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The Effect of an Unfamiliar Accent on Typically Developing Children's Comprehension of Spoken Sentences

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Abstract

Objective: To investigate whether children's performance on a sentence comprehension task is affected when sentences are spoken in an unfamiliar accent.

Method: Participants were 47 typically developing children living in southern Ireland consisting of a younger group (n = 24) of 4-year-olds and an older group (n = 23) of 6-year-olds. The children completed a sentence comprehension task in which half the instructions were spoken in a familiar accent and half in an unfamiliar accent. Sentences were matched for length and syntactic complexity.

Main results: The younger group's scores were significantly lower when sentences were presented in the unfamiliar accent, but there was no accent effect on comprehension for children in the older group.

Conclusions: For young children living in southern Ireland, an unfamiliar accent could reduce their comprehension of spoken language.

Key words: accent, receptive language, sentence comprehension, children, Token Test

Introduction

To communicate effectively requires an ability to understand the language that is spoken to us, a skill that is usually referred to as receptive language or language comprehension. There is now a substantial body of research to suggest that a variety of factors, such as rate of speech and background noise can affect intelligibility of a speaker (Adank, Stuart-Smith & Scott, 2009; Anderson-Hsieh & Koehler, 1988; Munro & Derwing, 1995; Rogers, Dalby & Nishi, 2004). Further factors impacting on intelligibility include the accent of the speaker. Research has shown that when an utterance is spoken in an accent that is unfamiliar to the listener, this can have an adverse effect on their comprehension (e.g. Burda, Brace, & Hosch, 2007; Nathan & Wells, 2001; O'Connor & Gibbon, 2011). Derwing and Munro (2009) define accents as "different ways of producing speech" (p. 746). Clark and Garrett (2004) and Nathan, Wells and Donlan (1998) recognise some attributes that constitute an accent including phonetic realisations, phonotactic distribution (i.e. environments in which phonemes occur), number of phonemes used, prosodic patterns, vowel quality and duration as well as syllable structure. These characteristics can vary considerably between both native and non-native accents. This study aims to add to the knowledge base around the effect of accent on comprehension in the speech and language therapy setting.

Although studies have shown that listeners can adapt to an unfamiliar accent (Baese-Berk, Bradlow & Wright, 2013; Bradlow & Bent, 2008; Clark & Garrett, 2004, Creel, 2012; Dunton, Bruce & Newton, 2010; Floccia, Butler, Goslin & Ellis, 2009a; Sidaris, Alexander & Nygaard, 2009), studies have also shown that strong or unfamiliar accents can reduce the speed and accuracy of word and sentence comprehension. Schmid and Yeni-Komshian (1999) and Gill (1994) suggested that comprehension of unfamiliar accents requires extra processing on the part

of the listener, which can have a negative impact on word recognition and sentence parsing processes (Adank & McQueen, 2007). If additional processing resources are required to understand an unfamiliar accent, it is likely that there will be fewer processing resources left to understand an incoming message. If this is true, then people with reduced processing capabilities may experience more difficulty with accented speech. This has been shown to be the case from results of previous research into children with speech disorders (Nathan & Wells, 2001) and also with participants who have aphasia (Bruce, To, & Newton, 2012; Burda et al., 2007; Dunton et al., 2011) and dementia (Burda, Hageman, Brousard, & Miller, 2004; Hailstone et al., 2012; Mahendra, Bayles, & Tomoeda, 1999). As these vulnerable populations are often represented on a speech and language therapist's caseload, it is rational to conclude that speaker accent is an important and relevant variable to consider in both assessment and therapy (Nathan & Wells, 2001).

Further to impacting children and adults with processing difficulties, several studies have proposed a developmental trajectory in the comprehension of an unfamiliar accent in that processing accents can improve with age. Van Heugten, Krieger and Johnson (2014) conducted several experiments to examine the developmental route of toddlers' comprehension of unfamiliar regional accents. Their findings showed that older toddlers (25 months) outperformed their 20-month-old peers on the recognition of accented words. Best, Tyler, Gooding, Orlando and Quann (2009) found similar results in their study on the influence of accented speech with 15 and 19 month participants. This illustrates that competency in accent processing can improve as children grow and develop.

