational partner (Clark, 1996). It is not enough for the speaker to have an idea of the words that she wants to say; rather, to successfully convey her intentions in an appropriate manner, she would have to be mindful of the needs of her listener. These needs would be determined both by dynamic factors such as the listener's perspective, as well as by demographic traits like his or her age or linguistic ability. A failure to take into account these needs might lead to a communication breakdown, and lead to confusion for both the listener and the speaker (Grice, 1975). The need to tailor one's communication style to one's partner is significant enough that there are professional services devoted to helping people achieve this goal. For example, one such service makes modifications to your e-mails' "words, phrases, style, and tone" to adjust to the recipient's style. The service's creators promise that these modifications will end e-mail miscommunication and "build healthier, more productive relationships" (https://www.crystalknows.com).

Consider another example which highlights the need to adjust one's oral communication style to one's listener: A conversation about the benefits of a healthy and balanced diet might sound very different if a public health nurse was addressing a 5-year-old patient, an adult, or a newcomer with little proficiency in English. When addressing these patients, the nurse's speech would likely vary with respect to a number of linguistic elements. She might tailor what she says to ensure that the complexity of her vocabulary and sentence structure is appropriate for each individual's comprehension ability. Moreover, she might tailor aspects related to *how* she speaks,

including her intonation and speech rate. Indeed, even if she uses simple words and short sentences when addressing the preschooler, she is most likely to be understood if she delivers those words slowly, with varied intonation, than if she speaks quickly and monotonously. Thus, the nurse's ability to finely tailor her communication style according to her audience will determine how effectively she conveys her message, and ultimately, does her job. This ability to appropriately and flexibly use language according to the social context is known as pragmatic competence, which is a critical skill that children and adults need to master for effective interpersonal functioning.

Driven with the intention of understanding one central aspect of pragmatic competence better, the underlying motivation of this dissertation is to explore children's developing understanding of listener dependent speech modifications. I will specifically focus on the prosodic aspects of these speech style changes, which pertain to pitch, volume, and speech rate. In the first set of experiments, I will present data on school-aged children's (and adults') knowledge about the association between prosodic styles and listeners. These results will help clarify findings from previous research that show that children have knowledge about which speech styles are used for various listeners (e.g., infants, teachers, foreign-language speaking children; Wagner, Greene-Havas, & Gillespie, 2010). While children in this past research matched speech styles to listeners using a range of cues (e.g., lexical and prosodic), the present work will clarify the strong role of prosody specifically in influencing their decisions about who the intended listener of speech might be. In a subsequent set of experiments, I will explore whether children's (and adults') judgments about speakers' and listeners' social and communicative competence are affected by whether speakers' prosodic styles are appropriately or inappropriately tailored to the listener (in other words, whether the speaker is using a prosodic

style that is typically used for a particular listener or not). This last set of experiments will serve as a preliminary exploration of possible implications of these prosodic style modifications. My primary interest is in exploring answers to these questions based on the performance of children in the early school years (i.e., 5- to 10 years). This age group was chosen because past research has shown that there are shifts in how strongly children rely on prosody within this developmental period (Morton & Trehub, 2001). Though the primary focus is on the early school years, this dissertation also includes data from adult samples to situate the findings within a larger developmental perspective.

Prior to the presentation of these experiments, this literature review will frame these questions within a historical perspective on the study of listener dependent speech modifications generally, which includes semantic content modifications. I will then turn to a more specific discussion of prosody, which will include consideration of its function in communication, children's sensitivity to these functions, and prosody's prominent role in speech style modifications for various listeners.

The History of the Study of Listener Dependent Speech Modifications

The study of speakers' ability to adjust their communication, and more specifically, the content of their speech, according to listeners' needs has been examined for decades by communication researchers. One such line of enquiry examines how interlocutors take into account each other's perspectives when comprehending and producing speech (e.g., Bahtiyar & Küntay, 2009; Glucksberg, Krauss, & Weisberg, 1966; Nadig & Sedivy, 2002; Nilsen & Graham, 2009; Pechmann & Deutsch, 1982). Such referential communication studies explore individuals' ability to successfully refer to things in the world. For instance, I would have to specify that I wanted "the book on language disorders" for my friend to be able to clearly

disambiguate the book that I wanted from the array of books on her shelf. Simply asking for "the book" would be insufficient. Failing to refer to objects with enough information for the listener to understand the message, or providing too much information, can have negative consequences for the listener. Morisseau and colleagues (2013) showed that 3- to 5-year-old children's comprehension of utterances was delayed and/or disrupted when speakers did not provide enough information or provided overly descriptive statements (Morisseau, Davies, & Matthews, 2013). As adults, we use referential language frequently, and at first glance, seemingly automatically (though the process is in fact effortful; Epley, Keysar, Van Boven, & Gilovich, 2004; Horton & Keysar, 1996; Lin, Keysar, & Epley, 2010). As for children, while findings from early referential communication studies supported Piaget's assertion that children's communicative style reflects their egocentric biases (e.g., Glucksberg et al., 1966; Pechmann & Deutsch, 1982), later studies, with simplified task demands, revealed preschoolers' ability to tailor their utterances to their listeners' visual perspectives (e.g., Matthews, Lieven, Theakston, & Tomasello, 2006; Nadig & Sedivy, 2002; Nilsen & Graham, 2009). Moreover, this skill of describing objects with enough information for their listener to understand was shown to have continued development into late childhood (Lloyd, Mann, & Peers, 1998).

While adjusting the amount of information that one provides for one's listener is certainly critical to communicating effectively, the example of the nurse was intended to highlight that prosodic changes are important, too. Yet, prosodic speech modifications are relatively understudied compared to semantic changes (the latter being the focus of the referential communication studies referenced earlier; e.g., Nadig & Sedivy, 2002), despite acknowledgement of prosody's relevance to communication (Roach, 2000). In a subsequent section of this dissertation, I will discuss the few studies that document the prosodic changes that

children make for their listeners. In contrast, the referential communication literature to which I alluded earlier features a rich array of studies that explore the lexical changes that children make for their listener. With the aim of advancing the research on prosody understanding, this dissertation will help to address the relative paucity of research on children's knowledge about listener dependent prosodic changes.

The Functions of Prosody

Prosody refers to the aspects of speech that are separate from semantic content, and includes vocal pitch, volume, and speech rate. Prosody can be used to convey information beyond that of the words spoken and is thought to serve three communicative functions, though these are not mutually exclusive: affective, grammatical, and pragmatic (Roach, 2000). Specifically, emotional meaning is largely conveyed by pitch and speech rate, which can be used to identify emotions across languages (Banse & Scherer, 1996; Breitenstein, Van Lacker, & Daum, 2001; McCluskey, Albas, Niemi, Cuevas, & Ferrer, 1975; Van Bezooijen, Otto, & Heenan, 1983). Prosody serves grammatical functions such as communicating information about whether an utterance is a declarative or a question (Soderstrom, Ko, & Nevzorova, 2011), and helping listeners infer syntactic structure when interpreting otherwise ambiguous phrases like, "*tap the frog with the flower,"* because of the correlation between prosodic and grammatical structure (Jusczyk et al., 1992; Snedeker & Trueswell, 2003; Soderstrom, Seidl, Nelson, & Jusczyk, 2003). Pitch, volume, and speech rate also convey information about properties of the physical world, independent of semantic content (Herold, Nygaard, Chicos, & Namy, 2010; Jesse & Johnson, 2012; Shintel & Nusbaum, 2007). As will be discussed further in the next section, prosodic cues alone can convey whether a speaker is referring to an object that is big or small, or moving quickly or slowly (Herold et al., 2010). Thus, given how informative prosody

can be, understanding what prosodic cues convey is an important component of overall communicative competence.

The Development of Children's Prosodic Sensitivity

Indeed, prosody is an important component of language. The development of the ability to access meaning from prosody follows an interesting trajectory. The focus in this section will be on children's developing sensitivity to affective prosody and pragmatic prosody due to the relevance of these types of prosody to this dissertation (which will focus less on grammatical prosody, which refers to the type of prosody that conveys information about grammatical structure). Studies on the interpretation of emotions highlight early evidence of children's sensitivity to prosody, though the developmental trajectory is nonlinear (Morton & Trehub, 2001; Quam & Swingley, 2012). Infants as young as 5 months of age responded to prosodic emotional cues by showing more positive facial affect to approval vocalizations and negative facial affect to prohibitive vocalization, even in unfamiliar languages (Fernald, 1993). Further, 12-month-old infants modulated their behaviour in response to fearful vocal prosody alone (Mumme, Fernald, & Herrera, 1996). More specifically, within the context of a novel toy social referencing paradigm, infants presented solely with fearful vocal signals kept further from the toy, looked longer at their mothers, and showed more negative affect than infants presented with neutral vocal affect (Mumme et al., 1996). In these ways, young infants show a marked sensitivity to prosody.

At approximately 15 months of age, infants show evidence of a lexical bias in which they respond to what is being said as opposed to the prosody in which it is conveyed (Friend, 2001). Lexical content continues to take precedence in the preschool years (Aguert, Laval, Le Bigot, & Bernicot, 2010; Morton, Trehub, & Zelazo, 2003; Waxer & Morton, 2011). For example, when

children ranging in age from 4- to 8 years heard a positive situation described with sad vocal prosody, they relied on content and judged the emotion of the speaker to be happy. In contrast, adults' emotion judgments in these conflicting situations were influenced exclusively by vocal affect (Morton & Trehub, 2001). At 9- to 10 years of age, children start to consider prosody in contexts in which lexical and prosodic cues conflict (Aguert et al., 2010; Friend, 2000; Morton & Trehub, 2001; Wells, Peppé, & Goulandris, 2004). In one study in which children were presented with vignettes in which the valence of the situational context conflicted with the vocal prosody of one of the characters in said context, 9-year-olds relied both on prosody and situational context when judging the character's emotional state (Aguert et al., 2010). Thus, though infants can use prosody to infer meaning, situations with conflicting linguistic cues show a more nuanced developmental trend. That is, in these conflicting contexts, young children derive meaning from semantic content but show an increasing reliance on prosody as they age.

In addition to inferring meaning about emotional states, young children can use prosody to make inferences about a speaker's intent. Sakkalou and Gattis (2012) presented 16-month-old infants with actions that were marked prosodically as either intentional (i.e., through the utterance of a Greek word presented with falling pitch) or accidental (i.e., Greek word presented with rising pitch). Infants reproduced more of the intentional behaviours. Importantly, as the lexical content was presented in a foreign language, these results demonstrate infants' ability to modulate their behaviour based solely on prosodic cues about intent. In a study by Grassman, Stracke, and Tomasello (2009), 2-year-olds watched an adult gaze at an object while labelling it with excitement. When the speaker had not seen the object before, children assumed that the label referred to the object at which the speaker was gazing. In contrast, when the adult had played with the object before, children looked around for another object, presumably to account

for the speaker's surprise. Though, children in this study might have been influenced by the adult's facial affect in addition to her vocal prosody, as her face was always visible. An example of children's ability to use vocal prosody alone to infer a speaker's communicative intent is a study by Berman, Chambers, & Graham (2010). In their study, children were presented with similar objects and heard a referentially-ambiguous utterance instructing them to look at the one of the objects (Berman et al., 2010). Four-year-olds were more likely to look towards a broken doll instead of an intact doll when they heard "look at the doll" uttered with negative vocal affect (also see Berman, Graham, Callaway, & Chambers, 2013).

Though much of the work on the development of prosodic abilities has to do with emotions, children's ability to use prosody when making inferences is not limited to the affective domain. Recent work indicates that prosody can provide cues to meaning about properties of objects, and that young children are implicitly aware of these cues. Results from the adult literature indicate that speakers use prosody to convey meaning by increasing their pitch to describe vertical motion and speaking more quickly to describe objects that are moving quickly (Shintel, Nusbaum, & Okrent, 2006). Four- and 5-year-olds also evidenced similar spontaneous prosodic modifications such that their descriptions of fast-moving objects were delivered with a faster speech rate than their descriptions of slow-moving objects (Hupp & Jungers, 2013). Thus, both adults and children appear to spontaneously produce prosody that conveys meaning about physical objects. It follows that children might also be able to use prosody to infer meaning about physical properties of objects. Indeed, in a pragmatic prosody comprehension study, 5-year-olds assumed that a word spoken in a low, loud, and slow voice referred to a large flower; in contrast, they assumed that a word spoken in a high, fast, quiet voice referred to a small flower

(Herold et al., 2010). The results from the literature reviewed in this section point to children's early sensitivity to prosody in a range of contexts.

Prosodic Modifications in Speech

In addition to its aforementioned communicative functions, prosody is also important for the listener dependent communication modifications that are central to this dissertation. The body of work that best demonstrates prosody's role in speech adjustments is that of communicative register. Register refers to speech styles that vary according to the social context (Ellis & Ure, 1969; Halliday, McIntosh, & Strevens, 1964; Reid, 1956; Verma, 1969). Not only are these speech styles determined by characteristics of our communicative partners that impact their linguistic needs such as their age and language ability (which will serve as the focus of this dissertation), but also by the nature of the social relationship that we hold with the person to whom we are speaking, the speaker's communicative goals, and the social context in general (Andersen, 1990).

One well-studied example of adults modifying their speech to their listeners' age is child-directed speech (CDS)[1], which varies from adult-directed speech (ADS) with respect to syntactic complexity, lexicon, and most saliently, prosody (Ferguson, 1964). The prosodic features of CDS include higher mean pitch, greater pitch and volume variability, and longer vowels and pauses (Fernald & Simon, 1984; Garnica, 1977). CDS is thought to serve a number of functions, which are consistent with the functions of prosody that were previously proposed. First, CDS

[1] The terms "child-directed speech" (CDS) and "infant-directed speech" (IDS) are both used in the literature to refer to speech style modifications made to young children. Evidence suggests that the degree to which adults make speech (and prosodic) modifications to infants and young children can vary with children's age, (e.g., pitch range most exaggerated for 4-month old infants relative to newborns or 1- or 2-year-old children; Stern, Spieker, Barnett, & MacKain, 1983). However, the literature does not clearly distinguish between IDS and CDS, or mark where the use of IDS ends and CDS begins. In the interest of simplicity, the term CDS will be used throughout this dissertation to denote speech styles used with infants and young children.

serves an affective role (Singh, Morgan, & Best, 2002). Infants prefer CDS to adult-directed speech (even in non-native languages; Werker, Pegg, & McLeod, 1994). Furthermore, infants' preference for CDS seems to be largely driven by vocal pitch (Fernald & Kuhl, 1987). A second proposed function of CDS is that it engages and maintains infants' attention (Fernald & Simon, 1984). Third, CDS serves a didactic role (Thiessen, Hill & Saffran, 2005). Mothers adjust their volume and word length when reading antonyms (presumably to differentiate their meanings, though the degree to which mothers do so explicitly is unclear; Herold, Nygaard, & Namy, 2011). Even adults' word learning is facilitated by child-directed presentation relative to an adult-directed presentation (Golinkoff & Alioto, 1995). Possible facilitating cues in the Golinkoff study (1995) included longer vowel sounds for the target word in CDS relative to ADS, placement of the target word at the end of the sentence in CDS as opposed to the middle of the sentence in ADS, as well as increased volume for the target word relative to the other words in CDS. Another study that provides support for the benefits of CDS for word learning showed that parents' use of CDS with their 2-year-old toddlers predicts the size of children's receptive vocabulary one year later, after controlling for earlier vocabulary skill (Rowe, 2008), suggesting that it plays a facilitating role for language development. Similarly, infants from Spanish-speaking families from low socioeconomic backgrounds who had more exposure to CDS at 19 months had larger expressive vocabularies at 24 months, and were more efficient in processing familiar words (Weisleder & Fernald, 2013). Of note is that language outcomes were not related to the amount of speech that infants simply overheard. This finding suggests that CDS in particular has benefits for language development. Interestingly, Song and colleagues (2010) found that some aspects of CDS but not others improved 19-month-olds' recognition of words. Namely, toddlers' recognition of words was facilitated by a slower speech rate and by hyper-

articulation of vowels, but not by a wider pitch range (Song, Demuth, & Morgan, 2010). The authors suggested that toddlers might be most influenced by the CDS prosodic cues that are most linguistically relevant.

The Dynamic Nature of Prosody's Function and Output

Interestingly, the nature of CDS output (and its prosodic features) seems to differ at different stages of development. Evidence for this notion comes from a longitudinal study by Kitamura and Burnham (2003), who showed that the function of mothers' CDS varied with their infants' age. In their study, at 3 months, mothers' pitch most strongly conveyed comfort; at 6 months, mothers' pitch was most approving; and, at 9 months, mothers' pitch was most directive. The authors suggested that the shifts in the nature of mothers' CDS reflected their responsiveness to their infants' development and changing social needs. A follow-up study showed that infants' preferences generally followed this same trajectory (i.e., from comforting to approving to directive; Kitamura & Lam, 2009). These findings suggest that prosodic aspects of speakers' CDS change in response to child needs, which is purported to facilitate aspects of development. Similarly, Stern and colleagues (1983) showed an interesting nonlinear trend, in that pitch range was most exaggerated for infants at 4 months, more so than for newborn infants and for older children who were 1- and 2 years old. These authors suggested that less variation in pitch was needed to draw the attention of newborns, and that means other than pitch were used with older children. Their findings provide further support for the notion that features of CDS might vary to complement developmental needs. Further evidence that the prosodic elements of CDS manifest differently depending on the listener's behaviour and needs was provided by the case study of Niwano & Sugai (2003). They found that a Japanese mother's CDS was produced differently for each of her 3-month-old fraternal twins, as she had a different primary communicative function

with each of them. Namely, she used more features that elicited vocalization such as a higher mean pitch and more frequent rising intonation contours when interacting with the infant who vocalized less, relative to the infant who vocalized more. The authors suggested that the nature of the mother's CDS was shaped by individual differences in her children. The findings from these studies fit with the "fine-tuning" hypothesis, which has been mostly discussed regarding syntactic and semantic changes in CDS (e.g., Snow, Perlmann, & Nathan, 1987). This hypothesis suggests that caregivers adjust the kind and degree of speech adjustments they make as children's abilities improve and develop (though the findings as to whether fine-tuning occurs are mixed; see Snow et al, 1987). A final example that is consistent with this fine-tuning hypothesis comes from Shatz and Gelman (1973), though their focus was on syntactic changes. Shatz and Gelman (1973) suggested that speech changes made to a 2-year-old were cued by the 2-year-old's own behaviour; namely, that he responded best to language that was just above his developmental level. The authors suggested that, through such a process, children elicit the type of speech that is most helpful for their development. Taken together, these findings suggests that despite having gross features that tend to be commonly applied according to the listener, the exact manner in which CDS is produced can be dependent on (and elicited according to) the listener's needs.

This idea, in some ways, adds a layer of complexity to the way in which speech style changes were discussed in early writings. On the one hand, register, especially in early writings, was often discussed as a type of sociolinguistic *knowledge* (Andersen, 1990), in that one learned to make a set of changes for certain listeners, after acquiring this knowledge through experience (Ellis & Ure, 1969). Yet, the ideas presented in this section suggest that register use is dynamic, in that the exact nature of its output can vary according to listeners' needs.

Universality of Prosodic Changes

Given the apparent benefits of CDS, it is perhaps unsurprising that this speech style is thought to be ubiquitous across genders and cultures (Broesch & Bryant, 2015), though the exact manner in which this register is manifested is thought to be culturally bound (Nakamura, 2001; Ratner & Pye, 1984). For instance, a study by Ratner & Pye (1984) called into question the universality of the phenomenon of using higher pitch in CDS. Data from a sample of three Quiche Mayan-speaking mothers showed that their child-directed register did not feature a higher mean pitch. Yet, these mothers nonetheless made speech adjustments, in that they *lowered* their pitch slightly when talking to babies relative to adults. However, other researchers have cautioned drawing strong conclusions from this work given its small sample size (e.g., Broesch & Bryant, 2015).

Another study provided support for the hypothesis of a universal general pattern of prosodic modifications with slight cultural variations. Fernald and colleagues (1989) compared the prosody of mothers' and fathers' speech to preverbal infants, who ranged in age from 10 months to 1 year and 2 months, in several languages and dialects: English, French, Italian, German, Japanese, British English, and American English. Semi-structured home observations showed a high degree of consistency across the various languages. That is, parents' speech directed toward infants relative to that for adults evidenced more pitch variability, higher mean volume, shorter utterance length, and longer pauses. American English speakers, relative to speakers of the other languages and dialects, were found to use more exaggerated prosody when speaking to infants. These results are thus suggestive of general trends in how prosody is generally used for young children across languages and dialects, which may be subject to subtle variations according to culture. In another study that provided striking evidence for the cultural

and linguistic universality hypothesis, Broesch and Bryant (2015) compared speech that mothers in three different cultures – rural Fiji, Bukusu of Kenya, and middle-class North America – spontaneously produced for their infants (whose average age was approximately 8 months). The findings were that, relative to when they were speaking to other adults, mothers in all three cultures used a higher mean pitch, more pitch variability, and a slower speech rate when speaking to their infants. Interestingly, like Fernald et al. (1989)'s study, the data suggested that North American mothers used a higher mean pitch when addressing infants when compared to the other two cultures; however, cultural differences disappeared after controlling for maternal education (in that higher education was related to the use of a higher mean pitch). Taken together, despite some inconsistencies, these studies are suggestive of overall similarities in how CDS is produced across strikingly disparate cultures, languages, and dialects.

