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ONOMATOPOEIA IN CANADIAN MOTHERS' INPUT: EXPLORATORY PILOT STUDY

BY

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Abstract

We designed an exploratory pilot study to examine the nature of onomatopoeia use in Canadian mother's speech to infants (12-18 months old) on the brink of a period of rapid productive vocabulary development with prevalent individual variation in vocabulary size (Fenson et al, 1994). The study included the use of a novel design for eliciting onomatopoeia in semi-spontaneous child directed speech (CDS). The study aims to build on previous findings regarding the nature of onomatopoeia in British mothers' CDS to 8 month old infants (Laing et al, 2017). We aimed to create a method of eliciting onomatopoeia and associated conventional words in CDS, in order to analyze prosodic features including pitch, pitch range, and duration. We additionally aimed to analyze the nature of onomatopoeia use in semi-spontaneous CDS discourse, including analyzing the proportion of target words produced in isolation, proximity of onomatopoeic words to associated conventional words, target word utterance position, reduplication and repetition, and frequency of target word use. Finally, we aimed to explore the possible role of onomatopoeia in word learning by analyzing maternal onomatopoeia use compared to infant vocabulary size. The results from the data revealed a number of differences between onomatopoeia and conventional word use in CDS. We discuss future research directions based on the findings from the current pilot study.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

Background

1.0 Onomatopoeia in CDS

Onomatopoeia are an interesting subcategory of words in that they are common in early infant language development and input and fairly uncommon in adult speech (Laing et al, 2017). However, this phenomenon has not been widely explored in previous literature (Laing et al, 2017). Onomatopoeia are among the top 20 most common first 10 words produced by English, Cantonese and Mandarin acquiring infants (Tardif, Fletcher, Liang, Zhang, Kaciroti & Marchman, 2008). Sound effect words have been found to make up approximately 10% of English, Cantonese and Mandarin corpora of infants' first 10 words (Tardif et al., 2008). Tardif et al (2008) report that onomatopoeia is sometimes used by infants in the earliest stages of productive language acquisition in the place of a noun (e.g., *woof-woof* in place of the noun 'dog') (Tardif et al, 2008). Additionally, in a study of cross-linguistic variation in infant directed speech, Fernald & Morikawa (1993) noted that a large proportion of noun labels produced by Japanese parents speaking to their 6, 12 and 19 month old infants were onomatopoeia (e.g. *wan-wan* (i.e. *'woof-woof'*) as a noun label for 'dog', *buu-buu* (i.e., *'vroom-vroom'*) for truck). They reported this feature of Japanese CDS as contrastive with American-English CDS, where using onomatopoeia as noun labels was relatively uncommon (Fernald & Morikawa, 1993) The prevalence of onomatopoeia in early vocabulary may be related to the fact that many of them are reduplicated (e.g. *woof-woof, baa-baa, choo-choo)*, as reduplicated word forms have been attested to be more easily segmented and learned by preverbal infants than non-reduplicated words (Ota, 2018).

Previous researchers have theorized that sound symbolic words, including onomatopoeia, may be important to language acquisition (Imai & Kita, 2014; Monaghan, Shillcock, Christiansen, Kirby, 2014). Monaghan et al (2014) describe onomatopoeia as an example of words in language that are not strictly arbitrary representatives of meaning, but rather are iconic representations of sound. They propose that sound-symbolic words, including onomatopoeia, may be an important tool in early language acquisition,

providing children not only with one iconic link between a certain word and its meaning, but also with the information that speech sounds are linked with meaning in some way (Monaghan et al, 2014). In a corpus analysis of English words, the researchers found that non-arbitrary sound-meaning mapped words are statistically more pronounced among early acquired words compared to later acquired words (Monaghan et al., 2014). Imai and Kita (2014) proposed the 'sound symbolism bootstrapping hypothesis for language acquisition'. In this hypothesis, they state that sound symbolic words (including sound effect words) in input, provide infants with a non-arbitrary link between sound and linguistic meaning (Imai & Kita, 2014). They propose that this may be used as a basis of linguistic representation to be later generalized to arbitrary word form-meaning links (Imai & Kita, 2014). They cite evidence of a high instance of onomatopoeia in Japanese maternal speech to their infants, as well as evidence that 3 year old children are better able to generalize novel verbs that are sound symbolic than those that are arbitrary (Imai & Kita, 2014).

An additional view is that onomatopoeia may be highly salient in infant directed speech, drawing infants' attention to words associated with the onomatopoeia, additionally functioning as a conversation scaffold for mothers to use while their babies are in the early stages of productive vocabulary development (Laing, 2016, 2017; Kauschke 2007). Prosodic modifications such as increased pitch, pitch range, and duration have been reported as a means of altering speech register to infants across a number of languages (e.g. Fernald et al, 1989). Laing, Vihman & Keren-Portnoy (2017) analyzed maternal speech to 8 month old infants while reading a simple picture book and found onomatopoeia to be frequent and salient in the input (Laing et al., 2017). They found onomatopoeia words (OW) to be more prosodically salient than conventional words (CW) associated with the onomatopoeia (Laing et al, 2017). A large majority of the onomatopoeia occurred within 10 words of the associated noun, and 59% occurred directly adjacent (Laing et al, 2017). This evidence supports the hypothesis that onomatopoeia may bootstrap the learning of less salient associated words (Laing et al, 2017). Additionally, there is evidence

from analysis of longitudinal mother-infant interactions that mothers use more onomatopoeia when their infants have a smaller productive vocabulary size (Kauschke et al, 2007; Laing et al, 2016). Mother-child interactions were analyzed between 13 and 36 months and found onomatopoeia to be most frequent in the maternal input at 13 months, with a decline correlated to an increase in the child's productive vocabulary (Kauschke et al, 2007). The researchers suggest that onomatopoeic words are used by mothers to facilitate conversation between them and their infant while their infant has not yet developed enough productive vocabulary to fully participate in conversation (Kauschke et al, 2007).

1.1 Current Pilot Study

This pilot study is designed to explore the nature of onomatopoeia in maternal speech to infants. The study is exploratory in nature and aims to build on the work by Laing et al (2017) and investigate previously unexplored topics regarding onomatopoeia in speech to infants. We designed a study to elicit onomatopoeia from participants using a unique methodology. The aim of this thesis is to explore the nature of onomatopoeia use in maternal speech to infants, compared to their use of conventional words associated with each onomatopoeia in child directed speech (CDS), and compared to their use of onomatopoeia in an adult directed speech (ADS). We aimed to expand on the work by Laing (2017) by eliciting target onomatopoeic words (OW) and target conventional words (CW) in CDS, and by analyzing the prosodic modification (pitch, pitch range and duration) and the nature of target word use in the discourse (including use in isolation, utterance position, and frequency of use). We additionally included analysis of OW and CW used in ADS for comparison between speech registers. In order to further explore the possible effect of OW use in conventional word learning, we aimed to analyze maternal CDS to infants 12-18 months, an age range documented as being on the brink of rapid vocabulary development (e.g., Fenson et al, 1994).

Given the nature of this study, we will provide our hypotheses below:

Hypothesis 1: Mothers will replicate differences in acoustic correlates between ADS and CDS overall (e.g., Fernald et al, 1989) and onomatopoeia in CDS will be produced with greater pitch, pitch range, and longer word duration or increased reduplication compared to the onomatopoeia produced in ADS (Laing, 2017).

Hypothesis 2: Mothers will emphasize OW more than CW in CDS through greater reduplication and repetition, and increased pitch, duration, and pitch range (Laing, 2017) to a greater extent than onomatopoeia will be exaggerated in ADS.

Hypothesis 3: Onomatopoeic words, when compared to conventional words, will show differences between use in isolation, amount of reduplication and repetition, (Laing, 2017) and utterance position. Onomatopoeia being produced in close proximity to the conventional words they are associated with (e.g. *quack quack* appears shortly before or after the word 'duck' in the input), would also support the hypothesis that they may function to aid in word learning by drawing infant attention to the less salient associated word (Laing, 2017).

In addition to:

Hypothesis 4: Mothers of infants with higher productive vocabulary scores will utilize onomatopoeia less in the input than those of infants with a smaller productive vocabulary. This hypothesis is based on findings from previous research that onomatopoeia may be used by mothers to grab infant attention and to scaffold conversation while their infants are just beginning to speak (Kauschke et al, 2007; Laing et al, 2016).

92

Methods

2.0 Participants

The primary participants of the study were Canadian mothers with 12-16 month old infants, the secondary participants being the 12-16 month old infants. Participants were recruited from the University of Alberta campus, and establishments such as coffee shops and recreation centers throughout Edmonton and surrounding areas using posters advertising for mothers of 12-18 month old infants. We aimed to recruit infants ranging in age from 12-18 months in order to explore the nature of maternal OW to infants spanning an age range reported for high individual variation in vocabulary development **(**Fenson et al, 1994), in hopes of recruiting participants with a large range in productive vocabulary. The participants we were able to successfully recruit however, resulted in a more restricted age range. We recruited 5 participants whose infants ranged in age from 12 months 4 days to 16 months 0 days old. Prior to the experimental procedure, mothers filled out a MacArthur Bates Communicative Development Index (MBCDI) (Fenson et al, 2007) including information on their child's current productive and receptive vocabulary, as well as birth date information. The reported productive vocabulary scores resulted in a range of 0 words spoken to 17 words spoken. All participants spoke English as their first and primary language. Recordings from all 5 participants were included in analysis.

2.1 Stimuli

In order to specifically examine the prosodic nature of OW and the nature of OW use in CDS discourse, we designed a novel procedure for eliciting OW and associated CW in semi-spontaneous CDS. The stimuli consisted of a PowerPoint slideshow with a child directed condition that would take around 4 minutes, followed by an adult directed condition that would take around 30 seconds. The CDS section was comprised of 8 colourful cartoon images, 4 of which were chosen to elicit onomatopoeia we deemed to be directly associated with a conventional word that was a concrete noun (e.g. CW: cat associated with

OW: *'meow'*) and the other 4 chosen to elicit onomatopoeia that are passively associated with an action (e.g. a tree breaking:- *'crack'*). Each of the target elicitation images were alternating in a fixed presentation order. We aimed to create stimuli that depicted sound in order to successfully elicit onomatopoeia, without priming participants with actual audio files of real world sounds associated with the target OW. To do this, images were altered so that three black lines representing sound were added to the image, making it appear as though an animal or object was making a sound (see appendix A). We designed the stimuli as a slideshow to create a task that would be reminiscent of a mother reading a picture book with her baby, but in which we would be able to control the time each participant spoke about each target. We did this in order to more easily compare the frequency of target word use across participants. Each slide consisted of one of the images accompanied by an audio recording of a two sentence story, recorded by a female experimenter speaking in CDS, that described what was happening the scene. The recorded short story was followed by 20 seconds of silence in which the participants were instructed to describe the scene (see table 1 for examples). The timed target slides alternated with an untimed blank slide that allowed the participants to continue to the next image on her own accord, in case of infant fussing or fatigue. Following the CDS section was the ADS section, comprised of slides with a written sentence designed to directly elicit the OW targeted in the CDS section and the CW that may be associated with each target onomatopoeia (e.g. the OW *'vroom'* is associated with the conventional word *car,* so participants read the sentence "*A car goes vroom*") (see table 1). The only OW that was reduplicated in ADS was for train (*'choo-choo*') because we deemed that *'choo'* would not naturalistically occur as a non-reduplicated form. The OW we deemed to be associated with an action were assigned an associated conventional word that made sense in the context of the experimental stimuli (e.g. *tree/branch* associated with crack). The experimental items are displayed in appendix A.

Table 1: *List of experimental items*

Images	CDS sentence (recorded)	ADS sentence
Directly associated with a concrete noun		
1) A cat on a couch meowing	"*Look at the kitty-cat. The kitty-cat is sitting on the couch"*	"*A cat says meow"*
2) A train blowing its whistle	*" Look at the train. The train is going down the track'*	*"A train goes choo-choo"*
3) Ducklings quacking, following a mother duck	*"Look at the ducklings. The ducklings are following their mommy*	*"A duck says quack"*
4) A car driving fast	*"Look at the car. The car is driving fast"*	*"A car goes vroom"*
Associated with an action/verb		
1) A horse trotting on cobblestone	"*Look at the horsey. The horsey is trotting down the path*	"*A horse goes clip-clop"* *"A horse says neigh"**
2) A little boy sneezing	*"Look at the little boy. The little boy is sneezing"*	*"When you sneeze, you say achoo*
3) A tree breaking in a storm	*"Look at the tree. The tree broke in the storm*	*"A branch goes crack"*
4) Little kids jumping in a puddle	*" Look at the happy kids. The kids are jumping in the puddle"*	*"A puddle makes a splash*

***** "A horse says neigh" added to the ADS portion after running the first 3 participants based on mothers' responses to the horse image in the CDS task.

2.2 Procedure

Participants first completed a child directed speech (CDS) condition, followed by an adult directed speech (ADS) condition. During the CDS condition, semi-spontaneous speech was elicited from picture stories. Mothers were not told that we were targeting onomatopoeia. The ADS condition consisted of participants reading sentences aloud, each containing a target OW and its associated target CW (e.g. *"A **duck** says **quack**"*). Because we did not want the participants to figure out from the ADS condition that we were eliciting onomatopoeia before they completed the CDS condition, the conditions were not counterbalanced. During briefing prior to the experimental tasks, participants were told that they and their infant would listen to a series of brief stories accompanying scenes displayed on a computer. They were instructed to listen to the audio recorded story, and then talk about the story and the image on the screen to their infant. They were told they could do this by describing the scene, using sound effects,

commenting on the story, and generally speaking to their infant as they typically would while playing or looking at a picture book with them. Mothers were directed to try to make the scenes interesting and engaging to their infants, while they were being audio recorded.

