2014

The Role of Native Language Acquisition in Infant Preferences of Speech and Song

Emma J. Fogel

THE ROLE OF NATIVE LANGUAGE ACQUISITION IN INFANT PREFERENCES OF SPEECH AND SONG

by

Emma Fogel

Department of Psychology

Submitted in Partial Fulfillment

of the requirements for the degree of

Bachelor of Arts

In

Honours Psychology

Faculty of Arts and Social Science

Huron University College

London, Canada

April 2, 2014

HURON UNIVERISTY COLLEGE

FACSIMILE OF CERTIFICATE OF EXAMINATION
(The Original With Signatures is on file in the Department)

Advisor: Dr. Christine Tsang

Reader: Dr. Mark Cole

The thesis by:

Emma Fogel

Entitled:

The Role of Native Language Acquisition In Infant Preferences of Speech And Song

is accepted in partial fulfillment of the requirements for the degree of

Bachelor of Arts

In

Honours Psychology

April 21, 2014
Date

Dr. Christine Tsang
Chair of Department

Abstract

Previous research by Persaud (2013) found that infant listeners preferentially listen longer to sung stimuli over spoken stimuli, regardless of the age of the infant. The present study tests two age groups of infants to determine whether early language exposure affects infants' listening preferences for song and speech. Six- to seven-month-old infants and eight- to ten-month-old infants from English speaking homes were presented with auditory stimuli of English-speaking women speaking or singing and tested in a head-turn preference task. Consistent with the findings from Persaud (2013), it was found that both age groups listened longer to the sung stimuli compared to the spoken stimuli. This suggests that song is inherently more attractive to infants, possibly because song stimuli are generally less acoustically variable compared to speech stimuli, and therefore ultimately easier for infants to cognitively process compared to speech stimuli. The results of this study support a processing-based account of infants' preferences for ID-stimuli.

Acknowledgments

I would first and foremost like to thank my family and friends for their support throughout this process. They offered unconditional love, strength and encouragement that was imperative for the completion of my thesis. To my boyfriend Dustin, thank you for your unfailing ability to uplift my spirits and motivate me each and every day. You have been my steady rock of support for the past eight years, and for that I am eternally grateful. Finally, to Dr. Christine Tsang - my professor, my advisor and my mentor throughout the majority of my undergraduate career. Your guidance, feedback, and unwavering patience have made a monumental impact on me. I trust and value your advice not just in reference to psychology, but in other areas of my life as well. I truly believe that you are one of the best educators I have ever had, and it was a privilege to have you as a mentor.

Table of Contents

Introduction

Both speech and song are forms of vocal communication, composed of produced words that connect together smoothly to produce comprehensible sentences or phrases. They both utilize a combination of the respiratory system, the larynx and the vocal tract in order to provide the crucial variation range that is required for production of vocal pitch, frequencies, and phonetic distinction (Mantell & Pfordresher, 2013). Speech and song differ in various ways; song typically has more amplitude energy (intensity) at steady and repetitive frequencies (Stegemoller, Skoe, Nicol, Warrier & Kraus, 2008), and speech generally has a quicker tempo with a larger variation of utterances in terms of length (duration), complexity and grammar (Soderstrom, Seidl, Nelson & Jusczyk, 2003).

Infant-directed (ID) speech and song are both syntactically and semantically simplified, and have been shown to be preferred over adult-directed (AD) stimuli by infant listeners. The acoustic qualities of ID communication are simplified and exaggerated phonetics (Liu, Kuhl & Tsao, 2003), heightened pitch, slower tempo, shorter utterances with frequent pauses, repetition, and more inflated pitch contours in comparison with AD communication (Trainor, 1996). These exaggerated characteristics are believed to allow the infant to process and understand the communicative intent easier than that of adult-directed speech and song, which possibly explains why infants generally prefer to listen to ID stimuli over non-ID stimuli (Liu, et al., 2003).