So far, the discussion has focused on adjustments to infants and children; however, adults adjust their speech styles according to other types of perceived needs. Another similar style of speech that is used depending on the age of one's communicative partner is elder-directed speech (Caporael, 1981; Caporael & Culbertson, 1986; Kemper, 1994). In one study, adult participants described routes on maps with modified prosody, namely, a slower rate of speech and simplified syntax when addressing older adults relative to younger adults (Kemper, Vandeputte, Rice, Cheung, & Gubarchuk, 1995). These speech style adjustments helped: Older adults whose speakers adjusted their style were more accurate when completing their maps (Kemper et al., 1995). It may be the case that a slower rate of speech and more frequent pauses in between words allowed the listeners more time to process the information. In another study assessing judgments about the appropriateness of speech modifications, both younger and older adults rated prosodic modifications of increased volume and slower speech rate as appropriate for use

with older listeners (Kemper, Ferrell, Harden, Finter-Urczyk, & Billington, 1998). That volume and speech rate modifications were rated as appropriate suggests that speakers might have perceived a need to adjust to older adults' possible hearing and cognitive deficits.

An additional example of a similar speech style is that which is used for second language learners. Like child- and elder-directed speech, this style is used to adapt to the perceived needs of the listener. When speaking to second language learners, adults reduce their speech rate (Biersack, Kempe, & Knapton, 2005), and simplify grammatical structures (Ferguson, 1975). It is interesting to note that though speech rate is reduced for both children and adult language learners, the prosodic changes are thought to be fine-tuned according to the differing needs of both groups (Biersack et al., 2005). That is, adults tended to slow down their speech for adult language learners by lengthening their pauses, whereas they slowed their speech for children by lengthening their vowels. Biersack et al. (2005) suggested that the affection conveying and attention maintaining function of vowel lengthening was irrelevant for the cognitively capable language learners, whose comprehension would have presumably benefited more from hearing pauses in between words. In other words, speakers' modifications for adult language learners were primarily language related, while their modifications for children were primarily affective (though children, too, could have benefited from pauses in between words). Thus, despite some similarities in how speech is fine-tuned to children and other various groups, prosodic changes appear to be adapted to (at least, partially) specific listener needs.

Goals of the Present Research

The examples of speech style shifts explored in the previous section highlight how adult speakers modify their speech, as well as their prosody, according to their audience. They might be adjusting to a number of perceived possible needs of their listeners, including those that are

related to their listeners' age, cognitive ability, and linguistic ability. These shifts are posited to have benefits for listeners' comprehension ability. Given the developmental focus of this dissertation, a core area of enquiry is the nature of children's understanding of the link between prosodic styles and listener characteristics. While the process of making communicative adjustments to listeners involves many aspects of discourse, much of the existing literature focuses on how children learn about semantic content adjustments (e.g., Shatz & Gelman, 1973; Warren-Leubecker & Bohannon, 1983). This dissertation is an attempt to begin to address the relative dearth of research on how children learn about the prosodic changes that speakers make for listeners.

Given this gap in the literature, several research questions emerge. First, to what extent do children recognize that certain prosodic styles are more appropriate for addressing some listeners than others? Second, what kinds of judgments do children make when they hear prosodic styles that are appropriate (versus inappropriate) for the listener? More specifically, what kinds of inferences do children make about speakers who use appropriate versus inappropriate prosody, as well as about addressees to whom this speech is directed?

The overall goal of the four experiments in this dissertation was to systematically answer the aforementioned research questions about children's competence with the prosodic adjustments that speakers make for listeners. I will first present an experiment on children's understanding of the fit between prosodic styles and listeners. I will then present an experiment that explores the judgments that children make based on the prosody that speakers use. Though my main interest is in studying these phenomena in children, additional experiments (i.e., Study 1 – Experiment B and Study 2 – Experiment C) were run with samples of adults to examine performance at a later developmental stage.

Study 1 (Experiments A and B): Understanding the Fit between Prosodic Style and Listener

The studies in this dissertation explore various aspects of children's (and adults') understanding of the prosodic adjustments that speakers make for listeners. Indeed, this first experiment explores children's knowledge of the association between prosodic styles and listeners. Despite my focus on comprehension abilities, I will discuss the existing literature on children's production of listener dependent prosodic changes as background for the comprehension work. A discussion of the production research is important because its limitations give rise to interesting research questions whose answers can be explored with comprehension studies.

Literature discussed in the previous section showed that adults adjust the prosody of their speech based on factors such as listeners' age and language ability. However, much less is known about children's ability to tailor their prosodic style to their listeners. This being said, children's ability to modify other aspects of their speech (i.e., content) based on the needs of an *adult* listener have been demonstrated (e.g., Bahtiyar & Küntay, 2009; Nadig & Sedivy, 2002; Nilsen & Graham, 2009). Similarly, research conducted on children's speech to *infants* provides evidence of their ability to tailor some communicative behaviours to their listeners. In one study, 2-year-olds shortened their utterances and included more attention-getting and attention-holding utterances and repetitions when speaking to their 14-month-old infant siblings relative to their mothers (Dunn & Kendrick, 1982). There was, however, significant variability amongst children with respect to how much and what they modified in their speech. Similarly, another study showed that children ranging in age from 3- to 5 years old made syntactic changes including repetitions and imperatives, in addition to lexical changes such as using the listener's name more

frequently when speaking to younger children relative to adults (Sachs & Devin, 1975). Shatz and Gelman (1973) showed that 4-year-olds used shorter, and less complex utterances when speaking to 2-year-olds compared to adults. The preschoolers in Warren-Leubecker and Bohannon's (1983) study similarly shortened their utterance length when addressing 'verbal' toddler dolls (who were fitted with speakers) compared to when addressing adults. These studies suggest that young children can adjust some of their communicative behaviours to their listeners, at least when their listeners are infants; however, the documented changes tend to be at the syntactic and lexical levels of discourse. Recall, however, that adults also make prosodic changes when addressing children and infants. Thus, producing these prosodic changes may be one of the markers of sophisticated communicative competence.

Yet, only a few studies have examined whether children adjust their prosodic styles to their listeners, and these have produced mixed results. Syrett and Kawahara (2014) showed that 3- to 5-year-olds produced longer vowels with a higher pitch mean and range when they were asked to teach words to an animal puppet than when they were asked to simply name the words (when labeling pictures). Moreover, these changes were perceptible to adults. The results suggest that children can adjust prosodic aspects of their speech when they are instructed to be clear. Two studies examined children's prosodic adjustments to infants. Tomasello and Mannle (1985) used naturalistic-observation and found that preschoolers who ranged in age from 3- to 5 years used, what the researchers termed, an 'infant-directed intonation' when interacting with their infant siblings, who ranged in age from 12 to 24 months, though they did so less consistently than their mothers; however, the researchers did not compare children's speech to infants to their speech to adults, and assessed intonation using subjective ratings, which can be biased by coders' perceptions of non-prosodic communicative behaviours. Thus, Weppelman

and colleagues (2003) addressed these limitations and used computer software to extract prosodic measurements. They found that young children do not reliably make the same prosodic changes when talking to infants that adults do. More specifically, while 4-year-olds spoke more slowly to infants than to adults when talking about a story and a toy, they did not modify their pitch (Weppelman, Bostow, Schiffer, Elbert-Perez, & Newman, 2003).

The inconsistency in the extent to which children produce such changes begs the question of whether children have knowledge of the association between prosodic features and listener characteristics. That is, one explanation for why changes are not made is simply that children do not recognize that certain prosodic features are commonly associated with certain listeners. Experiment A explores how strongly children associate the prosodic features of child-directed speech with children, and those of adult-directed speech with adults. If children are found to be attuned to the association between prosodic style and listener, then their difficulty with producing prosodic changes consistently is likely not attributable to a lack of knowledge about appropriate prosodic styles, but rather, to difficulty implementing that knowledge.

Partial evidence that children might be sensitive to the match between prosodic features and people comes from the study of Wagner and colleagues (2010), who played audio clips of the same speaker uttering greetings to unidentified listeners. These greetings differed in terms of their prosody, lexicon, and syntax. Five-year-olds were successful at identifying which greetings were intended for an infant versus an adult, and for a foreign-language speaker versus an English speaker (Wagner et al., 2010). These results suggest that children might be able to associate prosody with listeners; however, as the greetings differed in terms of multiple features, which included prosody, the relative weight of prosody in influencing children's associations of speech styles with listeners is left unknown. That is, it is unclear whether the speaker's words or her

prosody was more impactful in communicating information about the likely listener. If children were presented with semantic content that indicated one listener, and prosodic content that indicated another, the cue upon which they based their decision of listener would provide insight into the degree of sensitivity to that cue. The first study of this dissertation explored this question using such a paradigm.

Experiment A was designed such that children were presented with statements with prosodic and content cues that were indicative of either an infant or adult listener so as to determine the relative influence of each set of cues. After hearing these statements, children were asked to select whether the intended listener was an infant or an adult. Moreover, the prosodic and content cues were either congruent or incongruent. On half of the trials, the cues were congruent; namely, the prosodic and content cues were tailored toward the same listener (i.e., infant or an adult). These congruent conditions were included to replicate past research that has shown evidence of young children's ability to infer the listener based on multiple linguistic cues (e.g., Wagner et al., 2010). The other trials featured incongruent cues wherein prosodic cues were indicative of one listener (e.g., infant), while the semantic content was indicative of the other (e.g., adult). In this context, children's choice of listener provides information regarding the influence of prosodic versus content cues in their thinking about appropriate speech styles. For example, if, after hearing a statement featuring adult content cues delivered in child-directed prosody (i.e., high pitch and volume mean and variability), children decided that the intended listener was an infant, it would suggest that they are more influenced by prosodic cues. Thus, the benefit of this conflict paradigm was that it would inform us about which set of cues (i.e., either prosodic or content) most strongly influences children's thinking about intended listeners of speech. Had the design presented each cue individually instead, we would have only learned

whether children could infer the listener based on that cue. If prosodic cues most strongly signal the listener, that finding would suggest that children are indeed sensitive to this cue (but at a young age, may not be able to actively produce such features, as per the past production studies).

It is reasonable to expect that a developmental trend will emerge that is consistent with that for children's interpretation of conflicting verbal and nonverbal emotional cues. More specifically, as children younger than 9 years show a lexical bias (Morton & Trehub, 2001), they will likely pick the listener based on semantic content. In contrast, older children will likely pick the listener based on prosody. This study was conducted with children aged 5- to 10 years old to allow for such a trend to emerge, should it exist.

Additionally, after children chose the intended listener, they were asked to provide verbal explanations for each of their listener choices. This data was included to provide more specific information about the cues upon which children based their decisions. Wagner et al., (2010) found that 5-year-olds provided stronger explanations for their listener choices than 4-year-olds, and suggested that there could be a connection between their register knowledge as assessed by their dichotomous choices and their metalinguistic knowledge. In this study, it would be interesting to examine possible age related differences in how frequently particular cues are referenced.

After discussing the child data in Experiment A, I will discuss data from the same paradigm conducted on a sample of adult participants in Experiment B. Adults' ability to consistently produce child-directed prosody suggests that they strongly associate child-directed prosodic styles with child listeners and adult-directed prosody styles with adult listeners. However, given that they also make, and consequently presumably understand, the semantic changes associated with adult and child listeners, of interest is whether the prosodic bias that

they show in conflicting conditions elsewhere (e.g., Morton & Trehub, 2001) will also hold in this communicative context.

Method: Experiment A

Participants

Children were recruited through the public school board of a mid-size Canadian city. The first step in the recruitment process involved seeking permission from principals to have the study run in their schools. The second step consisted of sending out information letters and consent forms to parents of children in the study's age range. Children whose parents returned the consent form were given the opportunity to participate. Participants were tested individually by a female experimenter, in a quiet room in their school. They were given a pencil at the end of the task to thank them for their participation. All children received the listener identification task first, followed by a receptive vocabulary task.

The final sample consisted of 72 English-speaking children: 24 5- and 6-year-olds (M = 75.88 months, SD = 6.78), 24 7- and 8-year-olds (M = 95.00 months, SD = 5.49), and 24 9- and 10-year-olds (M = 118.04 months, SD = 7.06). The socio-economic status of the sample was consistent with that of the broader community, which is mainly comprised of families from the middle-class. An additional eleven children were excluded for reasons such as insufficient language skills (receptive vocabulary standard score below 80; n = 2; Wechsler Individual Achievement Test - Third Edition [WIAT-III]; Wechsler, 2009; described further in the Method section), inaccurate responses on the certainty scale check (n = 2; described further in the Method section), failure to vary their listener choices (n = 1), failure to follow the task instructions (by picking the speaker; n = 1), and failure to finish the task (n = 5). These excluded participants were replaced to preserve the counterbalancing scheme.

Materials and Procedure

Listener identification task. Children watched a series of videos of a speaker (i.e., a llama puppet) uttering a greeting and were asked to decide whether the addressee was an adult or

an infant. Following Wagner et al. (2010), the audio consisted of the puppet greeting and asking for a person's name and was recorded by a female researcher. The prosody and content (i.e., lexical given the differing word choice, and syntactic given that one utterance was a statement and the other utterance was a question) featured in the audio was either tailored toward infants or adults. As a result, the speaker's prosody and content were either congruent (i.e., prosody and content both tailored to the same listener), or incongruent (i.e., prosody and content each tailored toward a different listener). Thus, these manipulations allowed for four within-subject conditions: 1) infant prosody + infant content (IN.Pros/IN.Cont; i.e., "Aww! I wonder what your name is!" delivered in infant-directed prosody); 2) adult prosody + infant content (AD.Pros/IN.Cont; e.g., "Aww! I wonder what your name is!" said with adult-directed prosody); 3) adult prosody + adult content (AD.Pros/AD.Cont; e.g., "Excuse me. Can you tell me your name?" said with adult-directed prosody); 4) infant prosody + adult content (IN.Pros/AD.Cont; e.g., "Excuse me. Can you tell me your name?" delivered with infant-directed prosody). The same four clips were presented three times in a randomized order, within three blocks, for a total of twelve trials. In terms of scoring, each trial was scored '0' for a choice of the adult listener and '1' for a choice of the infant listener. The score for each condition thus ranged from 0 to 3, given that there were three trials per condition.

The content in the clips was highly similar to that used in Wagner et al., (2010). Six adult raters rated the prosody of each clip on a three-point Likert scale that ranged from *adult-* (1) to *infant-directed* (3). A t-test confirmed that the raters could distinguish between the adult- (M = 1.42, SD = .38) and infant-prosody conditions (M = 3.00, SD = .00), $t(5) = -10.30$, $p < .001$. Additionally, Praat (Boersma & Weenink, 2014) was used to extract pitch and volume measures, which were measured in Hertz and Decibels respectively: Pitch mean (adult-directed: M =

233.05, *SD* = 8.31; child-directed: *M* = 297.66, *SD* = 14.49); Pitch variability (adult-directed: *M* = 194.27, *SD* = 65.85; child-directed: *M* = 271.16, *SD* = 64.37); Volume mean (adult-directed: *M* = 71.91, *SD* = 1.17; child-directed: *M* = 73.65, *SD* = 3.94). T-tests were used to compare the pitch and volume measures for the adult- prosody conditions to those for the infant-prosody conditions and showed a statistically significant difference for pitch mean, $t(2) = -5.47$, $p = .03$. Though differences between the prosody conditions on the other measures did not reach statistical significance, ps $> .09$, the means nonetheless followed the expected pattern.

Children were first introduced to the llama puppet (i.e., Patty), told that the puppet likes to meet new people, and asked to tell the puppet their own names (see Appendix A for protocol). They were told that Patty was going to be meeting new people and that they were to guess to whom she was talking. After subsequently introducing the infant and adult listeners, children were asked to listen to the audio clip and then point to the listener picture (i.e., either an adult or an infant) that they thought best depicted the intended addressee (i.e., "Who was Patty talking to?"). All of the adult and infant listeners were White females with neutral expressions. The position of the pictures (e.g., infant left or right) was counterbalanced across participants.

Following each trial, children indicated their confidence in their choice of listener, which allowed for a measure of the extent to which they were sensitive to the match (or mis-match) between the cue types. Moreover, while children's listener choices provided insight into whether prosodic or content cues are more influential, children's certainty ratings elucidated whether the non-selected cue still influenced children's thinking. To this end, children were asked, "how sure are you that Patty was talking to the baby/grown up?". Children responded using a three-point pictorial Likert scale with options of [I'm] "sure" [it's her] (depicted with two checkmarks), "kind of sure" (a checkmark and a question mark), and "not sure" (two question marks). Further,

children received a certainty-scale understanding check at the beginning of the listener identification task during which they were asked to indicate their certainty of their response to an easy question (e.g., the colour of an object) and a difficult, ambiguous question (e.g., the contents of an opaque box). Children were excluded from the task if they did not indicate that they were less certain about the ambiguous question than the easy question.

Finally, following their certainty judgments, children were asked to explain their choices: "What made you pick the baby/grown-up?" If resulting responses were vague or marginal, children were prompted once to clarify their answer with the statement, "Tell me more about it". The coding scheme for their explanations was designed to understand the cues that children used to make their choices. The coding scheme (Table 1) took into account whether children referenced the speaker's prosody and/her semantic content, however vaguely (e.g., "because of her sweet voice" [prosody]; "because you don't say 'excuse me' to babies" [content]). Also of interest was whether children spontaneously referenced *why* the modifications were made. One code captured whether they referenced norms (e.g., "because that's how you talk to babies/adults"). Another code captured whether children's utterances referenced the function of modifications (e.g., "she talked like that so the baby would laugh"). A final code was used to capture responses that were uninformative (e.g., "I don't know") or otherwise irrelevant (e.g., "because Patty moved her head"). Codes were not mutually exclusive. That is, if a child referenced both prosody and semantic content, his or her response would be coded as having referenced both features.

Children's explanations (i.e., one for each listener choice, which resulted in twelve) were assessed for the presence of each of the five codes (i.e., prosody; content; norms; function; DK/Irrelevant). Primary coding was conducted by a research assistant who was blind to the

purpose and hypotheses of the study. To ensure reliability, I coded twenty five percent of the data. Interrater reliability was assessed by computing the kappa statistic (recommended for nominal data; Kottner et al., 2011) for each of the five codes. The resulting values for the child data were as follows: prosody $\kappa = .74$; content $\kappa = .87$; norms $\kappa = .37$; function $\kappa = .64$; DK/Irrelevant $\kappa = .92$. Landis and Koch's (1977) classification scheme suggests that the interrater reliability for children's explanations ranged from "fair agreement" (0.21 – 0.40) for norms, "substantial agreement" (0.61 – 0.80) for prosody and function, to "almost perfect agreement" (0.81 – 1.00) for content. Discrepancies were discussed and codes were modified if mutual agreement was achieved. When agreement was not achieved, the code generated by the primary coder was used (note that previously stated kappa values represent the degree of agreement *prior* to discussion). Kappa values derived from the data following discussion were as follows: prosody* $\kappa = .75$; content $\kappa = .87$; norms* $\kappa = .49$; function* $\kappa = .78$; DK/Irrelevant $\kappa = .92$. (Kappa values for the variables marked with an asterisk were those that changed after discussion).

Receptive vocabulary task. Children were given a receptive vocabulary measure to ensure that they had the age-appropriate language skills needed to perform in the task. To this end, children were given the receptive vocabulary subtest from the WIAT-III (Wechsler, 2009), in a standardized fashion. Specifically, children were asked to point to the picture that matched a given word. Age-based norms were used to exclude any participants with a standard score under 80 (i.e., scores under 80 were those that fell below the Low Average range).

Results

Preliminary Analyses

The listener choice and certainty variables were split by age group so as to examine their standardized values for outliers (i.e., $\pm$ 3SD). There were two outliers for the AD.Pros/AD.Cont choice variable (i.e., both had Z scores of 3.29) and three outliers for the IN.Pros/IN.Cont choice variable (i.e., one with a Z score of -3.81, and two with Z scores of -3.25). Only one of the certainty variables had outliers; that is, the IN.Pros/IN.Cont certainty variable had two outliers (i.e., with *Z* scores of -3.17 and -3.52). However, given that outliers were not a result of typographical or measurement error and instead were mostly driven (as expected) by the youngest children in the sample, subsequent analyses feature the original dataset with outliers unaltered (moreover, as a check, analyses were run after the outliers were winsorized; but, the pattern of results was identical to that which was produced with the original data).

Preliminary analyses also explored the effect of participant sex. 2(prosody: infant- or adult-directed) x 2(content: infant- or adult-directed) x 3(age group) x 2(sex) mixed model ANOVAs showed that the effect of sex was not statistically significant for the listener choice scores, *p*s > .06, or the certainty scores, *p*s > .38. Sex was not included in subsequent analyses.