The experimenter showed the participants an example of the type of image and sentence they would see (a dog barking) and demonstrated the manner in which they should speak to their infants in the 20 seconds following each sentence (see appendix A). The demonstration and instruction included the use of an example onomatopoeia (*'woof-woof'*) in order to prime participants to use OW, but also included description of the image and comments on the story as distractors, so that the target of analysis would not be revealed. The same female experimenter performed the example CDS using a memorized script so that each participant received similar CDS priming (see appendix A). The infants sat on their mother's lap in a sound attenuated booth, facing a laptop computer screen on a small table. The mothers were asked on which side they would normally hold their infant, and the experimenter attached a lapel microphone on the mothers' shoulder on the opposite side. After the experimenter explained the procedure to the participant, she left the sound booth and instructed the participant to knock on the door once the CDS phase was finished. Participants were informed that the experimenters would not be able to hear what they were saying in the booth and would just hear muffled sound. This provided the participant privacy in order to avoid stilted or awkward speech that might have occurred if they thought the experimenter was listening. The experimenter would re-enter the sound booth on the participants cue, and remain in the sound booth for the ADS portion. Mothers were directed to read the sentences on the slides to the experimenter as if they were having a normal conversation with another adult (see table 1 for sentences). They were instructed to direct their speech to the experimenter, and to speak in a tone they would typically use when conversing with another adult, even though some of the words in the sentences were typically 'baby-words'. Participants were told that the ADS recordings would be used as a baseline to compare to the CDS portion. Participants were given the option of having their baby leave the sound

booth to play with a second experimenter, or to have their baby stay with them in the sound booth. All participants opted to have their baby leave the booth with an experimenter.

Results

3.0 Analysis

We analyzed prosodic features of the target OW and CW by hand using Praat (Boersma & Weenink, 2019) in order to compare speech register conditions (CDS vs ADS) and target word conditions (OW vs CW). The duration of the CDS recordings ranged, in seconds (s), from 220.98s - 229.57s (*M*= 226.374 sec), while the ADS recordings ranged from 19.96 s - 32.71 s (*M*=25.49 s). We aimed to analyze the prosodic features (pitch, pitch range, duration, and pauses before and after) of up to each participant's first three mentions of an OW (n=56), and each participant's first mention of the target CW (n=36) . Some data were removed from the analyses due to unreliable pitch measures (due to infant vocalizations overlapping the mother's speech or due to poor recording quality, OW: n=6; CW: n =2). Because of this, data analyses included n= 50 OW and n = 34 CW for pitch and all data were analyzed for duration (OW: n = 56; CW: n = 36). Additionally, we analyzed sentence position, word isolation, word proximity, repetition and reduplication, and participant MBCDI scores for all mentions of CW (n=84) and OW (n=58). As in Laing (2017), we classified words as reduplicated if the pause between token reduplications was less than 200ms, and as repeated if the pause between two consecutive OW tokens was greater than 200ms. Words were classified as 'not isolated' if the pauses before the onset and after the offset of the target were less than 300ms, as 'partially isolated' if the pause either before the onset or after the offset were greater than 300ms, and as 'fully isolated' if the pauses both before the onset and after the offset of the target were greater than 300ms (Laing, 2017).

3.1 Frequency Count

In order to explore how frequently OW would occur in CDS compared to CW, and to explore variation of onomatopoeia use between individual participants, we calculated the number of onomatopoeic words used by each participant and reported a frequency count score. The participants used a total of 58 OW (table 2), when reduplicated word forms were classified as one count (e.g., *'choo-choo'*=1) and 84 associated conventional target words CW (table 3). 43.1% (25/58) of the target onomatopoeia words were reduplicated, while 0% (0/84) of the conventional words were reduplicated. The total number of onomatopoeic tokens when each reduplication was included in the count (e.g. '*choo-choo'*=2) was 124 mentions (table 4). There were no participants who did not use any target OW or CW. Target word use was greatly varied among participants. The number of onomatopoeic tokens used by participants ranged from 2 tokens produced by the participant who used the least OW, to 43 tokens produced by the participant who used the greatest amount of OW. The target onomatopoeia for 'sneeze' (*'achoo'*) was the only target OW produced at least once by each participant, and the target OW for a tree cracking (*'crack'*) was the only target not produced by any participant. The image of a tree breaking in a storm did not elicit target OW *'crack',* but did elicit non-target OW '*whoosh*', '*woo'* and *'pitter-patter*' from some participants, which were analyzed. The image of a horse trotting succeeded in eliciting variations of the target OW *'clip-clop'*, and additionally elicited the non-target onomatopoeia *'neigh'* from some participants, which was also analyzed. The target OW for train and a trotting horse were the only targets that were always reduplicated, and the onomatopoeia '*neigh'* and '*achoo'* were the only targets that were never reduplicated. The distribution of target word use is displayed in the tables 2-4 below.

Table 2: *Onomatopoeia Word Count*

* OW that are reduplicated counted as one whole word (e.g., "quack-quack-quack"= 1)

Participants	Train OW	Tree OW	Storm OW	Cat OW	Puddle OW	Car OW	Horse trotting	Horse OW neigh	Duck OW	Sneeze OW	Total
101	2	0	1	1	1	2	1	1	3	3	15
102	4	0	3	2	2	2	1	1	2	3	20
103	0	0	0	1	0	0	0	0	0	4	5
104	0	0	0	0	0	0	0	0	1	1	2
105	2	0	1	2	0	2	1	2	3	3	16
Total	8	0	5	6	3	6	3	4	9	14	58

Table 3: *Associated Conventional Word Count*

Participants	TrainCW	TreeCW	CatCW	PuddleCW	CarCW	HorseCW	DuckCW	SneezeCW	Total
101	1	1	4	1	2	3	4	0	16
102	1	2	3	1	2	3	4	1	17
103	1	2	3	0	4	3	1	3	17
104	2	4	1	0	1	1	3	1	13
105	3	3	5	0	4	3	1	2	21
Total	8	12	16	2	13	13	13	7	84

Table 4: *Onomatopoeia Token Count*

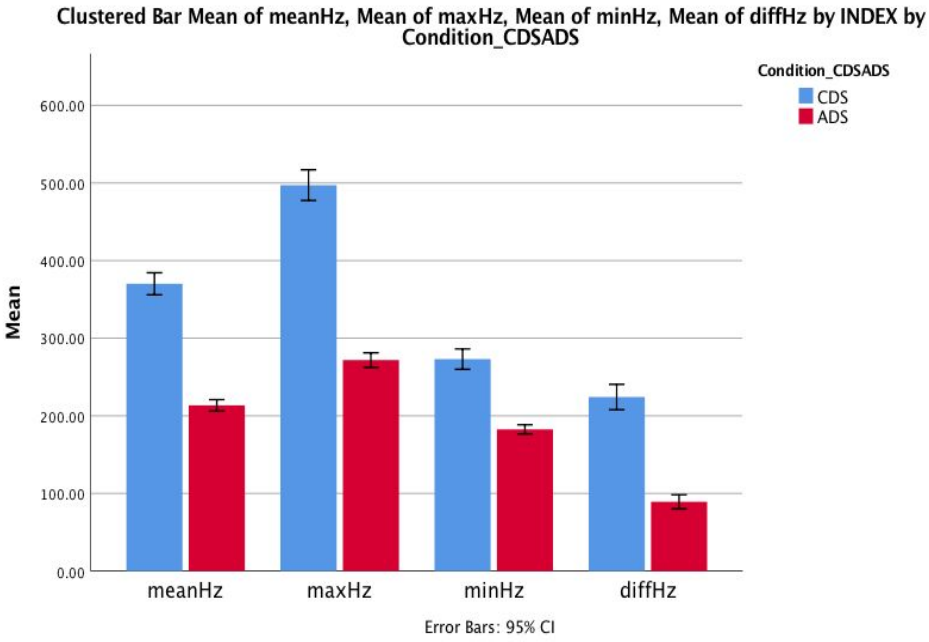
* Every reduplication of an OW counted as a token (e.g. "quack-quack-quack' = 3)

Participants	TrainOW	TreeOW	StormOW	CatOW	PuddleOW	CarOW	HorseOW trotting	HorseOW neigh	DuckOW	SneezeOW	Total
101	6	0	1	3	3	2	8	1	10	3	37
102	16	0	6	2	4	2	5	1	4	3	43
103	0	0	0	1	0	0	0	0	0	4	5
104	0	0	0	0	0	0	0	0	1	1	2
105	8	0	1	3	0	4	8	2	8	3	37
Total	30	0	8	9	7	8	21	4	23	14	124

3.2 Pitch

Considering the exploratory nature of this pilot study, amount of available mother-child dyads (N=5), and variability of mothers' expressive style, we analyzed these data using Independent-samples T Tests. Prosodic modification including increased pitch and pitch range is a reported characteristic of child directed speech (e.g., Fernald et al, 1989). In order to explore whether our experimental task was successful in eliciting speech that was prosodically different between conditions, we first analyzed the mean, maximum, minimum and difference in pitch (i.e., pitch range) for each register (CDS, ADS) using Praat (Boersma & Weenink, 2019). The mean pitch (measured in Hertz (Hz)) in the CDS condition was 370.1Hz (*SD*=130.0Hz, n=84 all target words (OW and CW)) and the mean pitch in ADS was 213.5Hz (*SD*=64.0Hz, n=78 target OW and CW). The difference within register (CDS, ADS) in mean pitch was significant ($t(122.968)=9.827$, $p<0.0001$). Similarly, difference in average max pitch (CDS: $M = 497.2$Hz, *SD*= 181.5Hz versus ADS: $M =271.7$Hz, *SD*=82.9Hz) was also significant ($t(118.039)=10.284$, $p<0.0001$), as were the difference in average min pitch (CDS: $M = 273.0$ Hz, *SD*= 120.5Hz versus ADS=182.5Hz, *SD*=52.2) ($t(114.851)=6.281$, $p<0.0001$) and the difference between pitch range (max pitch - min pitch = difference score (diffHz)) (CDS= 224.2 Hz, *SD*= 149.6 Hz vs ADS=89.3 Hz, *SD*= 79.1 Hz) ($t(127.968)=7.246$), $p<0.0001$). The significant pitch differences between CDS and ADS conditions reflect the expected difference in pitch between registers due to prosodic modification in CDS (see figure 1). Figure 1 demonstrates the difference in the average mean, max, minimum pitch and pitch range of the target words measured in CDS compared to ADS.

Figure 1: *Average mean, max, min pitch and pitch range in CDS vs ADS.*



In order to determine the prosodic nature of OW use in maternal CDS to 12-16 month old infants, we analyzed the average mean, min and max pitch and pitch range of target OW compared to those of CW in CDS and ADS conditions. In the CDS register the average of the mean pitch of OW was 409.0Hz (*SD*= 138.9Hz) compared to a mean pitch in CW of 312.9Hz (*SD*= 90.6Hz), $t(81.895) = 3.838$, ($p < .0001$). There was also a significant difference in average max pitch (OW=551.7Hz, *SD*=191.4 vs CW=417.0Hz, *SD*=131.8Hz), ($t(81.895) = 3.819$), ($p>0.0001$) and min Hz (OW= 306.867Hz, *SD*= 138.890 vs CW=223.161Hz, *SD*=86.866), ($t(81.999) = 3.556$, $p=0.001$) between OW and CW targets in the CDS condition. There was no significant difference between pitch range of OW and CW (no significance (*n.s.*)) in the CDS condition. The difference between average mean pitch and minimum pitch of OW and CW in the ADS condition was not significant. There was a significant difference between mean max Hz (OW=293.556Hz, *SD*=95.397 vs CW=252.111Hz, *SD*=64.817), ($t(62.484)= 2.220$, $p=0.03$) and pitch range (OW= 116.828Hz, *SD*=90.033 vs CW= 64.4596Hz, *SD*=58.382), ($t(60.646)=3.012$,

p=0.004) in ADS. Difference in pitch between CW and OW in ADS and CDS are displayed below in figures 2 and 3. These results demonstrate that, in line with our hypotheses, onomatopoeic words are produced with higher pitch than are associated conventional words in a child-directed speech register. It appears as though increased pitch (but not an increase in pitch range) is one factor contributing to onomatopoeia being more salient in input than associated conventional words in CDS. Figure 2 displays the significant difference between mean, max and minimum pitch of OW and CW in CDS, and the insignificant difference between pitch range of OW and CW in CDS whereas Figure 3 displays the significant difference between max pitch and pitch range between OW and CW in ADS, and the insignificant difference between mean and minimum pitch between OW and CW in ADS.