Recently, studies have found that infants prefer to listen to ID-song over ID-speech (Falk, 2011; Nakata & Trehub, 2004; Persaud, 2013), but the question is – why does this occur if both forms of ID communication share similar acoustic properties? Although both ID-speech and -song have exaggerated audible characteristics, music may

have the inherent ability to communicate with more emotion, than does speech. The intent of the majority of ID-songs is to soothe, comfort or arouse the infant, while the aim of ID-speech is to communicate verbal content (Trehub, Unyk & Trainor, 1993). This may contribute to the preference for song, as the objective of ID-music is to induce positive emotions within the child, in comparison to the goal of ID-speech, which is to educate the spoken language's semantics. Consistent with its intention to elicit positive affective states, the acoustics of ID-song are preferred early on by infants as they are more attractive to attend to, compared to ID-speech: the contours are smoother, there is more repetition and the pitch is narrower than ID-speech (Trehub, et al., 1993). These specific acoustic characteristics of song are even more exaggerated than those of ID-speech, which hypothetically could enhance the listening preference exhibited by infants'.

Another potential reason as to why ID-song is preferred to ID-speech involves the frequency of vowel information present in both types of communication. The ratio of vowels to consonants in song is 5:1, and in speech it is 1:1 (Liu, et al., 2003). It has been established that the more vowels present in the speech/song sample, the easier it is for the infant to be able to accurately discriminate speech (Liu, et al., 2003). Bradlow, Torretta and Pisoni (1996) investigated why this occurs, and found that communication with more vowels was found to convey superior clarity over communication with more consonants. Vowels allow for greater articulatory precision and more easily identifiable acoustic differences between phonemes (Bradlow et al., 1996). This suggests that ID-song, with its relatively higher vowel count, allows for clearer dialogue production versus ID-speech

with less vowels, making the communicative intention in song easier to understand for infants, and thus the reason why they prefer it.

The acoustic stability of the stimulus may also contribute to infant listening preferences for ID-song over ID-speech. In observing the characteristic acoustic differences between ID-song and ID-speech, the features of ID-speech are considered to be significantly more variable than ID-song stimuli (Falk, 2010; Eckardt, 1999; Liu, et al., 2003). Trainor, Clark, Huntley and Adams (1997) established that common features of ID-speech such as higher pitch, increased pitch ranges and fewer vowels are perceived to be less stable than the narrow pitch ranges, smoother contours and increased vowel content that exist in ID-song. Furthermore, there is more variation between and within speakers with regards to speech in comparison to singing. This is another potential reason as to why infants prefer ID-song stimuli versus ID-speech– in an environment that is ever changing, infants perhaps prefer to attend to stimuli that offer more stable and consistent qualities, versus stimuli that are unpredictable. Fewer cognitive resources are required in the perceptual processing of stable stimuli in comparison to variable stimuli, allowing for less effortful comprehension of the stimuli (Trainor et al., 1997).

Nakata & Trehub (2004) demonstrated results that were in support of the theoretical research regarding infant preferences for musical stimuli over spoken language. Their study demonstrated that infants 5.5–6.5 months of age had longer cumulative visual fixation and minimal body movement when their mother's voice was sung over a video in comparison to situations in which their mother's voice was simply speaking. Infants' increased attention to song versus speech, revealed their attentional preference for sung stimuli over spoken stimuli.

Most recently, Persaud (2013) established that infants listened longer to an ID-song sample compared to ID-speech sample when tested using a head-turn paradigm. The participant samples were two groups of English-speaking 6- and 7- month olds and 8- and 9- month olds. Both the spoken and sung samples used were presented in Russian, a language that the infant participants presumably had little or no exposure to. Interestingly, Persaud (2013) found that both age groups showed longer looking times to song samples versus speech samples. This is intriguing, because it could be hypothesized that the two participant groups, different in age, might have attended to dissimilar stimuli. This prediction is supported by the fact that older infants have had longer exposure to spoken language, and as a result would recognize speech more readily than would younger infants. This would then lead to the hypothesis that older infants would attend longer to the speech sample of communication, and younger infants, with less exposure to spoken language and lesser cognitive processing abilities, would attend longer to the song sample.

A possible explanation for the lack of speech preference due to age reported by Persaud (2013) is perhaps due to the language of the communication samples. As all the samples were in Russian and the participants were all from English-speaking families, it is likely that both age groups had no familiarity with Russian and therefore their lack of familiarity caused both participant groups to neglect the semantic component of the communication samples. In other words, there was no need for the older sample to use their superior processing to process the speech stimuli, because the speech was not perceived as semantic utterances of English that could be segmented as language. Furthermore, the sung sample presumably had more vowels, higher pitch, slower tempo,

and more emotionality in comparison to the speech sample, which is generally more attractive to infants.