Listener Choice

To explore the effects of prosody and content on listener choices, scores (i.e., total number of times infant was chosen) were subject to a 2(prosody: infant- or adult-directed) x 2(content: infant- or adult-directed) x 3(age group) mixed model ANOVA (Figure 1). A significant effect of content, $F(1, 69) = 30.22$, $p < .001$, $\eta_p^2 = .31$, suggested that children were more likely to choose the adult listener in the adult-content conditions ($M = 1.24$, $SE = .07$) than in the infant-content conditions ($M = 1.91$, $SE = .07$). A significant effect of prosody, $F(1, 69) =$

150.09, p <.001, η_p^2 = .69, was qualified by a significant prosody*age interaction, $F(2, 69)$ = 14.35, p <.001, η_p^2 = .29. This interaction was followed up with 2(prosody) x 2(content) ANOVAs for each age group, though effects involving content were ignored so as to solely determine possible differential effects of prosody for the various age groups. This follow-up ANOVA showed a significant effect of prosody for all age groups: 5/6-year-olds, $F(1, 23)$ = 5.38, p = .03, η_p^2 = .19, 7/8-year-olds, $F(1, 23) = 91.52$, $p < .001$, η_p^2 = .80, and 9/10-year-olds, $F(1, 23) = 120.80$, $p < .001$, η_p^2 = .84. Bonferroni-adjusted post hoc comparisons on the estimated marginal means showed that, for adult-directed prosody conditions (collapsed across content), 5/6-year-olds chose the adult listener less often (M = 1.25, SE = .13) than both 7/8-year-olds (M = .56, SE = .56), and 9/10-year-olds (M = .54, SE = .13), ps < .001. There was no statistically significant difference between how often 7/8-year-olds and 9/10-year-olds picked the adult listener, p = 1.00. The same pattern emerged for the infant-prosody conditions: 5/6-year-olds picked the infant listener less (M = 1.85, SE = .11) than 7/8-year-olds (M = 2.63, SE = .11), and 9/10-year-olds (M = 2.63, SE = .11), ps < .001. There was no statistically significant difference in how often 7/8-year-olds and 9/10-year-olds picked the infant in the infant-prosody conditions, p = 1.00.

Further, single sample t-tests showed that children, with the exception of 5/6-year-olds, chose the listener according to the prosody of the greeting significantly greater than was expected by chance (1.5) in all conditions, ps < .01. More specifically, children from all age groups chose the listener accurately in the congruent conditions. Seven- to 10-year-olds chose the adult in the AD.Pros/IN.Cont condition, and similarly chose according to prosody in the IN.Pros/AD.Cont condition, in which they chose the infant. In contrast, despite picking

accurately in the congruent conditions, 5/6-year-olds showed no consistent pattern to how they chose the listener in the incongruent conditions, *p*s > .49.

Certainty

Certainty scores were similarly analyzed using a 2(prosody) x 2(content) x 3(age group) mixed model ANOVA (Table 2). While prosody did not affect children's certainty, $p = .14$, a significant effect of content emerged, $F(1, 69) = 6.55$, $p = .01$, $\eta_p^2 = 0.09$, which was qualified by a significant prosody*content interaction, $F(1, 69) = 25.24$, $p < .001$, $\eta_p^2 = 0.27$. Subsequent paired samples t-tests with the Bonferroni correction (hand-calculated using critical values from Howell, 2009 in all instances in which SPSS [IBM SPSS Statistics; Version 23.0] could not be used to generate Bonferroni-corrected post hoc comparisons) showed that children were more sure about their choices in the congruent infant condition ($M = 2.77$, $SD = .37$) than they were about their choices in the two incongruent conditions (IN.Pros/AD.Cont condition, $M = 2.45$, $SD = .45$; $t(71) = 5.34$, $p < .01$, $d = 0.78$; AD.Pros/IN.Cont condition, $M = 2.49$, $SD = .44$; $t(71) = 4.24$, $p < .01$, $d = 0.69$, and in the adult congruent condition ($M = 2.59$, $SD = .43$), $t(71) = 2.80$, $p < .05$, $d = .45$. There were no statistically significant differences between children's certainty in the other conditions, *p*s > .05.

A main effect of age group, $F(2, 69) = 4.19$, $p = .02$, $\eta_p^2 = .11$ and post hoc comparisons adjusted with the Bonferroni correction showed no statistically significant difference between 5/6-year-olds ($M = 2.59$, $SD = .06$) and 7/8-year-olds ($M = 2.46$, $SD = .07$), or 9/10-year-olds ($M = 2.69$, $SD = .04$), *p*s > .35. However, 7/8-year-olds were significantly less certain about their choices than 9/10-year-olds, $p = .02$.

Explanations

Table 3 provides descriptive statistics that include the mean number of times that children of each age group referenced each type of cue on each trial (maximum of '1'), within each condition. In this section, the two main explanation types of interest – those that referenced prosody and those that referenced content – were subject to further analyses to determine whether explicit reference to each of these cues was affected by condition as well as age group. Consequently, each of these explanation types were subject to a 2(prosody) x 2(content) x 3(age group) mixed model ANOVA. Explanations that referenced prosody and those that referenced content will each be discussed in turn.

Explanations referencing prosody. Children's explanations that referenced prosody interestingly showed a main effect of content, in that children referenced prosody more in the child content conditions (M = .67, SE = .04) than in the adult content conditions (M = .51, SE = .04)**,** $F(1, 69) = 28.86$, $p < .001$, $\eta_p^2 = .30$. A likely explanation for this finding is that children were given credit for referencing prosody if they clearly (as determined by the researcher during the study administration) adjusted their prosody to imitate infant-directed prosodic features. For instance, all children who said "aww" in their explanation while using an infant-directed prosodic style when delivering their explanation would get a point for content *and* prosody. There also appeared to be an effect of age group, $F(2, 69) = 3.26$, $p = .04$, $\eta_p^2 = .09$, though this effect will not be discussed further given that the post hoc pairwise comparisons with the Bonferroni correction applied were all not statistically significant; ps > .06.

Explanations referencing content. The results of the ANOVA that analysed explanations that referenced content showed a main effect of content, $F(1, 69) = 11.37$, $p = .001$, $\eta_p^2 = .14$, which was qualified by a significant prosody*content interaction, $F(1, 69) = 16.94$, $p < .001$, $\eta_p^2 = .20$. Bonferroni corrected paired-samples t-tests (critical values from Howell, 2009)

showed that children referenced content more in the adult congruent condition (M = .39, SD = .33) than in the IN.Pros/AD.Cont condition (M = .28, SD = .32), $t(71) = 3.17$, $p < .05$, $d = 0.34$, despite the presence of adult content cues in both conditions. This finding makes sense given that children (at least, 7- to 10-year-olds) chose the infant in the IN.Pros/AD.Cont condition despite the adult content. Therefore, the infant prosody was more compelling than the adult content in choices and explanations. Another statistically significant comparison was that children referenced content more in the infant congruent condition (M = .47, SD = .40) than in the IN.Pros/AD.Cont condition, $t(71) = 4.86$, $p < .01$, $d = 0.52$. This comparison suggests that children are processing content cues whilst choosing the listener according to prosody and further suggests that having congruent prosodic and content cues might have made the content cues more salient. Finally, there was also a significant effect of age group, $F(2, 69) = 4.48$, p = .02, $\eta_p^2 = .12$. Post hoc comparisons with the Bonferroni correction showed that 9/10-year-olds (M = .26, SE = .06) referenced content significantly more than 5/6-year-olds (M = .51, SE = .06), p = .01. The number of times that 7/8-year-olds referenced content (M = .38, SE = .06) did not significantly differ from either of the other two age groups, ps > .36. It appears that children's explicit understanding of cues, as evidenced by their explanations, increased with age.

Introduction: Experiment B

As the results of Experiment A demonstrated the strong influence of prosody on children's thinking about intended addressees of speech, of interest was whether prosody's influence was similarly strong for adults. For this reason, Experiment B featured the same paradigm that was used in Experiment A, except with a sample of adults. Adults' reliance on prosody relative to semantic content in conflicting contexts has been demonstrated in the affective prosody literature (e.g., Morton & Trehub, 2001). Thus, it was expected that adults would choose the listener according to prosody in the incongruent conditions in Experiment B, too. The adult data would help situate the child findings within a broader developmental perspective by illustrating whether the reliance on prosody when determining the intended addressee of a greeting that was demonstrated between ages 7- to 10 years remains in adulthood.

Method

Participants

Participants were undergraduate students who were recruited through a research pool at the University of Waterloo. They were given course credit for their participation.

The sample consisted of 24 English-speaking adults, half of whom were male. One individual was excluded for having insufficient language skills (i.e., a receptive vocabulary standard score below 79). The standard scores for people above the age of 18 were derived from the norms for 18-year-old individuals, as these were the best norms available. The excluded individual was replaced with a new participant to preserve the counterbalancing.

Materials and Procedure

To prepare participants for the child-friendly nature of the task, adult participants were told that this study was also being conducted with children, but that data from adult participants were needed to compare against children's responses. The procedure was highly similar to that given to children, except that some aspects that were intended to increase children's comprehension and engagement were deemed unnecessary for adults and were thus omitted. For example, adult participants were not asked to tell Patty their names.

With respect to explanations, coding and reliability coding was conducted in the same manner that was described in Experiment A. The Kappa values for the data prior to discussion were as follows: prosody $\kappa = .75$; content $\kappa = .92$; norms $\kappa = .58$; function $\kappa = .47$; DK/Irrelevant $\kappa = .74$. According to Landis and Koch's (1977) classification scheme, these kappa values suggest "almost perfect agreement" for content, "substantial agreement" for prosody and DK/Irrelevant, and "moderate agreement" for function. Kappa values from the data following discussion increased for all variables: prosody $\kappa = .82$; content $\kappa = .96$; norms $\kappa = .87$; function $\kappa = 1.00$; DK/Irrelevant $\kappa = 1.00$.

Results

Preliminary Analyses

Examination of the data showed no outliers (i.e., ± 3SD) for any of the dependent measures. Analyses exploring the effect of participant sex did not yield statistically significant effects for the Listener Choice variables, *p*s > .05, or the Certainty ratings, *p*s > .19.

Listener Choice

The effects of prosody and content on listener choices were determined by subjecting scores (i.e., total number of times the infant was chosen) to a 2(prosody) x 2(content) within-subjects ANOVA (Figure 2). There was a significant effect of prosody, $F(1, 23) = 533.84$, $p < .001$, $\eta_p^2 = .96$, and a significant effect of content, $F(1, 23) = 5.55$, $p = .03$, $\eta_p^2 = .19$, though the two-way interaction was not significant, $p = .25$. These results suggest that adults were sensitive to the difference between adult-directed prosody ($M = .29$, $SE = .10$) and infant-directed prosody ($M = 2.92$, $SE = .04$); they were also sensitive to the difference between adult-directed content ($M = 1.46$, $SE = .05$) and infant-directed content ($M = 1.75$, $SE = .10$).

Single sample t-tests were used to compare adult participants' choices in each condition to chance levels (1.5). The results indicated that adult participants chose according to the prosody of the greeting in all conditions, at a level that was greater than would be expected by chance, *p*s < .001. More specifically, they chose the adult listener in the adult congruent condition ($M = .08$, $SD = .28$) and the AD.Pros/IN.Cont condition ($M = .50$, $SD = .98$). In contrast, they chose the infant listener in the infant congruent condition ($M = 3.00$, $SD = 0$) and in the IN.Pros/AD.Cont condition ($M = 2.83$, $SD = .38$). The t-test could not be computed for the IN.Pros/IN.Cont condition because all participants chose the infant on both trials (which resulted in a standard deviation of 0).

Certainty

Adult participants' certainty scores were similarly analysed using a 2(prosody) x 2(content) within-subjects ANOVA (Table 4). In this case, significant effects of prosody, $F(1, 23) = 14.34$, $p = .001$, $\eta_p^2 = .38$, and content, $F(1, 23) = 6.59$, $p = .02$, $\eta_p^2 = .22$, were qualified by a significant prosody*content interaction, $F(1, 23) = 18.74$, $p < .001$, $\eta_p^2 = .45$. Subsequent Bonferroni-corrected paired samples t-tests (critical values from Howell, 2009) showed that (even though they always chose according to prosody), adult participants were more certain about their choice of infant listener in the infant congruent condition ($M = 2.92$, $SD = .20$) than when they chose the infant in the IN.Pros/AD.Cont condition ($M = 2.76$, $SD = .25$), $t(23) = 3.41$, $p < .05$, $d = 0.71$. Similarly, they were more sure about their choice of adult listener in the adult congruent condition ($M = 2.82$, $SD = .26$) than in the AD.Pros/IN.Cont condition ($M = 2.32$, $SD = .61$), $t(23) = 3.67$, $p < .01$, $d = 1.07$. Collectively, these comparisons showed that content still had an influence, despite the fact that prosody determined their listener choices. When comparing participants' choices in the incongruent conditions, they were more sure about their choice of infant listener in the IN.Pros/Ad.Cont condition than their choice of adult listener in the AD.Pros/IN.Cont condition, $t(23) = 3.56$, $p = .01$, $d = 0.94$. This comparison suggests that the infant prosodic cues had an especially strong pull relative to adult prosody cues, even when presented alongside adult content cues. It was therefore not surprising that participants were more sure about their choice of infant listener in the infant congruent condition than they were about their choice of adult listener in the AD.Pros/IN.Cont condition, $t(23) = 4.65$, $p < .01$, $d = 1.32$. Their certainty in choosing the adult in the adult congruent condition did not significantly differ from their certainty in choosing the infant in the IN.Pros/AD.Cont condition, $p > .05$. This comparison also likely speaks to the relatively strong influence of the infant prosodic cues such that participants' certainty in both conditions did not differ, despite the incongruence caused by

the adult content cues. Finally, participants' certainty in both congruent conditions did not significantly differ, $p = .13$. In other words, the certainty inspired by the presentation of infant prosody and content cues together was not significantly different from that inspired by the presentation of adult prosody and content cues together.

Explanations

Table 5 provides descriptive statistics that include the mean number of times that adults referenced each type of cue on each trial (maximum of '1'), within each condition. The means suggest that adults mainly reference prosody in their explanations, which supports the notion that this cue is especially salient for them (as per their choice data). Subsequent analyses determined whether explicit reference to prosody and content respectively was affected by condition. Each of those two explanation types was accordingly subject to a 2(prosody) x 2(content) repeated measures ANOVA. Explanations that referenced prosody and those that referenced content will each be discussed in turn.

Explanations referencing prosody. The ANOVA on the mean number of explanations that referenced prosody yielded a significant effect of prosody, $F(1, 23) = 7.19$, $p = .01$, $\eta_p^2 = .24$. Participants referenced prosody more often in the infant prosody conditions ($M = .93$, $SE = .02$) than in the adult prosody conditions ($M = .79$, $SE = .04$), which supports the findings elsewhere that infant prosody might have been especially salient for them (this also makes sense, given the distinctive features of IDS relative to ADS).

Explanations referencing content. The ANOVA on the mean number of explanations that referenced content yielded a significant effect of prosody, $F(1, 23) = 15.87$, $p < .001$, $\eta_p^2 = .41$, which was qualified by a significant prosody*content interaction, $F(1, 23) = 6.76$, $p = .02$, $\eta_p^2 = .23$. Subsequent Bonferroni corrected t-tests (critical values from Howell, 2009) showed

that participants referenced content more in the adult congruent condition than in the IN.Pros/AD.Cont condition, $t(23) = 5.01$, $p < .01$, $d = 1.02$, suggesting perhaps that the adult content was more salient when presented in a congruent context relative to an incongruent one. Participants also referenced content more in the AD.Pros/IN.Cont condition than in the IN.Pros/AD.Cont condition, $t(23) = 3.42$, $p < .05$, $d = 0.70$, which might have suggested that infant content delivered in adult prosody was especially salient relative to adult content delivered in infant prosody.

Study 1 (Experiments A and B) Discussion

While previous work has shown that children can identify speech styles based on a number of cues (e.g., Wagner et al., 2010), this is the first demonstration of the strong and unique influence of prosody in children's thinking about the appropriateness of speech styles for listeners. The strong influence of prosody emerged at 7 years of age. Even in conditions in which prosodic and content cues were incongruent, in that each cue type was directed toward a different listener, 7- to 10-year-olds chose the listener according to prosody. In contrast, 5- and 6-year-olds' choices were at chance levels in these incongruent conditions, suggesting that the conflicting cues left them unsure about whom to choose. That these youngest children were unsure about whom to choose also challenges an alternative interpretation of the findings that prosody's influence on older children was due to the prosody manipulation being stronger than the content manipulation (which is an issue to consider when designing cue weighting studies generally). If the prosody manipulation was indeed that much stronger than the content manipulation, 5-year-olds likely would have been able to resolve their confusion by choosing according to prosody, given research elsewhere that shows that children as young as 4 years of age show more sensitivity to prosody when its cues are exaggerated (Hupp & Jungers, 2013).

The strong influence of prosody that emerged at 7 years was also present for adults. Experiment B demonstrated that adults chose the intended listener according to the prosody of the greeting in all conditions, including those in which the prosodic and content cues conflicted. Though past research has shown that adults can distinguish speech styles based on prosody alone (e.g., Bryant & Barrett, 2007), this is the first study to demonstrate that adults associate prosodic styles as being used with certain listeners even when the semantic content provides conflicting information.

That prosody most strongly signals the listener's identity fits with the idea that prosodic features are the most distinctive features of registers such as CDS. A study which strikingly demonstrates the communicative power of prosody was conducted with Shuar adults, who live in an indigenous culture in South America that is neither industrialized nor literate (Bryant & Barrett, 2007). Not only could they distinguish between CDS and ADS based on prosody alone (using recordings of native English-speaking mothers' speech, whose semantic content the Shuar could not understand), but they also recognized what intentions were being conveyed. Moreover, they were significantly more accurate in identifying intentions in CDS compared to ADS. Thus, the prosodic features of these speech styles are particularly important given how much information they convey.

Yet, the certainty ratings revealed that children and adults were sensitive to content cues, whilst choosing according to prosody. Children were more certain of their choice when they were presented with an utterance featuring infant-directed prosody *and* infant-directed content, than when they were presented with an utterance with infant-directed prosody and adult-directed content, despite choosing the infant in both cases. Similarly, adults were more certain about their choices when they picked the listeners in both congruent conditions than when they picked the same listener in the corresponding incongruent conditions. These results suggest that though their choices were guided most strongly by prosody, adults and children were nonetheless still processing the content of the utterances.

The findings from the child and adult experiments echo work on the interpretation of emotions, which highlights early sensitivity to prosody, though the developmental trajectory is nonlinear. In situations in which content and prosodic cues conflict, adults respond almost exclusively based on prosody. At 9- to 10 years of age, children start to consider prosody,

whereas younger children show a lexical bias, in that their interpretation of the emotional content in these conflicting contexts is based on the words in the utterance (e.g., Morton & Trehub, 2001). While it was not the case in the present study that younger children relied on lexical content more than older children, older children were able to resolve the confusion caused when content differed from prosody (by relying on prosody). In contrast, 5- and 6-year-olds were not able to resolve this confusion. Thus, older children judge the appropriateness of speech for infants and adults as less dependent on what is said (which makes sense given that adults speak to infants despite infants' limited comprehension ability), and instead, on how it is said.

In these ways, Study 1 (Experiments A and B) demonstrated the strength of prosody's influence in children and adults' thinking about the intended addressees of speech (see Varghese & Nilsen, 2016). In other words, findings illustrate that children and adults have expectations for the kinds of prosodic styles that are used for addressing infants and adults. This begs the question of what the consequences of violating those expectations might be. That is, if speakers address a listener using prosody that is not typically used to address that listener, what kind of judgments might observers of that interaction make about the speaker, and about the listener? The next study was designed to explore this question in adults and children.

Study 2 (Experiments C and D): Observers' Judgments about Communicators Based on Speakers' Prosodic Fit

Study1 showed that children and adults strongly associate certain styles of prosody with particular listeners; however, the importance of such work on the fit between speakers' prosodic styles and listeners is most apparent when it is placed within the broader context of socio-communicative competence. That is, of interest was whether producing appropriate, expected styles of prosody *matters* for how speakers and listeners are perceived. This question served as the motivation for Study 2, which was designed to test whether observers of an interaction judge speakers who make these expected prosodic modifications as being more competent communicators, and more competent in other related domains (i.e., social and intellectual). A related question explored in Study 2 was whether observers also make judgments about listeners depending on the prosodic style used to address them. If it is the case that tailoring one's communication style to a listener plays a role in interpersonal success, the fit of speakers' prosody for their listeners should leave observers with impressions about the speakers' (and listeners') communicative and social functioning.

