

Florida State University Libraries

Electronic Theses, Treatises and Dissertations

The Graduate School

2012

Mothers' Singing to Fetuses: The Effect of Music Education

Candice Sirak



THE FLORIDA STATE UNIVERSITY
COLLEGE OF MUSIC

MOTHERS' SINGING TO FETUSES: THE EFFECT OF MUSIC EDUCATION

By

CANDICE SIRAK

A Thesis submitted to the
College of Music
in partial fulfillment of the
requirements for the degree of
Master of Music

Degree Awarded:
Summer Semester, 2012

Candice Sirak defended this thesis on April 2, 2012.

The members of the supervisory committee were:

Jayne Standley
Professor Directing Thesis

Alice-Ann Darrow
Committee Member

Diane Gregory
Committee Member

Clifford Madsen
Committee Member

The Graduate School has verified and approved the above-named committee members, and certifies that the thesis has been approved in accordance with university requirements.

Dedicated to Christopher Sirak

TABLE OF CONTENTS

List of Tables	v
List of Figures	vi
Abstract	vii
1. CHAPTER ONE, Review of Literature	1
2. CHAPTER TWO, Method	10
3. CHAPTER THREE, Results	14
4. CHAPTER FOUR, Discussion.....	19
APPENDICES	
A. IRB APPROVAL LETTER AND CONSENT FORM	22
B. QUESTIONNAIRE	26
C. RAW DATA	30
REFERENCES.....	39
BIOGRAPHICAL SKETCH.....	44

LIST OF TABLES

Table 1 Subject Demographics	11
Table 2 Correlation of Demographics on Pre and Postnatal Singing	16
Table 3 Percentage of Mothers Who Supply Music to Their Feutses by Musical Experience	16
Table 4 Music Education’s Effect on Mothers Singing Prenatally.....	17
Table 5 Music Education’s Effect on Mothers Singing Postnatally	17
Table 6 Effect of Prenatal Singing on Overall Temperament.....	18

LIST OF FIGURES

Figure 1 Genres of Music Mothers Sing During Pregnancy.....	15
Figure 2 Genres of Music Used as a ‘Special Song’ During Pregnancy	15

ABSTRACT

Most mothers would agree that music is a tool they use to calm their baby. Many mothers even use music prenatally for bonding as well as relaxation. The purpose of this study was to discover if having had at least four years of music education during the school years had an effect on whether or not mothers sang to their baby prenatally and if singing prenatally has any effect on the infant's temperament. Volunteer mothers were asked to fill out an on-line questionnaire. The research concluded that having at least four years of music education did not affect whether or not the mother sang to her baby prenatally but that mother's age and income level were correlated (younger mothers and those in a lower income bracket were more likely to sing prenatally). Singing prenatally did significantly affect the mothers' perception of infant temperament. Infants who were sung to during pregnancy were perceived to be more calm overall, but they did not calm significantly faster than infants who were not sung to during pregnancy. It was found that mothers chose to sing popular music almost as often as lullabies. This information could be helpful to music therapists in implementing a prenatal music therapy program.

CHAPTER ONE

REVIEW OF LITERATURE

The World of the Fetus

Fetal Hearing

Most new mothers will read in their baby books or on-line resources, beginning in the 19th week, that mothers are encouraged to talk to or sing to their baby because their growing fetus can hear their voice (Your Pregnancy: 19 Weeks, n.d.). Hepper and Shahidullah (1994) found that the first fetal response to sound happened at 19 weeks to a 500 Hz tone. They were examining behavioral responses from 19-35 weeks gestational age (GA) using pure tone stimuli of 100 Hz, 250 Hz, 500 Hz, 1000 Hz, and 3000 Hz. By 35 weeks GA, the fetuses responded to tones from 250 Hz to 3000 Hz and they concluded that the auditory system of the fetus matures as it grows. Although the sounds the fetus hears are muffled by the tissues and amniotic fluid surrounding it, it is still able to hear the phonemes of the human voice (Griffiths, Brown, Gerhardt, Abrams, & Morris, 1994). Furthermore, by using fetal cochlear microphonics, the sound that the fetus hears is recognizable by adult listeners: a recording of Beethoven's Fifth Symphony was played outside of the womb and recorded in-utero, it was then played for listeners who correctly identified the piece (Abrams, Griffiths, Huang, Sain, Langford, & Gerhardt, 1998).

According to Dirix, Nijhuis, Jongsma, and Hornstra (2009), the fetus exhibits both short term and long term memory. Fetuses have a short term memory of 10 minutes beginning at 30 weeks GA, possibly earlier. This was found using habituation testing, where the fetus was exposed to a stimulus (single tone) every thirty seconds until there was no fetal movement one second after the stimulus, showing it had become used to the stimulus. 10 minutes later, the fetus was again exposed to the stimulus and it was observed that less stimuli were needed to achieve a habituation response. By 38 weeks GA, the fetus exhibits a long term memory of 4 weeks.

Between 32 and 38 weeks GA fetuses are able to remember music stimuli they were exposed to over several days as shown by Wilkin (1995/1996). As the fetus listened to the song selection the initial response was a jerky movement, but upon hearing the selection daily the fetus exhibited a more relaxed, swimming movement. The fetus then did not hear the song selection for up to four days. When the song selection was reintroduced, the fetus initially began

jerky movements but quickly resumed the swimming movement as it had done over the previous observation time.