Furthermore, studies have identified that experimental task design can impact on accent comprehension. Barker and Turner, in their 2013 study examining the effect of accent in

preschoolers using word recognition tasks and story comprehension, found that the preschoolers recognized more words when presented in the familiar accent than the unfamiliar accent. However, participants showed higher comprehension accuracy when the story was narrated by the speaker of the unfamiliar accent than when given by the speaker with the familiar accent. The authors highlight the importance of the experimental task when looking at effect of accent on comprehension in that listening environment, context and 'saliency' can also play a part in accent processing.

Nathan et al. (1998) conducted a study examining children's ability to process and define single words in a familiar accent and an unfamiliar accent. They found that comprehension was significantly reduced in the unfamiliar accented condition and that the 4 year old children performed significantly lower than 7 year olds. The authors hypothesised that as children get older they are better able to use sentence context to facilitate and support accent processing in addition to their broader experience with a wider range of accents. This finding is supported by the results of a study by O'Connor and Gibbon (2011) who examined the effect of speaker accent on sentence comprehension in typically developing (TD) children. This study found that the younger group of participants (aged 7 to 8 years) made significantly more errors in the task when presented in the unfamiliar accent compared to the familiar accent while the older age group (aged 9 to 10 years) scored almost equally well in both accented tasks. They concluded that younger children may have a reduced processing capacity for unfamiliar accented speech, while older children may benefit from allocating more processing resources to the task in order to extract full meaning from unfamiliar accented sentences. Although O'Connor and Gibbon (2011) highlighted the need to investigate the effect of an unfamiliar accent on younger typical children's comprehension of language, so far this has not yet been investigated. With a view to

addressing this gap, the current study seeks to build on O'Connor and Gibbon's study using 4 and 6 year-old children as participants. Results of the current study will help to shed light on accent processing in this age group as it has limited presence in the literature. Furthermore, O' Connor and Gibbon used a regional/native accent as the unfamiliar accent while this study uses a non-native accent. Adank et al. (2009) and Floccia, Goslin, Girard and Konopczynski (2006) found that an unfamiliar non-native accent requires more processing than an unfamiliar native accent. The current study aims to provide more insight into the effect of native versus non-native unfamiliar accents on comprehension.

Method

Participants

Forty-seven typically developing children were recruited from mainstream schools and preschools in Cork, southern Ireland. Participants consisted of two groups, younger children aged 4;00-4;11 years (n=24: 14 male, 10 female), and older children aged 6;00-6;11 years (n=23: 12 male, 11 female). Ethical approval was granted from the Clinical Research Ethics Committee of the Cork Teaching Hospitals and written consent was obtained from schools, parents and participants before data collection. Children were included in the study if, by parent report, they (a) were typically developing (b) had no previous history of cognitive, speech, language, or hearing difficulty, (c) were monolingual English speakers (d) were resident in Cork, Ireland for the past three consecutive years and (e) had not had sustained direct contact with someone who speaks with a non-native accent.

Materials

The comprehension task used pre-recorded instructions that were spoken by two females. One speaker had a self-reported native Cork accent and one had a self-reported non-native

Cantonese English accent. From this point forth, the native accent (Cork) will be referred to as the familiar accent and the non-native accent (Cantonese English) as the unfamiliar accent. The speakers were both professionals aged between 20 and 40, eligible to work in Ireland and experienced in testing children. The speaker with the unfamiliar accent had been working in English-speaking countries for eight years.

Although familiarity was not rated in the current study, the accents were selected on the basis that one was likely to be familiar (Cork) and one was likely to be less familiar (Cantonese English) to the participants. In addition, the two chosen accents were selected because they differed significantly in their phonetic realisation through their differing vowel systems, consonantal features and prosodic features (see Table 1 for summary of phonetic differences).