The ability to flexibly use language to achieve communicative goals is important for social competence. More specifically, difficulty with the ability to flexibly use language based on the social context (which generally includes consideration of prosody, though prosodic competence was not the focus of, or even necessarily measured directly in, the following studies) has been linked to greater likelihood of social difficulty in children from a wide age range (i.e., 4- to 15 years; Botting & Conti-Ramsden, 1999, 2000; Gibson, Adams, Lockton, & Green, 2013; Helland, Lundervold, Heimann, & Posserud, 2014; Ketelaars, Cuperus, Jansonius, & Verhoeven, 2010). However, of interest was whether there are social implications for adjusting one's speech

for one listener. There is some support for the notion that difficulty with adjusting (or, at least, knowing how to adjust) one's speech in socially appropriate ways could be associated with social difficulty. Bates and Silvern (1977) examined relations between 2- to 9-year-olds' production and comprehension of polite speech, which included consideration of harsh versus soft intonation, and their teachers' ratings of their social adjustment. The measure of polite speech comprehension required children to decide which of two frog puppets had asked for candy in a more polite manner. The frogs' utterances varied in terms of word choice (e.g., "will you" versus "would you", or "may I" versus "can I"), semantics (e.g., presence and absence of "please"), and intonation (e.g., harsh versus soft). Preschoolers who were better able to recognize, or comprehend, polite speech were rated by their teachers as being less likely to have conduct problems. Note, however, that though understanding of politeness included consideration of intonation, a range of other linguistic elements were involved, too. Nonetheless, it seems as if understanding socially appropriate speech, at least as it pertains to politeness, is related to social functioning; however, it is unclear from Bates and Silvern's results the extent to which difficulty with the prosodic aspects of politeness per se relates to these social difficulties.

Yet, the argument for a link between prosody understanding or use and social adjustment has been made in studies with clinical samples such as individuals with Autism Spectrum Disorder (ASD). ASD is associated with atypical prosody across a range of expressive and receptive functions, especially those which pertain to pragmatic and affective processes (Paul, Augustyn, Klin, & Volkmar, 2005; Peppé, McCann, Gibbon, O'Hare & Rutherford, 2006; Shriberg, Paul, McSweeny, Klin, Cohen, & Volkmar, 2001; albeit, note that the patterns of atypical prosody are not entirely consistent, and some studies have failed to show marked differences between ASD and typical controls; see McCann & Peppé [2003] for a review).

Nonetheless, researchers studying this clinical group have posited that prosodic deficits in particular pose a significant barrier to the social and vocational acceptance of individuals in this group (Shriberg et al., 2001). Moreover, within a typically-developing population, affective prosody use has been shown to relate to social and academic functioning. Specifically, 7-year-old children who were able to encode and decode verbal affect tended to have fewer social and academic problems (Goodfellow & Nowicki, 2009). This study thus suggests the relevance of competence with affective prosody to social functioning; yet, the presence of a possible link between listener dependent prosodic modifications and social functioning remains to be seen.

Despite the lack of research on how people perceive listener dependent prosodic modifications, previous research has shown that people make judgments based on prosody alone. More specifically, adults have been shown to make judgments about personality based on prosodic quality. For example, adults' ratings of the 'babyishness' of preschoolers' voices were negatively correlated with perceived competence, leadership, and interpersonal dominance, and positively correlated with perceived honesty and warmth (Berry, Hansen, Landry-Pester, & Meier, 1994). In the adult literature, pitch and intensity have been linked to perceptions of friendliness, likeability and confidence (Apple, Streeter, & Krauss, 1979; Gravano, Levitan, Willson, Beñus, Hirschberg, & Nenkova, 2011; Liscombe, Venditti, & Hirschberg, 2003). Raters have even used adult speakers' prosody to accurately predict a range of personality traits (Mohammadi & Vinciarelli, 2012; Scherer, 1978).

It is not only absolute prosodic features like pitch and intensity that convey information that might be relevant to social interactions. Another area of research that suggests how prosody might be relevant to social interactions is that on accommodation. This is the phenomenon by which speakers adjust their verbal (e.g., relating to lexicon, grammar, pronunciation, prosody)

and nonverbal communication (e.g. facial expressions and body gestures) to be similar to that of their conversational partner (Communication Accommodation Theory; Giles & Coupland, 1991; Giles, Coupland & Coupland, 1991). Speakers tend to accommodate to their conversational partner's prosody so that both communicators exhibit similar pitch contours, loudness, and speech rate (e.g., De Looze, Oertel, Rauzy & Campbell, 2011; Goldinger, 1998; Gregory, Webster, & Huang, 1993; Natale, 1975). What can be argued to serve as an early precursor to this process is seen in infants: imitation of prosodic contours has been observed in infants as young as 2 months (Gratier & Devouche, 2011; Kuhl & Meltzoff, 1996; Papoušek & Papoušek, 1989) Such vocal accommodation (as it is studied in adults) is thought to facilitate social interactions by promoting affiliation, approval, and acceptance (Gallois & Callan, 1998; Giles et al., 1991; Natale, 1975). Moreover, De Looze & Rauzy (2011) found that prosodic accommodation was more marked when communicative partners were more engaged and interested in the conversation (see also, De Looze, Scherer, Vaughan & Campbell, 2014). Not only did communicators accommodate their prosody more when they were motivated to have a conversation, but they also judged speakers whose speech rates were similar to their own as being more competent and socially attractive (Feldstein, Dohm, & Crown, 2001). Thus, positive judgments are formed when speakers adjust their prosody, in this case, to be similar to their conversational partners.

Since judgments are made based on prosodic characteristics, this begs the question of whether observers form judgments based on the degree of speakers' prosodic *fit* to their listeners. That is, if communicators adjust their prosody such that it is what one would typically use for their listener, does that have implications for how they are perceived? One study examined how children's ability to flexibly tailor their speech (including their prosody, grammar, and

semantics), affected perceptions of their communicative competence (Harasty, Rosenthal, Reed, & Jones, 1994). Results showed that children in Grades 4, 5, and 6 who were more inflexible with tailoring their speech, when speaking to listeners of varying ages and authority statuses were judged by speech-language pathologists as being less communicatively competent overall. The raters also judged these children as being more likely to have a communication disorder than children who were more communicatively flexible (Harasty et al., 1994). However, the relative role of prosody in these judgments is unclear as children's ability to show flexibility in their communication was assessed in a variety of areas, from grammatical complexity and semantic content to prosody. Nonetheless, the study demonstrates that difficulty with adjusting one's communication style to the listener in general tends to have negative consequences for judgments of communicative competence.

The present study was developed to build on evidence from these literatures that show that people make judgments based on speakers' vocal prosody, as well as the flexibility with which they shift their communication style generally. The main research aim of Study 2 was to assess the degree to which individuals form judgments based on the appropriateness of a speaker's prosodic style for her listener. Though adult speakers frequently make prosodic changes when adjusting their communication styles to their listeners, the potential implications for others' judgments of making such prosodic changes are not understood. Given the dearth of research in this area generally, this question was first explored with a sample of adults (Experiment C) to determine whether adult observers show any sensitivity to the speaker's prosodic style when making judgments about the speaker's and listener's competence. Subsequently, the question was explored with children (Experiment D). In this way, I could infer

whether the judgments of child and adult observers were both influenced by the fit of a speaker's prosody to her listener.

This study was also designed to explore the possible range in the *kinds* of judgments that observers make about communicators based on speakers' prosodic style. First, given that participants made judgments about people who are communicating for the sake of conveying specific information, the most directly relevant judgments pertained to communication. More specifically, of interest was whether speakers who use inappropriately matched prosody are thought of as poor communicators who have not spoken well, and/or who have not addressed their particular listener well. Also of interest was how *broadly* observers penalize speakers who use inappropriate prosody, given that past literature has shown that judgments based on prosody extend to general competence and social qualities (e.g., Berry et al., 1994; Gravano et al., 2011). Consequently, in addition to being perceived as poor communicators, are users of inappropriately matched prosody also thought to be less likely to succeed at the task at hand? This possibility was plausible, as success with the task depended on how well the listener understood the speaker's utterances. Further, are there consequences for lacking prosodic fit, such that observers are less likely to want to perform such a task with speakers who use inappropriate prosody for their listener relative to those who use appropriate prosody? Moreover, are judgments made about other characteristics that are relevant to social functioning, such as friendliness and politeness? Finally, though not based on prosody, past work has shown that 9- and 10- year-old children form judgments about speakers' intellectual ability ("smartness"), as well as their social traits, based on their accent (which sheds light on the kinds of perceptions or stereotypes that tend to be associated with various accents; Kinzler & DeJesus, 2013a). To determine whether

prosodic fit similarly affects judgments about intellect, observers were asked to assess communicators' intellectual ability.

In addition to advancing the literature by exploring observers' judgments about speakers based on the fit of their prosody to their listeners, another aim of Study 2 was to explore perceptions of listeners, or addressees, based on the prosody used to address them. That is, while the vast majority of existing studies examine perceptions of speakers' interpersonal qualities based on their vocal characteristics, this study also examined how *listeners* addressed with (in)appropriate prosody are viewed. Recall that child-directed speech (and prosody) is used with children, less so as they age, as well as with English-language learners and the elderly, for reasons which partially relate to facilitating comprehension. Given this, of interest was whether adult listeners addressed with child-directed prosodic features are viewed as less competent in the various domains of interest than adults addressed with adult-directed prosodic features. More specifically, it was hypothesised that observers might judge adult listeners who are addressed with child-directed prosody as being less effective listeners than those addressed with adult-directed prosody, because they might assume that there is a reason for them to be addressed in that manner (perhaps limited comprehension ability). In a similar vein, observers might rate child listeners addressed with adult-directed prosody as more competent than children addressed with child-directed prosody. Child listeners might be seen as needing to be especially competent to process and understand instructions delivered in adult-directed prosody. Hence, effectiveness with listening was measured by asking observers how good the various listeners were "at listening". Possible social implications of prosodic style use were assessed by asking how much observers would want to participate in a communicative task with listeners addressed in appropriate prosody relative to inappropriate prosody. Observers were also asked to judge

listeners' intellectual competence. If observers reasoned that those addressed in child-directed prosody *need* to be addressed in a slower, intonated, and loud way than those addressed in adult-directed prosody (especially, adults), they might have also reasoned that these listeners are less intelligent overall. In a similar vein, participants were asked to estimate listeners' ages to determine whether listeners addressed in child-directed prosody are perceived as being younger than those addressed in adult-directed prosody. Though participants (especially children) were not be expected to be accurate with their age estimates, of interest was whether the speakers' prosody affects participants' perceptions of the listeners' ages.

To summarize, after observing an interaction between a speaker and listener, half of the participants were asked to comment on *speakers'* communicative competence, their effectiveness with the task, and their social competence. The other half of participants were asked to comment on *listeners'* communicative competence, effectiveness with the treasure-finding game, social competence, intellectual competence, and age. A more in-depth discussion of the specific questions used to explore each domain is included in the Method.

As mentioned, prior to assessing children's judgments, I was interested in determining whether prosodic fit impacted adults' evaluations of communicators given the lack of relevant research with either population. Given this goal, the task was designed to be developmentally appropriate for children, yet plausible for both adult and child samples. Experiment C tested these research questions with a sample of undergraduate students, and Experiment D featured a sample of children aged 7- to 10 years. This age range of children was chosen for the child sample given that Experiment A showed that children strongly associate prosodic styles with listeners from the age of 7 years of age and onwards.

Method: Experiment C

Participants

The adult sample consisted of 32 English-speaking adults, half of whom were male. Participants were recruited through the research pools at the University of Waterloo, and were offered either course credit or a gift card in appreciation for participation.

Materials and Procedure

Participants were tested individually in a quiet laboratory room. All participants received the judgments task first, which was followed by a receptive vocabulary task.

Judgments task. Participants watched video clips of a speaker delivering instructions to a listener. Each speaker was an adult, who addressed a listener who was either an adult or a child, in prosody that was either adult-directed or child-directed. The speaker's prosody was thus tailored appropriately to her listener in some cases (e.g., adult-directed prosody to address an adult listener), and was inappropriately tailored to her listener in other cases (e.g., child-directed prosody for an adult). Following each clip, participants answered questions designed to probe their judgments of the linguistic, social, and intellectual competence of either the speaker or the listener. The prosody variable was within-subjects, given that this was the main manipulation of interest. Consequently, every participant heard speakers who used child-directed prosody, as well as speakers who used adult-directed prosody. There were two trials of each prosody type (wherein each trial involved a different speaker), such that each participant was administered four trials in total. In other words, participants were presented with four different speakers, two of whom spoke using child-directed prosody, and two of whom used adult-directed prosody (as well as four different listeners). The trials were presented in a blocked fashion that was counterbalanced across participants, such that half of the sample heard the two child-directed

prosody trials first, while the other half of the sample heard the two adult-directed prosody trials first. However, the listener type (i.e., whether the listener was an adult or a child) and ratings' target (i.e., whether participants were rating the speaker or the listener) manipulations were both between-subjects. The listener type manipulation was critical to ensuring that I was exploring the phenomenon of prosody-listener *fit* as opposed to judgments based on prosodic style alone. That is, it would not be enough to know how child-directed speech is perceived, for example; instead, of interest, is how the judgments about a child addressed in child-directed speech would compare to an adult addressed with the same speech style. Despite its importance in the design, listener type was between-subjects because of the need to limit the number of trials to prevent participants from getting bored and/or generating a similar response style across trials. That meant that half of the sample watched videos in which the speaker was addressing a child listener (i.e., adult-child teams), whilst the other half of participants were exposed to speakers who addressed adults (i.e., adult-adult teams). As mentioned, ratings' target was also set as a between-subjects variable. It was anticipated that, had this been a within-subjects manipulation, the effects of rating the speaker first, followed by the listener (or vice-versa), might carry over. In this scenario, it would have been difficult to interpret data from the second condition. Given these concerns, half of the sample answered questions that were primarily about the speaker (i.e., speaker as the ratings' target), while the other half of the sample answered questions that were primarily about the listener (i.e., listener as the ratings' target; however, a subset of questions were about the team itself and were thus common to the speaker and the listener questions).

The videos were introduced to participants within the context of a treasure-finding game. This particular context was chosen given that it was a plausible scenario in which a speaker could deliver an utterance to a listener, and both individuals would have a strong motivation for

the message to be understood. Participants were told that they would be shown videos of various teams playing the treasure-finding game (see Appendix B for the protocol). It was indicated that each team would feature a speaker and a listener, who were each in separate rooms such that they could hear each other, but not see each other. Participants were told that the speaker knew where the treasure was, and that she was using a walkie-talkie (which was visible in the video) to tell the listener how to find the treasure, but that the listener did not know where the treasure was, and therefore needed headphones (visible in the videos) to hear the speaker's instructions, so that she could go and find the treasure for the team (though the act of finding the treasure was not shown on screen).

The videos featured two White female actors who were each sitting in a chair facing the wall, such that their backs were visible to the camera. This pose was chosen so as to minimize potential confounding effects of facial expression and body language. Moreover, the actors wore the same t-shirts, which were either white or grey, across all of the videos. The instruction, "Here's *another* team" on subsequent trials helped distinguish teams. The players were shown on split-screen to emphasize that they were each in different rooms. The position of the players was held constant, such that the speaker was always shown on the left hand of the split screen, and the listener, on the right hand of the screen.

A different set of actors was necessarily used in the videos featuring the adult listeners and those with child listeners. In both cases, a different speaker and listener was featured in each of the four trials, such that they were eight different actors in total. The audio was recorded separately by four different females, who were not the actors, though these voice-actors' voices were consistently matched to the actors. That is, Actor A always 'spoke' in Voice-Actor A's voice, and Actor B always 'spoke' in Voice-Actor B's voice, etc. Indeed, though different actors

were used for the adult listener team videos and the child listener team videos, the same four voice actors were used in both sets. Recordings were used so that participants were exposed to similar stimuli. The designation of voice actors' prosodic style as "child-directed" and "adult-directed" was verified with ratings of how child-directed or adult-directed each of the utterances sounded, and with acoustical analyses from Praat (Boersma & Weenink, 2014). Ten adult participants (who were not administered Study 2) listened to each of the four voice actors' utterances delivered in child- and adult-prosody, and rated each clip based on how it sounded. More specifically, they made their ratings using a six-point Likert scale which ranged from "extremely child-directed" to "extremely adult-directed". The resulting scores were analyzed with a 2(prosody) x 4(voice actor) repeated-measures ANOVA. There was a significant effect of prosody, which confirmed that the two prosody types were distinct from each other, $F(1, 9) = 284.55$, $p < .001$. The prosody*speaker interaction was not significant, $p = .21$, which suggested that the differences between how child-directed and adult-directed the utterances were, were equal amongst the four speakers. Subsequent comparisons of voice actors' ratings (collapsed across prosody type) showed that voice actors were not significantly different from each other, $p = .06$. Moreover, paired samples t-tests conducted on dimensions extracted from Praat (i.e., pitch mean and standard deviation, volume mean, and utterance duration) also showed that the prosody types were distinct from each other, ps $< .008$ (while the difference between CD and AD volume standard deviation was not statistically significant, $p = .21$, the trend was in the expected direction). The values were as follows: pitch mean (adult-directed: $M = 190.25$, $SD = 18.50$; child-directed: $M = 257.43$, $SD = 22.27$); pitch variability (adult-directed: $M = 46.39$, $SD = 7.67$; child-directed: $M = 77.50$, $SD = 9.40$); volume mean (adult-directed: $M = 73.44$, $SD = 3.14$; child-directed: $M = 77.62$, $SD = 1.01$); volume variability (adult-directed: $M = 12.03$, $SD = 2.15$;

child-directed: *M* = 13.36, *SD* = 1.32); utterance duration (in seconds; adult-directed *M* = 9.53, *SD* = .70; child-directed: *M* = 16.05, *SD* = 1.73). Additionally, the prosody that each voice actor used was counterbalanced across participants, such that some participants heard Voice Actor A use child-directed prosody, while other participants heard that same voice actor use adult-directed prosody. Thus, any differences between voice actor and their speech styles would have been mitigated through the counterbalanced design. The trials differed in semantic content, though only slightly, so as to balance the need for preventing habituation effects with that of avoiding confounds (see Appendix C for scripts).

To orient participants to the player about whom they would be questioned, a yellow circle was placed around either the speaker or the listener and remained there throughout the video (see Figure 3 for a screen capture of one of the videos). Following each video, participants were asked seven questions about either the speaker or listener's communicative competence, specific effectiveness within the context of the treasure-finding game, social competence, intellectual competence, and age (see Appendix D for the questions). Some of these domains were more relevant for either the speaker or the listener and were thus only asked for either the speaker or listener. (Recall that ratings' target was a between-subject variable). While most of the concepts could have been conceivably asked of speakers, attempts were made to limit the number of speaker questions to be equivalent to the number of listener questions (i.e., seven). Four questions were common to both the speaker and listener ratings so that a comparison could be made to determine whether prosody manipulations affected perceptions of the speaker and listener similarly. For example, the question about *communicative competence* that was asked about speakers and listeners pertained to how effective they were at communicating. More specifically, the question queried how good the speaker was at "speaking", and how good the

listener was at "listening". The communicative competence questions that were unique to speakers asked how much the participant would try to speak just like that speaker when addressing that listener, and if there was anything "weird" about how the speaker spoke. With respect to evaluating the dyads' *effectiveness*, two questions were asked about speakers and listeners. These questions probed how likely it was that each team would win the treasure-finding game, and how much the participant would want to be on a team with each speaker or listener. With respect to the *social competence* questions, there was one question about the individual's friendliness which was common to speakers and listeners. Participants rating speakers were asked to comment on how polite they were. Politeness was not queried for listeners as this concept seemed to be more relevant for how one addresses another person versus how one listens. In contrast, the *intellectual competence* was only asked about listeners, as the question of interest was whether participants made judgments about a person's intellect based on how she was addressed. Specific questions included how much help they would need on a difficult school problem, and more directly, how smart they were, both relative to others their age (though these questions could have been asked about speakers as well, questions about speakers were limited in order to have an equal number of questions asked of listeners and of speakers). Finally, those participants who rated listeners were also asked how old they thought each listener was. Participants rating speakers were not asked about speakers' ages given that age was seen to be more relevant for how one was addressed as opposed to the prosody that one used to address another.

The order of presentation of the questions was randomized such that each participant received the questions in a different order. The exception was the last question. Specifically, for the speaker rating conditions, participants were always asked the "weird" question last (i.e.,

"Was there anything weird about how she spoke?"), lest it prime participants too much. Similarly, participants given the listener rating conditions were always asked the "smart" question last for the same reason (i.e., "How smart is she, relative to other kids [or adults] her age?").

Participants responded to each of the competence questions using a three-point Likert scale ranging from "not at all" (depicted pictorially with two 'X's) to "a bit" (depicted with one 'X' and one checkmark) to "very much" (depicted with two checkmarks). The score for each trial (i.e., question) ranged from 1 to 3. A Likert scale response of "not at all" was rated as '1', and "very much" was rated as '3'. Analyses were conducted on average scores, which aggregated both trials of each prosody type (e.g., the rating for the "smart" question for both of the two teams in which the speaker used child-directed prosody), such that the possible ranges for each average score ranged from 1 to 3.

Receptive vocabulary task. As in Study 1, the receptive vocabulary subtest from the WIAT-III (Wechsler, 2009) was administered to ensure that participants had adequate language skills. Age-based norms were used to exclude any participants with a standard score under 80 (scores under 80 were those that fell below the Low Average range; $n = 2$). Additionally, the task was discontinued for another participant who stated that she could not speak English fluently. One additional participant was removed due to the experimenter giving the wrong protocol. Participants who were excluded were replaced to preserve the full counterbalancing scheme.