Would the same preference for song in older infants still occur if the communication samples were in the native language of the participants? In other words, would infants pay more attention to stable acoustic characteristics over important semantic distinctions in the samples? Guenther and Gjaja (1996) claimed that infants acquire speech perception of their native language within the first year due to early exposure to that language which results in greater sensitivity to that language's phonetics, consequentially causing superior discriminatory abilities. Therefore, it is assumed that the older the infants are, the more exposure they will have had to their native language, making their perceptual abilities of the language more advanced than those of a younger infant. This research supports the notion that in a preference task of speech versus song in the infants' native language, older infants will attend longer to the speech sample as they have superior processing abilities and presumably are more familiar with spoken language. In comparison, younger infants have had less exposure to spoken language, and their language processing abilities are not as sophisticated, thereby influencing their attention preferences towards the song sample.

The current study is a partial replication of the Persaud (2013) study, but instead of using Russian ID-samples, the present study uses English ID-samples. It is predicted that with the similar age groups and using English samples of communication instead of Russian, the speech versus song preferences of the infant groups will differ. A prediction is that the older participants will attend longer to the speech sample over the song sample, as the infants have had longer exposure to their native language of English. Because of

their age, they may understand more about the linguistic properties of English and consequently will recognize (and prefer) speech over song. The younger infants are predicted to attend longer to song, as they will focus more on the acoustic qualities of music being that they have not had as long exposure with their native language linguistics, and therefore cannot comprehend it as well as the older sample. However, an alternative hypothesis is that both age groups may prefer to attend to song stimuli overall regardless of the language of presentation, similar to what has already been found by Persaud (2013), as song stimuli has less variability and therefore requires fewer cognitive resources for accurate comprehension. Furthermore, song stimuli has been established to be inherently more attractive for an infant to attend to, which may influence both participant groups' preferences.

Method

Participants

Ten 6- to 7-month old infants (two boys and eight girls, mean age = 6.89, range = 6.14-7.19) and eleven 8- to 10-month old infants (four boys and seven girls, mean age = 8.88, range = 8.08-10.27) participated in this study. At the time of testing, infants were healthy and had no reported history of ear infections or family hearing loss.

Materials

Infant-directed samples from a study examining differences in the manner in which mothers sang and spoke to their infants were used in the current research. The song samples were short melodies of English mothers singing to their infants. The speech samples were short phrases of English. Both the speech and song samples were matched acoustically to the each of the individual Russian samples used by Persaud (2013). The

duration of the speech samples, the range and the number of syllables in each speech sample were almost identical to those of the Russian speech samples. Similarly, the duration of the song samples, the sample's stability and the number of syllables in each song sample were almost identical to those of the Russian song samples. Word frequencies in English for both the song and speech samples were calculated, based on the World Frequency database (Davies, 2013). The word "highchair" was the one noun excluded from frequency analysis of the 51-word list, as it was not listed in the database. An analysis of the word frequency in both the speech and song stimuli indicated that there was no reason to believe the two stimuli sets were different from one another on this dimension.

Adult listeners were asked to rate the six speech samples and five song samples on two 7-point emotionality scales, based on the speakers' tone of voice. For the first scale, 1 represented "Not Loving" and 7 represented "Very Loving". On the second emotionality scale, 1 presented "Not Smiley", and 7 represented "Very Smiley". The emotionality ratings were tabulated and then averaged among listeners to determine the overall emotionality rating for each speech and song sample. The song stimuli were rated as more "loving" and "smiley" than the speech stimuli, and additionally the speech stimuli ratings had a larger range of ratings, revealing that the perception of speech stimuli were more variable than song stimuli.