Table 1 here

The test stimuli used in this study comprised of 50 pre-recorded test sentences taken from the Token Test for Children-2nd Edition (TTFC-2) (McGhee, Ehrler & DiSimoni, 2007). The TTFC-2 is a standardised assessment used to assess receptive language in children aged 3;0 - 12;11 years. During this assessment, the examiner gives spoken instructions, which the child carries out by manipulating real objects (called tokens) of different shapes, sizes and colours. As the test progresses, sentences increase in length while syntactic structure remains relatively simple and predictable (see Table 2).

Table 2 here

In the current study, recorded instructions from the Token Test were played via audio files as part of a Microsoft PowerPoint slide-show presentation. Sentence stimuli were evenly divided into two sections: odd numbered and even numbered sentences, each section containing 23 task sentences preceded by two trial sentences. -Each task section was presented randomly in

a different accent which limited the influence of order of presentation of test sentences or accent on results.

Experimental Procedure

The children completed the testing process individually in a quiet room within their school/preschool. The task took approximately 20 minutes to complete. Before the testing began, each participant was read a script outlining what would be expected of them in the assessment. This script alerted each child to a change in speaker voice in the task. This was done in order to avoid a reaction described by Clark and Garret in their 2004 study whereby participants who were not familiarized with speaker voices prior to the task had slower reaction times. At the beginning of each accent task, the recorded speaker read an extract from a Mr Men book (Hargreaves, 1976) in order to facilitate each child in accustoming to the speaker's voice and phonological system before the task (Nathan et al., 1998). Such exposure to an individual's speech and phonological system would typically occur in a clinical situation during informal conversation and rapport building which is recommended prior to formal assessment (Ferguson & Armstrong, 2004; Horton & Byng, 2000). Order of presentation was varied for participants to limit this as a possible influence on performance. Throughout testing, the researcher gave encouragement to the children but did not give any indication of a correct or incorrect response.

Rate of Speech

The sentences spoken by the familiar and unfamiliar speakers were matched in terms of rate. Sentence duration was measured using Praat software and speaker rate was calculated in syllables per second using the formula: 'speaking rate = number of syllables/total duration'. The study controlled speech rate using a method similar to Anderson-Hsieh and Koehler (1988) whereby one speaker controlled their rate to match that of the other speaker. Care was taken to

vary the speech rate only to the point where it still felt natural for the speaker. In addition, task sentences were recorded three times for each speaker to eliminate silent and verbal speaker hesitations, which have been shown to influence listeners' online sentence processing and subsequent comprehension (Corely, MacGregor & Donaldson, 2007; MacGregor, Corely & Donaldson, 2010).

Scoring and Analysis

Participant response accuracy was binary scored in accordance with the TTFC-2 manual. Statistical analysis in this study was carried out using Statistical Package for the Social Sciences (SPSS) software Version 17 (SPSS, 2007).

Results

A 2 x 2 split-plot analysis of variance was conducted to examine the effects of age (older, younger) and accent (familiar, unfamiliar) on test scores. A statistically significant interaction effect was present ($F(1,45) = 27.64$, $p < 0.001$) and the effect size was large (partial eta squared = 0.38). An interaction below the 0.05 significance level shows that accent affected the performance of the younger children only.

There was a highly significant difference between accuracy scores for the familiar and unfamiliar accented conditions for the younger group ($t(23) = 8.059$, $p < 0.001$). T-tests confirmed that the older children's scores were not affected by accent ($t(22) = 0$, $p > 0.05$). This shows that for the younger group (4-year-olds), test instructions spoken in the unfamiliar accent resulted in significantly lower accuracy scores. Figure 1 shows that the mean accuracy scores for the younger children in the familiar accent was 14.17 (SD =3.24) and for the unfamiliar accent it was 10.17 (SD = 3.82). For the older group, the mean accuracy score in the familiar accent was 15.17 (SD = 3.51) and for the unfamiliar accent it was also 15.17 (SD = 2.76).