Results and Discussion

Preliminary Analyses

Examination of the data revealed no outliers (i.e., ± 3SD). Between subjects groups were analysed for equivalence in receptive vocabulary raw scores. Independent samples t-tests showed that the groups did not differ in this respect. More specifically, the group of participants who rated speakers did not differ from the group who rated listeners with respect to language ability, $p = .20$. Similarly, the group of participants who rated child listeners did not differ in language ability from that which rated adult listeners, $p = .83$.

Preliminary analyses examined the effect of participant sex on the dependent measures. The questions that were common to speaker and listener ratings were analysed using 2(prosody: adult- or child-directed) x 2(listener type: adult or child) x 2(ratings' target: speaker or listener) x 2(participant sex: male or female) ANOVAs. The data from the questions that were unique to one of the ratings' targets (i.e., only listener or speaker) were analysed with a 2(prosody) x 2(listener type) x 2(participant sex) mixed model ANOVA. There were no statistically significant main effects or interactions involving sex, *p*s > .06; therefore, this variable was not included in further analyses.

Further analyses examined whether the order in which participants heard the two prosody types affected analyses. A series of 2(prosody) x 2(listener type) x 2(ratings' target) x 2(prosody order: adult-directed prosody presented first, or child-directed prosody presented first) ANOVAs were used. Effects of interest were prosody*listener type*prosody order, which would have suggested that the order in which participants heard prosody affected the extent to which they took prosodic fit into account. However, this interaction was not statistically significant for any of the judgments questions, *p*s > .21.

Judgments Questions

Each judgments question was analysed individually, though the results will be organized and discussed by topic area. Recall that these topic areas were communicative competence, effectiveness with the treasure-finding game, social competence, intellectual competence, and age. Also recall that some of the questions were featured in both the speaker- and listener-question sets, while others were only asked about either the speaker or the listener. Therefore, a different ANOVA was used to analyse questions that were common to speakers and listeners (i.e., 2[prosody] x 2[listener type] x 2[ratings' target]), than that which was used to analyse questions that were asked only of speakers, or only of listeners (i.e., 2[prosody] x 2[listener type]). The section for each question will explicitly state the ANOVA that was used to analyse its data. The highest priority lay in examining the data for prosody by listener type interactions, as these would have indicated an effect of prosodic match. Given this, where appropriate, interactions were always first followed up in a way that would allow for an examination of this effect. However, for analyses for which such a strategy was not informative enough (when such follow-up analyses did not successfully explain the interaction), interactions were instead followed up so as to best explain the interaction. Thus, ultimately, interactions were analysed in a way that shed light on their meaning. See Table 6 for descriptive statistics.

Communicative competence. Communicative competence was assessed with three questions in total. One question probing communicative competence was asked about speakers and listeners (i.e., how good the speaker/listener was at speaking/listening). Two remaining questions were asked only about speakers (i.e., how much participants would speak like that speaker, and if there was anything 'weird' about how she spoke).

How good at speaking/listening? General communicative competence was assessed of speakers with the question, "How good is she at speaking to this grown-up/kid", and of listeners with the question, "How good is she at listening?" Data from these questions were analysed together with a 2(prosody) x 2(listener type) x 2(ratings' target) mixed model ANOVA. The results showed a significant prosody*listener type interaction, $F(1, 28) = 40.10$, $p < .001$, $\eta_p^2 = .59$, that was qualified by a significant prosody*listener type*ratings' target interaction, $F(1, 28) = 11.93$, $p = .002$, $\eta_p^2 = .30$. To understand the three-way interaction, separate 2(prosody) x 2(ratings' target) ANOVAs were run for each listener type. Ratings from teams with a child listener showed a significant prosody*ratings' target interaction, $F(1, 14) = 31.99$, $p < .001$, $\eta_p^2 = .70$. Follow-up analyses revealed a statistically significant effect of prosody for speakers, $t(7) = 5.29$, $p = .001$, $d = 1.78$, but not for listeners, $p = .08$. That is, speakers who addressed children using child-directed prosody ($M = 2.69$, $SD = .46$) were rated as better speakers than those who addressed children with adult-directed prosody ($M = 1.69$, $SD = .65$). Further, independent samples t-tests showed no statistically significant difference in the communicative competence of speakers and child listeners who used, or were addressed in adult-directed prosody, $p = .06$, or between speakers and child listeners who used or were addressed in child-directed prosody, $p = .27$. The picture that emerged from the data from teams with adult listeners was less complex. Namely, the prosody*ratings' target interaction was not statistically significant, $p = .09$. Instead, there was an effect of prosody, $F(1, 14) = 16.89$, $p = .001$, $\eta_p^2 = .55$, such that speakers and adult listeners who used and were addressed with adult-directed prosody were rated as being more competent at speaking or listening ($M = 2.66$, $SE = .13$) than those who used or were addressed with child-directed prosody ($M = 1.88$, $SE = .15$).

Thus, to reiterate the findings, adult participants attended to the fit between prosody and listener when assessing how good a particular speaker was. Speakers were rated as being better speakers if they used the prosodic style that was appropriate for their listener. Participants' ratings of child listeners' competence did not seem to be impacted by the prosody used by the speaker; in contrast, adult listeners were rated as weaker listeners when addressed in child-directed prosody than in adult-directed prosody.

Would you speak like this speaker? Another question that was designed to assess judgments of communicative competence for speakers asked, "If you were telling this listener how to find the treasure, how much would you speak like this speaker?". The results of the 2(prosody) x 2(listener type) mixed model ANOVA showed a significant prosody*listener type interaction, $F(1, 14) = 33.00$, $p < .001$, $\eta_p^2 = .70$. Paired-samples t-tests for each listener type showed an effect of prosody for both child listener teams, $t(7) = -4.43$, $p = .003$, $d = 2.46$, and adult listener teams, $t(7) = 3.74$, $p = .007$, $d = 2.08$. The means showed an opposite pattern for each listener type. That is, participants indicated that they would be more likely to speak like speakers who addressed children with child-directed prosody ($M = 2.44$, $SD = .42$) than speakers who addressed children with adult-directed prosody ($M = 1.38$, $SD = .44$). As expected, the opposite pattern emerged for speakers addressing adults. That is, participants indicated that they would speak more like speakers who addressed adults in adult-directed prosody ($M = 2.38$, $SD = .52$), than those who used child-directed prosody ($M = 1.38$, $SD = .44$). Further, independent samples t-tests showed that speakers who used adult prosody with adult listeners were rated as demonstrating a more desirable style than those who used adult prosody with child listeners, $t(14) = 4.15$, $p = .001$, $d = 2.08$. Similarly, speakers who used child prosody with child listeners were rated as using a more desirable style than those who used child prosody with adult listeners,

$t(14)= 4.94$, $p < .001$, $d = 2.47$. In sum, prosodic match was critical in participants' ratings of how much they would speak like a given speaker. There were more likely to want to speak like those speakers who used the appropriate prosodic style for their listeners.

Anything 'weird' about how she talked? As their final question, participants rating speakers were asked, "Was there anything weird about how she talked?" The 2(prosody) x 2(listener type) mixed model ANOVA on ratings of speakers' weirdness yielded a significant effect of prosody, $F(1, 14) = 9.74$, $p = .008$, $\eta_p^2 = .41$, that was qualified by a prosody*listener type interaction, $F(1, 14) = 5.48$, $p = .04$, $\eta_p^2 = .28$. The effect of prosody was significant for adult listener teams, $t(7) = 4.78$, $p = .002$, $d = 2.11$, but not for child listener teams, $p = .65$. More specifically, speakers who used child-directed prosody ($M = 2.19$, $SD = .46$) to address adult listeners were rated as being weirder than speakers who used adult-directed (and therefore, appropriate) prosody ($M = 1.31$, $SD = .37$) to address an adult. Further, independent samples t-tests showed an effect of listener type for child prosody trials, $t(14) = 2.33$, $p= .02$, $d = 1.23$, but not for adult prosody trials, $p = .66$. For child prosody trials, speakers addressing adults in child-directed prosody ($M = 2.19$, $SD = .46$) were rated as being weirder than speakers addressing children in child-directed prosody ($M = 1.56$, $SD = .56$).

Thus, participants' perceptions were that addressing an adult in the prosodic style that one would use for a child was odd; however, speakers could address children in either style without it being perceived as particularly odd.

Effectiveness with the game. Participants were asked about players' effectiveness with the treasure-finding game with two questions. Both questions were asked of speakers and listeners.

Want to be on the same team? One of the questions that assessed speakers' and listeners' effectiveness with the treasure-finding game was, "If you really wanted to win the treasure-finding game, how much would you want to be on a team with this particular speaker/listener?" A 2(prosody) x 2(listener type) x 2(ratings' target) mixed model ANOVA was used to analyse participants' ratings of how much they indicated that they wanted to be on the same team as the various players to which they were exposed. These results showed a prosody*listener type interaction, $F(1, 28) = 8.65$, $p = .007$, $\eta_p^2 = .24$. Paired samples t-tests examining the effect of prosody separately for each listener type showed a statistically significant effect of prosody for adult listener teams, $t(15) = 2.48$, $p = .03$, but not for child listener teams, $p = .12$. For teams with adult listeners, participants were more likely to want to be on team with speakers and listeners who used or were addressed with adult-directed prosody ($M = 2.31$, $SD = .51$) than players who used or were addressed with child-directed prosody ($M = 1.69$, $SD = .57$). Moreover, independent samples t-tests showed an effect of listener type for child prosody trials, $t(30) = 2.92$, $p = .007$, $d = 1.15$, but not for adult prosody trials, $p = .09$. For child prosody trials, participants indicated that they were more likely to want to be on a team with players on teams with child listeners ($M = 2.25$, $SD = .52$) than those on teams with adult listeners ($M = 1.69$, $SD = .57$).

Taken together, the results show that prosodic fit impacted participants' willingness to be on a team with the various players. When asked about teams with adult listeners, participants indicated that they wanted to be on teams with players who used or were addressed with appropriate, adult-directed prosody. In other words, they were less likely to want to play with speakers or listeners on teams in which the speaker addressed her adult listener with child-

directed prosody. Participants did not penalize players on teams in which adult-directed prosody was used to address children.

Likelihood of winning the treasure-finding game. The question, "How much do you think that this team will win the treasure-finding game?" was asked of adults rating speakers and listeners. Ratings on the likelihood of winning the treasure-finding game was assessed using a 2(prosody) x 2(listener type) mixed model ANOVA. Note that ratings' target was not included in this ANOVA despite the fact that the question was asked of speakers and listeners. Given that this question pertained to the team, and that participants were not rating speakers and listeners separately, ratings' target was not included in the analyses. The ANOVA showed a significant prosody*listener type interaction, $F(1, 30) = 11.95$, $p = .002$, $\eta_p^2 = .29$. Paired samples t-tests showed a significant effect of prosody for the child listener teams, $t(15) = 4.37$, $p = .001$, $d = 1.22$, but not for the adult listener teams, $p = .36$. Teams with speakers who used child prosody ($M = 2.59$, $SD = .46$) to address child listeners were rated as more likely to win than teams with speakers who addressed child listeners with adult-directed prosody ($M = 1.91$, $SD = .64$). Independent samples t-tests showed that on trials in which speakers used child-directed prosody, teams with child listeners ($M = 2.59$, $SD = .46$) were rated as being more likely to win than teams with adult listeners ($M = 2.06$, $SD = .68$). Taken together, in addition to rating players on teams with children as being more likely to win in general, prosodic fit mattered for teams with child listeners, but not on teams with adult listeners. That is, prosody mattered for child listeners, perhaps because children would have less success with understanding and following through on instructions delivered with adult-directed prosody than they would if the instructions were delivered in child-directed prosody. In contrast, adult listeners would likely have an equal chance of winning irrespective of whether their speakers' prosodic style was appropriate for them or not.

Social competence. Two questions probed social competence. Judgments about friendliness were asked about speakers and listeners, while perceptions of politeness were asked only about speakers.

Friendliness. Participants rating speakers and listeners were asked, "How friendly is she?" Friendliness ratings were analysed with a 2(prosody) x 2(listener type) x 2(ratings' target) mixed model ANOVA. An effect of prosody, $F(1, 28) = 18.42$, $p < .001$, $\eta_p^2 = .40$, was qualified by a prosody*ratings' target interaction, $F(1, 28) = 13.37$, $p = .001$, $\eta_p^2 = .32$. Paired samples t-tests showed an effect of prosody for speakers, $t(15) = 4.28$, $p = .001$, $d = 1.24$, but not for listeners, $p = .43$. The lack of effect for listeners shows that participants were not making global judgments about all members of the interaction based on the speaker's prosodic style alone. Instead, speakers who used child-directed prosody ($M = 2.72$, $SD = .55$) were rated as being friendlier than speakers who used adult-directed prosody ($M = 1.94$, $SD = .70$), irrespective of whether the listener was an adult or a child. Independent samples t-tests also showed that speakers who used child-directed prosody had higher friendliness ratings ($M = 2.72$, $SD = .55$) than listeners ($M = 2.25$, $SD = .45$) who were addressed with child-directed prosody, $t(15) = 4.28$, $p = .001$, $d = 0.94$. There was no difference between speaker and listener ratings for the adult-directed prosody trials, $p = .43$.

Thus, unlike the other domains discussed so far, prosodic fit was not seen as being important for friendliness, given that speakers who used child-directed prosody generally were rated as being friendlier than speakers who used adult-directed prosody. Further, nothing was assumed about the friendliness of listeners to whom child-directed speech was directed. For example, participants did not seem to assume that speakers' use of child-directed speech had anything to do with the possibility that those listeners might have been friendlier themselves.

Politeness. Participants rating speakers were asked, "How polite is she?" Their resulting politeness ratings were analysed with a 2(prosody) x 2(listener type) mixed model ANOVA. There were no statistically significant main effects or interactions, *p*s > .09.

Intellectual competence. Judgments about listeners' intellectual competence were assessed with two questions. One question pertained to how much help listeners would need on a difficult school problem, and another asked how smart that listener was.

Help on a hard school problem. As a measure of intellectual competence, participants rating listeners were asked, "Compared to other grown-ups/kids her age, how much help would she need on a hard school problem?" The results of a 2(prosody) x 2(listener type) mixed model ANOVA showed no statistically significant main effects or interactions, *p*s > .11.

Smart. This question was phrased, "Compared to other grown-ups/kids her age, how smart is she?" Ratings of listeners' intelligence showed a main effect of listener type, $F(1, 14) = 7.30$, $p = .02$, $\eta_p^2 = .34$. Interestingly, children ($M = 2.25$, $SE = .12$) were rated as being smarter than adults ($M = 1.81$, $SE = .12$); though, recall that this question asked about smartness relative to other children. It might be that children were perceived as needing to be smart to perform well in the game, as some of them were addressed with adult-directed prosody. Participants might have reasoned that most adult listeners would likely not have had much difficulty keeping up with the instructions, irrespective of how they were delivered. In other words, they might have thought that adult listeners need not be especially intelligent to play the game.

Age. Given that the use of child-directed speech decreases with age, participants were asked to guess listeners' age to test the hypothesis that listeners addressed in child-directed speech would be judged as being younger than those addressed with adult-directed prosody. To this end, participants were asked, "How old do you think the listener is?" The 2(prosody) x

2(listener type) mixed model ANOVA used to analyse age ratings yielded only a significant effect of listener type, $F(1, 14) = 28.25$, $p < .001$, $\eta_p^2 = .69$. Unsurprisingly, adult listeners (M = 17.38, SE = 1.43) were rated as being older than child listeners, (M = 6.96, SE = 1.34). Thus, the hypothesis that perceptions of listeners' age would be affected by the prosodic style in which they were addressed was not supported by the data.

Summary of Findings

These results answer questions about whether prosodic fit matters in adults' judgments about communicators, and if so, to which areas of competence it applies. The data also provide insight into whether prosodic fit matters for some listeners more than others (i.e., adults or children). Another area into which the data shed light is whether participants make judgments about listeners based on how they were addressed, in addition to speakers.

First and foremost, these data suggest that adults are highly sensitive to prosodic fit. Their responses reflected the view that matching one's prosody to one's listener has implications for a number of areas, which include communicative competence, and success with the task at hand. More specifically, participants indicated that speakers who failed to match their prosody to their listeners were worse speakers than those who tailored their prosody appropriately. Further, when asked to indicate how they would address the various listeners, participants rated themselves as wanting to emulate speakers who matched their prosodic style to their listeners, more so than speakers who used an inappropriate prosodic style for their listeners.

Participants considered prosodic fit in a more nuanced way for the other areas of competence. That is, when participants rated teams' chances of winning the treasure-finding game, prosodic fit mattered for child listeners but not for adult listeners. That is, children addressed inappropriately were seen as being less likely to bring success to their team, possibly

because understanding instructions delivered in adult-directed prosody would be difficult and might stymie their comprehension. In other words, adult participants could be showing sensitivity to the facilitating effects of child-directed prosody on comprehension. In contrast, participants seemed to think that adult listeners' chances of winning would be unaffected by how they were addressed. Indeed, there is no detriment to adults' comprehension when they are addressed in child-directed speech, as per the previously discussed literature that showed that child-directed presentation helps adults as well as children (Golinkoff & Alioto, 1995).

Prosodic fit was unimportant for ratings of friendliness and politeness (though child-directed prosody was considered to be more friendly overall, which is unsurprising given that child-directed prosody is similar to that which is used to convey happiness [Trainor, Austin, & Desjardins, 2000]). Yet, participants' ratings nonetheless hinted at possible negative social implications for failing to fit one's prosodic style to the listener. That is, they were less likely to want to be on a team with speakers who used inappropriate prosody when addressing adults (though they were not bothered by speakers who used adult-directed prosody when speaking to children). Further, participants thought that speakers who used inappropriate prosody for adults spoke in a "weirder" fashion than those who used adult-directed prosody for adults; yet, like their ratings of their willingness to play on teams with the various players, they were forgiving of speakers who used adult-directed prosody to address children. These last two findings suggest that using child-directed prosody to address adults provokes harsher, more negative attributions than using adult-directed prosody with children. Using adult-directed prosody to address children might not be wholly unusual given that the use of child-directed prosody decreases as children grow older (i.e., for 5-year-olds relative to children less than 1-year-old; Ervin-Tripp, 1973; Garnica, 1977; Liu, Tsao, & Kuhl, 2009; Stern et al., 1983). Hence, as children age past the

preschool years, the prosody used to address them might not be purely child-directed. Moreover, though child-directed speech is commonly used with children, there are individual differences in people's usage of this speech style (Ikeda & Masataka, 1999; Rowe, 2008). In stark contrast, using child-directed prosody for an adult is uncommon, except for scenarios in which the adult listener has a salient need for such modifications. Examples include if the listener is elderly (Caporael, 1981) or a second language learner (Biersack et al., 2005; Ferguson, 1975). Given that there was no reason to assume that the adult listeners in this study were elderly or English language learners, there should not have been a good reason for the speakers to adjust their speech in such a manner when addressing adults. It is for these reasons that this discrepancy in penalizing inappropriate prosodic styles for adult listeners but not child listeners might have emerged in the social domain.

Participants made judgments about listeners, too, based on how they were addressed. Adult listeners spoken to in adult-directed prosody were rated as being better listeners than those adults who were addressed in child-directed prosody. Perhaps participants reasoned that adult listeners did not have to be particularly skilled listeners to take in information presented in the slow and varied pitch associated with child-directed speech. Additionally, they might have reasoned that speakers might have been speaking to listeners as they would children because of a priori knowledge that the listeners needed information to be presented that way.

Introduction: Experiment D

As the phenomenon of prosodic fit was observed to affect adults' judgments about communicators, an important question, given the developmental emphasis of this dissertation, is whether school-age children are similarly attuned to prosodic fit. Experiment D used the same methodology as Experiment C but used a sample of children aged 7- to 10 years. As Experiment A showed that children in this age range strongly associate certain prosody features with certain listeners, of interest are the kinds of judgments that children make about speakers when they do or do not use the prosodic style that is expected for the listener, and of listeners when they are or are not addressed with the prosody that would be expected for them. Children between the ages of 7- to 10 years old was the age range chosen because Experiment A showed that children of this age strongly associate certain prosodic cues with certain types of listeners.

Method

Participants

The sample consisted of 64 English-speaking children: 32 7- and 8-year-olds (M = 98.97, SD = 7.11; 16 males) and 32 9- and 10-year-olds (M = 120.72, SD = 6.86; 16 males). Children were recruited through the public school board of a mid-size Canadian city. The socio-economic status of the sample was representative of the broader community (which is comprised of mainly middle-class families). An additional child was tested but was excluded and replaced due to difficulty following the instructions.

Materials and Procedure

Participants were tested individually in a quiet room in their school. All children received the judgments task first, followed by a receptive vocabulary task.