Because the fetus has the ability to remember the sounds it hears, and because by the third trimester it can hear most sounds outside the womb and the mother's voice, researchers sought to know what sounds the fetus can distinguish in-utero. At 36-40 weeks GA, the fetus can discriminate changes in pairs of consonant-vowel to vowel-consonant sounds as well as a change in the gender of a speaker (Lecanuet, Granier-Deferre, Jacquet, Capponi, & Ledru, 1993). The fetus also can distinguish between their own mother's voice and the voice of a female stranger; when exposed to the mother's voice the fetus's heart rate increased by 5-bpm whereas the heart rate decreased by 4-bpm when exposed to the female stranger's voice. The changes in heart rate were sustained during the time the voices were heard, indicating an ability to maintain attention to stimuli (Kisilevsky et al., 2003). 36-39 week old GA fetuses are able to discriminate between two differently pitched notes (Lecanuet, Granier-Deferre, Jacquet and DeCasper, 2000).

Sallenbach (cited in Blum, 1993) played music for a fetus and, after several hearings, the fetus seemed to move to the beat. When the music was changed to include dissonance the fetus stopped moving. Then, when they continued to play the music with the dissonant section the fetus kept the beat even over the dissonant section, indicating that the fetus learned the new music.

Fetal Memory and Newborn Preference

The fetus lives in a world full of sound: it hears the mother's heartbeat, gastrointestinal sounds, and voice. When it is finally born, the newborn shows a preference for certain sounds over others; sounds it became familiar to during its last few months as a fetus. The newborn prefers speech over non-speech stimuli (Vouloumanos & Werker, 2007), native language over foreign language (Moon, Cooper, & Fifer, 1993), and the mother's voice over a strange female voice, even as young as 3 days old (DeCasper & Fifer, 1980; Hepper, Scott, & Shahidullah, 1993; Standley & Madsen, 1990). Newborns even prefer a learned auditory stimulus over a novel one when both are provided by the mother. DeCasper and Spence (1986) had 16 women read *The Cat in the Hat* twice a day during the last 6 ½ weeks of their pregnancy, then when the babies were born they heard either a recording of their own mother reading *The Cat in the Hat* or a poem in a different meter, *The King, the Mice, and the Cheese*. Through non-nutritive sucking patterns the babies were able to choose which recording would play and they chose *The Cat in*

the Hat. This finding was also supported by DeCasper, Lecanuet, Busnel, Granier-Deferre, and Maugeais (1994)

The fetus is able to hear the low frequencies and contours of music and, although some of the detail is lost as the sound travels through the abdominal tissues, this might account for the infants' immediate awareness of octaves, simple harmony, and frequency ratios (Trehub, Schellenberg & Hill, 1997). Newborns can recognize a melody even when it is transposed, as long as the intervallic sequence remains the same. They can also recognize a tone sequence if the tempo changes as long as the relative durations remain the same. Possibly this is because of exposure to music, even just the melody and rhythm of human speech, in the womb (Trehub, 2001). 2-3 day old infants show surprise when a drummer misses a beat; they probably learn their sense of rhythm in-utero by listening to the mother's heart beat and feeling the rhythm of her walking (Szabo, 2009).

As stated previously, Wilkin (1995/1996) played music daily for fetuses beginning at 32 weeks GA. Then, after the babies were born, they were observed daily for 6 weeks while hearing the piece of music they heard in-utero. According to observation, the babies in the experimental group showed more alertness and seemed to recognize the music as evidenced by relaxed facial and body tension.

Polverini-Rey (1992) found that 4 week old infants exposed to a calming piece of music for 10 minutes a day, 5 days a week for 9 or 10 weeks prenatally spent more time calm, and also calmed quicker, during observations than infants in the control groups. The control groups were infants who received postnatal exposure to the same lullaby and infants who did not receive any exposure to the lullaby. There was no significant difference in time spent calm between the two control groups, indicating that learning does occur prenatally and that it carries over after birth up to at least 4 weeks. Polverini-Rey suggests that the fetus learns to associate the sound stimulus with the soothing environment of the womb.

Infants and Music

Mothers Singing to Infants

Most adults will use an altered speech pattern when they talk to infants. This is referred to as 'motherese'. Motherese has "higher pitch, broader pitch and amplitude variation, and lower speed than adult-directed speech" (Csibra, 2010, p. 147). Interestingly, in the first weeks of life the newborn does not prefer motherese to the mothers normal speaking voice, probably because

it remembers, and is used to, the prosody of the voice it heard in-utero. But by one month there is no preference and by four months, the infant prefers motherese (Csibra, 2010). According to Fernald (1985) 4 month old infants will prefer to hear motherese rather than adult speech even when the motherese is spoken by a stranger. Bergeson and Trehub (2007) found that mothers have patterns to their infant directed speech, or “signature tunes,” that are distinct from other mothers and that there are discernible interval patterns. With its lilting rhythm and elongated vowel sounds motherese seems only a short distance away from singing.

Bergeson and Trehub (2002) recorded 19 mothers speaking and singing to their infants in two sessions, each at least a week apart. They found that the two speaking examples, while identical in content, were varied in pitch and tempo. The singing examples, however, differed by less than a semitone and by 3% in tempo. This tendency toward absolute pitch and tempo could be attributed to motor memory because the mothers tend to repeat favorite songs from a small repertoire. Trehub, Unyk, Kamenetsky, Hill, Trainor, Henderson and Saraza (1997) asked parents to sing to their infant, and then sing the same song while the infant was not present. They found that observers were able to determine which selection was infant-directed and which was sung while simulating that the infant was there. They listened to both mothers and fathers singing in each style and reported that the infant directed selection contained more emotional engagement, were higher in pitch, and slower tempo. The findings suggest that parents adjust their singing when with their infant, intuitively changing the way they communicate to capture and hold infant attention. O’Neill, Trainor and Trehub (2001) reported that fathers also use a distinctive infant directed style of singing.