Figure 1 here

Wilcoxon matched pairs t tests were carried out to examine the difference in performance between each accented condition across task parts for each age group. Results showed that across all task parts, each of increasing length and linguistic complexity, accuracy scores differed significantly for the younger 4 year old children in each accented condition (see table 3 and figure 2). This suggests that as processing load increased for the younger children, the effect of the unfamiliar accent on comprehension remained significant. Conversely, no significant difference was found between the accuracy scores in each accented condition in any task part for the older children (see table 3). Hence as processing load increased for the 6 year old children, presentation of instructions in an unfamiliar accent did not adversely affect their comprehension.

Table 3 here

Figure 2 here

Discussion

The aim of this study was to determine whether children's performance accuracy on a sentence comprehension task was affected when sentences were presented in two accents, one which was likely to be familiar and the other likely to be unfamiliar. The results illustrated that there was no difference in performance scores between accent tasks for the older children. However, the younger children achieved significantly lower accuracy scores in the unfamiliar accent. These results are similar to those of O'Connor and Gibbon (2011) who also examined the effect of an unfamiliar accent in different age groups of children using task stimuli from the TTFC-2. The results correlated in that the younger participants experienced significantly more difficulty with the unfamiliar accent than the older participants. Yet the age of the participants

differed notably between the two studies. O'Connor and Gibbon (2011) used 7-8 and 9-10 year old participants while the current study included 4 and 6 year old participants. There are several possible explanations for this variability, such as subtle differences in study methodologies. Contrasting to O'Connor and Gibbon (2011) the current study controlled for speaker rate and verbal hesitations in recording task stimuli. Furthermore, O'Connor and Gibbon alternated accents presented between each successive task sentence in order to avoid listener familiarisation to the unfamiliar accent due to prolonged exposure. In contrast, the current study presented accented stimuli in two blocks, alerting each child to a change in accent prior to providing the stimulus. It is therefore possible that the 6 year old children were able to compensate for the unfamiliar accent due to accent familiarisation following prolonged exposure to the accent. Moreover, different accents were used in the studies which may explain why the 6 year olds used in this study did not experience a negative accent effect while the 7-8 year olds in O'Connor and Gibbon's study performed significantly poorer in the unfamiliar accented condition. Conversely, Nathan et al. (1998) also investigated age-related differences in accent processing using a single word comprehension task and involved similar aged participants to the current study (4 and 7 years). Their research found that the older participants showed fewer difficulties in understanding an unfamiliar accent compared to the younger children. They suggest that interpreting accents is a skill that "improves with age" (p. 359).

There are a number of possible explanations as to why the older children in this study did not experience significant difficulty in the unfamiliar accented condition while the younger children obtained lower accuracy scores. Firstly, the younger children may not have been able to comprehend the unfamiliar accent as well as their older counterparts due to reduced processing capacity. As the 4 year olds' cognition is still developing, their attention and memory may be

compromised with the added burden of processing an unfamiliar accent proving too much of a load to interpret. Dunton et al. (2010), who investigated accent variation with individuals who had an acquired language disorder, suggest that an increased cognitive effort is necessary for processing an unfamiliar accent. Other researchers who also investigated effect of accent on the comprehension of vulnerable populations found an effect with the unfamiliar accent (Bruce et al., 2012; Burda et al., 2007; Hailstone et al., 2012). Therefore, individuals who have a compromised processing system, including developing children, may not possess the necessary skills required to fully comprehend speech when presented to them in an unfamiliar accent. This hypothesis is supported by the findings of the current study in that the 4 year old participants experienced significant difficulty in comprehending instructions given in an unfamiliar accent as processing load increased.