Procedure

Infants were tested individually in a head-turn preference procedure. During this preference test, the parent sat on a chair in between two cabinets, and infants were seated on their parent's lap directly across from the experimenter. Sound speakers, which played

the audio stimuli, were located on the top of the cabinets and below each speaker was a monitor that displayed the visual stimuli. See Figure 1 for the laboratory setting arrangement. The visual stimulus was Mickey Mouse, used to attract the attention of the infant as well as serve as a directional cue for the location of the auditory stimuli. Both the experimenter and the parent listened to masking music through headphones, which made them subsequently deaf to what the infant heard during the experiment. Each trial was initiated by the experimenter pressing a key on the keyboard when the infant was attentive and facing forward. This triggered the computer to flash the visual stimulus on the monitor, either on the right side or the left side of the infant. When the infant produced a 45-degree head-turn towards Mickey Mouse, the experimenter pressed another button and the computer began to play one of the two types of stimuli (e.g., song on left). Pressing this button also initiated a timer for the looking-time behavior for this particular trial. Concurrently, Mickey Mouse stopped flashing on monitor and remained as a still image, to act as the visual target for the infant to look at. The trial ended when the infant looked away (45 degree head turn) for a minimum of 2 seconds, where then the experimenter pressed another button to extinguish the auditory presentation and the visual display.

The following trial occurred on the other side of the infant, and consisted of the other stimulus (e.g., speech on right) and the same visual display. Speech and song trials alternated until the infant has completed 10 trials in total (i.e., five speech stimuli trials and five song stimuli trials). Infants were counterbalanced for direction (i.e., half started on the left and the other half started on the right).

Figure 1. Head-turn preference procedure laboratory setting.

Results

Before we conducted the analysis to determine whether infants listened longer to the speech or song stimuli, a preliminary analysis was conducted to ensure that the initial side of presentation did not affect infant looking times. A 2 X 2 analysis of variance with initial side of presentation (right or left) as the between-subjects variable and overall looking times to both speech and song stimuli as the within-subjects variable. No significant effects were found. Thus, we collapsed across side of presentation in the subsequent analysis.

A 2 X 2 analysis of variance with age (6- to 7-months or 8- to 10-months) as the between-subjects variable, stimulus type (ID-speech or ID-song) as the within-subjects variables. Looking-time (in seconds) was the dependent variable. There was no significant main effects found for stimulus type, $F(1, 19) = 2.22$, $p = 0.15$, $\eta^2 = 0.1$. There was a significant main effect for age, $F(1, 19) = 5.70$, $p = 0.03$, $\eta^2 = 0.62$, such that

younger infants generally looked longer than older infants (38.41 sec compared to 28.03 sec, respectively). In addition, there was no significant interaction for age and looking time to both ID-speech and ID-song, $F(1,19) = 0.23$, $p = 0.64$, $\eta^2 = 0.012$. Figure 2 shows the looking times to speech and song stimuli across the two age groups in the experiment.

Discussion

Persaud (2013) found that independent of age, infant participants significantly preferred ID-song over ID-speech. Based on these past results, the prediction in the present study which included stimuli of the participants' native language, was that older English-speaking infants would prefer English spoken samples as they have had longer exposure to their native language in their surroundings. This is in comparison to younger English-speaking infants, who presumably have had less exposure to spoken English and therefore would use acoustic qualities as the primary basis for their preference. It was predicted that the older infants would utilize their superior knowledge of English in their cognitive perceptual processing of the incoming stimuli, and attend predominantly to the semantic qualities of the stimuli over the acoustic properties of the stimuli. While statistically the results did not reach significance, the directionality of the results is consistent with past studies (Falk, 2011; Nakata & Trehub, 2004; Persaud, 2013), Infants looked longer to ID-song compared to ID-speech in both age groups.
such that ID-song was marginally preferred by both age groups, despite using native language stimuli. In effect, the presence of native language seems to have actually diminished the differences between infants' attentional preferences between speech and song stimuli, but did not change the overall directionality of the preference.