According to Hefer, Weintraub and Cohen (2009), newborns can distinguish between music and random sound. Three observed newborns exhibited circular hand movements during music selections that stopped during the random sound selections. Also, according to EEG results, the organized sound is perceived differently than the random sound; the music produced cognitive activity that the random sound did not. This supports the theory that babies have an inborn ability to process music. In their ability to process sound, there is no significant difference between newborn heart rate and behavior state across 3 decibels analyzed by gender (Dureau, 2005) but females have an advantage over males at high frequencies (Cassidy & Ditty, 2001).

Infants in all cultures respond to music and use their innate musical behaviors to communicate to the world around them (Fox, 2000). It is possible that babies are born with a

musical sense because it helps with communication. In a study by Brand (1985) a mother reported that her son seemed to differentiate talking and singing: “He always waited until I finished talking to him before he started cooing. But when I sang a lullaby, he crooned with me—in harmony, or so it seemed”(p. 30).

In a phone survey conducted by Custodero and Johnson-Green (2008) parents were asked if they had anything to say about how or why they use music with their infant. They used Bornstein’s four care giving domains to determine music’s role in parenting. They found that music is part of a parenting strategy that satisfies the parent’s desire to be both teacher and observer. Use of music with infants is thought to be a primary in Social Caregiving.

Custodero, Britto, and Brooks-Gunn (2003) found through a survey of over 2000 families that 62% reported playing or singing music for their children (age birth to 3) daily and 32% reported engaging in music weekly. Street, Young, Tafuri and Ilari (2003) surveyed 100 mothers, of the 91 that responded no mother reported never singing to her infant, 29% report it is easier to sing than to talk to an infant, and 50% reported they do not think they sing well. Many of the reasons mothers reported singing were to enhance quality time, to calm both baby and mother, and to elicit positive response from the infant.

Cevasco (2008) also found that the mothers in an experimental group, who made a recording of themselves singing, sang daily compared to the mothers in the control group who did not make a recording of themselves singing. Mothers in the experimental group might have been more inclined to sing because the act of making the CD showed them that they had a good repertoire of songs to sing to their infants and because they realized that singing might be important for the infant through taking part in the research study. Though many mothers reported feeling self-conscious about their singing, the researcher gave them positive feedback and support which might have made them feel more comfortable singing at home.

It does not seem to be important that the mother sing well, only that she sing at all (Brand, 1985). Infants at 5, 8, and 11 months preferred to hear unaccompanied singing according to a study by Ilari and Sundara (2009) where infants listened to accompanied and a capella singing in a foreign language. This is good news for parents because, since infants prefer simple melodies, parents do not have to be intimidated by instrumentation or complexity. But, the researchers go on to say, this does not mean infants are incapable of listening to music with rich textures and they should be exposed to a variety of music.

Music's Effect on Temperament

There is often a circular pattern when parents are frustrated by an infant's crying. The infant senses the parent's frustration and that in turn makes the infant more distressed and causes more crying. Unfortunately for new parents, crying is the newborn's only method of communicating its needs. Among the research done to find ways to alleviate crying, three ways stand out as making a significant difference: tactile, vestibular, and auditory stimulation (Schaper, 1982). Or as most parents know them: patting, rocking, and singing. In fact, Trehub (n.d.) states that the rhythm of music for infants might be related to how infants are carried and rocked (cited in Fox, 2000).

Singing might be useful in communicating emotions, like reassurance, as well as regulating infant's behavior states (Rock, Trainor, & Addison, 1999.) In the early months, parents can use music to condition their baby to respond positively to music and, as Brand (1985) states, "associate music with comfort and security" (p. 30). Parents tend to choose songs according to the behavior state of their infant, a lullaby for a tired baby and a play-song for an active baby, etc., because music is a strong regulator of infant behavior states. (Rock, Trainor, & Addison, 1999; Shenfield, Trehub, Nakata, 2003)

Music interventions have also been found beneficial for physiological variables in premature infants. Keith, Russell and Weaver (2009) studied the effect of music on inconsolable crying in premature infants. When music was used as in intervention, premature infants had inconsolable periods only four times a day for about 5.5 minutes, versus seven times a day for about 23 minutes when music was not used. The intervention was so successful that many of the parents withdrew their newborns from the study because they did not want them to have any non-music days. In a study by Cevasco (2008), mothers of preterm and full term infants were recorded singing a song of their choice. Mothers in the experimental group reported that their infants attended to the recording and smiled or stopped crying.

Walworth (2009) found that, although not significant, mothers who participated with their infants in a music group exhibited more positive and less negative play behaviors with their infants than mothers who did not attend the music group. The infants themselves demonstrated more social play behaviors than infants who did not attend the music groups.

Anecdotal evidence supports the claim that babies hear music prenatally and respond to it positively after birth. Shetler (1985) reported that mothers taking private lessons felt their unborn

babies move more when they were rehearsing on an instrument and those babies were observed after birth to be more attentive, were able to imitate sound, and developed language early. Custodero (2006) followed 10 families that used music with their children. One mother said that she sang the Phil Collins song “You’ll Be in My Heart” from Tarzan while she was pregnant. After her daughter that was the “only song that [the mother] could sing to her that would calm her down” when she was very fussy.

Music Education’s Effect on Mothers’ Singing

In a review of research by Reimer in 1965, an unpublished doctoral dissertation by Thomas Birch found a correlation between “taste and discrimination” in music and types of music education: students with three or more years of high school music had better taste in music than those without, vocal students more than instrumental students, and there was not a difference between classes and lessons but students who took both had better musical taste and discrimination than those who only had one or the other. Also in Reimer’s review, an unpublished doctoral dissertation by Kenneth Falkner found a direct relationship high school music involvement and music involvement as an adult. For second grade children, the strongest indicators of music achievement are parent’s attitude towards music and singing to and with the child, but the parent having played an instrument did not have an effect (Brand 1986).