In addition, due to their more mature processing capacity, the older children may have been aided by the lexical constraints of the task. The constant presence of the task stimuli, predictable vocabulary and limited response possibilities may have allowed the 6 year olds compensate for the unfamiliar accent in reducing breakdown in understanding. Nathan and Wells (2001) investigated the impact of an unfamiliar regional accent on the performance of speech disordered versus TD children. No difference in scores was found in the TD group between familiar and unfamiliar accented conditions. The authors suggested that this lack of difference in performance may be due to task design. In contrast to previous studies, this study made use of visual stimuli. The authors suggested that the use of pictures reduced the lexical search that was needed as the child needed only to compare the input to their lexical representation of the picture, reducing task complexity. This is supported by the findings of Stibbard (2004). In his study, listeners were required to mark out a route on a map spoken by a person with an

unfamiliar Cantonese accent. Breakdowns in accuracy rarely occurred and Stibbard hypothesised that the listeners were able to scan the map for the closest approximation to the word they were hearing in the unfamiliar accent. This allowed them to compensate for different phonetic realisations of the word suggesting that the provision of context is an important variable in the comprehension of an unfamiliar accent. On the basis of this observation, if the demands of the task are low and the possible responses restricted, a typically developing school-aged child should be able to overcome any ambiguity. The findings of the current study would support this hypothesis in that the older children showed no significant difference in performance between accent conditions as task processing load and linguistic complexity increased. However, according to studies by Adank and McQueen (2007), Floccia et al. (2009b) and Adank et al. (2009), response time can be a more subtle indicator of accent processing difficulties than comprehension accuracy. Therefore, measuring response time might be a useful strategy in investigating the subtle effect of an unfamiliar accent on older children's processing.

Another possible explanation could be that because the 4 year old children are younger, they may have had less exposure to alternative accents either in school or the wider community (Nathan et al., 1998). As children get older, they encounter more languages, dialects and accents, hence, the older children in this study are more likely to have been exposed more to accents and have acquired more experience in the skills needed to process unfamiliar speech.

In conclusion, the results of this study support findings of previous similar studies that the presentation instructions in an unfamiliar accent may negatively impact on listener comprehension to a sufficient degree to influence score validity and development of an accurate and efficient diagnostic system.

The general scarcity of studies on this topic along with the often contrasting findings emphasizes the need for additional investigation into this area. Future research may involve testing of larger sample sizes with a variable demographic to give a wider applicability to the general population (Dewberry, 2004).Further to this, a more detailed scoring system, possibly including both qualitative and quantitative information, in future studies may help to learn more about differences in performance across accent conditions. For example, reporting about the types of errors made by participants would be useful. It would be interesting to see if errors with target items are due to phonetic similarities or if they are semantically related. Future studies may also wish to investigate the performance of bilingual children as the literature suggests that bilingual children display more highly developed meta-phonological abilities than their monolingual counterparts (Bialystok, Majumder, & Martin, 2003). Moreover, investigation of clinical populations is also warranted based on findings of research by Nathan and Wells (2001) and Dunton et al. (2010).Such an investigation may have important clinical implications in both assessment and therapy.

Exclusionary criteria relating to participants' overall development in this study was based on parent-reported information collected as part of a parent questionnaire. Although the validity of parent report is questioned by some professionals, previous studies have suggested that parents can be accurate reporters of their child's current developmental skill status (Bodnarchuk & Eaton, 2004; Jacewicz & Fox, 2014). Future studies may avail of more objective methods to support findings in parental reported data (e.g. formal testing methods or teacher report).

Although not granted (according to test manual), more repetitions were requested for instructions presented in the unfamiliar accent. Therefore continued research into the conditions

required to facilitate understanding of an unfamiliar accent may be beneficial in providing considerations for clinicians and other professionals when providing their services.