Figure 2: *Mean, min, max pitch and pitch range between OW and CW in CDS*

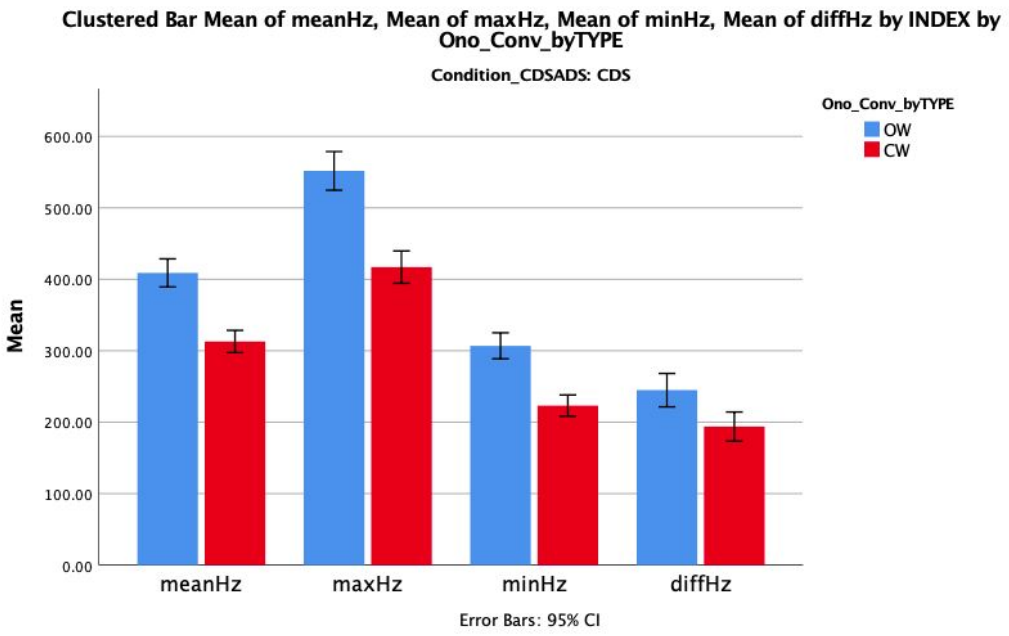
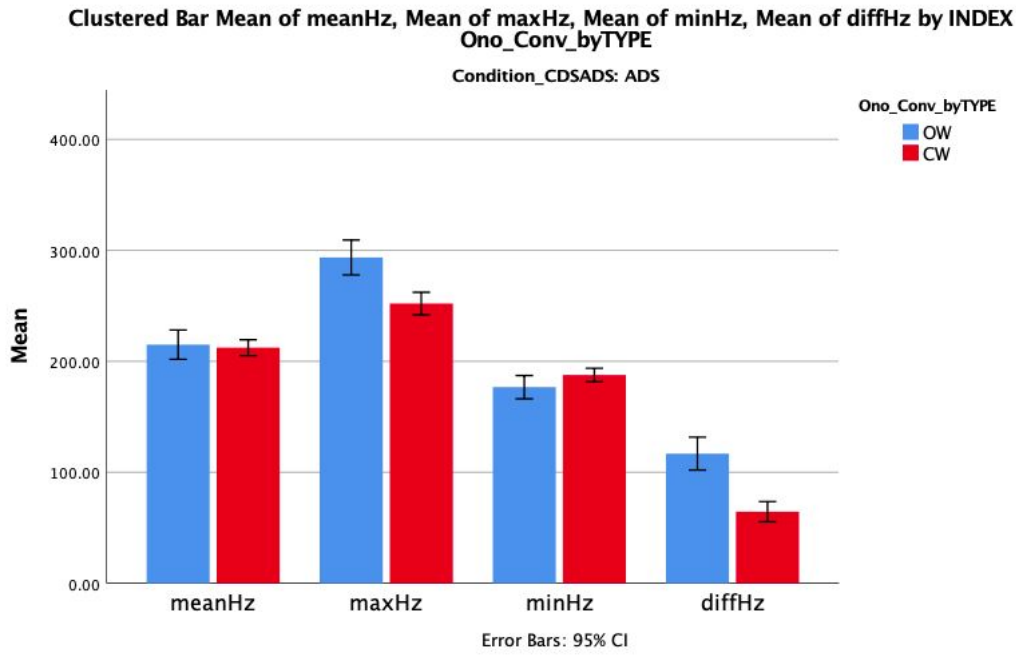


Figure 3: *Mean, min, max pitch and pitch range of OW and CW in ADS*



3.3 Duration

We analyzed the duration of the target OW and CW words in CDS and ADS conditions in order to explore whether increased word duration of OW compared to CW was used by participants as a means of increasing onomatopoeia salience in the input (Laing, 2017). We analyzed the duration of OW and CW targets using Praat (Boersma & Weenink, 2019). The mean duration of target OW and CW words in CDS was 0.927s (*SD*= 0.549s) and in ADS was 0.476s (*SD*=0.197s). The difference between the conditions was significant ($t(116.724)=7.354$, $p>0.0001$). Regarding duration between OW and CW in the ADS register, OW (*M*= .588s; *SD* = .195s) were significantly longer than CW (*M*= .367s, *SD*= .126s) ($t(66.298)=6.031$, $p>0.0001$) by approximately 221ms (see figure 4). In the CDS condition, OW were significantly longer than CW in CDS (OW: *M*=1.174s, *SD*=.558s; CW=.542s *SD*=.213; $t(76.624)=7.650$, $p>0.0001$), by approximately 632 ms. (see figure 5).

Figure 4: *Mean Duration (sec) of OW vs CW in ADS Condition*

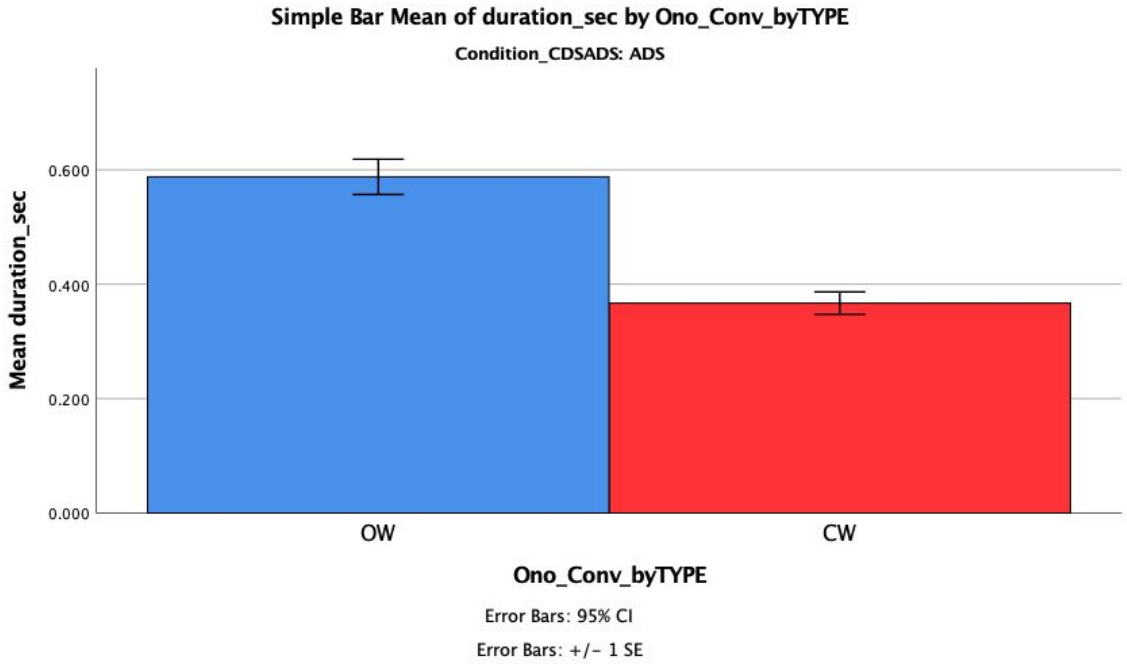
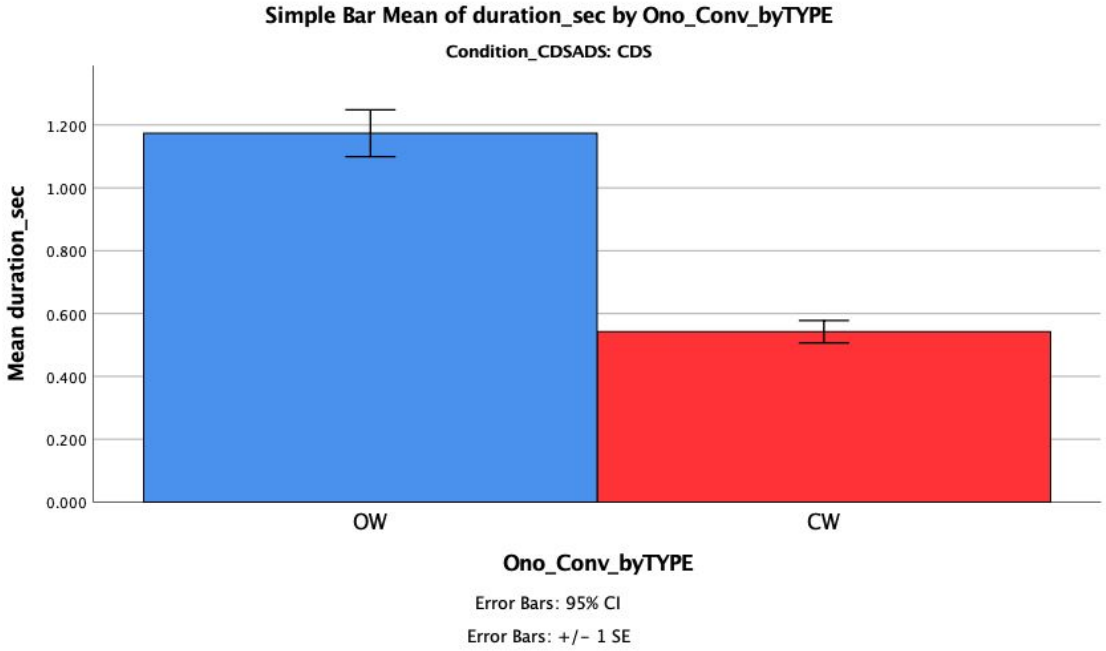


Figure 5: *Mean duration (sec) of OW vs CW in CDS condition*



As in Laing (2017), we analyzed whether the increased duration of OW in CDS compared to CW may just be due to reduplication, or also due to whole word lengthening. Unlike in Laing (2017) which found 84% of their target OW to be reduplicated, less than half (44%, n=26) of the OW in the current study were partially or fully reduplicated. We compared the duration of reduplicated and non-reduplicated OW to CW in CDS. In CDS, reduplicated OW (M = 1.35s, SD = .672s) were slightly longer than OW that were not reduplicated (M = 1.051s, SD=.431s) with only a marginal difference (t(34.5) = -1.885, p=.068). It appears as though onomatopoeia are significantly longer in duration than conventional words due to increased frequency in reduplication (e.g., *choo-choo*) or to prosodic modification of increasing single token word forms (e.g., *'achoo'*).

3.4 Repetition and Reduplication

We calculated the amount of target words that were reduplicated and repeated in the input. We analyzed this in order to examine whether reduplication impacted the amount of OW tokens used in the maternal input compared to CW tokens. As in Laing (2017), we classified reduplicated words as more than one consecutive token separated by a pause of less than 200ms, and repetition as more than one consecutive token separated by a pause of 200ms or longer. We did not analyze the amount of reduplication and repetition in ADS as the target words were read from fixed sentences, therefore the frequency of reduplication and repetition of target words was controlled. Half (n=29/58, 50%) of the OW were either reduplicated or repeated. This is contrasted to the large majority (87%) of repeated and reduplicated OW reported by Laing et al (2017). Approximately 43.1% of the 58 OW produced were reduplicated (n=25). Of the reduplicated words, approximately 24% (n=6) were considered partially reduplicated (*'chugga-chugga-choo-choo', 'pitter-patter-, 'clip-clop-')* and the remaining 76% (n=19) were full reduplications. The majority of the reduplicated words were reduplicated more than twice (n=17, 68%). A breakdown of OW use by number of tokens can be seen in Table 5.

Table 5: *OW number of reduplicated tokens*

Number of Tokens	*OW Variations*	*Number of Occurrences*
1 token (not reduplicated)	• StormOW- 'woo' (1 occurrence) • StormOW- 'whoosh' (3 occurrences) • StormOW -' shhhhh' (1 occurrence) • CatOW - ' meow' (3 occurrences) • CatOW - 'meowing' (1 occurrence) • CarOW - 'zooming' (2 occurrences) • CarOW - 'vroom' (1 occurrence) • CarOW - 'brrrrr' (*lip trill*) (2 occurrences) • HorseOW- 'neigh' (4 occurrences) • DuckOW - 'quacking' (1 occurrence) • SneezeOW- 'achoo' (11 occurrences) • SneezeOW - 'hachoo' (3 occurrences)	33
2	• TrainOW- 'doo-doo' (1 occurrence) • TrainOW - 'choo-choo' (3 occurrences) • CatOW - 'meow-meow' (1 occurrence) • DuckOW - 'Quack-quack (3 occurrences)	8
3	• CatOW- 'mowmowmow' (1 occurrence) • PuddleOW- 'splash-splash-splash' (2 occurrences) • DuckOW - 'quack quack quack (3 occurrences) • DuckOW- 'peep-peep-peep'(1 occurrence) • CarOW- 'vroom-vroom-vroom' (1 occurrence)	8
4	• TrainOW- 'chugga-chugga-choo-choo' (2 occurrences) • TrainOW- 'choo-choo-choo-choo' (1 occurrence) • DuckOW - 'quack-quack-quack-quack'(1 occurrence) • StormOW- 'pitter-patter-pitter-patter' (1 occurrences)	5
5	• HorseOW- 'pitter-patter-pitter-patter-pitter'	1
8	• HorseOW- 'clip-clop-clip-clop-clip-clop-clip-clop' (1 occurrence) • HorseOW -'click-click-click-click-click-click-click-click (1 occurrence)	2
10	• TrainOW- 'chugga-chugga-chugga-chugga-chugga-chugga-chugga-chugga choo-choo' (1 occurrence)	1
TOTAL		58

In addition to reduplicated word forms, we analyzed how many target words, onomatopoeia and conventional, were repeated. We coded target CW and OW as tokens that occurred directly after the same target following a pause of 200ms or greater as a repetition. As with the reduplicated targets, there were no instances of repetition for the conventional words, while 15.5% of the OW mentions were repetitions (n=9). Table 6 lists the context in which repetitions were produced.