Parents with formal (non-music) education are more likely to sing to their infants (Custodero, Britto, & Brooks-Gunn, 2003). In a study done by Ilari (2005) 100 Canadian mothers were asked about their musical activities with their infants. She found that professional mothers sang more often, probably because they felt the benefit related to bonding and they tried to make their time as high quality as possible. It is also possible that these women were aware of the importance of singing to infants because they were more educated.

However, with the development of technology, our culture has moved away from music making in the home. Now, people are more often passive music listeners and parents do not think they can provide musical instruction to their children in the home (Walworth, 2009). It is possible that modernization and media claims that listening to Mozart and other types of background music makes infants smarter have reduced the time parents spend doing musical activities with their infants, suggests Papousek (1996).

Custodero and Johnson-Green (2003) found that parents who had music education were more likely to sing to their infants, especially those who had singing experiences like choir.

Parents who had experiences playing an instrument were more likely to play recorded music, often classical, because that was the music they had more exposure to, and if they sang they were most likely to sing made up songs. Custodero and Johnson-Green further suggested that music educators be aware of the influence they have on the continuation of music practices in future generations. However, a study by Ilari, Moura and Bourscheidt (2011) found that among 43 Brazilian mothers surveyed, there was no relationship found between previous musical experience, education, age or enjoyment of music with use of music with children under 2. The research did find that mothers who played an instrument listened to music more often than mothers who did not play an instrument. Mothers who did not participate in ensemble music listened to popular music while mothers who did participate in ensemble music listened to mostly classical music. Mothers who had a close family member who was a musician tended to sing more popular or made up songs while mothers with no family members sang stereotypical lullabies and children's songs. This might be due to the fact that the musician family members value music that might affect the musical attitudes of the rest of the family. In order to develop good listening skills, a child must first absorb unconscious listening, whether by being read to, sung to, or just spoken to (Brand, 1985). The same goes for music listening. Most music packaged for infants with a storytelling text are not beneficial; infants should be exposed to many musical styles with songs that have steady tempo, changing dynamics and timbre, and a pleasing tone quality (Gordon, 1979).

Benefits of Prenatal Music

Fox (2000) says that the musical environment of a child is so important that music should be taught in parenting classes and the relationship between music and bonding/attachment and communication should be stressed. It is possible that learning the mother's voice prenatally may contribute to bonding and, later, language development (Hepper, Scott, & Shahidullah, 1993; Brand, 1985). The importance and perceived benefit of singing and making music during pregnancy has become well known enough that a simple internet search will return many results for prenatal Music Therapy and music centered childbirth preparation classes (Whitwell, n.d.)

Ilari, Moura and Bourscheidt (2011) found that forty-eight percent of mothers reported a change in musical attitudes during pregnancy, mostly manifested as a growing interest in lullabies and children's songs as well as attention to volume. Seventy-six percent of mothers reported singing during pregnancy for many reasons; as a bonding tool as well as a way to calm

both mother and unborn baby. Some women also stated that they sang during pregnancy because it “stimulated early infant perception and cognition (57)”; usually because they heard it was a ‘good idea’ from media and personal sources.

According to Montemurro and Rosario (1996) mothers in Spain who participated in a prenatal music group expressed that they benefited from emotional expression, relaxation and bonding with their fellow mothers to be. After the babies were born, the mothers who had sung to their babies during pregnancy reported greater confidence in and ability to sing to their infant to sleep and they were able to breastfeed longer. Carolan, Barry, Gamble, Turner & Mascarenas (2011) found that singing lullabies during pregnancy can also benefit the mother as it promotes relaxation and bonding as well as providing a care giving tool for when the baby is born.

PURPOSE

The purpose of this study was to determine if having had formal music education for four or more years influenced a mother to provide singing stimulus to her baby prenatally. Further the research investigated whether having had prenatal music experiences effected the mothers’ perception of infant temperaments after birth, either by making them more calm and less fussy overall or by causing them to calm better when sung to.

CHAPTER TWO

METHOD

PARTICIPANTS

Participants were recruited from various prenatal classes, support groups, ‘mommy and baby’ play groups, and a local online social network for mothers in a large urban city in the southeastern United States. The criterion was that the mothers have a child one year old or less. After the researcher explained to them the nature of the research and allowed for any questions, mothers were asked to volunteer by giving their e-mail addresses as well as their baby’s birth date or due date and indicating if they had at least four years of music education. An e-mail was then sent containing a link to the on-line survey. For those mothers who were recruited from prenatal classes the e-mail was sent one month after the written due date so mothers would be able to answer the questions in the fourth section of the survey. Mothers were also sent reminder e-mails if necessary during the data collection period. Seventy-five mothers volunteered to do the survey. Seventy-three e-mails were sent because two of the e-mails were returned as un-sendable. After the initial e-mail was sent with a link to the survey, up to three follow up e-mails were sent as reminders to complete the survey; they also included the link. Of the seventy-three e-mails sent, fifty-two completed surveys for a seventy-one percent response rate. The fifty-two women surveyed ranged in age from 22-45 with an average age of thirty-one. All the women completed at least some college. See Table 1.