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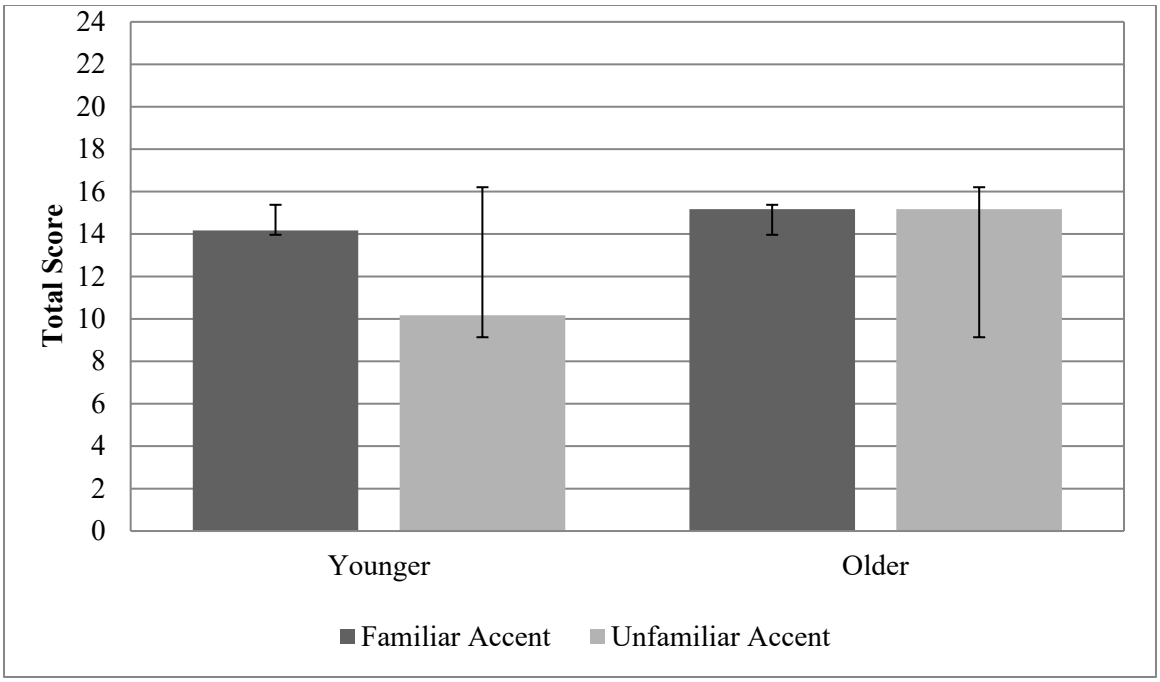


Figure 1. Mean and standard deviation accuracy scores on comprehension task with sentences spoken in familiar and unfamiliar accents for younger (4-year-old) group and older (6-year-old) group. Total score is out of 23.