Table 6: *OW repetitions*

* Bolded words were coded as the repetitions

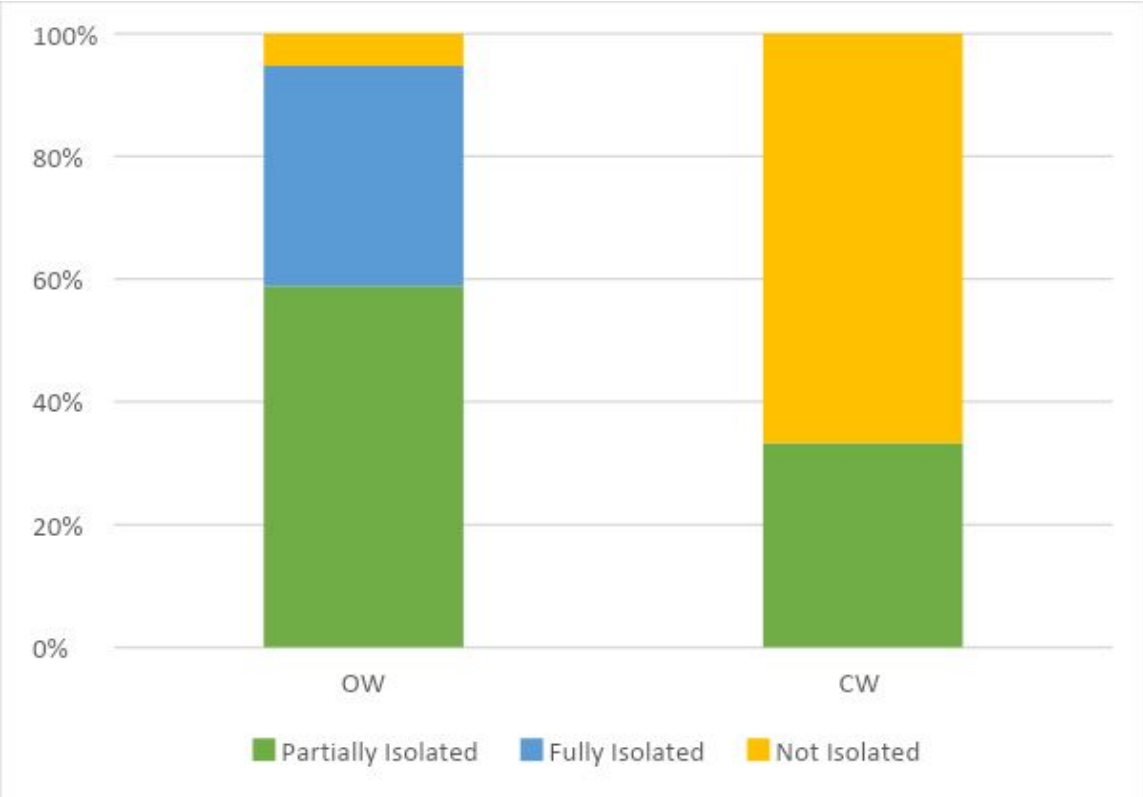
Participant	Context of repetition
101	NA
102	1. "Oh, do you see the train? Choo-Choo (*pause)* **Choo-choo..."** 2. "Oh no it's so windy! Whoosh *(pause)* **Whoosh..."** 3. "Do you see the cat? Meow *(pause)* **Meow..."** 4. "Aw the duck! Quack-Quack *(pause)* **Quack-Quack..."**
103	1. "...Do you wanna try to make an achoo? *(pause)* **Achoo!**..."
104	
105	1. "...Wow (baby's name) look, look at the train! It's going choo-choo-choo-choo *(pause)* **Chugga-Chugga-Choo-Choo…"** 2. "...Kitty's going meow *(pause)* **meow-meow..."** 3. "Oh (baby's name) look at the car! It's going vroom-vroom-vroom *(pause)* **vroom…"** 4. "(baby's name) what does a horsey say? Neigh *(pause)* **Neigh…"**

3.5 Isolation

In order to better understand the function of onomatopoeia in maternal CDS discourse, we analyzed the proportion of target OW and CW that occurred in isolation. We classified the first three mentioned target OW and the first mention target CW in CDS as not isolated (pauses of less than 300 ms before and after the onset and offset of the target), partially isolated (a pause of 300 ms or greater either before the onset or after the offset of the target) or fully isolated (pause of 300 ms or greater both before the onset and after the offset of the target) (Laing, 2017). We did not analyze frequency of isolation for the ADS condition as they were read from fixed target sentences where no target occurred in isolation.

Out of the 56 analyzed OW, 94.6% were at least partially isolated (partially or fully) (n=53), and 38% were fully isolated (n=20). Only 5% of the OW were not isolated (n = 3). Of the 36 analyzed target CW 33.3% were partially isolated (n= 12), 0% (n=0) were fully isolated, and 66.7% (n=24) were not isolated. Figure 6 displays the percentage of OW (first three mentions) and CW (first mentioned) that occurred in full isolation, partial isolation and no isolation in CDS.

Figure 6: *Distribution of isolated OW and CW in CDS*



3.6 Utterance Position

In order to better understand how OW and CW function in CDS discourse, we additionally analyzed utterance position and classified words as being utterance initial, medial, final or isolated. Here our definition of isolation differed in that we based the classification of isolation on whether it was part of a larger utterance, rather than whether it was preceded by and followed by a pause 300 ms or longer *(e.g.,*

"And there's a whistle." *(pause 249ms) "Doo-Doo!"* = isolated). Utterances that consisted only of a target word following a determiner (e.g. *"the tree")* were also considered to be isolated when calculating utterance position, but not when calculating acoustic isolation. We classified utterance initial targets as being the very first lexical word in an utterance, optionally following a determiner (*e.g. "**Kitty's** going meow"),* utterance medial as a target following and preceding any lexical word in an utterance *(e.g.* "*(baby's name) what does a **horsey** say?")*, and utterance final as the final target in an utterance *(e.g. "There's a mama **duck**"*; see appendix B for complete transcriptions and coding of participant recordings). As the ADS condition was read from fixed sentences, 100% of the CW in ADS occurred utterance medial or initial following a determiner, and 100% of the OW in ADS occurred utterance final. 60.3% (n=35) of the 58 analyzed OW were produced in isolation, 34.4% were produced utterance final (n=20), 1.7% (n=1) were produced utterance initial and 3.4% (n=2) were produced utterance medial in CDS. 86.9% of the CW were produced either utterance final or utterance medial. Almost half (48.8% (n=41)) of the 84 CW were produced utterance final and 38.1% (n=32) were produced utterance medial. There were 9 instances of a CW produced in utterance initial position and 2 instances of a CW produced in isolation. Tables 7 and 8 display the distribution of sentence position for OW and CW in CDS. Every participant produced CW in both the utterance medial and final positions. Four of the 5 participants produced OW in isolation and utterance final. Only 1 participant produced 1 target OW in utterance medial position. We suspect that this participant might have been using speech influenced by the experimental condition as the entirety of their recording was comprised of very long, conjunction heavy utterances, where the participant explained each picture scene in extreme detail (see appendix B).

Table 7: *Utterance Position Distribution of OW in CDS*

Participant	Initial	Medial	Final	Isolation	*Total*
101	0	0	8	7	15
102	1	0	3	16	20
103	0	0	3	2	5
104	0	2	0	0	2
105	0	0	6	10	16
	1	2	20	35	58

note: table displays the number of OW produced in each utterance position by each participant the CDS condition

Table 8 : *Utterance Position Distribution of CW in CDS*

Participant	Initial	Medial	Final	Isolation	*Total*
101	0	7	9	0	16
102	6	3	8	0	17
103	1	5	10	1	17
104	0	11	2	0	13
105	2	6	12	1	21
	9	32	41	2	84

note: table displays the number of CW produced in each utterance position by each participant the CDS condition

Though we analyzed the speech of only 5 participants, from our limited analysis it appears as though OW are more likely to occur in isolation than are CW in CDS, and not as likely to occur utterance initial or medial as CW. The majority (70%, n=14/20) of the OW that occurred in the utterance final position occurred in a similar sentence structure, following the verb 'to go' (e.g. *X is going OW/ X goes OW.)*

3.7 Proximity

As in Laing (2017) we calculated a proximity score for each OW based on how many words occurred between the target onomatopoeia and the nearest associated CW (See appendix C for transcription of participant recordings with proximity score coding). We then calculated the proximity score for each CW based on how many words occurred between the target CW and the associated OW. Based on previous findings from Laing (2017), we hypothesized that a large proportion of OW would occur within close proximity (10 words or less) to their associated CW. For analysis of OW proximity we included the non-target OW and CW for storm/wind/rain unintentionally elicited by our target picture for a tree breaking in the wind (we included OW *pitter-patter, whoosh, woo* and CW *rain, raining, wind, windy*). 82% (n=48) of the OW were produced in proximity to CW of 10 words or less. 22% (n=13) of the OW were separated from the CW by 1 word and only 17% of the OW were produced directly adjacent to an associated CW. Twelve percent (12%; n=7) of the OW were produced with a proximity of more than 10 words from a CW and 5.2% (n=3) OW produced by one participant was produced when no associated CW was produced. Forty-seven point 6 percent (47.6%) (n=40) of the CW were produced in proximity to OW 10 words or less, 9.5% (n=8) were separated from an OW by one word and another 9.5% (n=8) were produced directly adjacent to an OW. 30.1% (n=26) were not produced in any proximity to an associated OW.

We suspected that the speech of one of our participants (participant 104) might have been influenced by the experimental setting. This participant was both loquacious and rapid in her speech while describing aspects of the images (e.g. *"Do you see there's a little boy sneezing and this picture is not quite like a big full picture it's more like a small picture in the middle"*). She frequently made comments on the images making a sound, without using onomatopoeic words (*e.g. "… And you can see the way it's drawn, it has 1 2 3 4 5 6 7 8 wheels. It's going on the black track, umm you can see there's a whistle on the train and it has three lines coming out of it and that means that there's sound so you can*

see…") (see appendix B for transcription). As she did not use a lot of target OW or CW, a high proportion of her target words were coded as being in no proximity to other target words, therefore we calculated the percentage of proximity scores for CW with the data from participant 104 removed. With this data removed we did find that a small majority (53.5%, n=38) of the remaining 71 target CW were produced in 10 word or less proximity from an associated OW. Implications from these results are explained in the discussion section.

3.8 Infant Vocabulary

Due to the small participant sample size, and the restricted age range of participants we were able to recruit (12-16 months rather than 12-18 months as advertised) it is difficult to discuss results related to infant productive vocabulary. Table 9 displays each participant's OW and CW use, as well as their respective infant's age and MBCDI vocabulary development scores. Infants ranged in age from 12;4 months to 16;0 months. The participant whose infant had the highest productive vocabulary score reported that her infant could produce 17 words from the MBCDI and understand 15 additional words. Two of the participants' infants had not yet produced their first word. The mother of the infant with the highest reported productive vocabulary produced the greatest amount of OW words and OW tokens.

Table 9: *Participant target word use and Infant vocabulary*

Participant	*Target CW production*	*Target OW production (word)*	*Target OW production (token)*	*Infant CDI understand*	*Infant CDI Produce*	*Infant Age Months;days*
101	16	15	37	9	0	12;4
102	17	21	39	15	17	13;3
103	17	5	5	7	0	12;24
104	13	2	2	46	15	16;0
105	21	16	37	20	9	14;3

note: the number of OW and CW used by participants, the size of each infant's reported productive and receptive vocabularies and the age of the infants.

Discussion

4.0 Pilot Study Outcomes

This was an exploratory pilot study, in which we aimed to explore a method of studying OW in CDS through elicitation and examine the nature of the use of OW and associated CW by Canadian-English speaking mothers of infants in the early stages of productive vocabulary development. We aimed to explore properties of OW, any effect of individuals differences (infant age and vocabulary) on OW and CW use, as well as analyze multiple characteristics of target word production (frequency of occurrence, pitch, pitch range, duration, repetition, utterance position, isolation, and CW/OW proximity). As this was a pilot study, there were several limitations, including a very small participant sample size, restricted infant age and vocabulary range, and high variability between participants use of OW.

Our first aim in this pilot study was to design a study for eliciting target onomatopoeia and associated conventional words in maternal CDS. We designed a method that allowed us to control recording time and prime mothers to use some onomatopoeia to ensure that we had some target words to analyze, without informing participants of the goal of our study and without designing a task that would not elicit naturalistic CDS. The experimental design was successful in eliciting OW and CW from participants (though the extent to which this was successful was varied between participants), and we were successful in identifying a number of factors in which OW were produced differently than CW in the input (including differences in isolation, utterance position, pitch, duration, pitch range, reduplication and repetition, and frequency of use). While we additionally compare our results to the findings of Laing et al. (2017), it is important to note several differences between their study and the current study, including a difference in task and extent to which the study was controlled, difference in recording length, difference in infant age, and difference in speech dialect. Laing et al. (2017) conducted a study in which participants, mothers of 8 month old infants and speakers of dialects of British-English, read from picture books to their infants in a spontaneous manner, resulting in a variety of recording lengths ranging from

approx. 5 min to approximately 40 minutes (mean 20 minutes and 12 seconds) (Laing et al, 2017). Our current study explores the OW use of Canadian English speaking mothers of 12-16 month old infants in much shorter (around 3 minutes and 45 seconds), more controlled experimental task with the addition of an adult directed speech portion. Despite the differences in methodology, we will comment on the similarities and differences between the results of our study and the previous study.

4.1 Hypotheses Revisited

Hypothesis 1

We hypothesized that participants would demonstrate a difference in acoustic correlates between ADS and CDS overall, and that onomatopoeia in CDS will be produced with greater pitch range and longer duration compared to the onomatopoeia produced in ADS. As predicted, the analysis of the conditions overall revealed significantly greater prosodic modification (higher pitch, greater pitch range, longer duration) of words in the CDS condition than in the ADS condition. This is expected of typical CDS (e.g. Fernald et al, 1989), but suggests that our novel experimental method was successful in eliciting naturalistic speech registers.

Hypothesis 2

Our second hypothesis that participants would emphasize OW compared to CW in CDS through reduplication and repetition, and increased duration, pitch and pitch range (Laing, 2017) to a greater extent than ADS was partially supported by the data. We found OW compared to CW in CDS to be produced with greater pitch and duration, but not greater pitch range. As we predicted, OW in ADS were not significantly different in mean or minimum pitch compared to CW, and there was a greater increase in duration between OW and CW in CDS (approx. 600ms longer) compared to ADS (approx. 220ms longer). These findings support the conclusion that OW are used significantly differently than CW in CDS, and the difference between OW and CW in ADS is not as pronounced. As duration is an acoustic

feature that has been found to facilitate word learning in similarly aged infants (14 months) (e.g., Archer & Curtin, 2018), this data supports the hypothesis that OW have acoustic properties in input that increase their salience in CDS.

Though it was not predicted, we did find some significant difference between max pitch and pitch range of OW vs CW in ADS suggesting that there is some prosodic modification (though not to the same extent as in CDS) of OW compared to CW. We speculate that in truly naturalistic speech, these differences might be less pronounced. For one, all of our target onomatopoeia words in the adult directed speech occurred in an utterance final position in a fixed target sentence, while all of the target conventional words occurred prior to the OW in an utterance medial or initial position. It is possible that some of the prosodic differences noted between OW and CW may have been due to the fact that we did not balance sentence position, rather than prosodic modification specific to them being OW. In future iterations of this research it would be more optimal to balance the sentence position of OW and CW in order to determine whether this was a factor. Furthermore, in our study the CDS condition always preceded the ADS condition, as we did not want participants to figure out what we were targeting from the fixed ADS sentences before completing the semi-spontaneous CDS condition. Additionally, due to the nature of the study, the content of the adult condition sentences was more typical of child directed language (*e.g. "a train goes choo-choo')*. Even though we directed participants to use an adult conversational tone regardless of the presence of 'baby-words' in the sentences, it may have been that some of the participants' adult-directed speech was influenced by these factors, possibly resulting in a more child-directed-speech like register than what they may typically use in truly naturalistic adult conversation.