Table 1
Subject Demographics

Subject	Age	Baby's Age (months, rounded)	Baby's Gender	Highest Education Level Completed	Annual Household Income	At least 4 years of music
1	35	3.5	Male	Some college	50,001-75,000	No
2	24	1	Female	Some college	20,001-50,000	No
3	36	3	Female	Bach. degree	75,001-100,000	No
4	27	3	Female	Bach. degree	20,001-50,000	Yes
5	27	4	Male	Grad degree	20,001-50,000	Yes
6	31	3	Female	Bach. degree	More than 100,000	No
7	32	2	Male	Grad degree	50,001-75,000	No
8	29	1	Female	Bach. degree	20,001-50,000	Yes
9	30	1	Female	Bach. degree	50,001-75,000	No
10	31	2.5	Male	Bach. degree	75,001-100,000	Yes
11	40	1	Male	Some college	More than 100,000	No
12	25	8	Male	Bach. degree	20,001-50,000	Yes
13	30	12	Male	Bach. degree	20,001-50,000	No
14	26	2	Male	Grad degree	75,001-100,000	Yes
15	30	2	Male	Some college	75,001-100,000	Yes
16	31	1.5	Female	Grad degree	More than 100,000	Yes
17	38	11	Female	Grad degree	50,001-75,000	No
18	22	1.5	Male	Bach. degree	20,001-50,000	No
19	23	6	Female	Bach. degree	20,001-50,000	No
20	32	9	Female	Bach. degree	Less than 20,000	No
21	32	11	Female	Bach. degree	50,001-75,000	No
22	31	9	Female	Bach. degree	More than 100,000	No
23	33	11	Male	Grad degree	50,001-75,000	No
24	36	8.5	Female	Bach. degree	50,001-75,000	Yes
25	30	12	Female	Grad degree	20,001-50,000	Yes
26	33	8	Male	Bach. degree	Less than 20,000	Yes
27	32	7	Female	Bach. degree	50,001-75,000	Yes
28	36	1	Male	Grad degree	More than 100,000	No
29	37	10.5	Female	Bach. degree	75,001-100,000	No
30	32	1	Female	Some college	More than 100,000	No
31	26	2	Female	Grad degree	50,001-75,000	No
32	34	12	Female	Some college	Less than 20,000	No
33	26	3	Male	Grad degree	50,001-75,000	No
34	38	2	Female	Grad degree	75,001-100,000	Yes

Table 1, Cont.
Subject Demographics

Subject	Age	Baby's Age (months, rounded)	Baby's Gender	Highest Education Level Completed	Annual Household Income	At least 4 years of music
36	31	3	Female	Bach. degree	More than 100,000	Yes
37	34	4	Male	Bach. degree	More than 100,000	No
38	22	5	Male	Some college	20,001-50,000	Yes
39	37	9	Female	Grad degree	More than 100,000	No
40	29	1	Female	Grad degree	75,001-100,000	Yes
41	32	2	Male	Grad degree	More than 100,000	Yes
42	27	6	Female	Bach. degree	More than 100,000	Yes
43	34	1	Male	Bach. degree	50,001-75,000	No
44	27	1	Female	Some college	Less than 20,000	Yes
45	25	1	Male	Bach. degree	50,001-75,000	No
46	30	3	Female	Bach. degree	50,001-75,000	No
47	31	1	Female	Bach. degree	More than 100,000	No
48	37	1	Male	Grad degree	More than 100,000	Yes
49	26	6	Male	Bach. degree	Less than 20,000	No
50	39	1	Female	Grad degree	More than 100,000	No
51	37	9	Male	Some college	20,001-50,000	No
52	45	11	Female	Grad degree	More than 100,000	Yes

PROCEDURE

The survey was created using Google.docs. All questions were optional except for their name and date which fulfilled the Consent Form (Appendix A) and allowed them to continue on to the questionnaire (Appendix B), and their E-mail address which allowed the researcher to contact them if necessary. The survey was comprised of four sections. The first section was a demographic section including age and gender of the baby and information on the mother's socioeconomic status. The second section detailed the mother's music education. If mothers did not have at least four years of combined music education in both classes and private instruction they skipped to the third section. If they did have at least four years further questions were asked about the details of their music education. Four years was the selected criterion for having music education because both high school and college usually last four years and the researcher felt that

those years would be the closest chronologically to the time mothers were having babies and that those years would be musically formative. According to Gates (1991) musicians who see music as serious leisure (that is, not just a hobby) will find it more difficult to stop including music activities in their lives. The third section asked about the mother's prenatal music interaction with their baby. If mothers did not sing to their baby prenatally they skipped to section four. The final section asked about the mother's post-natal music interaction with the baby. If they did not sing to their baby they were finished with the survey. If they did sing to their baby they were asked more about how they made music. They also answered questions in this section regarding the baby's overall temperament on a seven point scale ranging from very fussy to very calm and whether singing made the baby more fussy or more calm. This was assuming that music was used to regulate the baby's emotional state since mothers mostly use singing as a means of calming their baby, rather than for stimulation (Cevasco, 2008).

CHAPTER THREE

RESULTS

General Findings: Singing During and After Pregnancy

Of the fifty-two mothers who completed the survey, 19% reported singing daily to their unborn baby, 25% reported singing 3-6 days a week, 25% reported singing 1-2 days a week, 15% reported singing less than one day a week, but not never, and 15% reported they never sang to their baby prenatally. Participants also reported singing to their newborn daily, 62%; 3-6 days a week, 31%; 1-2 days a week, 4%; and less than one day a week but not never, 4%. No mothers in the survey reported that they never sang to their newborn. Of the mothers who reported singing during pregnancy, 50% stated they began singing specifically with the intention of their baby hearing them in the second trimester, possibly because at 19 weeks most pregnancy guides explain that the baby has begun to develop hearing; 41% reported starting to sing during the first trimester and 9% started singing during the third trimester.