Judgments task. The administration of the Judgments Task for the child sample was similar to that which was used with the adult sample. However, a few elements were added to help ensure children's understanding. For example, speakers' and listeners' walkie-talkies and headphones were pointed out more explicitly (e.g., "Can you see her headphones?") to ensure that children understood how individuals in separate rooms would be communicating. Further, following completion of the four trials in the Judgments Task, children's understanding of the response scale was tested by asking them to name their favourite and least favourite food. After they provided a response to each question, they were asked to point to an option on the Likert scale to show how much they liked (or disliked) each option. Any children who did not indicate that they liked the favored food more than the food that they had indicated that they disliked would have been excluded, though all children in this sample answered this understanding check correctly.

Receptive vocabulary task. As in Study 1, the receptive vocabulary subtest from the WIAT-III (Wechsler, 2009) was administered to ensure that participants had adequate language skills. No children were removed on the basis of low WIAT-III scores, as all participants had standard scores of 80 or higher (which indicated a score in the Low Average range or higher).

Results and Discussion

Preliminary Analyses

The distributions for each of the dependent variables were examined after splitting them by ratings' target and age group. There were no statistical outliers (i.e., $\pm$3SD) for any of the dependent variables.

Then, independent samples t-test were used to check that the between subjects groups did not differ in terms of age of the participants (in months) and receptive vocabulary raw scores. T-tests indicated that all groups of interest did not differ in terms of those variables. The group of children who rated speakers did not differ in age or receptive language ability from that which rated listeners, *p*s > .16. Similarly, the group of children who rated teams with child listeners did not differ in age or language ability from that which rated adult listeners, *p*s > .50.

Preliminary analyses examined the effect of participant sex on the dependent measures. For the questions that were common to speakers and listeners, a 2(prosody: adult- or child-directed) x 2(listener type: adult listener or child listener) x 2(ratings' target: rated speaker or rated listener) x 2(participant sex: male or female) was conducted. For those dependent variables that were unique to either the speaker or listener rating target, a 2(prosody) x 2(listener type) x 2(sex) mixed model ANOVA was run. There were no statistically significant main effects or interactions involving sex for any of the dependent measures, *p*s > .12. Similarly, a series of 2(prosody) x 2(listener type) x 2(ratings' target) x 2(prosody order: adult-directed prosody presented first, or child-directed prosody presented first) mixed model ANOVAs did not yield statistically significant interactions involving prosody, listener type and prosody order, *p*s > .08. In other words, there was not a statistically significant effect of whether participants heard child-prosody trials first or adult-prosody trials first on their ratings.

Judgments Questions

Communicative competence. Recall that communicative competence was assessed with three questions, one of which was asked about both speakers and listeners, and the remaining two of which were asked only about speakers.

How good at speaking/listening? Children rating speakers were asked, "How good is she at speaking to this grown-up/kid?", whereas, children rating listeners were asked, "How good is she at listening?" These data were analysed with a 2(prosody) x 2(listener type) x 2(ratings' target) x 2(age group: 7- and 8-year-olds or 9- and 10-year-olds) mixed model ANOVA (Table 7). A significant main effect of ratings' target, $F(1, 56) = 11.46$, $p = .001$, was qualified by a prosody*ratings' target interaction, $F(1, 56) = 5.33$, $p = .03$, $\eta_p^2 = .09$. Paired samples t-tests were used to examine the effect of prosody separately for speakers and listeners; however, the effect of prosody was statistically significant for neither speakers nor listeners, ps > .08. Independent samples t-tests were used to examine the effect of ratings' target on each prosody type. On trials in which speakers used adult-directed prosody, speakers ($M = 2.33$, $SD = .50$) were rated as being less competent communicators than listeners ($M = 2.78$, $SD = .31$), (irrespective of whether the listener was a child or an adult), $t(51.60) = -4.35$, $p < .001$, $d = 1.08$. In other words, children rated speakers who used adult-directed prosody as worse at speaking than their listeners were at listening. Children might have felt that speech delivered in adult-directed prosody was generally difficult to follow. They might have reasoned that listeners would have had to be skilled listeners to understand speech delivered in this way. However, there was no difference between how speakers and listeners were rated on trials in which the speaker used child-directed prosody, $p = .64$. No other main effects or interactions from the omnibus ANOVA were statistically significant, $p > .06$. Thus, children did not seem to be sensitive to prosodic

match when rating general communicative competence. That is, they were not attuned to the fact that adult listeners might have been able to manage the demands of adult-directed speech. Instead, children's ratings suggested that they thought that listeners would have had to be especially skilled to understand and follow speech that was delivered in adult-directed prosody.

Would you speak like this speaker? Another question that assessed communicative competence for speakers asked, "If you were telling this listener how to find the treasure, how much would you speak like this speaker?" These data were analysed with a 2(prosody) x 2(listener type) x 2(age group) mixed model ANOVA and yielded a significant effect of prosody, $F(1, 28) = 5.28$, $p = .03$, $\eta_p^2 = .16$. Children reported that they would be more likely to speak like speakers who used child-directed prosody ($M = 2.23$, $SD = .10$) than those who used adult-directed prosody ($M = 1.92$, $M = .09$). This preference for wanting to deliver their speech like those who used child-directed prosody was not affected by who the listener was. In other words, children indicated that they would use child-directed prosody to address both adults and children. No other main effects or interactions were statistically significant, ps > .09.

Anything 'weird' about how she talked? Another question that assessed participants' judgments about speakers' communicative competence asked, "Was there anything weird about how she talked?". Results of a 2(prosody) x 2(listener type) x 2(age group) mixed model ANOVA showed a significant prosody*listener type*age group interaction, $F(1, 28) = 4.53$, $p = .04$, $\eta_p^2 = .14$. This interaction was understood by conducting separate 2(prosody) x 2(age group) ANOVAs for each listener type. Data from ratings of teams with child listeners showed a significant prosody*age group interaction, $F(1, 14) = 4.47$, $p = .05$, $\eta_p^2 = .24$. Subsequent paired samples t-tests were used to determine the effects of prosody within each age group. Seven- and 8-year-olds' perceptions of speakers' weirdness was not affected by prosody, $p = .32$; however,

9- and 10-year-olds rated speakers who used adult-directed prosody to address a child as weirder (M = 1.69, SD = .70) than speakers who used child-directed prosody to address a child (M = 1.38, SD = .44), $t(7) = 2.38$, $p = .049$, $d = 0.53$. In contrast, data from teams with adult listeners did not show a significant prosody*age group effect, $p = .33$.

Thus, when evaluating speech, children found it to be especially odd for a child to be addressed with adult prosody; however this result only emerged for the 9- and 10-year-olds, suggesting that the sense of how to appropriately address a child strengthens with age. Interestingly, children did not report that it was weird to address adults in child-directed prosody. One possibility for this might be because their *own* preferences for child-directed speech might have prevented them from reflecting on the fact that that same speech style would likely be odd for adult listeners. Note that, while children were not asked whether they explicitly *preferred* child-directed speech (as that preference was inferred from their competence ratings), 7/8-year-olds have been shown to rate speakers who use positive-sounding prosody (and words) as being more likeable than those who do not use positive prosody and words (Gillis & Nilsen, 2016). Thus, children in the current study might have enjoyed the positive affect conveyed by speakers using CD speech. Alternatively, children might have been attuned to the fact that the features of child-directed speech might have been helpful for any listener, child or adult, having to listen to a list of instructions and keep them in mind.

Effectiveness with the treasure-finding game. Recall that two questions assessed effectiveness with the treasure-finding game and were asked of speakers and listeners.

Want to be on the same team as this player? One of the questions which assessed children's judgments about players' effectiveness within the context of the treasure-finding game asked, "If you really wanted to win the treasure-finding game, how much would you want to be

on a team with this speaker/listener?". This question was asked in both rating tasks and was therefore analysed using a 2(prosody) x 2(listener type) x 2(ratings task) x 2(age group) mixed model ANOVA. There were no statistically significant main effects or interactions with this variable, *p*s >.09. In other words, none of the manipulated variables, including prosody, seemed to affect children's ratings of their desire to be on the same team as a given speaker or listener.

Likelihood of winning the treasure-finding game. Another question that was asked when rating speakers and listeners was, "How much do you think this team will win the treasure-finding game?" Data from this question were analysed with a 2(prosody) x 2(listener type) x 2(age group) mixed model ANOVA. Analyses yielded a significant effect of prosody, $F(1, 60) = 14.04$, $p < .001$, $\eta_p^2 = .19$. Children rated teams with speakers who used child-prosody ($M = 2.48$, $SE = .06$) as more likely to win than teams with speakers who used adult-directed prosody ($M = 2.17$, $SE = .06$). Thus, child-directed prosody was favoured, irrespective of the identity of the listener. No other main effects or interactions were statistically significant, *p*s > .10.

Social competence. Two questions were asked about social competence, one of which was asked about both speakers and listeners, and one of which was only asked about listeners.

Friendliness. The question, "How friendly is she?" was asked of children who rated speakers and those who rated listeners. The 2(prosody) x 2(listener type) x 2(ratings' target) x 2(age group) mixed model ANOVA showed main effects of prosody, $F(1, 56) = 5.47$, $p = .02$, $\eta_p^2 = .09$, and age, $F(1, 56) = 5.12$, $p = .03$, $\eta_p^2 = .08$, that were qualified by a prosody*age interaction, $F(1, 56) = 6.62$, $p = .01$, $\eta_p^2 = .11$, and a prosody*ratings' target interaction, $F(1, 56) = 17.72$, $p < .001$, $\eta_p^2 = .24$. The prosody*age group interaction was first explored by using paired samples t-tests to examine the effect of prosody within each age group. Seven- and 8-year-olds did not show an effect of prosody, $p = .89$, suggesting that they judged (speakers and

listeners who used or were addressed in) adult- and child-directed prosody as equally friendly. However, 9- and 10-year-olds rated individuals (both speakers and listeners) as being more friendly if they used, or were addressed with child-directed prosody (M = 2.61, SD = .44) relative to adult-directed prosody (M = 2.28, SD = .44), $t(32) = 3.39$, $p = .002$, $d = 0.75$. This finding suggests that the perception that child-directed speech is friendlier than adult-directed speech emerges around 9 years. Further, independent samples t-tests showed an effect of age for adult prosody, $t(62) = -3.13$, $p = .003$, $d = 0.52$, but not for child prosody, $p = .88$. More specifically, 9- and 10-year-olds reported that adult-directed prosody was less friendly overall (M = 2.28, SD = .44) than did 7- and 8-year-olds (M = 2.64, M = .48). Thus, the attribution of friendliness to communicators using child-directed speech is more marked around 9- and 10 years of age. Further, at that age, children tend to perceive adult-directed prosody as being less friendly in general (irrespective of whom the listener is).

The prosody*ratings' target interaction was explored with paired samples t-tests that investigated an effect of prosody within each ratings' target. The effect of prosody on friendliness was significant for speakers, $t(31) = 4.18$, $p < .001$, $d = 1.03$, but not for listeners, $p = .16$. Speakers who used child-directed prosody were rated as being friendlier (M = 2.73, SD = .36) than those who used adult-directed prosody (M = 2.30, SD = .47). Further, independent samples t-tests showed the opposite effect of ratings' target for each prosody type. Specifically, the significant effect of listener type for adult prosody, $t(62) = 2.82$, $p = .006$, $d = 0.71$, manifested such that listeners addressed in adult-prosody were rated as being friendlier (M = 2.63, SD = .46) than speakers who used adult-prosody (M = 2.30, SD = .47). In contrast, the significant effect of listener type for child prosody, $t(62) = 2.40$, $p = .02$, $d = 0.59$, was such that speakers who used child-directed prosody were rated as being friendlier (M = 2.73, SD = .36)

than listeners who were addressed with child-directed prosody (M = 2.50, SD = .42). This interaction adds to the discussion of judgments about communicators' friendliness in two ways. First, children generally found speakers who used child-directed prosody as being friendlier than speakers who used adult-directed prosody. Second, children interestingly seemed to think that listeners addressed with adult-directed prosody were friendlier than speakers who used it.

Politeness. Another aspect of social competence was that of politeness. "How polite is she" was only asked of children rating speakers. A 2(prosody) x 2(listener type) x 2(age group) mixed model ANOVA showed a significant effect of prosody, $F(1, 28) = 11.54$, $p = .002$, $\eta_p^2 = .29$. Children rated communicators as being more polite if they used, or were addressed with, child-directed prosody (M = 2.75, SE = .07) relative to adult-directed prosody (M = 2.39, SE = .09). None of the other main effects or interactions were statistically significant, ps > .07. Thus, like judgments about friendliness, children found child-directed prosody to be more polite than adult-directed prosody. Also like judgments about friendliness, children did not take the listener, and thus, prosodic fit, into account. That is, child-directed prosody was seen as being more polite, irrespective of whether that style was appropriate for the listener.

Intellectual competence. Children rating listeners were asked two questions designed to tap into the domain of intellectual competence.

Help on a hard school problem. Children rating listeners were asked, "Compared to other grown-ups/kids her age, how much help would she need on a hard school problem?". The resulting ratings were analysed using a 2(prosody) x 2(listener type) x 2(age group) mixed model ANOVA. Therein emerged significant main effects both of listener type, $F(1, 28) = 6.86$, $p = .02$, $\eta_p^2 = .20$, and of age group, $F(1, 28) = 4.39$, $p = .045$, $\eta_p^2 = .14$. That is, children unsurprisingly rated child listeners (M = 2.15, SE = .08) as needing more help than adult listeners (M = 1.84, SE

= .08). Further, 7- and 8-year-olds (*M* = 1.88, *SE* = .08) rated listeners as needing less help than did 9- and 10-year-olds (*M* = 2.13, *SE* = .08). Thus, children's perceptions of how much help people needed on a difficult problem were not affected by the way in which they were addressed.

How smart. The other question that children answered as a measure of their judgments about listeners' intellectual competence was, "Compared to other grown-ups/kids her age, how smart is she?" None of the main effects or interactions for this ANOVA were significant, *p*s > .07.

Age. Participants who rated listeners were asked, "How old do you think the listener is?" The results were analysed with a 2(prosody) x 2(listener type) x 2(age group) mixed model ANOVA. Significant main effects of prosody, $F(1, 27) = 4.45$, $p = .04$, $\eta_p^2 = .14$, and listener type, $F(1, 27) = 94.65$, $p < .001$, $\eta_p^2 = .78$, were qualified by a significant prosody*listener type*age group interaction, $F(1, 27) = 5.30$, $p = .03$, $\eta_p^2 = .16$. A 2(prosody) x 2(listener type) ANOVA was run for each of the two age groups to try to understand the interaction. However, the prosody*age group interaction was not significant for the 7- and 8-year-olds or the 9- and 10-year-olds, *p*s = .07. For this reason, the interaction was not interpreted further. Instead, interpreting the main effects from the omnibus ANOVA suggested that children rated listeners in adult-directed prosody as being older (*M* = 12.86, *SE* = .62) than listeners addressed in child-directed prosody (*M* = 11.84, *SE* = .57). Further, children unsurprisingly rated child listeners as being younger (*M* = 7.08, *SE* = .75) than adult listeners (*M* = 17.61, *SE* = .78).

Summary of Findings

School-aged children who ranged in age from 7- to 10 years did not demonstrate sensitivity to prosodic fit as reflected by their judgments of speakers and listeners. That is, children's judgments about communicators' competence typically did not take the speaker's

addressee into account. Instead, generally speaking, children showed an overwhelming preference for child-directed prosody, even when that prosodic style was used inappropriately (i.e., to address adults).

In the realm of communication, children perceived listeners addressed with adult-directed prosody as being especially skilled at listening (more so than speakers who used that prosodic style), even when they were adults. Moreover, children indicated that they would want to emulate the speech of speakers who spoke in child-directed prosody, even when they would be addressing adult listeners. Further, 9- and 10-year-old children thought that addressing a child listener with adult-directed prosody would be weirder than addressing a child with child-directed prosody; however, they interestingly did not seem to rate addressing adults with child-directed prosody as weirder than addressing adults with adult-directed prosody.

Though prosody did not affect children's ratings of their willingness to be on a team with the various listeners, they again showed the same strong preference for child-directed prosody when judging which teams would be more likely to win. That is, children rated teams with speakers who used child-directed prosody as being more likely to win, irrespective of who the listener was. This positive perception of child-directed speech also extended to the social domain. Children rated speakers who used child-directed prosody as friendlier (only 9- and 10-year-olds, that is) and more polite than speakers who did not.

However, the positive perception of child-directed prosody did not extend to children's attributions about listeners' intellectual competence, though there was an effect on children's perceptions of adult listeners' ages. That is, adults addressed in adult-directed prosody were seen as being older than adults addressed in child-directed prosody.

When comparing how children made judgments about speakers relative to listeners, there were instances in which they penalized speakers for using adult-directed prosody whilst more favourably rating listeners who were addressed with that prosodic style. For example, children rated speakers who used adult-directed prosody as being worse at speaking than listeners (who were addressed in adult-directed prosody) were at listening. This finding is in contrast to work in the referential communication literature that shows that young children (i.e., 3- to 6 years old) penalize listeners, rather than speakers, for communication breakdowns (Robinson & Robinson, 1978). Yet, in the current context, this finding might reflect children's relative distaste for adult-directed prosody such that they strongly penalized speakers who used it, and awarded listeners who were addressed with it (perhaps because they, themselves, found the instructions delivered in adult-directed prosody as being difficult to follow).

In a similar vein, children's judgments extended to listeners when they were asked to consider communicators' friendliness. Though prosody did not affect how children rated listeners' friendliness, recall that children rated listeners addressed in adult-directed speech as friendlier than speakers who used it. One possibility is that children might have reasoned that, given that adult-directed speech sounds unfriendly, a listener would have to be exceptionally friendly to be willing to play a game with a person whom would address them in such a manner.

Study 2 (Experiments C and D) Discussion

The goal of the set of experiments in Study 2 was to examine whether observers of an interaction make judgments about speakers and listeners depending on the appropriateness of the speaker's prosodic style for the listener. In stark contrast to adults, there was no evidence to suggest that children were attuned to the fit between the speaker's prosodic style and the listener (i.e., whether she was a child or an adult) when rating communicators' competence. Instead, children had fairly global and positive impressions about speakers who used child-directed prosody, irrespective of who the listener was. In some cases, this pattern held for listeners who were addressed with child-directed prosody. It appears that children's preference for child-directed prosody (Werker et al., 1994) affected their ratings of how they themselves would want to speak (even when addressing adult listeners), the likelihood of success for the various teams, friendliness, politeness, and even listener age. Listeners' intellectual competence was one area that was not affected (suggesting that children may have been able to discriminate somewhat amongst the various domains, though these comparisons were not analysed statistically), as was children's willingness to be on a team with the various listeners.

Why did child-directed prosody so strongly affect children's judgments, even when use of that prosodic style was inappropriate? One factor that might be relevant in explaining children's performance in the current study is the development of their nuanced knowledge about the appropriate use of language. Though Experiment A showed that children of this age robustly associate prosodic styles with various types of listeners, they might not have yet developed a sophisticated understanding of the implications of the use of these prosodic styles. That is, the sophisticated understanding that is required is that, while delivering instructions in child-directed prosody to adult listeners would likely not hinder their comprehension (and might even benefit

them; Golinkoff & Alioto, 1995), use of this speech style with adults is perceived as unpleasant and socially inappropriate. Adults' sensitivity to this notion comes from Experiment C: adults did not rate the use of child-directed prosody for adults as negatively affecting adult listeners' success. Instead, they simply seemed to find this prosodic style less socially desirable when used with adults. Children might have viewed child-directed prosody so positively, even when used with adults, because they were affected by its benefits whilst being unaware of its negative implications for use with adults. Indeed, research from other areas of pragmatic language supports the idea that children's understanding of the appropriate social use of language increases into the school years (e.g., regarding politeness; Garton & Pratt, 1990).

Another possible explanation for children failing to take prosodic fit into account might be that their preference and need for child-directed speech might have made it difficult to consider what adults' needs and preferences would be. Whereas the previous explanation pertained to children lacking *knowledge* about adults' preferences, this possible explanation suggests that children might be experiencing difficulty setting aside their needs and preferences to consider others'. More specifically, children might have extended the benefits of child-directed prosody to adults given that they themselves likely more easily understood and preferred speech presented in a child-directed prosodic style. It could be that children's failure to consider adults' preferences and abilities (i.e., that adults would likely prefer and be able to understand speech delivered with adult-directed prosody) was indicative of an egocentric style. Indeed, other work on children's ability to appreciate communicative attempts from a third-person perspective suggests that early school-aged children have difficulty setting aside their own perspective to take into account a listener's perspective when determining how this listener will interpret ambiguous language (e.g., Nilsen, Glenwright, & Huyder, 2010; Nilsen & Graham, 2012). That

is, not unlike the 'curse of knowledge' (Birch & Bloom, 2004), children may be biased by their own preferences and needs when trying to determine the communicative preferences of someone with divergent needs.

Of course, these explanations are not mutually exclusive. It might be that as children's ability to consider others' perspectives and apply that knowledge to their behaviour improves, and as their knowledge of the nuances of pragmatic language grows, they would show more consideration of prosodic fit when judging the various socio-linguistic qualities considered here.