Hypothesis 3

Our third hypothesis was that OW would function differently in the discourse than CW due to increased frequency of occurrence in isolation, repetition and reduplication, (Laing, 2017), and

differences in utterance position. We additionally examined whether OW occurred in close proximity to CW in the discourse (Laing, 2017). While our conclusions about these factors are tentative due to our very small sample size, our data supports each facet of this hypothesis. We did find that half of the OW occurring in the input were either reduplicated or repetitions, while there were no instances of reduplication or repetition of conventional words. Additionally, in our calculation of the total number of OW and CW used in the input from all participants, we found conventional words (n=84) to outnumber onomatopoeia (n=58) when counting entire words (e.g. *'choo-choo'* = 1 word). When each target word token was calculated however (e.g. *choo-choo* = 2 tokens), we found onomatopoeia (n=124) to outnumber conventional words (n=84). From our data, it appears as though instance of reduplication may be a factor influencing the increased prevalence of onomatopoeia tokens in input. The amount of reduplication and repetition in our data (50% of all OW were either reduplicated or repetitions) however did not occur to the same extent as in Laing et al (2017), who reported nearly all (87%) of the occurrences of OW to be reduplicated or repeated (Laing et al, 2017). Also similar to Laing (2017) and in line with our hypothesis, the vast majority (94.6%) of OW were isolated (fully or partially) compared to a much smaller proportion of conventional words occurring in in partial isolation (33.3%). Additionally, a proportion of OW (38%) were fully isolated in the input, compared with no fully isolated conventional words.

In our predictions, we noted that onomatopoeia being produced in close proximity to the words they are associated with would support the hypothesis that they may function to aid in word learning by acting as an 'attention-grabber' (Laing, 2017). We did find that a majority of OW (approx. 82%) were produced within 10 words of an associated CW, however we did not find this to the same extent as previous researchers (Laing et al, 2017), and contrary to Laing (2017) we did not find that a majority of CW were produced in 10 word or less proximity to OW (47.6%), though this was close to half. While Laing's (2017) study found that more than half of the OW produced occurred directly adjacent to an associated CW, our study revealed only 17% of OW to occur directly adjacent to an associated CW. The

studies are not entirely comparable in experimental design and target words, however this difference is notable. Though due to the small sample size we can only speculate at our conclusions, this difference in results might suggest some difference in the way OW are used in Canadian-English dialects differing from British-English, or a difference in OW use to older infants. Previous research has found that British infants demonstrate slower development of vocabulary comprehension and production than North American infants (Hamilton et al, 2000). It has been suggested that differences in the infant directed speech of British-English and North-American English may be a contributing factor to this difference (Hamilton et al, 2000). Finally, we did find differences in the overall utterance position of OW vs CW in the CDS, with the majority of OW occurring in syntactic isolation, as well as a high proportion occurring utterance final following the verb 'to go', and the majority of CW occurring utterance final or medial. It appears from these results that OW do not only function prosodically differently than CW in CDS in a manner than may increase their salience, but also appear to function differently in CDS discourse in a way that may increase their salience in input (Laing, 2017).

Hypothesis 4:

We additionally predicted that mothers of infants with higher productive vocabulary scores would utilize onomatopoeia less in the input than those of infants with a smaller productive vocabulary, based on findings from previous research that onomatopoeia may be used by mothers to grab infants' attention and to scaffold conversation while their infants are beginning to speak (Kauschke, 2007; Laing, 2016). We were limited in reporting findings to support these results as we had a very small sample size, with a more restricted age range than we had hoped to recruit. Likely because of this, all of the infants in our study had relatively small reported productive vocabularies (all less than 20 words). Due to the sample size and limited vocabulary range we are not able to draw any conclusions regarding the hypothesis that mothers of infants with smaller vocabularies use more OW. Future research with a greater number of participants

and a wider diversity in vocabulary size would be necessary to draw conclusions about vocabulary size effects.

4.2 Infant Vocabulary

As mentioned in the results section, one of the participants (participant 104) produced CDS that we believe may have been due to influence from the experimental setting and described the picture scenes in great detail (see appendix C for transcription). An additional participant (participant 103) did not produce a high number of OW. From the three participants who did consistently use both target OW and CW consistently throughout the CDS condition however, we noticed some patterns in the nature of their OW use that we can speculate might be in some way related to infant vocabulary development. Of the 5 participants, only the baby with the highest vocabulary score (the infant of participant 102 who had a reported productive vocabulary of 17) made vocalizations and produced words while in the recording booth. In total, the baby made 11 vocalizations, many of which were judged as possible approximations of target CW and 2 of which were judged to be approximate productions of target OW. The mother directly commented on 10 of the 11 baby vocalizations. Two of the comments produced utterances that contained a target CW *(baby:* "da-da"- *Mom: "*the cat, ya"*)* and *(baby:*"duh-duh" - *Mom:* "Ducky ya"*)*, and 2 of the comments produced utterances that contained a target OW *(baby: "*brrrr *(voiced lip trill)"- Mom "*Ya the car goes brrrrr *(voiced lip trill)"* and *baby:* "neigh" - *Mom:* "neigh, that's right!"*).* This commenting style is reminiscent of the findings of Laing et al (2016) in a study of OW in mother-infant interaction. While we cannot draw conclusions from the production of a single participant, we noticed that participant appeared to produce speech in CDS that was highly influenced by her baby's speech. Though we can only tenuously discuss the nature of OW use with infants with higher vocab scores from the data of a single participant, we might predict that running this study again with a greater variation of infant vocabulary scores might yield results with more participants shaping their CDS similarly by following the vocalizations of their baby. We might expect that if the infants produced a number of OW in the

recording, the mothers would too, but if the infants produced a number of words or vocalizations unrelated to OW, the mothers would also produce fewer OW.

Participants 101 and 105 did not have any instances of infant vocalizing, but both produced 37 OW tokens in their input. Participant 101 had the youngest infant that participated in the study (12 months, 4 days) who had not acquired any productive vocabulary. Participant 105 had an infant with a reported productive vocabulary of 9 words. Both participants produced more than ⅓ of their OW productions in utterance final position, all but 2 of which occurred following the verb 'to go' (14 productions between the participants). Participant 102 on the other hand, produced the large majority of her onomatopoeia in isolation, and despite her having the highest amount of OW production (n=20) she only had 2 productions of an OW that occurred following the verb 'to go', one of which was a direct comment on her baby producing an OW. Anecdotally, it appears that there may be a slight difference in the way that OW are used by participants conversing with their infants who produce words in 'conversation' compared to those that don't, however further research would be required to make any conclusive remarks regarding this topic.

4.3 Syntactic Function and Individual Word Differences

Due to the fact that onomatopoeic words are iconic representations of real-world sounds, we would expect that the prosodic nature of OW in CDS may be influenced by the acoustic nature of the real world sounds associated with them (Laing, 2017). We suspect because of this, we noticed similarity between the prosodic production of some specific isolated OW within and between participants. For example, many productions of the target OW *'chugga-chugga-choo-choo'* often had a low pitch at the beginning (*chugga-chugga)* followed by a relatively high mean pitch *(choo-choo),* perhaps in imitation of a real world train whistle. Many iterations of '*achoo'* had an extended first syllable, a break between the first and second syllable, and a high descending pitch on the second shorter syllable, iterations of '*quack'*

were reduplicated more than twice with short, lower pitched tokens, and iterations of *'neigh'* were long and descending in pitch (see figure 7 and 8). As expected based on the insignificant mean pitch differences between OW and CW in ADS, these trends in pitch contour similarities possibly due to real world sound imitation, were not noticeable in the ADS condition, and there was little noticeable difference between different target onomatopoeia and target conventional words (see figure 9 for examples). Variation between individual OW word forms might have been reflected in the high variation in pitch range noticed between words, where words such as *clip-clop, achoo* and *neigh* seemed to have a greater pitch range than words such as *splash* and *quack* (see figure 10).

Figure 7: *Pitch Contour Similarity in productions of 'Neigh' by two participants in CDS*

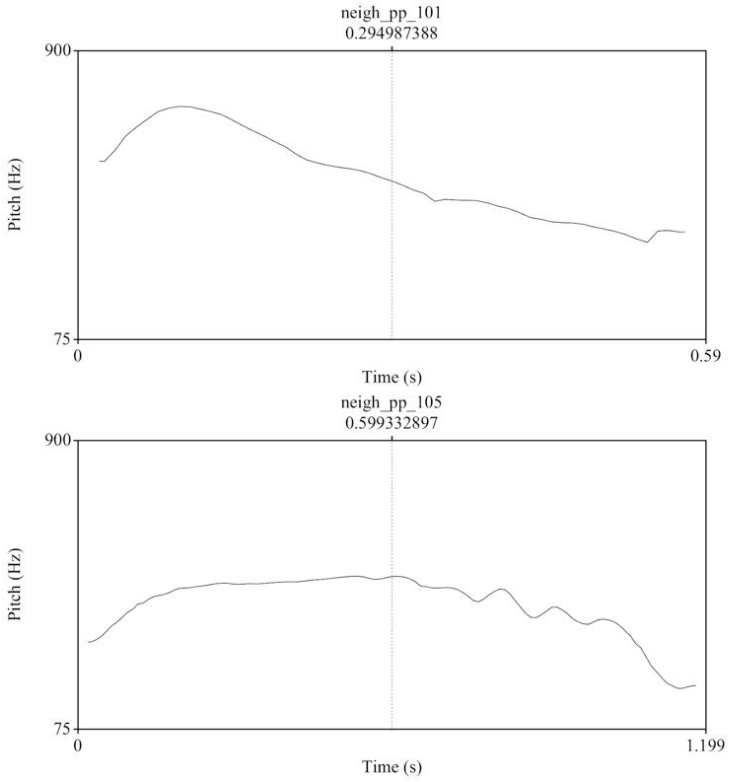


Figure 8: *Pitch contour similarity in productions of 'Achoo' by three participants in CDS*

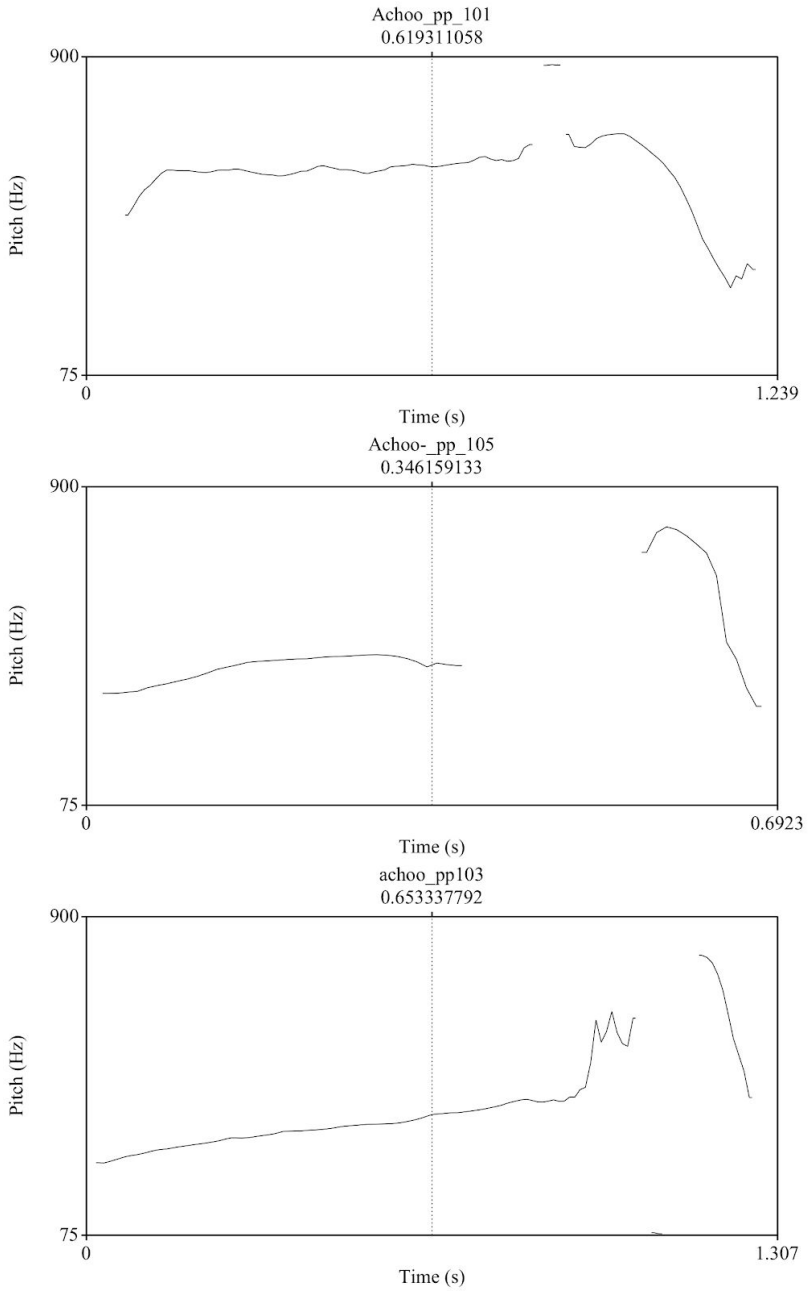
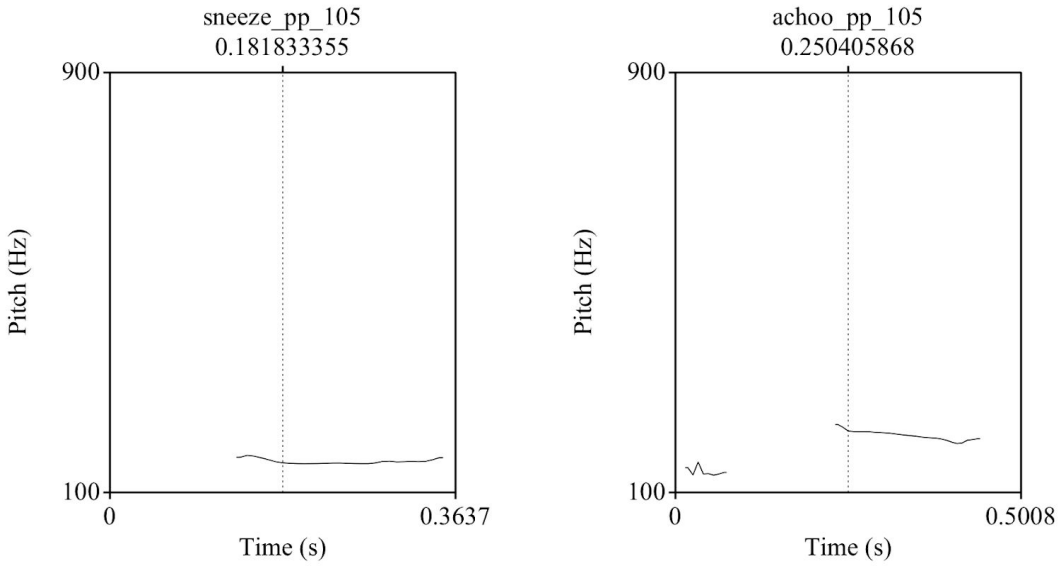