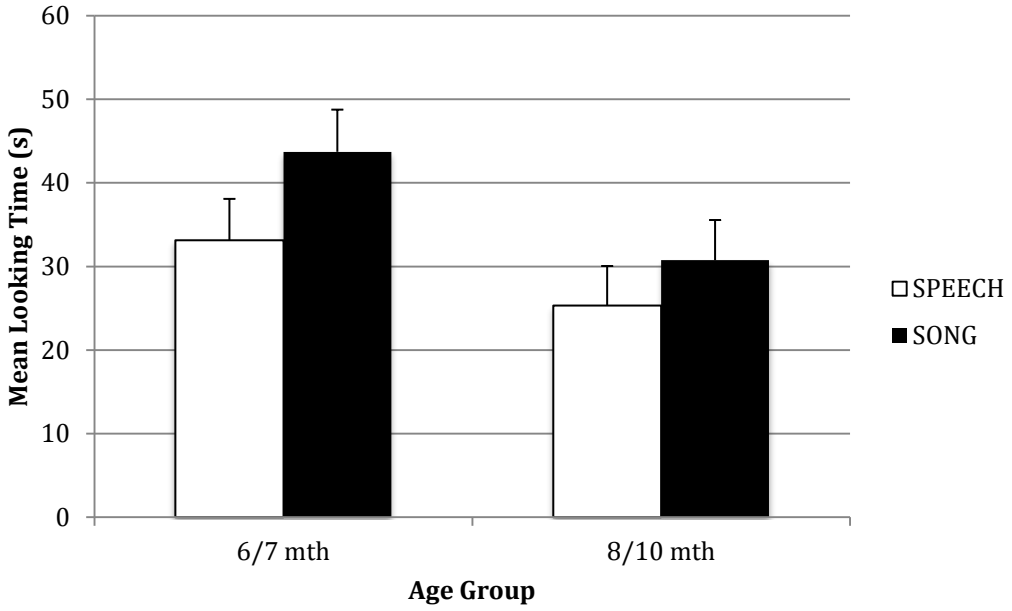

Figure 2. Overall looking time in seconds to ID-speech and ID-song stimuli across age group. Error bars represent the standard error of the mean.

Although the results of the present study were not found to be statistically significant, a general attentional bias for song stimuli was observed. While Persaud (2013) found a significant main effect of stimulus preference (in the same direction as in the present study), this difference can potentially be attributed to the presence of native language in the current study. The stimuli used by Persaud (2013) were in an entirely unfamiliar language to the infant participants. It is unlikely that a non-native Russian-speaker would be able to make linguistic sense of the phonetic variability present in the stimuli, much less understand the semantics of any of the samples. This enabled the infants to focus predominantly on the simple acoustics of the sample stimuli, of which the song stimuli are the most stable, and therefore more attractive.

The use of English stimuli in the present study may have contributed to the increased variability in infant looking times, as knowledge of their own native language would contribute the infants' comprehension of the samples. This superior comprehension of English phonetics and semantics would impact the infants' recognition and perceptual processing of acoustic variability within the stimuli, influencing their attentional capacity more so than a non-native language.

Another possible explanation for preference of song in comparison to speech can be attributed to the fact that the characteristics of ID-song are significantly more stable and consistent than ID-speech, and therefore the cues for the communicative messages and linguistic structures within the musical stimuli are more accessible for the infants and easier to perceptually process. Common features of ID-speech are increased pitch ranges and higher pitch, which have been established to be less stable than the narrow pitch

ranges found in ID-song (Trainor et al., 1997). Moreover, ID-speech, along with spoken language in general, varies significantly between speakers and within speakers, adding to the immense variability. The frequent and augmented changes in speech are more difficult for an infant for process cognitively. Consequently, the processing necessary for accurate comprehension of speech stimuli requires more effort and focus. The variability within speech presumably decreases the infants' desire to attend to these ever-changing stimuli, as enhanced attentional capacities are required. This is in comparison to ID-song, which contains more rhythmic and pitch regularities (regular intervals and beat structure) and the amount of segmental consistency over time is substantially increased due to the expansion of sonorant portions in the signal (Persaud, 2013). This largely contributes to the consistency and stability of song stimuli. Less variability in the song stimulus may influence the infants' attention and subsequent preferences as perceptual breakdown of these stimuli are easier to process, and therefore easier to understand. The regularity within music and song stimuli requires less complex and arduous processing by the infant as there are less variations for the cognitive load to constantly adjust to, presumably manipulating infant preferences.

The notion that infants would prefer to cognitively process stimuli that contain less variability is supported by various studies (Trainor, Wu & Tsang, 2004; Trainor, Tsang & Cheung, 2002) that show infants' enhanced ability to perceive the consistencies that exist in a musical context. Infants have demonstrated their ability to perceive pitch relations and melodic contour in music stimuli (Trainor, et al., 2004), and furthermore discriminate between consonant and dissonant musical intervals (Trainor, et al., 2002). It can therefore be assumed that the cognitive load required to process song samples is

lighter and/or easier for the infant in comparison to processing speech samples. Due to its enhanced variability, speech is more difficult for an infant to process and consequently understand, providing support for the infants' preference of song in the current examination.