Mothers who sang during pregnancy also reported the types of music they sang. Participants were able to choose as many genres as were applicable from a checklist. The choices given were “Lullabies”, “Classical or songs I learned from choir”, “Jazz”, “Rap/Hip-hop”, “Country”, “Adult Contemporary”, “Hard Rock/Classic Rock” or “Other”. The categories “Showtunes” and “Religious” were derived from the category “Other” because they had more than one response each. Although the most popular type of music was “Lullabies” at 25%, it was closely followed by “Hard Rock/Classic Rock” at 15%, “Country” at 15% and “Adult Contemporary” at 14% (Fig.1). A similar trend was found regarding mothers who sang a special, specific song to their unborn baby: 32% were classified as Lullabies or Children’s music followed by 26% classified as popular. For this question, participants were able to enter their response in free text. One independent observer, along with the researcher, classified these songs into 5 predetermined categories. Inter-rater reliability was at 100%.

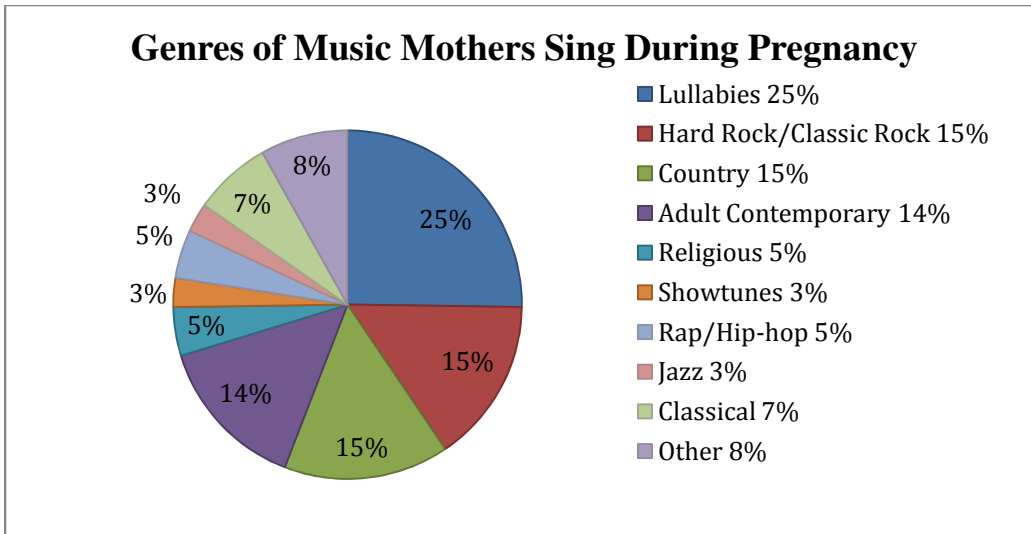


Figure 1. Genres of Music Mothers Sing During Pregnancy

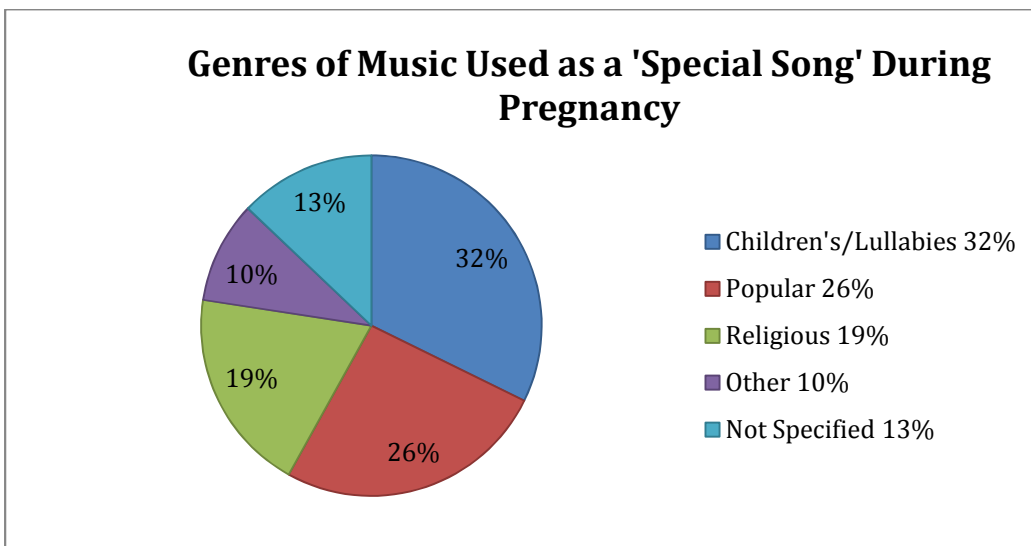


Figure 2. Genres of Music Used as a 'Special Song' During Pregnancy

There were only weak correlations between various demographic data and how often mothers sang during or after pregnancy. Younger mothers were significantly more likely to sing prenatally ($r^2 = -.23, p = .05$) and mothers with lower income were more likely to sing prenatally ($r^2 = -.19, p > .05$) and significantly more likely to sing postnatally ($r^2 = -.24, p < .05$). See Table 2.

Table 2

Correlation of Demographics on Pre and Postnatal Singing

Demographic Information	Prenatal		Postnatal	
	r_s	t	r_s	t
Age (22-45)	-0.23	-1.67	0.02	0.13
Highest Education Level (Some College-Graduate)	0.04	0.30	-0.11	-0.79
Income (Less than 20,000-More than 100,000)	-0.19	-1.39	-0.24	-1.76

Note: N=52, df=50

Music Education's Effect on Singing During and After Pregnancy

Table 3 reports how often mothers with at least 4 years of music education and less than 4 years of music education sang to their baby both pre and postnatally.