Figure 9: *Lack of 'real-world sound influence' on pitch contours in ADS target words*

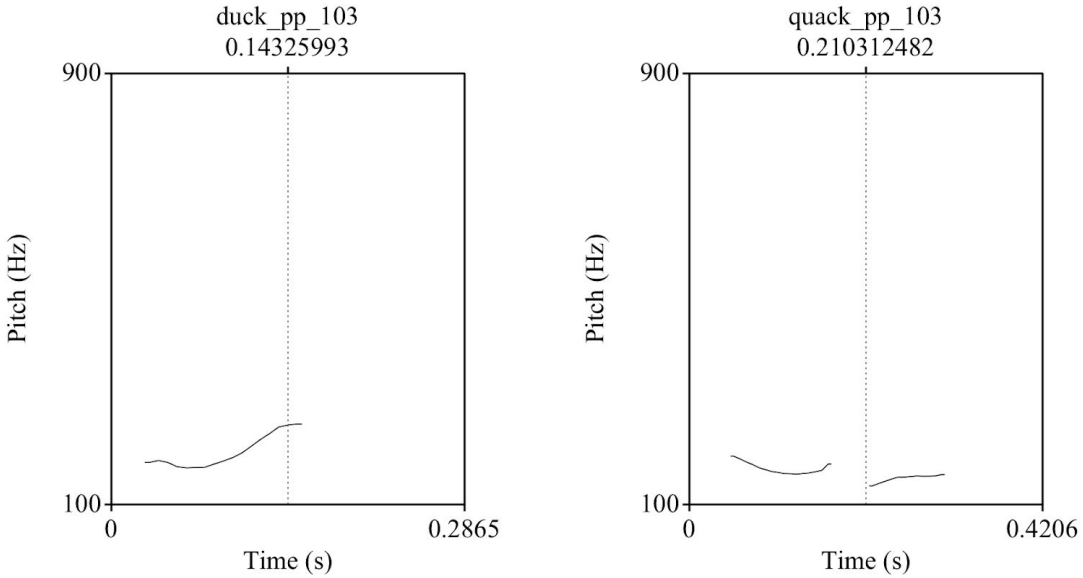
a)



' sneeze' *'achoo'*

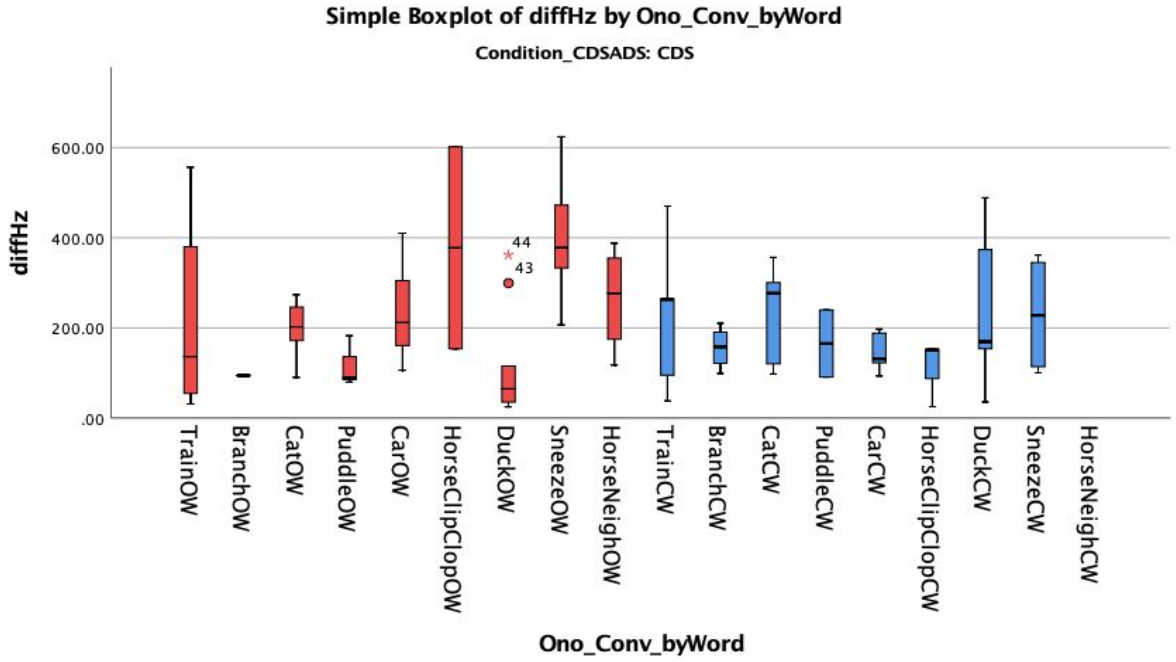
Figure 9: *Lack of 'real-world sound influence' in pitch contours in ADS target words*

b)



'duck' *'quack'*

Figure 10: *Pitch range of individual CW and OW in CDS*



note: variation between target onomatopoeia are displayed in red and target conventional words are displayed in blue

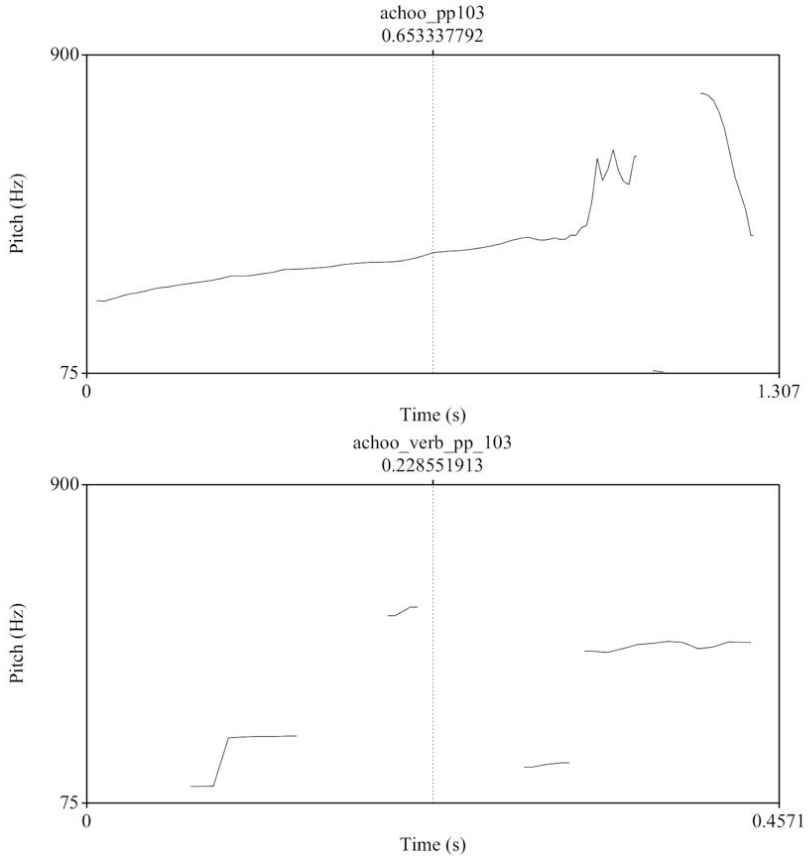
Through our analysis, we noticed that mothers may have been imitating real world sounds when producing OW in isolation, or in utterance final positions following phrases such as (‘*it goes…’, ‘it’s going....’, ‘a X goes …’*). We noticed that the recordings sounded as though in many cases when OW are used as imitations they may reflect the real world nature of the sound they represent. Alternatively, in a few instances mothers did not use onomatopoeia as imitations in isolation or following specific carrier phrases, but rather used them in a context where the OW functioned as a noun or verb. It appeared that the OW produced by the participants when used as nouns or verbs (*e.g. “the kitty is meowing”, “he’s making an achoo”)* did not show this real-world influence in their pitch contour to the same extent. We speculated that there may be a difference in prosodic modification of OW used as imitations vs OW used as more conventional verbs or nouns in CDS. We coded OW for their syntactic function of the words based on their conventional function as a noun or verb, or those that did not (functioning as imitations)

(See appendix B for coding of OW as verb/noun). We found the OW only occurred in speech in positions where they functioned as conventional nouns or verbs in the following CDS contexts:

*Pp 101: "Oh look at the car its **zooming!***
*Pp 101: "And the car, it's green and yellow and it's **zooming!"***
*Pp 103: "I think it's supposed to be the kitty **meowing"***
*Pp 103: "Do you wanna try to make an **achoo?**"*
*Pp 103: "What sound is sneezing? Is it **achoo?"***
*Pp 104: "And their mommy is **quacking** and...**"***

We noted in our results section for utterance position that the majority of onomatopoeia that occurred in a sentence final position fell into a similar sentence structure where they followed the verb 'to go' (14 of the 20 occurrences fit this structure). Five of the 6 remaining OW that occurred in an utterance final position that did not follow the verb 'to go' functioned as nouns/verbs. This finding is in line with reports from a study of cross-linguistic variation between Japanese and American-English child directed speech, which found American-English parents' infrequent use of onomatopoeia as noun labels to be in contrast with Japanese parents using onomatopoeia as noun labels for over half of the study's target objects (Fernald & Morikawa, 1993). Similarly, there were only 2 instances of an onomatopoeia used a noun label in our data. Figure 11 demonstrates the contrast between one participants production of *achoo* in isolation compared to the same participant's production of *achoo* used as a noun. There is a clear difference between the word *achoo* used in isolation (top picture) with a duration of 1.307 sec, and the same participant's use of *achoo* in the context "*do you wanna try to make an achoo?"* (bottom picture) with a duration of 0.457 sec (see figure 11).

Figure 11: *Participant 103 production of achoo in isolation (top) and as a noun (bottom)*



Though due to our small sample size it is not possible to draw conclusions about these anecdotal observations, future research could explore the impact of the syntactic function of OW in CDS discourse further.

4.4 Real-World Sound Associations

In our original design of the study, based on the observation that infants may acquire onomatopoeia in the place of concrete nouns in early development (Tardif, 2008), we hypothesized that mothers would produce onomatopoeia that are highly associated with concrete nouns (such as *meow*- 'cat') with greater prosodic modification and more frequently than they would onomatopoeia associated with actions or verbs (such as *crack* - 'tree breaking'). This distinction proved complicated however. Due

to a lack in literature background defining parameters of what determines a OW and associated CW pair, we used our intuition to determine which OW might be primarily associated with a concrete noun and which OW would be primarily associated with a verb. The division between what word an onomatopoeia is primarily associated with was not clear cut (e.g. *vroom* could be primarily associated with the concrete noun 'car' or with the verb 'to drive'). Because of these complications we did not find any distinguishable difference in the way that OW were used in maternal input in relation to the type of word they were associated with.

From the data, we propose that it may instead be the case the OW use is conditioned more on the interest, salience, and acoustic nature of the real-world sound it is associated with, rather than the conventional word it is associated with. As noted in our results section, we speculated that mothers may be prosodically modifying OW after the pitch contours of stereotypical real world sounds that OW are iconically representative of, when using them as imitations. Though further research would be required to examine this, we propose that the frequency and prosodic exaggeration of individual OW may be influenced by the salience, frequency of occurrence, or interest to babies of the real word sounds associated with them. If this was the case, in conjunction with our findings of low occurrence of OW directly adjacent to CW in the input, it might suggest that OW may function in Canadian-English maternal input to 12-16 month old infants to elicit positive emotional reaction from an infant, rather than specifically grabbing infant attention for word learning. Further research would be required to explore this possibility.

4.5 Future Research

Because this was an exploratory study of a topic not extensively analyzed in previous research, we have identified a number of possible future directions for further examination. For future directions of 6/669this research, it would be interesting to explore the role of the associated 'real-world' sound salience and frequency of occurrence on associated OW production (e.g. sneezing may be salient/interesting to a

baby and likely occurs relatively frequently, therefore *achoo* may be used in greater frequency and with highly exaggerated prosodic characteristics vs. a tree breaking may be less salient/interesting to a baby therefore *crack* may be used infrequently in CDS). Larger sample sizes and a larger age and vocabulary range would allow for thorough analysis of infant vocabulary effects. Because we had not used this experimental design before, we decided to prime participants by giving them the instruction to use sound effects, embedded among other distractor instructions to describe the picture, comment on the story, and engage their infant as they would if they were looking at a picture book, to increase the likelihood of eliciting target OW for analysis without revealing the purpose of the study to the participants. Because of this, our analysis regarding frequency of onomatopoeia in CDS input cannot necessarily be generalized to fully naturalistic speech to infants. In future iterations of this research, it would be more ideal to run a control group of participants to whom we would not give priming instructions, to compare whether priming had an effect on participant OW or CW use. Additionally, in order to assess OW function as a means of engaging infants and eliciting positive emotional reaction from infants, it may be interesting to analyze maternal OW use alongside video-recording of infants' reaction and affectual-emotional response to OW, in order to determine whether this influences mothers further use of onomatopoeia. Analysis of infant affectual response to onomatopoeia in relation to maternal use of onomatopoeia may allow for further delineation of the role of onomatopoeia in input in terms of its role in word learning or otherwise.