The characteristic acoustic qualities and increased acoustic stability that exist in song stimuli have also been found to be inherently more attractive for an infant to attend to (Trehub, Unyk & Trainor, 1993), and likely influences infant attention, language, and emotional learning capacities. For example, song stimuli have longer vowel portions and increased pitch stability, which may contribute to infants' language learning by making the individual vowels more physically and perceptually distinct (Uther, Knoll & Burnham, 2007). This is important as infants have been found to attend and discriminate vowels earlier than consonants (Werker & Tees, 2005), and as aforementioned, there are significantly more vowels present in song samples than in speech (Liu, et al., 2003). In addition, the narrow pitch range, smooth melodic contours and slower tempo of ID-song have also been found to correlate with the vocal expression of love and the practice of comforting between caretaker and infant (Trainor, Austin & Desjardins, 2000). This may contribute to the inherent attraction of song by the infants as the same sentiment of comfort and soothing will be evoked by the musical qualities of song as they would during caretaking.

The participant group size and age range are both limitations that may have contributed to the lack of significant effects and variability within the data. The small sample size of the current study (21 infants) and the unbalanced age range, perhaps caused within-subject variability to have a significant impact on the overall results. It is

predicted that if the subject group was larger, the variability within the results would decrease and the significance of the main effect of infant stimuli preferences towards ID-song would increase. Additionally, there were not an equal number of younger and older infants, nor were there an equal number of males and females in the sample. There were only six male infant participants, with the rest being female. The younger infant age range included both 6-month and 7-month-olds, yet it must be noted that only two 6-month olds were present in the sample. Furthermore, the older infant group range was 8-month to 10- month olds, but there were no 9- month olds included in the participant sample. This limited the possible differences between the two groups tested in the present study, and future extensions of this study should increase the overall sample size, ensure a better balance between males and females, and incorporate a larger range of ages. It would also be interesting to observe in a future replication if the age range was amplified to include younger infants (e.g., 4- month-olds) versus even older infants (e.g., 14-month-olds), and whether the stability of song would still hold superior influence in the perceptual processing of stimuli.

An additional intriguing future examination could be to investigate if there are specific characteristics within the stimuli that infants are most sensitive to in their perceptual processing. While variability of stimulus remains as a supportive explanation to justify infant preferences, is there is a certain characteristic within the stimulus is the infant most responsive to? In other words, what aspect of the stimulus can infants detect or attend to the most, and are therefore most sensitive to that trait's variability? Perhaps the infant is not detecting the stimuli's overall variability, but rather the changes within an individual trait. The speech and song stimuli utilized in the current study contained

various pitch heights, ranges and temporal mechanisms. Therefore, it is unclear whether the variability detected within the speech stimuli specifically pertained to pitch variability, contour variability or other linguistic characteristics. This future study could investigate which characteristic within the speech and song stimuli are most captivating and attractive for infants, thereby providing evidence for which trait influences their subsequent cognitive processing the most.

This examination provided further confirmation that infants have a general attentional preference for song stimuli. With its characteristics of consistency regarding pitch ranges, temporal mechanisms, melodic contours, and higher presence of vowels, ID-song is inherently more attractive and hypothesized to be easier for infants to cognitively process in comparison to the variability that exists in ID-speech. This study also elicited some insight into the role of native language in cognitive processing of speech and song stimuli, suggesting that superior knowledge of the native language influences attentional capacities to focus not just on the acoustic qualities of the stimuli, but also on the immense variability and linguistic characteristics. This provides a potential explanation for why infants in the present study and various past examinations prefer the ID-song stimuli in comparison to the ID-speech samples.

References

Bradlow, A.R., Torretta, G.M., & Pisoni, D.B. (1996). Intelligibility of normal speech I: global and fine-grained acoustic- phonetic talker characteristics. *Speech Communication, 20*, 255–272.

Davies, M. (2013). Word Frequency Data: Corpus of Contemporary American English. Retrieved November 18, 2013, from http://www.wordfrequency.info/.