Table 3

Percentage of Mothers Who Supply Music to Their Fetuses by Musical Experience

When	Music Experience	Never	Less than one day a week, but not never	1-2 days a week	3-6 days a week	Daily
Prenatal						
	At Least 4 years of Music Lessons and/or Classes	15%	10%	25%	20%	30%
	Less Than 4 years of Music Lessons and/or Classes	16%	19%	25%	28 %	13%
Post-natal						
	At Least 4 years of Music Lessons and/or Classes	0 %	0%	5%	35%	60%
	Less Than 4 years of Music Lessons and/or Classes	0%	6%	3%	28%	63%

Overall, having had previous formal music education does not have any significant effect on whether or not mothers sang prenatally. According to t-test analysis, no significant difference was found between mothers with or without at least four years of music education and the amount of time they spent singing to their baby prenatally, nor was there a significant difference in the same two groups singing postnatally; $t(50) = -.97, p > .05$ and $t(50) = -.19, p > .05$. See Tables 4 and 5.

Table 4

Music Education's Effect on Mothers Singing Prenatally

Amount of Music Education	N	Mean	StDev	SE Mean
More than 4 Years	20	3.4	1.4	2.0
Less than 4 Years	32	3.0	1.3	1.6

Table 5

Music Education's Effect on Mothers Singing Postnatally

Amount of Music Education	N	Mean	StDev	SE Mean
More than 4 Years	17	4.5	0.6	0.4
Less than 4 Years	35	4.5	0.8	0.7

Prenatal Singing's Effect on Infant Temperament

Results indicate that mothers who sang during pregnancy were significantly more likely to perceive their infant's temperament as more calm than mothers who did not sing during pregnancy, $t(50) = 2.1, p < .05$. See Table 6. However, it was found that singing to the infant did not affect the perceived temperament of infants whose mothers sang prenatally any more than infants whose mothers did not, according to Fisher's Exact Test, ($N = 52, p > .05$).

Table 6

Effect of Prenatal Singing on Overall Infant Temperament

Singing During Pregnancy	N	Mean	StDev	SE Mean
Yes	44	4.8	1.7	2.9
No	8	6.1	0.4	0.1

Of mothers who sang during pregnancy, 85% reported singing a “special song” during pregnancy. Those mothers were asked whether they found singing their “special song” to their infant more effective, less effective, or the same as singing any other song. When comparing all three options, it was found that there was a significant difference, $\chi^2(2,31)=14.01, p<.05$, in the effectiveness of singing the “special song”. Further testing revealed that while there was no significant difference between mothers who found the “special song” more effective or the same, $\chi^2(1,29)=2.786, p>.05$, there was a significant difference between mothers who found the song less effective or the same, $\chi^2(1,21)=13.76, p<.05$, indicating that infants found the special song at least as comforting as any other song.

CHAPTER FOUR

DISCUSSION

The purpose of this research was to determine whether having had at least four years of music education effects whether or not a mother decides to sing to her baby during pregnancy and if singing during pregnancy has any effect on perceived infant temperaments. The overall result was that having four or more years of music education did not make a mother more or less likely to sing during pregnancy with the intention of her baby hearing her. Significant factors that correlated to singing during pregnancy were mother's age and annual income level: younger mothers and mothers in lower income brackets were more likely to sing to their fetus during pregnancy. The median income bracket was 50,001-75,000 annually. This might be because younger mothers are more technologically savvy and various sources on-line encourage prenatal bonding, including talking, reading, and singing. Also mothers in the lower income bracket sing significantly more after pregnancy. It is possible that, because the volunteers were acquired at classes, support groups, and play groups that met during the day, a large majority of mothers surveyed might be stay-at-home mothers which would give them more time with their infant and, consequently, more time for singing to take place.

Also, according to the sample in the current research, singing during pregnancy did have a significant positive effect on perceived infant temperament. This is congruent with the findings of Polverini-Rey (1992) who found that newborns exposed to music prenatally spent more time in a calm state than those in a control group. However, the current research is in opposition to Polverini-Rey's findings in that it found no significant difference in the time it took infants to calm, whether they were exposed to prenatal singing or not. No mother in the current study reported that singing made their infant more fussy and the majority reported that singing calmed their baby as soon as the mother started singing. This is an important finding for any professional working prenatally with mothers. Prenatal singing could be a powerful tool in helping new mothers, especially first-time and at risk mothers, feel a sense of control in a situation where they often feel they are losing control. New mothers are sometimes anxious because they have no idea what their infant will be like and, although singing during pregnancy is not a sure indicator that they will have a calm baby, mothers who sing prenatally can feel like they are doing something

proactive during their pregnancy and, hopefully, feel more relaxed and confident with their new baby.

There were also some interesting general findings. The current research was able to corroborate Custodero, Britto, and Brooks-Gunn's (2003) survey data regarding how often mothers sing or play music for their infants. They found that 62% of mothers played music or sang daily while the current research found that 62% sang daily and that 32% reported playing or singing music weekly while the current research found that mothers sing 35% weekly.

It was found that although lullabies and children's music were the most popular choice of genre, it was very closely followed by the major types of popular music, and if popular music were taken together, it would surpass lullabies 44% to 25%. The same was found for mothers who sang during pregnancy: 32% sang lullabies but 26% sang popular music. This is in opposition to anecdotal evidence from Illari and Bourscheidt (2011) whose mothers said, for instance, that they listened to classical music even though they did not like it; they only listened because it is supposed to be educational for the baby. This is a particularly important finding for music therapists seeking to encourage prenatal music because mothers can sing what they know and what they enjoy. There is no need to learn new lullabies or listen to classical music if the mother does not want to.