Conclusion

This exploratory pilot study broadly analyzed a number of features of onomatopoeia in CDS, our aim being to better understand the nature and function of onomatopoeia in maternal input to 12-16 month old infants. We can conclude from our results that onomatopoeia differ from conventional words in a number of prosodic and discourse features attributed to higher salience in CDS (Laing, 2017). We were able to identify a number of qualities of onomatopoeia and child directed speech in line with

findings from previous research (e.g. Laing et al, 2016, 2017; Fernald et al, 1989; Fernald & Morikawa, 1993). We additionally aimed to test a new methodology for examining onomatopoeia in semi-spontaneous maternal speech to infants. We can conclude that this experimental design was also successful in eliciting onomatopoeia, and speech that is semi-spontaneous and appears to be at least somewhat representative of naturalistic CDS. From our study, it appears as though there is a difference in the nature of onomatopoeia compared to conventional words in Canadian-English maternal input to infants in the early stages of vocabulary development.

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Appendix A.

Experimental Materials

CDS CONDITION
INSTRUCTIONS: Explained in person and presented on instruction slide for participants to read"

'You will see a series of pictures, accompanied by a recorded short story. The stories are 2 sentences long, and the pictures will stay on the screen for 20 seconds. In that time you will speak to your baby about the scene. After you hear the short story, talk to your child about the picture on the screen, as if you were looking at a picture book together. Talk about what is happening in the scene, use sound effect words, describe the scene etc.
After each picture you will be able to choose when you are ready to continue on to the next picture.
Speak in an enthusiastic voice that you would normally use while reading to or playing with your baby, making the pictures interesting and engaging. When you are finished, knock on the sound booth door, and an experimenter will show you the next step of the experiment. An experimenter will be waiting in the room to assist you and will be able to hear muffled speech, but won't be able to hear what you are saying in the booth.'

EXAMPLE SLIDE: CDS DEMONSTRATION

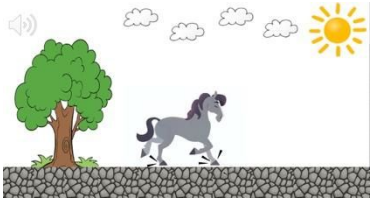

Recorded Story (Read in CDS): *"Look at the puppy! The puppy is running to the mailman"*
CDS DEMONSTRATION/PRIME (spoken by same experimenter for each participant) : "*Ooooh look at the puppy. He's barking... 'woof woof'... 'woof woof'... Look he's running to the mailman. And the puppy has brown fur. Look at the puppy!"*

EXPERIMENTAL ITEMS




1. *"Look at the train, the train is going down the track"*
2. *"Look at the tree. The tree broke in the storm"*
3. *"Look at the kitty-cat the kitty-cat is on the couch"*
4. *"Look at the happy kids. The kids are jumping in the puddle"*

5. "*Look at the car. The car is driving fast.*"



6. *"Look at the horsey. The horsey is trotting down the path"*

7. *"Look at the ducklings the ducklings are following their mommy*

8. *"Look at the little boy. the little boy is sneezing"*

ADS CONDITION

INSTRUCTIONS: Explained in person and presented on instruction slide for participants to read
"You will see a series sentences that you will read aloud to an experimenter. Each sentence will appear on the screen when you click the space bar, and will remain until you press the space bar to move on to the next sentence. Read each sentence in a tone of voice that you would normally use when speaking to another adult, even if some of the words are 'baby-words'. Your baby can stay with you, or go with an experimenter to play in the waiting area. If your baby stays with you, try your best not to read the sentences in a 'baby-talk' voice, speak directly to the experimenter"

EXAMPLE SLIDE: ADS DEMONSTRATION
Sentence read by the same experimenter to each participant in a typical ADS register: "A puppy says woof"

ADS SENTENCES: Presented in one sentence per slide in black text, size 36 font on an otherwise blank slide

1. A train goes choo-choo
2. A branch goes crack
3. A cat says meow
4. A puddle makes a splash
5. A car goes vroom
6. A trotting horse goes clip-clop
7. A horse says neigh*
8. A duck says quack
9. When you sneeze you say achoo

* Because the image of the horse was eliciting the non target OW "neigh" from participants, we added the additional ADS sentence "A horse says neigh" in order to analyze the non-target OW and compare it in the ADS condition for the remaining participants.

Appendix B.

Participant Transcriptions Coded for Utterance Position

Participant	*Transcription*
101	* Utterance position (isolation, initial, medial or final) of bolded target words is written at the end of each line containing a target CW or OW. **<u>Train</u>** Do you see the **train?** *Final* There's smoke coming out (baby vocalises) ya And there's a little house in the back And three trees 1 2 3 trees Its goes **chugga-chugga-choo-choo** *Final* (baby vocalizes) And there's a whistle **Doo-doo** *Isolation* **<u>Tree</u>** (Gasp) look its windy It's blowing **Wooossshhh** *isolation* And it's raining Do you see the rain? It was raining outside when we came in See the rain? And the clouds? And the **tree** is bent way over *Medial* **<u>Kitty</u>** **Mow-mow-mow** *Isolation* Do you see the **kitty?** *Final* There's a **kitty** his name is ned ya *Medial* And the **kitty's** watching TV *Medial* What else is in the room Do you see the drapes And the **kitty** he's grey *Medial* And he's got stripes **<u>Puddle</u>** **Splash-splash-splash** *Isolation* Do you like to jump in **puddles?** *Final* It's raining Remember the rain from the other slide? Mm-hmm And there's three little kids **<u>Car</u>** Oh look at that **car** its **zooming** *Medial - Final*

	Going to the race And it's got a big back tire and a little front one And what else is there There's a fence And the **car** is green and yellow *Medial* And its **zooming** *Final* It's going so fast It's got smoke behind it **Horsey** **Clip-clop-clip-clop-clip-clop-clip-clop** *Isolation* You see **horsey?** *Final* Its goes **neigh prrrrr** *Final* And he's walking on cobblestones And there's a sun shining And the **horsey's** gray *Medial* He's got four legs Ya hi **horsey** *Final* You can wave **Ducklings** There's a momma **duck** *Final* Goes **Quack-quack-quack-quack** *Final* And then three little baby **ducks** *Final* The little **ducklings** *Final* Goes **quack-quack-quack** *Final* **peep-peep-peep** *Isolation* And there going into a pond And those are cattails in the back See there's three 1 2 3 little **ducklings** *Final* **Sneeze** He goes **Achoo** *Final* Do you go **achoo?** *Final* Ya he's wearing a scarf He's gotta wipe his nose cuz he's sick **Achoo** *Isolation* He looks pretty sick He's got rosy cheeks His eyes are closed
102	**Train** Oh do you see the **train?** *Final* **Choo-choo** *Isolated* **choo-choo** *Isolated* Ya and there's grass Oh and the smoke coming out There **choo-choo** *Isolated* **Chugga-chugga-chugga-chugga-chugga-chugga-chugga-chugga-choo-choo** *Isolated* Do you see the house? Where's the house

	(baby vocalizes) ya there it is! **<u>Tree</u>** Oh no it's so windy **Woooshshhhhh** *Isolation* **shhhh** *Isolation* do you see the **tree?** *Final* The **tree** is sideways and its broken right there *Initial* And the clouds It's raining **Pitter-patter-pitter-patter** *isolated* Do you see the clouds? (baby vocalizes) mm-hmm **<u>Cat</u>** Ah the **cat** *Final* Do you see the **cat?***Final* **Meow** *Isolation* **Meow** *Isolation* And he climbed up on the couch is he supposed to be there? Mmm I don't know Maybe he'll jump down on the floor And lay on the carpet (baby : da-da) the **cat** ya *Initial* Do you see the flowers? Flowers (Baby: du-duh) ya the flowers Ok ready? **<u>Puddle</u>** (baby vocalizes da-da) Ya jump! There's 1 2 3 kids Going jump jump jump **Splash-splash-splash** *Isolation* And the **puddle**, see the water? *Medial* And the rain? (sung) '*Rain is falling down **Splash!'** Final* (Baby vocalizes: da da) **<u>Car</u>** (baby vocalizes brrrr) ya the **car** goes **brrrrr** *medial-final* It's going really fast do you see the dust that he makes from the back It means he's going really fast There's clouds in the background do you see them? And the fence And the **car** its yellow and green *Medial* **Brrrrrrr** *Isolation* **<u>Horsey</u>** (baby says 'neigh') **neigh** that's right *initial* The **horsey** it's a grey **horsey** *initial-final* And there's a tree and a sun

	Do you see the sun? (da) ya I know there too The **horsey** goes **pitter-patter-pitter-patter-pitter** *initial - final* **<u>Ducks</u>** Aw the **duck!** *Final* **Quack-Quack** *Isolation* **Quack-Quack** *Isolation* And look a mushroom Do you remember the mushroom from yesterday? And the water The du- The **duckies** are gonna go in the water *Initial* (baby vocalizes du-du) **Ducky** ya *Initial* 1 2 3 4 **duckies!** *Final* Sneeze **AAAA-choo** *Isolation* He's having a **sneeze** *Final* **Haaaa-choo** *Isolation* Do you see the Kleenex? I don't think you've seen that before Mm-hmm he's sick He might have cold Do you remember when you had a cold? **Haa-(baby says brrr)-choo** *Isolation* oh ya that's right brrrr my mistake
103	**<u>Train</u>** Do you see the **train** (baby's name)? *Medial* Ok here This is the first car, then the second car, then the third car Do you see where its blue Do you wanna point to where its blue Here's where its blue And what about at the top here do you see some… **<u>Tree</u>** The **tree** *Isolation* Here's the **tree** *Final* Do you see where it broke Right here And there's rain coming down And clouds And wind That's the storm What do you think Oh you wanna look around the room **<u>Kitty</u>** There's the **kitty** *Final* That **kitty** looks a little bit like our puppy doesn't it? *Initial*

	Sitting on the couch and what do you think this is I think it's supposed to be the **kitty meowing** *Medial- Final* Making a noise And what else is in this room There's a TV Do you see the TV A window **<u>Puddle</u>** Look at those kids how many kids do we see there There's 12 3 kids And there's rain coming down And water Ya know water See the sun water **<u>Car</u>** Oh look at the **car**, can you see the **car** going? *Medial- Medial* Here's the wheels of the **car** *Final* And it's going fast down the road And what's in behind the **car?** *Final* is it some mountains And some clouds Ya what do you think? **<u>Horsey</u>** Where's the **horsey?** *Final* Here's the **horsey** *Final* What else do we see in this picture there's a tree and the sun and some clouds And what do you think the **horsey's** trotting on *Medial* Is it a road Do you think so? **<u>Ducks</u>** Oooh there's the mommy just like you have a mommy Who's your mommy (baby's name) Is it me? Mommy (baby's name) There's the **ducklings** *Final* 1 2 3 Just like there were three children in the rain **<u>Sneeze</u>** What sound is **sneezing**? *Final* Is it **achoo?** *Final* Bless you **Achoo** *Isolation* That's what he's doing right there he's **sneezing** *Final* You love **sneezing** *Final* Do you wanna try to make an **achoo?** *Final* **Achoo** *Isolation* Nope

	You're gonna be serious?
104	**<u>Train</u>** So you can see the **train** (baby's name) *Medial* Look it's going to the left and you can see the way it's drawn It has 12345678 wheels It's going on the black track Umm you can see there's a whistle on the **train** and it has three lines coming out of it and that means that there's sound *Medial* **<u>Tree</u>** You can see there there's a **tree** and the **tree** has bark on it *Medial-Medial* Its drawn so you can see that Oh (baby's name) do you see the storm do you know who really likes the storms Daddy loves to study about storms and those swirls does that means that there's something happening? Maybe some wind and there's rain and it's blowing the **tree** *Final* do you think it's blowing the **tree?** *Final* **<u>Cat</u>** Look (baby's name) this is a **kitty cat** on an inside view *Medial* So you can see its inside a room and it has walls that are yellow kind of like our walls right and it's watching the TV and its talking but the tv doesn't have any pictures on it and you can see that there's pictures on the wall there's some art and there's... **<u>Puddle</u>** Wow (baby's name) do you see these kids I'll take your soother out here for a sec Look at them There's three of them and they all have their arms up like yippee just like you and do you see the rain that's just like in the picture before? **<u>Car</u>** (baby's name) that's a **car** and its green and yellow *Medial* and it's driving on the road and you can see there's like mountains or hills in the background with a blue sky and some fluffy clouds and you can tell its summer because there's green grass Boy it sure is going fast It looks like it might be a bit stinky to me **<u>Horsey</u>** Well (baby's name) can you see there's a gray **horse** and it's got its eyes closed like it's just kind of happily trotting down the path, but it doesn't have its eyes open *Medial* and it's going away from a tree Do you see there's a nice tree? It's got bark like we saw earlier And then there's clouds in the sky and this time there's a sun in the sky **<u>Ducks</u>** (baby's name) do you see that there's 3 little **ducklings** following their mommy? *Medial* And their mommy is **quacking** *Medial*

	and it has three lines and the **ducks** have 2 lines coming out so maybe their talking like a little baby **duck** and they're just right by the water and you can see that the water is blue and there's some reflections of the pussywillows in the water *Medial-Medial* **Sneeze** Do you see there's a little boy **sneezing,** and this picture is not quite like a big full picture it's more like a small picture in the middle *Medial* and the little boy is making a sound like **achoo** and you can see he's wearing a scarf and he's got a shirt on and everything because it's winter he might be cold *Medial* and sometimes when it's cold you can get... a cold Are you tired of this your sliding off my lap?
105	**Train** (baby's name) look there's a **train**, *Final* (gasp) look at the wheels on the **train** *Final* and there's trees (gasp) and look there's a house, Is that a house? Wow (baby's name) look, look at the **train**. *Final* It's going **choo-choo-choo-choo** *Final* **Chugga-chugga-choo-choo** *Isolation* (gasp) Should we do some more? Ready? **Tree** Oh no (gasp) Oh no (baby's name) Ya look at the **tree** it got an owee *Medial* (gasp) Oh no Its go- the wind is going **woosh-sh-sh-sh** *Final* Then it hit the **tree** over, ya the **tree** broke *Medial-Medial* (gasp) Look at the clouds (it's raining that's water That's water Should we do more? Let's see- (baby's name)? **Kitty** (gasp) (gasp) (baby's name) look at the **kitty** *Final* He looks like your **kitty** *Final* that looks like Eddy Look at Eddy **Kitty's** going **meow** *Initial- Final* **Meow-meow** *Isolation* Wow look at the **kitty's** watching TV? *Medial* What is the **kitty** doing watching TV? *Medial* **Puddle** (Baby's name) look at the kids They have shoes on Shoes just like you And (baby vocalizes) ya shoes And there's rain again that's water