Eckardt, F. (1999). *Sprechen und Singen im Vergleich artikulatorischer Bewegungen* [Comparing the articulatory movements in speaking and singing]. Darmstadt: Thiasos Musikverlag.

Falk, S. (2011): Melodic vs. intonational coding of communicative functions – A comparison of tonal contours in infant-directed song and speech. *Psychomusicology, 21,* 53-68.

Guenther, F. H., & Gjaja, M. N. (1996). The perceptual magnet effect as an emergent property of neural map formation. *Journal of the Acoustical Society of America*, *100*, 1111–1121.

Liu, H., Kuhl, P. K., & Tsao, F. (2003). An association between mothers' speech clarity and infants' speech discrimination skills. *Developmental Science, 6*, 1-10.

Mantell, J. T., & Pfordresher, P. Q. (2013). Vocal imitation of song and speech. *Cognition, 127,* 177-202.

Nakata, T., & Trehub, S. E. (2004). Infants' responsiveness to maternal speech and singing. *Infant Behavior & Development, 27*, 455-464.

Persaud, A. (2013). *Infants prefer infant-directed song over speech: A processing account of infants' perception of infant-directed stimuli.* (Unpublished Honors

B.A. Thesis Dissertation). Huron University College at Western, London, ON CANADA.

Shenfield, T., Trehub, S., & Nakata, T. (2003). Maternal singing modulates infant arousal. *Psychology of Music*, *31*, 365–375.

Soderstrom, M., Seidl, A., Nelson, D. G. K., & Jusczyk, P. W. (2003). The prosodic bootstrapping of phrases: Evidence from prelinguistic infants. *Journal of Memory and Language, 49*, 249-267.

Stegemoller, E. L., Skoe, E., Nicol, T., Warrier, C. M., & Kraus, N. (2008). Music training and vocal production of speech and song. *Vocal Production of Speech and Sound, 25*, 419-428.

Trainor, L. J. (1996). Infant preferences for infant-directed versus non infant-directed playsongs and lullabies. *Infant Behavior & Development, 19*, 83-92.

Trainor, L. J., Austin, C. M., & Desjardins, R. N. (2000). Is infant-directed speech prosody a result of the vocal expression of emotion? *Psychological Science, 11*, 188-195.

Trainor, L. J., Clark, E. D., Huntley, A., & Adams, B. A. (1997). The acoustic basis of preferences for infant-directed singing. *Infant Behavior & Development, 20*, 383-396.

Trainor, L. J., & Desjardins, R. N. (2002). Pitch characteristics of infant-directed speech affect infants' ability to discriminate vowels. *Psychonomic Bulletin & Review, 9*, 335-340.

Trainor, L. J., Tsang, C. D., & Cheung, V. H. W. (2002). Preference for sensory consonance in 2- and 4-month-old infants. *Music Perception, 20*, 187-194.

Trainor, L. J., Wu, L., & Tsang, C. D. (2004). Long-term memory for music: Infants remember tempo and timbre. *Developmental Science*, *7*, 289-296.

Trainor, L. J., & Zacharias, C. A. (1998). Infants prefer higher-pitched singing. *Infant Behavior & Development, 21*, 799-805.

Trehub, S. E., Unyk, A. M., & Trainor, L. J. (1993). Adults identify infant-directed music across cultures. *Infant Behavior and Development*, *16*, 193–211.

Uther, M., Knoll, M. A., & Burnham, D. (2007). Do you speak E-NG-L-I-SH? A comparison of foreigner- and infant-directed speech. *Speech Communication, 49*, 2-7.

Werker, J. F., & Tees, R. C. (1984). Cross-language speech perception: Evidence for perceptual reorganization during the first year of life. *Infant Behavior & Development, 7*, 49-63.

Curriculum Vitae

Name:	Emma Fogel
Place and Year of Birth:	Toronto, Canada, April 5, 1992
Secondary School Diploma:	Senior Matriculation, Bishop Strachan School, Toronto, Canada
Experience:	Independent study student in Development laboratory at Huron College, Western University Volunteer in Adolescent Mental Health Ward at St. Joseph's Hospital, in London, Canada
Awards:	Dean's Merit Scholarship at Yeshiva University, New York, USA