Though children did not consider prosodic fit, they were nonetheless influenced by prosody (in that they associated the child-directed prosodic style with a range of positive qualities). This is not the first documented instance of the influence of speech characteristics on children's judgments. Research demonstrates strong and early preferences for native languages and accents. Five- to 6-month old infants prefer to look at adults who spoke in their native language relative to a foreign language, and 10-month-olds similarly prefer to accept toys from native language speaking adults (Kinzler, Dupoux, & Spelke, 2007). This preference is also evident in older children. 5-year-olds show a social preference for those who speak their language with a native accent as opposed to a foreign accent, in that they pick children with native accents as friends (Kinzler et al., 2007), and judge native-accented adults as "nicer" (Kinzler & DeJesus, 2013b). Moreover, like children in the current study whose preference for child-directed speech extended to a number of domains, 9- and 10-year-olds elsewhere have been shown to make positive and negative assessments about a range of qualities based on accent (Kinzler & DeJesus, 2013a). For example, the 9- and 10-year-olds in Kinzler & DeJesus' (2013a) study judged individuals with an accent from Northern parts of America as being "smarter" and more "in charge" and judged individuals with accents from Southern America as

sounding “nicer”. Though the mechanisms driving children’s perceptions of various accents and those driving their judgments based on prosody could be different, the findings are nonetheless consistent with the notion that others’ speech characteristics can influence children’s social perceptions and behaviour.

This set of studies shows that adults’, but not children’s, judgments about communicators are affected by whether the speaker’s prosodic style is an appropriate fit for her listener. For school-aged children, the main finding is that prosody, rather than prosodic fit, influences their judgments about a range of characteristics related to communicators.

General Discussion

A rich understanding of how to adjust one's speech to a listener involves a consideration of not only what to say, but also, how to say it (i.e., consideration of the manner of speech). The two sets of experiments presented in this dissertation explore school-aged children's knowledge about prosodic adjustments. The main contribution of this dissertation is its illustration of the strong association that children make between prosodic styles and listeners, even in the presence of incongruent content cues, as well its demonstration of prosody's influence on children's and adults' judgments about speakers' and listeners' social and communicative qualities.

In working through the sets of experiments in order, I will highlight key findings, propose their theoretical and practical implications (where relevant), and suggest limitations and future directions. Beginning with Study 1 (Experiment A), the key findings were that children aged 7- to 10 years (and adults in Experiment B) chose the intended listener of greetings according to the prosody of the utterance, even when the semantic content was indicative of another listener. While past work demonstrated that children could identify the addressee of various speech styles based on multiple linguistic cues (Wagner et al., 2010), this study advanced the literature by clarifying that prosodic cues in particular carry substantial weight in children's inferences about the intended recipients of greetings. Another contribution to the literature was the illustration of a developmental progression in that 5- and 6-year-olds were unsure about which listener to choose in the incongruent conditions, whereas 7- and 10-year-olds chose according to prosody, suggesting that this strong influence of prosody on inferences about speech styles emerges at 7 years old.

One explanation for 5- and 6-year-olds' confusion in the incongruent conditions is that they are not as reliant or sensitive to prosodic cues (which would be consistent with work

elsewhere; e.g., Morton & Trehub, 2001). Another explanation for their confusion is that they were stymied by the conflicting cues, which left them unsure about whom to choose. While a limitation of this work is that the data cannot clearly disentangle these two explanations, they are not mutually exclusive. As per their certainty scores, older children were confused by the incongruence too. Like younger children, older children indicated that they were more certain about their choice of listener in one of the congruent conditions relative to the incongruent conditions; however, unlike younger children, older children resolved that confusion by selecting the listener based on the prosody of the greeting. Nonetheless, an interesting question for future work is whether 5- and 6-year-olds would have also had difficulty choosing the listener when presented with prosodic cues alone, without content cues (e.g., using low-pass filtered stimuli or words presented in a foreign language). If so, this result would suggest that 5- and 6-year-old children's confusion in the present study was due to a weaker reliance on prosody rather than difficulty with processing incongruent cues. If 7- to 10-year-old children truly associate prosodic styles with listeners more strongly than 5- to 6-year-olds, it would be interesting to know *why*. One possible hypothesis for the posited developmental improvement is that older children gain more experience with prosodic styles. As children age, they would presumably be exposed to more examples of speakers addressing infants and children with a child-directed prosodic style. Such experiences might solidify that link between high, variable pitch and infant listeners, for example. Moreover, via social learning, older children might model these modifications and learn to make them more consistently themselves.

Findings from Experiment A are also helpful for interpreting inconclusive findings fromprevious studies. Specifically, studies that are most relevant are those that examine children's ability to *produce* speech featuring the characteristic prosodic features that are

typically adjusted for various listeners. Recall the two studies discussed previously which provided inconclusive results regarding children's ability to adjust their prosody for their listeners. Tomasello and Mannle (1985) found that preschoolers ranging in age from 3- to 5 years old used an 'infant-directed intonation' when interacting with their infant siblings, though they did so less consistently than their mothers; Weppelman and colleagues (2003) found that while 4-year-olds spoke more slowly to infants than to adults, they modified neither their pitch nor their volume (Weppelman et al., 2003). This lack of clarity about the extent to which children produce prosodic style modifications begs the question of whether production ability depends on how strongly children associate certain prosodic features with certain listeners. That is, one explanation that emerges from Experiment A for why certain prosodic changes are not made when producing speech is simply that children younger than 7 years might not robustly associate certain prosodic features (i.e., high mean pitch and variability) with speech used to address infants. It might be that individual differences in the strength of this associative link between child-directed prosodic features and listeners might contribute to individual differences in the ability to produce these features. In this way, findings from Experiment A have theoretical implications for interpreting discrepancies in the production literature. It follows that an interesting future direction that emerges from the experiments in Study 1 is to test, using a production task, whether children's ability to make listener dependent prosodic changes is related to the strength with which they associate prosodic features with listeners (i.e., in a task similar to Experiment A). It might be that children who have knowledge about how prosodic features tend to be adjusted when addressing infants and adults are those who are more likely to adjust their own pitch, volume, and speech rate for infant listeners compared to adult listeners. Similarly, perhaps children who have a weaker understanding of which prosodic features tend to

be used when addressing infants are less likely to make such prosodic adjustments for infant listeners.

In addition to exploring this possible link between production and comprehension abilities, a future production task could be used to elucidate other variables that might be related to children's production of appropriate prosody for their listener. For instance, in their naturalistic study of children and their infant siblings, Dunn and Kendrick (1982) noted that the use of affective aspects of child-directed speech (though it is unclear exactly what those aspects were) were restricted to those children who were described as having particularly warm and affectionate relationships with their younger siblings. It would be interesting to clarify which aspects of child-directed speech (i.e., prosodic or lexical, and if prosodic, which features specifically) are related to the nature of the relationship between older speaker and younger sibling listener. Similarly, it would be interesting to note whether children's affective state affects whether they produce child-directed speech for younger listeners to whom they have no relation. Perhaps children would be more likely to produce aspects of child-directed speech when addressing unrelated infant siblings if they felt more warmth and positivity toward them.

Moving to the set of experiments in Study 2, the main finding is that, even by the age of 10 years, children are not showing sensitivity to prosodic fit when making judgments about a range of social and communicative characteristics. Adults weighed whether a speaker's prosodic style was appropriate for her listener when they judged communicative effectiveness, likelihood of success with the task at hand, and their desire to be on a team with the various individuals. In contrast, children did not take prosodic fit into account when making these judgments. Instead, for children as young as 7 years of age, the use of child-directed prosody was associated with more favourable ratings in aspects of communicative competence, effectiveness with the task

(though, not for *all* questions therein), friendliness, and politeness. Thus, though school-aged children were not sensitive to prosodic fit, their judgments about communicators' socio-communicative characteristics were nonetheless robustly influenced by whether speakers were using child-directed prosody.

This set of studies was unique in that it drew from multiple bodies of literature with the aim of understanding a novel phenomenon, namely, individuals' judgments of speakers and listeners based on the appropriateness of speakers' prosodic style. First, while it was previously known that children and infants show a preference for child-directed speech as early as 1-month-of-age (e.g., Cooper & Aslin, 1990), it was unclear that that preference would have implications for children's judgments about speakers' and listeners' socio-communicative characteristics (albeit, 7- to 10-year-olds' preference for child-directed speech is inferred from research that shows their preference for positive speech; Gillis & Nilsen, 2016). Second, while it was known that observers form impressions about others' personality based on the prosodic quality of their voice (Apple et al., 1979), and that people form positive judgments about communicative partners who match their own prosodic style (Feldstein et al., 2001), it was unclear whether (adult or child) observers would make judgments about interlocutors based on the fit of the prosodic style for a particular listener. The present findings further the literature by demonstrating that the fit or appropriateness of a speaker's prosodic style for her listener has relevance for how adults perceive aspects of communicators' communicative and social competence.

The main findings from Study 2 were that children's judgments about communicators' communicative and social competence were affected by whether speakers used child-directed prosody, whereas adults' judgments were affected by whether speakers' prosodic styles were

appropriate for their listeners. The notion that adult observers make judgments based on the appropriateness of speakers' prosodic styles to their listeners has implications for those who have difficulty adjusting their prosody. Recall that individuals with ASD can show global prosodic deficits (albeit, not consistently; McCann & Peppé, 2003), and that such prosodic deficits may pose a significant barrier to their social and vocational functioning (Shriberg et al., 2001). Experiment C suggests that prosody, and specifically, listener dependent prosodic modifications, could figure into (adults') impressions about a range of socio-communicative qualities. It might be that teaching appropriate ways in which to adjust one's prosody could be fruitful when remediating communication and social skills in such individuals. Indeed, intervention protocols like *Teaching Your Child the Language of Social Success* (Duke, Nowicki, & Martin, 1996) remediate aspects of nonverbal communication that include prosody. Components of that particular protocol include the recognition of emotions conveyed by vocal prosody, the ability to decipher what different speech rates might mean, and the effect of emphatic intonation on sentence meaning. There are some studies that assess the efficacy of interventions that target the appropriate and flexible use of communication generally, and prosody specifically, such as that of Duke and colleagues (1996), though these studies are limited in number, and their combined findings are unclear. For instance, one study taught children and adolescents with ASD how to use appropriate prosody (which was one of the components featured in the intervention) when engaging in various social behaviours such as sharing ideas, complimenting others, and recommending changes nicely (Webb et al., 2002). That study showed improvements in those targeted social behaviours after the intervention, which included appropriate use of prosody, though improvements in prosody specifically were not reported (Webb et al., 2002). Another study that featured an intervention that was based closely on Duke and colleagues' (1996)

nonverbal communication program for adolescents with ASD showed minimal development in these skills post-test; however, there was some evidence of improvements in related friendship and social skills (although it is unclear which aspects of the intervention might have led to those improvements; Barnhill, Cook, Tebbenkamp, & Myles, 2002). Open questions that remain to be answered by researchers studying the remediation of social and communicative deficits include which aspects of these deficits seem to be the most important to target, and what the results might be of targeting prosody comprehension and use specifically. The clinically relevant question that emerges most directly from this dissertation is how remediating listener dependent prosodic modifications specifically might be helpful for individuals who lack this ability. This clinically motivated line of research would help clarify how important listener dependent prosodic modifications are for positive interpersonal functioning. The first question that would need to be answered to set up this line of research asks about the relation between the ability to adjust one's prosody for a listener and social functioning. Are those who are better able to adjust their prosody in a range of contexts those who enjoy interpersonal relationships of a higher quality? While the studies in this dissertation focused on prosodic adjustments to infants, children, and adults, it would also be interesting to consider a broader range of adjustments such as those that are made according to the social context (e.g., formal contexts such as work compared to informal contexts such as social gatherings with friends). Moreover, if there is a relation between speech adjustments and social functioning, what is the unique contribution of prosodic adjustments (relative to lexical or syntactic adjustments for example)? If a relation between these two constructs is established, it would be interesting to develop intervention protocols (or further explore and improve upon existing intervention protocols) to remediate prosodic deficits and determine their efficacy in improving prosodic skill as well as social

functioning. Further, such studies could be done with community samples as well as clinical samples (consisting of individuals with ASD). Using a community sample would allow for an examination of response to intervention for individuals along a broad continuum of prosodic adjustment ability, whereas using a clinical sample would allow for an exploration of the effects of intervention for individuals with more significant deficits. Exploring questions such as these would highlight practical and clinical issues surrounding the ability to flexibly adjust one's prosodic style.

Given that the experiments in Study 2 were exploratory in nature, its findings open up several avenues for future work. For instance, one limitation of Experiment D is that it is unclear why children disregarded prosodic fit, whereas adults did. Thus, future work could explore possible mechanisms behind the developmental shift, which could include experience with inappropriate prosodic styles. Perhaps children did not penalize inappropriate use of child-directed prosody because they have not yet experienced that prosodic style as annoying or aversive. Given this, perhaps children would consider prosodic appropriateness in a first person task if they were addressed in a highly exaggerated child-directed style about a topic about which they were highly knowledgeable. If the effect of prosodic fit emerged here, that would suggest that children would need to have first-hand experiences of prosody being aversive before they could truly understand whether prosodic styles are socially appropriate or not.

Future research could explore other possible conditions under which children might consider prosodic fit. For instance, of interest is whether the context of the interaction - the treasure-finding game - led children to disregard prosodic fit and instead place a high value on child-directed prosody. More specifically, the context of the set of experiments in Study 2 was didactic, in that detailed, precise information had to be conveyed and remembered. Perhaps

children rated child-directed prosody favourably, even when it was used with adults, because of how that prosodic style facilitates comprehension. A future study could explore whether children would be more likely to take prosodic fit into account in a context that is purely social in nature (i.e., introductions and greetings), rather than one that is didactic in nature. If children *can* take prosodic fit into account in the purely social context (when the need for understanding complex information is reduced), then it is not that they cannot consider the appropriateness of a speaker's prosodic style for her listener when they make judgments about communicators' socio-communicative characteristics. Instead, as mentioned, children might have been placing such high value on the use of child-directed speech in Study 2 because of how it eased comprehension. If, however, children also disregard prosodic fit in the purely social context, that finding would be more indicative of true difficulty considering the appropriateness of speakers' prosodic styles for their listeners, and applying that consideration when making socio-communicative judgments.

Another future direction involves exploring whether children might be more likely to consider the appropriateness of a speaker's prosodic style for her listener if the listeners' needs are made more salient. That is, in Experiment D, children were presented with little information about the speakers and listeners, other than whether they were adults or children. It might be interesting to manipulate the nature and amount of information that children receive about a listener's need (or lack of need) for various prosodic styles to examine whether children are successful in applying that information to their judgments. For instance, if children were told that a listener is "very good at listening and remembering instructions" (versus "very bad at listening and remembering information"), would they still extend the benefits of child-directed speech to that highly competent listener? If they still favour the use of child-directed prosody for that

competent listener despite being informed that its slow, emphatic prosodic features are unnecessary for her, it might be that children's own preferences and needs for child-directed speech are colouring their view of others' preferences and needs. In this way, this future direction could be a more stringent test of whether children's difficulty taking prosodic fit into account in Experiment D is indicative of an egocentric style, in which their preferences and needs colour their thinking about others' preferences and needs.

If the resulting findings indicate that children have difficulty factoring in others' preferences and needs when making socio-communicative judgments, subsequent studies could continue in the vein of exploring how perspective taking ability might be relevant for children's consideration of prosodic fit when making judgments. For instance, a pertinent investigation could be whether individual differences in perspective taking ability and inhibitory control relate to consideration of prosodic fit. Inhibitory control could be particularly relevant given its link with the ability to consider others' needs in a communicative context shown elsewhere (e.g., Nilsen & Graham, 2009). This relation implies that children with stronger inhibitory control and perspective taking ability might be better able to inhibit their own preferences for prosodic styles and consider others' preferences. Moreover inhibitory control has been implicated in children's ability to regulate the paralinguistic features of their utterances during an interaction with their mothers (Nilsen, Rints, Ethier, & Moroz, 2016). If factoring prosodic fit into judgments about communicators requires more than simply having knowledge about prosody use, children with stronger inhibitory control and perspective taking ability might make judgments that take prosodic fit into account. The answers from such work elucidating relations between perspective taking, inhibitory control, and consideration of prosodic fit might help provide clues about another question that follows from the set of experiments in Study 2: at what age will children

take prosodic fit into account? As suggested previously, it might be that children need to further develop in their perspective taking and inhibitory control abilities, as well as in their nuanced knowledge about speech styles. Indeed, studies which required that participants apply knowledge of another's perspective while communicating show continued improvements into middle childhood (Epley, Morewedge, & Keysar, 2004), and even late adolescence (14- to 17 years; Dumontheil, Apperly, Blakemore, 2010). Yet, despite its limitations in what answers it cannot provide, the set of experiments in Study 2 served as an informative, initial foray into questions about how prosodic styles are perceived and the implications for communicators of using these prosodic styles appropriately and inappropriately.

Conclusion

One hallmark of sophisticated communication is flexibility. Mature communicators adjust their manner of speech to their addressees, and their prosodic changes are purported to have a range of benefits. Gaining insight into how children learn about these listener dependent prosodic modifications not only provides information about how an important aspect of communication develops, but also could provide valuable insight for individuals who have difficulty doing so. Overall, this dissertation showed that school-aged children aged 7- to 10 years (and adults), but not 5- to 6 years, use prosody to determine the intended listener of a greeting, even when presented with content cues that suggest another listener. The strong influence of prosody on 7- to 10-year-old children was also illustrated with the finding that their judgments about communicators' socio-communicative characteristics were positively influenced by whether the speaker used child-directed prosody; in contrast, adults' judgments were positively influenced by whether the speaker's prosodic style was appropriate for her listener.

These main findings advance the literature in several ways. They clarify previous work by highlighting the particularly strong influence of prosody on children's association of speech styles with the listeners with whom they are to be used. They offer a means by which to understand conflicting results pertaining to whether children can produce appropriate prosodic changes, by considering the strength of their prosodic style to listener associations. This dissertation's findings also build upon a number of distinct literatures to demonstrate that children are highly susceptible to a speaker's prosodic style when judging aspects of competence as well as certain social characteristics. Finally, they suggest that it could be important to investigate the value of remediating difficulties in adjusting one's prosodic style to one's listener,

given how failure to do so negatively affects adults' perceptions of individuals. Together, the results add to the growing body of work on children and adults' ability to uncover richness and meaning from statements beyond the words uttered.

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Table 1

Study 1 (Experiments A and B; Listener Identification Task) Explanations Coding – Sample Responses

Code	Sample Responses (Adult)	Sample Responses (Child)
Prosody	Because you wouldn't use that tone of voice with a baby.	Because she's talking in a sweet voice. Because it's a normal talking voice. Because she was surprised. Because she's acting in a less adulty and more softer voice.
Content	She asked what her name was, and a baby wouldn't be able to respond. If she was talking to an adult, she wouldn't just wonder what her name was because she'd ask.	Because she was like, "aw". Because it was like, "I wonder what your name is". Because babies don't know how to talk.
Norms	That's how you talk to babies.	It was like how grown-ups talk to babies.
Function	She's being playful with the baby.	Because she's trying to make the baby laugh.
Uninformative/ "don't know"/ irrelevant	She used the tone that you'd use for a baby and the words that you'd use for an adult, **but I'm not sure.**	Because this time, she had a look in her eyes.

Table 2

Mean Certainty Scores by Condition and Age Group in Study 1 (Experiment A; Child Participants)

	Age Group			
	5/6 years *M* (SD)	7/8 years *M* (SD)	9/10 years *M* (SD)	All ages *M* (SD)
Adult Prosody-Adult Content	2.60 (.38)	2.52 (.52)	2.67 (.37)	2.59 (.43)
Adult Prosody-Infant Content	2.49 (.50)	2.40 (.43)	2.58 (.37)	2.49 (.44)
Infant Prosody-Adult Content	2.49 (.41)	2.31 (.54)	2.57 (.35)	2.45 (.45)
Infant Prosody-Infant Content	2.76 (.30)	2.61 (.51)	2.93 (.17)	2.77 (.37)
All conditions	2.59 (.06)	2.46 (.07)	2.69 (.04)	

Note. Mean scores range from 0-3, with a score of '3' indicating a choice of "really sure".