	Ya that's water Lookit their wearing their jackets **<u>Car</u>** Oh (baby's name) look at the **car** *final* Its goin **vroom-vroom-vroom** *final* **Vroom** *Isolation* Lookit there's wheels on the **car** *final* The **car** is outside *Initial* Its driving fast Very Fast (baby vocalizes) Ya look at the **car** *Final* There's smoke behind it oh that must be going very fast **<u>Horsey</u>** (baby's name) what does a **horsey** say? *Medial* **Neigh** *Isolation* **Neigh** *Isolation* Ya look the **horsey** *Final* Its walking goin **click-click-click-click-click-click-click-click-click** *Final* (gasp) nice **horsey** *Final* Tha- (baby vocalizes) that's right and there's a tree Tree And the clouds **<u>Ducklings</u>** Oh (baby's name) look at the **duckies** *Final* **Quack-Quack** *Isolation* **Quack-quack-quack** *Isolation* There's a mommy and 1 2 3 babies Ya **Quack-quack-quack** *Isolation* They're about to go into the water For a swim Just like you were swimming **<u>Sneeze</u>** (baby's name) **sneeze!** *Final* **Achoo** *Isolation* **Sneeze** *Isolation* Oh, and look at the little boy her has-he's sick, he has to wipe his nose Poor little boy going **achoo** *Final* See **Achoo** *Isolation* (baby vocalizing) (gasp) Look at the little boy has red shoes on

Appendix C

Participant Transcriptions Coded for Proximity and OW Syntactic Function

Participant	*Transcription*
101	*Numbers denote proximity score Syntax of OW: I= used as an imitation, V=Used as a verb, N=Used as a noun **<u>Train</u>** Do you see the **train?** (22) There's smoke coming out (baby vocalises) ya And there's a little house in the back And three trees 1 2 3 trees Its goes **chugga-chugga-choo-choo**(I) (22) (baby vocalizes) And there's a whistle **Doo doo**(I) (0) *(Proximity analyzed in relation to CW 'whistle') **<u>Tree</u>** (Gasp) look its **windy** It's blowing **whoosh**(I) (2) And it's raining Do you see the rain? It was raining outside when we came in See the rain? And the clouds? And the **tree** is bent way over (no proximity) **<u>Kitty</u>** **Mow-mow-mow**(I) (4) Do you see the **kitty?** (4) There's a **kitty** his name is ned ya (7) And the **kitty's** watching TV (15) What else is in the room Do you see the drapes And the **kitty** he's grey (31) And he's got stripes **<u>Puddle</u>** **Splash splash splash**(I) (6) Do you like to jump in **puddles?** (6) It's raining Remember the rain from the other slide? Mm-hmm And there's three little kids **<u>Car</u>** Oh, look at that **car** its **zooming**(V) (1) (1)

	Going to the race And it's got a big back tire and a little front one And what else is there There's a fence And the **car** is green and yellow (6) And its **zooming**(V) (6) It's going so fast It's got smoke behind it **<u>Horsey</u>** **Clip clop clip clop clip clop clip clop**(I) (2) You see **horsey?** (2) Its goes **neigh prrrrr**(I) (2) And he's walking on cobblestones And there's a sun shining And the **horsey's** gray (12) He's got four legs Ya hi **horsey** (20) You can wave **<u>Ducklings</u>** There's a momma **duck** (1) Goes **Quack quack quack quack**(I) (1) And then three little baby **ducks** (4) The little **ducklings** (1) Goes **quack-quack-quack**(I) (1) **peep-peep-peep**(I) (2) And there going into a pond And those are cattails in the back See there's three 1 2 3 little **ducklings** (20) **<u>Sneeze</u>** He goes **Achoo** (I)**(**no proximity) Do you go **achoo?(I) (**no proximity**)** Ya he's wearing a scarf He's gotta wipe his nose cuz he's sick **Achoo** (I) **(**no proximity) He looks pretty sick He's got rosy cheeks His eyes are closed
102	**<u>Train</u>** Oh, do you see the **train?** (0) **Choo-choo choo-choo**(I) (0), (1) Ya and there's grass Oh, and the smoke coming out There **choo-choo**(I) (13) **Chugga-chugga-chugga-chugga-chugga-chugga-chugga-chugga-choo-choo**(I) (14) Do you see the house? Where's the house (baby vocalizes) ya there it is!

	<u>Tree</u> Oh no it's so windy **Woooshshhhhh** (I) (0) ***proximity compared to CW 'windy'*** **Wshhhh** (I) (1) do you see the **tree?** (no proximity) The **tree** is sideways and its broken right there (no proximity) And the clouds It's raining **Pitter patter pitter patter** (I) (0)***proximity compared to CW 'raining'*** Do you see the clouds? (baby vocalizes) mm-hmm **<u>Cat</u>** Ah the **cat** (5) Do you see the **cat?**(0) **Meow**(I) (0) **Meow** (I) (1) And he climbed up on the couch is he supposed to be there? Mm I don't know Maybe he'll jump down on the floor And lay on the carpet (baby : da-da) the **cat** ya (30) Do you see the flowers? Flowers (Baby: du-duh) ya the flowers Ok ready? **<u>Puddle</u>** (baby vocalizes da-da) Ya jump! There's 1 2 3 kids Going jump jump jump **Splash splash splash** (I) (2) And the **puddle**, see the water? (2) And the rain? (sung) Rain is falling down ***Splash!*** (I) (10) (Baby vocalizes: da da) **<u>Car</u>** (baby vocalizes brrrr) ya the **car** goes **brrrrr** (I) (1), (1) It's going really fast do you see the dust that he makes from the back It means he's going really fast There's clouds in the background do you see them? And the fence And the **car** its yellow and green (4) **Brrrrrrr** (I) (4) **<u>Horsey</u>** (baby says 'neigh') **neigh** (I) that's right (3) The **horsey** it's a grey **horsey** (3), (7) And there's a tree and a sun Do you see the sun?

	(da) ya I know there too The **horsey** goes **pitter-patter-pitter-patter-pitter** (I) (1), (1) **Ducks** Aw the **duck!** (0) **Quack-Quack Quack-Quack**(I) (0), (1) And look a mushroom Do you remember the mushroom from yesterday? And the water The du- the **duckies** are gonna go in the water (17) (baby vocalizes du-du) **Ducky** ya (24) 1 2 3 4 **duckies!** (30) Sneeze **AAAA-choo**(I) (3) He's having a **sneeze** (0) **Haaaa-choo** (I) (0) Do you see the Kleenex? I don't think you've seen that before Mm-hmm he's sick He might have cold Do you remember when you had a cold? **Haa-(baby says brrr)-choo**(I) (27) oh ya that's right brrrr my mistake
103	**<u>Train</u>** Do you see the **train** (baby's name)? (no proximity) Ok here This is the first car, then the second car, then the third car Do you see where its blue Do you wanna point to where its blue Here's where its blue And what about at the top here do you see some… **<u>Tree</u>** The **tree** (no proximity) Here's the **tree** (no proximity) Do you see where it broke Right here And there's rain coming down And clouds And wind That's the storm What do you think Oh you wanna look around the room **<u>Kitty</u>** There's the **kitty (**29) That **kitty** looks a little bit like our puppy doesn't it (27) Sitting on the couch and what do you think this is I think it's supposed to be the **kitty meowing** (V) (0), (0) Making a noise

	And what else is in this room There's a TV Do you see the TV A window **<u>Puddle</u>** Look at those kids how many kids do we see there There's 12 3 kids And there's rain coming down And water Ya know water See the sun water **<u>Car</u>** Oh look at the **car**, can you see the **car** going? (no proximity) ,(no proximity) Here's the wheels of the **car** (no proximity) And it's going fast down the road And what's in behind the **car** is it some mountains (no proximity) And some clouds Ya what do you think? **<u>Horsey</u>** Where's the **horsey?** (no proximity) Here's the **horsey** (no proximity) What else do we see in this picture there's a tree and the sun and some clouds And what do you think the **horsey's** trotting on (no proximity) Is it a road Do you think so? **<u>Ducks</u>** Oooh there's the mommy just like you have a mommy Who's your mommy (baby's name) Is it me? Mommy (baby's name) There's the **ducklings** (no proximity) 1 2 3 Just like there were three children in the rain **<u>Sneeze</u>** What sound is **sneezing**? (2) Is it **achoo?** (N) (2) Bless you **Achoo** (I) (5) That's what he's doing right there he's **sneezing** (7) You love **sneezing** (7) Do you wanna try to make an **achoo?** (N) (7) **Achoo** (I) (8) Nope You're gonna be serious?
104	**<u>Train</u>** So you can see the **train** (baby's name) (no proximity)

	Look it's going to the left and you can see the way it's drawn It has 12345678 wheels It's going on the black track Umm you can see there's a whistle on the **train** and it has three lines coming out of it and that means that there's sound (no proximity) **Tree** You can see there there's a **tree** and the **tree** has bark on it (no proximity),(no proximity) Its drawn so you can see that Oh (baby's name) do you see the storm do you know who really likes the storms Daddy loves to study about storms and those swirls does that means that there's something happening? Maybe some wind and there's rain and it's blowing the **tree** (no proximity) do you think it's blowing the **tree?** (no proximity) **Cat** Look (baby's name) this is a **kitty cat** on an inside view (no proximity) So you can see its inside a room and it has walls that are yellow kind of like our walls right and it's watching the TV and its talking but the tv doesn't have any pictures on it and you can see that there's pictures on the wall there's some art and there's... **Puddle** Wow (baby's name) do you see these kids I'll take your soother out here for a sec Look at them There's three of them and they all have their arms up like yippee just like you and do you see the rain that's just like in the picture before? **Car** (baby's name) that's a **car** and its green and yellow (no proximity) and it's driving on the road and you can see there's like mountains or hills in the background with a blue sky and some fluffy clouds and you can tell its summer because there's green grass Boy it sure is going fast It looks like it might be a bit stinky to me **Horsey** Well (baby's name) can you see there's a gray **horse** and it's got its eyes closed like it's just kind of happily trotting down the path, but it doesn't have its eyes open (no proximity) and it's going away from a tree Do you see there's a nice tree? It's got bark like we saw earlier And then there's clouds in the sky and this time there's a sun in the sky **Ducks** (baby's name) do you see that there's 3 little **ducklings (7)** following their mommy? And their mommy is **quacking** (V) (7) and it has three lines and the **ducks** (7) have 2 lines coming out so maybe they're talking like a little baby **duck** (21) and they're just right by the water and you can see that the water is blue and there's some reflections of the pussywillows in the water **Sneeze**

	Do you see there's a little boy **sneezing** (29)and this picture is not quite like a big full picture it's more like a small picture in the middle and the little boy is making a sound like(29) **achoo** (I) and you can see he's wearing a scarf and he's got a shirt on and everything because it's winter he might be cold and sometimes when it's cold you can get... a cold Are you tired of this your sliding off my lap?
105	**<u>Train</u>** (baby's name) look there's a **train**, (28) (gasp) look at the wheels on the **train** (21) and there's trees (gasp) and look there's a house, Is that a house? Wow (baby's name) look, look at the **train**.(2) It's going **choochoochoochoo** (I) (2) **Chuggachugga-choo-choo** (I) **(**3) (gasp) Should we do some more? Ready? **<u>Tree</u>** Oh no (gasp) Oh no (baby's name) Ya look at the **tree** it got an owee (no proximity) (gasp) Oh no Its go- the wind is going **woosh-sh-sh-sh** (I) (2) ******calculated proximity from 'wind'* Then it hit the **tree** over, ya the **tree** broke (no proximity) ,(no proximity) (gasp) Look at the clouds it's raining that's water That's water Should we do more? Let's see- (baby's name)? **<u>Kitty</u>** (gasp) (gasp) (baby's name) look at the **kitty** (14) He looks like your **kitty** that looks like Eddy(9) Look at Eddy **Kitty'**s going **meow** (I) (1),(1) **Meow-meow** (I) (2) Wow look at the **kitty'**s watching TV? (4) What is the **kitty** doing watching TV? (10) **<u>Puddle</u>** (Baby's name) look at the kids They have shoes on Shoes just like you And (baby vocalizes) ya shoes And there's rain again that's water Ya that's water Lookit their wearing their jackets **<u>Car</u>** Oh (baby's name) look at the **car** (2) Its goin **vroom-vroom-vroom** (I) (2) **Vroom** (I) (3)

	Lookit there's wheels on the **car** (5) The **car** is outside (7) Its driving fast Very Fast (baby vocalizes) Ya look at the **car** (19) There's smoke behind it oh that must be going very fast **<u>Horsey</u>** (baby's name) what does a **horsey** say? (1) **Neigh** (I) **Neigh** (I) (2) Ya look the **horsey** (3) Its walking goin **clickclickclickclickclickclickclickclick** (I) (1) (gasp) nice **horsey** (1) Tha- (baby vocalizes) that's right and there's a tree Tree And the clouds **<u>Ducklings</u>** Oh (baby's name) look at the **duckies** (0) **Quack Quack** (I) (0) **Quack-quack-quack** (I) (1) There's a mommy and 1 2 3 babies Ya **Quack-quack-quack** (I) (9) They're about to go into the water For a swim Just like you were swimming **<u>Sneeze</u>** (baby's name) **sneeze!** (0) **Achoo** (I) (0) **Sneeze (**0) Oh and look at the little boy he has-he's sick, he has to wipe his nose Poor little boy going **achoo** (I) (21) See **Achoo** (I) (23) (baby vocalizing) (gasp) Look at the little boy has red shoes on