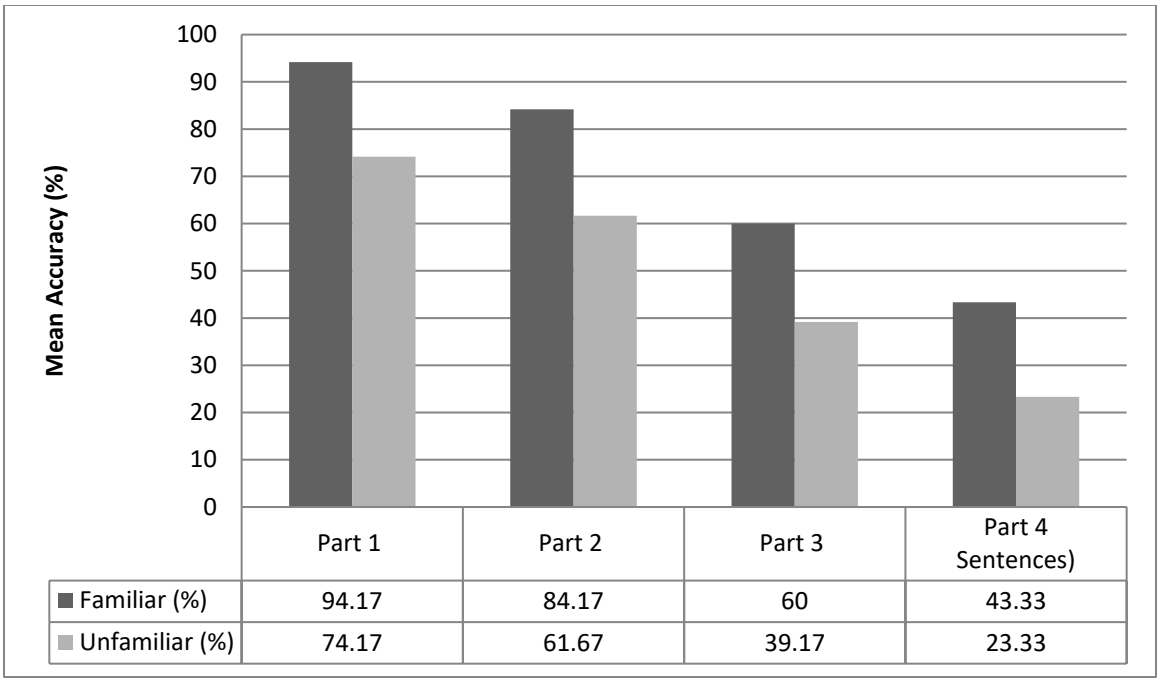


Figure 2: Mean percentage accuracy scores of typically developing 4 year old children across each task part of TTFC-2 in each accented condition

Table 1

Contrasting Phonetic Features between Southern Irish English (Hickey, 2004, 2007, 2015; Wells, 1982) and Cantonese English (Chan & Li, 2000; Hung, 2000; Stibbard, 2004). Italicized Items were Evident in the Speech Samples of the Speakers in the Current Study

Category of Speech	Southern Irish English	Cantonese English
Vowels	*-Includes wide range of vowels, short, /ɛ, ɪ, æ, ɑ, ʌ, ʊ/, long monophthongs / i, ɔ, a, e, o, u/ and diphthongs /ai, aʊ/* *-Rhotic features*	-Widespread monophthongisation e.g. [e] for /eɪ/ *-Rhotic features*
Consonants	- /ð/ and /θ/ commonly realised as dental plosives /t̪/ and /d̪/ *-/l/ is clear on all environments* *-/ɹ/ can have a dark resonance in final and preconsonantal environments*	-Fricatives subject to substitution e.g. [s] for /ʃ/ and [d] for / ð/ -Word initial [l] and [n] used in free variation -/ɹ/ realized as [l] and [w] *-Realizations of /p, t, k/ and /b, d, g/ are differentiated by degrees of aspiration*

		-Voiced plosives in word final position can be devoiced
Prosody	*-Intonation variations do not have lexical meaning.* *-Unstressed syllables are spoken significantly quicker and for shorter time periods when compared to stressed syllables.*	-All syllables, whether stressed or unstressed tend to occur at regular intervals. Unstressed syllables will influence occurrence of stressed syllables. *-Very little reduction of vowel length during syllable pronunciation.*

Note: C = consonant; V = vowel.
Footnote. According to Hickey (2015), some features in Southern Irish English are changing, particularly in young females e.g. /ð/ and /θ/ realised as s /t̪/ and /d̪/.

Table 2

Descriptions and Examples of Task Sentences by Task Part

Task Part	Example
Part 1	Touch the small green circle.
Part 2	Touch the blue circle and the green square.
Part 3	Touch the small green circle and the large white square.
Part 4	Put the yellow circle underneath the white square.

Table 3

Results of Wilcoxon Matched Pairs t Test for each task part for Typically Developing 6 Year Old Children

Task Part	**Younger 4 year olds**	**Older 6 year olds**
Part 1	z = -3.636, p<0.001**	z = -.513, p>0.05
Part 2	z = -3.39, $p\leq$0.01*	z = -1.039, p>0.05
Part 3	z = -3.18, $p\leq$0.001**	z = -.961, p>0.05
Part 4 (Complex Sentences)	z = -3.18, $p\leq$0.001**	z = -1.634, p>0.05

Note: *p<.01 **p<.001