Table 3

Mean Explanations by Condition in Study 1 (Experiment A; Child Participants)

	Prosody *M* (SD)	Content *M* (SD)	Norms *M* (SD)	Function *M* (SD)	DK/Irrelevant *M* (SD)
5/6-year-olds					
AD.Pros/AD.Cont	.32 (.34)	.30 (.30)	.11 (.19)	.07 (.22)	.32 (.37)
AD.Pros/IN.Cont	.49 (.37)	.26 (.35)	.07 (.17)	.03 (.09)	.32 (.40)
IN.Pros/AD.Cont	.42 (.42)	.21 (.32)	.08 (.17)	.10 (.29)	.35 (.42)
IN.Pros/IN.Cont	.46 (.42)	.31 (.39)	.13 (.22)	.08 (.18)	.32 (.40)
All Conditions	.42 (.06)	.27 (.06)	.10 (.04)	.07 (.03)	.33 (.05)
7/8-year-olds					
AD.Pros/AD.Cont	.49 (.33)	.36 (.32)	.31 (.28)	.04 (.11)	.13 (.22)
AD.Pros/IN.Cont	.72 (.34)	.36 (.35)	.26 (.34)	.06 (.16)	.13 (.26)
IN.Pros/AD.Cont	.54 (.37)	.28 (.32)	.25 (.26)	.10 (.18)	.22 (.32)
IN.Pros/IN.Cont	.72 (.32)	.51 (.39)	.26 (.35)	.10 (.18)	.11 (.23)
All Conditions	.62 (.06)	.38 (.06)	.27 (.04)	.07 (.03)	.15 (.05)
9/10-year-olds					
AD.Pros/AD.Cont	.63 (.32)	.51 (.34)	.31 (.26)	.10 (.18)	.04 (.11)
AD.Pros/IN.Cont	.76 (.29)	.54 (.38)	.25 (.33)	.06 (.21)	.06 (.13)
IN.Pros/AD.Cont	.68 (.32)	.35 (.30)	.22 (.29)	.14 (.24)	.11 (.19)
IN.Pros/IN.Cont	.85 (.20)	.60 (.38)	.26 (.22)	.14 (.26)	.04 (.11)
All Conditions	.73 (.06)	.50 (.06)	.26 (.04)	.11 (.03)	.06 (.05)

Note. Mean scores for each trial range from 0-1. Values in brackets are standard deviations for all variables except for "All Conditions", whose bracketed values represent standard errors.

Table 4

Mean Certainty Scores by Condition in Study 1 (Experiment B; Adult Participants)

	Certainty Scores *M* (SD)
Adult Prosody-Adult Content	2.82 (.26)
Adult Prosody-Infant Content	2.32 (.61)
Infant Prosody-Adult Content	2.76 (.25)
Infant Prosody-Infant Content	2.92 (.20)

Note. Mean scores range from 0-3, with a score of '3' indicating a choice of "really sure".

Table 5

Mean Explanations by Condition in Study 1 (Experiment B; Adult Participants)

	Prosody *M* (SD)	Content *M* (SD)	Norms *M* (SD)	Function *M* (SD)	DK/Irrelevant *M* (SD)
Adult Prosody-Adult Content	.74 (.29)	.42 (.38)	.07 (.14)	.04 (.11)	.06 (.13)
Adult Prosody-Infant Content	.85 (.26)	.31 (.35)	.08 (.18)	.07 (.17)	.12 (.24)
Infant Prosody-Adult Content	.93 (.14)	.06 (.13)	.04 (.11)	.13 (.26)	.06 (.13)
Infant Prosody-Infant Content	.93 (.17)	.18 (.26)	.07 (.17)	.11 (.16)	.00 (.00)
All Conditions	.86 (.02)	.24 (.04)	.07 (.02)	.09 (.02)	.06 (.02)

Note. Mean scores for each trial range from 0-1. Values in brackets are standard deviations for all variables except for "All Conditions", whose bracketed values represent standard errors.

Table 6

Means for Judgments Ratings in Study 2 (Experiment C; Adult Participants)

		Adult Listener		Child Listener	
Question	Target	Adult Prosody *M* (SD)	Child Prosody *M* (SD)	Adult Prosody *M* (SD)	Child Prosody *M* (SD)
Good at speaking	Speaker	2.63 (.58)	1.50 (.53)	1.68 (.65)	2.69 (.46)
Good at listening	Listener	2.69 (.46)	2.25 (.66)	2.25 (.38)	2.44 (.42)
Speak like this speaker	Speaker	2.38 (.52)	1.38 (.44)	1.38 (.44)	2.44 (.42)
Anything weird	Speaker	1.31 (.37)	2.19 (.46)	1.63 (.58)	1.56 (.56)
Be on a team with	Speaker	2.44 (.56)	1.63 (.64)	1.94 (.68)	2.38 (.52)
	Listener	2.19 (.46)	1.75 (.53)	2.00 (.53)	2.13 (.52)
Win	Team	2.25 (.48)	2.06 (.68)	1.91 (.64)	2.59 (.46)
Polite	Listener	2.31 (.70)	2.25 (.76)	2.00 (.65)	2.75 (.46)
Friendly	Speaker	2.13 (.74)	2.69 (.70)	1.75 (.65)	2.75 (.38)
	Listener	2.13 (.23)	2.19 (.37)	2.25 (.60)	2.31 (.53)
Smart	Listener	1.87 (.44)	1.75 (.46)	2.25 (.27)	2.25 (.27)
Help on a hard problem	Listener	1.94 (.50)	2.44 (.50)	1.88 (.52)	2.00 (.46)
How old	Listener	19.13 (3.67)	15.63 (7.46)	7.36 (1.99)	6.57 (1.43)

Note. Mean scores for all questions (with the exception of age) ranged from 1 – 3. A score of '1' indicated a response of "not at all", whereas a score of '3' indicated a response of "very much". For the age question, responses indicated years.

Table 7

Means for Judgments Ratings in Study 2 (Experiment D; Child Participants; Collapsed Across Age)

		Adult Listener		Child Listener	
Question	Target	Adult Prosody *M* (SD)	Child Prosody *M* (SD)	Adult Prosody *M* (SD)	Child Prosody *M* (SD)
Good at speaking	Speaker	2.44 (.40)	2.34 (.70)	2.22 (.58)	2.75 (.45)
Good at listening	Listener	2.84 (.30)	2.66 (.44)	2.72 (.31)	2.56 (.44)
Speak like this speaker	Speaker	1.91 (.42)	2.19 (.68)	1.94 (.60)	2.28 (.52)
Anything weird	Speaker	1.38 (.39)	1.53 (.62)	1.53 (.59)	1.50 (.63)
Be on a team with	Speaker	2.09 (.58)	2.31 (.70)	1.97 (.62)	2.31 (.54)
	Listener	2.31 (.51)	2.34 (.40)	2.28 (.45)	2.19 (.54)
Win	Team	2.18 (.58)	2.53 (.46)	2.17 (.43)	2.43 (.52)
Polite	Listener	2.41 (.42)	2.75 (.32)	2.38 (.59)	2.75 (.48)
Friendly	Speaker	2.25 (.48)	2.78 (.31)	2.34 (.47)	2.69 (.40)
	Listener	2.63 (.53)	2.53 (.43)	2.63 (.39)	2.47 (.43)
Smart	Listener	2.69 (.44)	2.66 (.47)	2.50 (.37)	2.38 (.47)
Help on a hard problem	Listener	1.84 (.54)	1.84 (.40)	2.03 (.46)	2.28 (.36)
How old	Listener	18.13 (4.81)	16.83 (3.77)	7.34 (1.70)	6.81 (2.19)

Note. Mean scores for all questions (with the exception of age) ranged from 1 – 3. A score of '1' indicated a response of "not at all", whereas a score of '3' indicated a response of "very much". For the age question, responses indicated years.

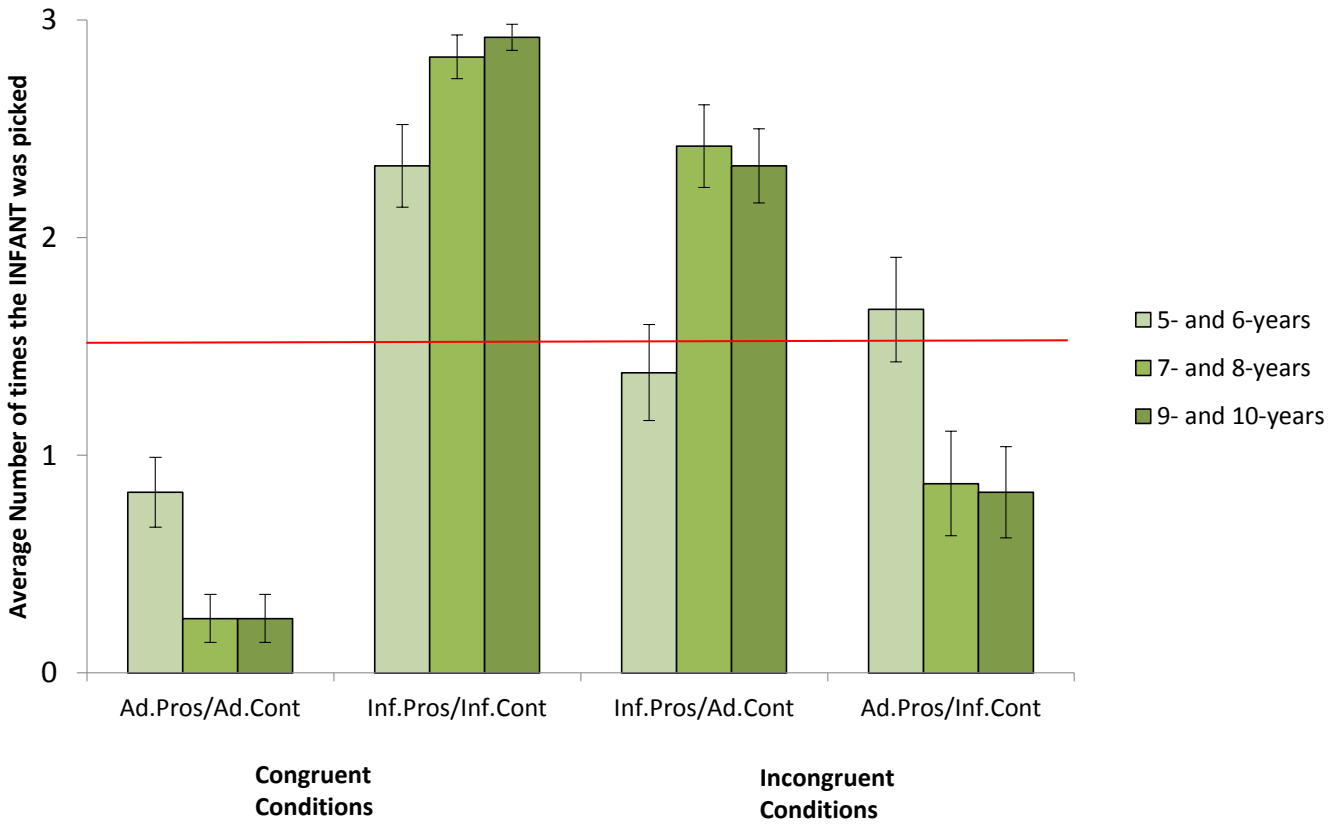

Figure 1. Graph depicting children's listener choices in Study 1 (Experiment A). The y-axis depicts the number of times the infant listener was picked in each condition.

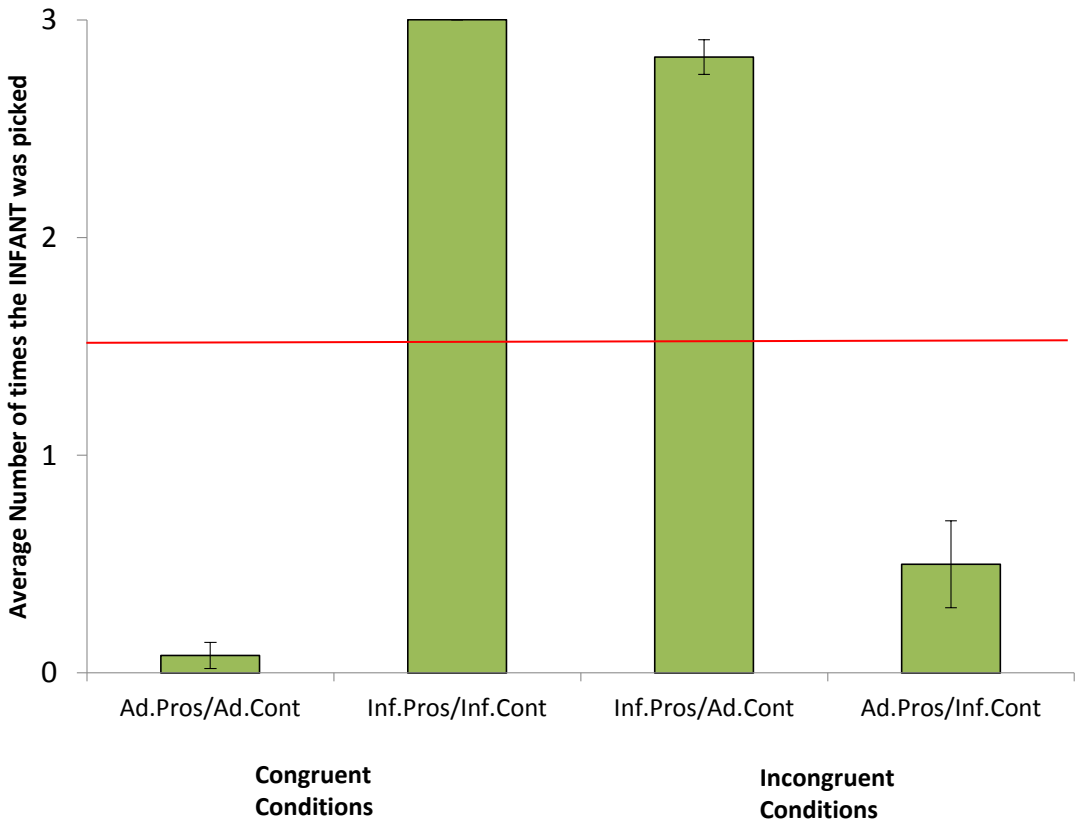

Figure 2. Graph depicting adult participants' listener choices in Study 1 (Experiment B). The y-axis depicts the number of times the infant listener was picked in each condition.

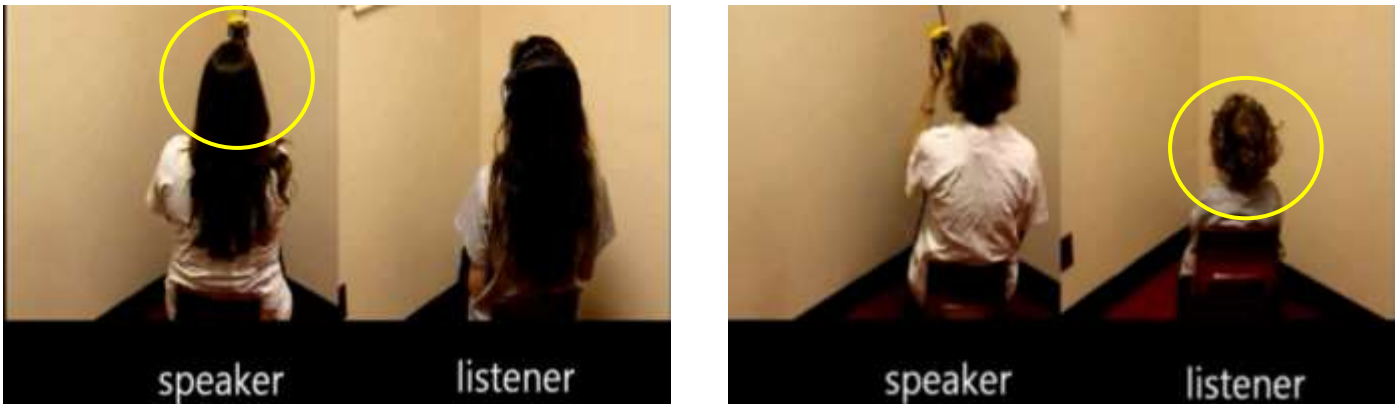

Figure 3. Screenshots taken from videos of two different Study 2 (Experiment C and D) trials. The screenshot on the left depicts an adult speaker and an adult listener, on a trial in which the participant was asked to rate the speaker (as indicated by the yellow circle). The screenshot on the right depicts an adult speaker and a child listener, on a trial in which the participant was asked to rate the listener.

Appendix A

Study 1 (Experiment A; Listener Identification Task) Protocol

[Teach the certainty scale]

We're going to be playing a guessing game today. But first, I'm going to teach you how to how to use these certainty pictures. You'll need them for the guessing game. You will use these pictures to tell me how certain or sure you are of your answers. You'll point to this if you're not sure *that you're right, this if you're* kinda sure *that you're right, and this if you're* really sure *that you're right*.

Let's practice. What colour is this apple? [If child gives response that's odd/isn't correct: *What colour would most people say it is?*] *How sure are you that that's green? Are you* not sure, kinda sure, *or* really sure? *Point to the one that shows how sure you are that that's green. That's right. You're really sure because you can see it, and you know what colour that is.*

Let's practice again. What's inside this box? [If child responds IDK*: take a guess.* If still no response: *If you had to guess something, what would you guess?*] *How sure are you that a (child's response) is inside this box? Are you* not sure, kinda sure, or really sure? *Point to the one that shows how sure you are that a (*child's response) *is inside this box. That's right, you're not sure because you can't see inside the box, and you don't know what's inside it.*

[Introduce puppet, and explain task]

Now you're ready to play the guessing game. This is Patty. Patty wants to meet new people. Tell Patty your name. Good! Patty is going to meet some new people. You have to listen to Patty, and guess who she is talking to.

[Introduce listeners]

Let's meet the listeners. This is a little baby. She's much younger than you. This is a grownup lady. She's much older than you.

Okay, now you're going to watch videos of Patty talking. Listen carefully, so you can guess if she's talking to the little baby or the grownup lady. Also, you'll see all the videos more than once. Are you ready?

[Play clip, and, following each clip, ask child to make listener choice, rate certainty and explain choice]

Who was Patty talking to? You picked the little baby/grownup lady. How sure are you that Patty was talking to her? Are you not sure, kinda sure, or really sure?

What made you pick the little baby/grownup lady? [Query a marginal response with, *tell me more about it/ what do you mean*]

[Introduce subsequent trials]

Let's do another one! Listen carefully, so you can guess who she's talking to.

[Introduce the next block of listeners]

Let's meet some more listeners. This is a little baby. She's much younger than you. This is a grownup lady. She's much older than you.

Now you're going to watch more *videos of Patty talking. Listen carefully, so you can guess if she's talking to the little baby or the grownup lady. Are you ready?*

Note: Slight modifications were made for the adult participants in Experiment B. See Study 1 (Experiment B) Method for details.

Appendix B

Study 2 (Experiment D; Judgments Task) Protocol

[Introduce tasks]

We're going to watch some videos of people playing a treasure-finding game.

[Show picture of set-up]

Here's an example. In each video, there's a speaker, who knows where the treasure is. She will be using a walkie-talkie to tell the listener how to find the treasure. Can you see her walkie-talkie? The other person is the listener, who does not know where the treasure is. She is using headphones to listen to the speaker tell where the treasure is. She'll look for the treasure later, after she hears the instructions. Can you see her headphones? They are in different rooms and can only hear each other. In each video you will only hear the speaker giving instructions. The listener doesn't say anything.

[Load and pause video while introducing the speaker and listener]

Here are some real people playing the treasure-finding game. This lady is the speaker. This lady/girl *is the listener. Remember, you'll hear the speaker giving instructions. The reason why we have this yellow circle over the speaker/listener is to remind you that, after we watch the video, I'm going to ask you questions about the* speaker/listener. *Are you ready?* [Play clip]

[Ask competence questions]

[For subsequent trials]

Here's another team. This lady is the speaker, and this lady/girl *is the listener. Remember, I'm going to ask you questions about the* speaker/listener. Are you ready?

[Following completion of the four trials, verify understanding of response scale]

I have a few more questions for you. What's your favourite food? Okay, so if I asked you, "how much do you like [child's response]?", *what would you say: "*not at all", "a bit", *or* "very much"? *Here's another question. What's your least favourite food? If I asked you,* "how much do you like [child's response]?", *what would you say: "*not at all", "a bit", *or* "very much"?

Note: Slight modifications were made for the adult participants in Experiment C. See Study 2 (Experiment C) Method for details.

Appendix C

Study 2 (Experiments C and D; Judgments Task) Semantic Content

Script	Content
1	First, find the road with rocks and mud on it. You'll see that the road is windy. At the end of the road, you'll see a big pile of dirt. That's where the treasure is.
2	First, walk past the pot with the flower in it. You'll see a bag with lots of stones in it. Walk around the bag and you'll see a bucket. That's where the treasure is.
3	First, walk past the beach, and past the big boats. You'll see a small pond and a dock. Walk to the middle of the dock, and you'll see an X. That's where the treasure is.
4	First, walk past the car, and past the big trucks. You'll see some wheels and a shed. Walk to the middle of the shed, and you'll see an X. That's where the treasure is.

Appendix D

Study 2 (Experiments C and D; Judgments Task) Questions

Domain	Question	Featured in the Speaker Ratings Task, the Listener Ratings Task, or both?
Communicative Competence	Compared to other grown-ups/kids, how good is she at speaking to this grown-up/kid/ listening?	Both
Communicative Competence	If you were telling this listener about the treasure, how much would you speak like this speaker?	Speaker
Communicative Competence	Was there anything weird about how she talked?	Speaker
Effectiveness with Game	If you really wanted to win the treasure-finding game, how much would you want to be on a team with this speaker/listener?	Both
Effectiveness with Game	How much do you think that this team will win the treasure-finding game?	Both
Social Competence	Compared to other grown-ups/kids, how polite is she?	Speaker
Social Competence	Compared to other grown-ups/kids, how friendly is she?	Both
Intellectual Competence	Compared to other grown-ups/kids, how much help would she need if she was working on a hard school problem?	Listener
Intellectual Competence	Compared to other grown-ups/kids, how smart is she?	Listener
Age	How old do you think the listener is?	Listener