There were some limitations with the current research. The sample size was small, owing to the fact that almost a quarter of the mothers who volunteered did not complete the survey. Those who did complete the survey were mostly educated middle class: 10 completed some college, 25 received bachelor's degrees, and 17 received graduate degrees; 67% of mothers listed their income at \$50,001.00 or above. Also, because many of these mothers were recruited from breastfeeding support groups, mother and baby music groups, and play groups they may have already had both a knowledge of the importance of prenatal music and an interest to provide music for their child before and after birth, whether or not they had experience with music themselves or not.

Further research is needed to understand how exposure to music prenatally affects a newborn. Anecdotal evidence is available but more empirical data needs to be obtained before we are able to say definitively that prenatal music is beneficial for both newborn and mother. And, although there is little doubt that mothers who engaged in music prenatally, either by listening, singing, or playing an instrument, felt an attachment to their unborn child and gladness

that their future baby could hear them—this fact was repeatedly stated to the researcher—further research regarding mother’s feelings about singing during pregnancy and how that effected them after the baby was born would also benefit the field.

APPENDIX A
IRB APPROVAL LETTER AND CONSENT FORM

IRB APPROVAL LETTER

Office of the Vice President For Research

Human Subjects Committee

Tallahassee, Florida 32306-2742

(850) 644-8673, FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 4/25/2011

To: Candice Sirak

Dept.: MUSIC SCHOOL

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research

Mothers' Singing to Fetuses: The Effect of Music Education

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and one member of the Human Subjects Committee. Your project is determined to be Expedited per 45 CFR Â§ 46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 4/23/2012 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is FWA00000168/IRB number IRB00000446.

Cc: Jayne Standley, Advisor

HSC No. 2011.5765

FSU BEHAVIORAL CONSENT FORM

Mothers' Singing to Fetuses: The Effect of Music Education

You are invited to be in a research study of music's effect on newborns. You were selected as a possible participant because you supplied your e-mail address. We ask that you read this form before agreeing to be in the study.

This study is being conducted by Candice Sirak, MT-BC, Music Therapy department at the College of Music, Florida State University

Background Information:

The purpose of this study is: 1) to find out if having previous music education affects the likelihood that mothers will sing to their fetuses and 2) if singing to fetuses has any correlation to the temperament of newborns.

Procedures:

If you agree to be in this study, we would ask you to do the following things: Complete the following survey, answering all questions truthfully and to the best of your ability. Completing the survey should take 5-10 minutes.

Risks and benefits of being in the Study:

The study has no anticipated risks or benefits to participants. The results of the study may have an impact on future parents.

Confidentiality:

The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University. If you decide not to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Candice Sirak. If you have a question later, you are encouraged to contact her at FSUmusicresearch@gmail.com. Or you may contact Jayne Standley, 850-644-4565, jstandley@fsu.edu, faculty advisor.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the FSU IRB at 2010 Levy Street, Research Building B, Suite 276, Tallahassee, FL 32306-2742, or 850-644-8633, or by email at humansubjects@magnet.fsu.edu.

Statement of Consent:

I have read the above information. By signing my name below, I consent to participate in the study.

Name and Date

APPENDIX B

QUESTIONNAIRE

Note: This questionnaire was administered on-line. Not all participants answered every question. For example, if a participant answered “No” to Question 1: “Have you had at least 4 years of music classes either in school or in a private music organization?” they were not given the option to answer questions 1a-1c describing how many years they took each type of class.

Section 1: Demographic Questions

- 1: Your e-mail address
- 2: Your age:
- 3: Your Baby’s Age
- 4: Your Baby’s Gender
- 5: Your Highest Education Level Completed

Did not complete high school

High School or GED

Some College

Bachelors Degree

Graduate Degree

- 6: Your Annual household Income

Less than 20,000

21,000-50,000

50,001-75,000

75,001-100,000

More than 100,000

Section 2: Music Education

- 1: Have you had at least 4 years of music classes either in school or in a private music organization?

1a: Band, Choir, or Both

1b: How many years of band? Please indicate 0 if you did not take band

How many years of choir? Please indicate 0 if you did not take choir

1c: When did you take classes?

Middle School

High School

College

Community Organization as an adult

Other

2: Have you had at least 4 years of music lessons, either in school or in a private music organization?

2a: Instrument, Vocal, or Both

2b: How many years of Instrument? Please indicate 0 if you did not take instrument lessons

How many years of vocal? Please indicate 0 if you did not take voice lessons

2c: When did you take lessons?

Middle School

High School

College

Community Organization as an adult

Other

Section 3: Singing During Pregnancy

How often did you sing to your baby (that is, with the intention of your baby hearing you) during pregnancy?

Daily

3-6 days a week

1-2 days a week

Less than once a week, but not never

Never

1: At what point did you start to sing to your baby?

First Trimester

Second Trimester

Third Trimester

2: What sort of songs did you sing to your baby during pregnancy?

Lullabies

Classical or songs I learned from choir

Jazz

Rap/hip hop

Country

Adult contemporary

Hard Rock

Other

3: Did have a particular song that you sang to your baby? What was it?

Section 4: Your baby's temperament

1: How would you describe your baby's overall temperament?

Very Fussy

Fussy

Somewhat Fussy

Neutral

Somewhat Calm

Calm

Very Calm

2: How often do you sing to your baby now?

Daily

3-6 Days a Week

1-2 Days a Week

Less than once a week, but not never

Never

3: What effect does singing have on your baby's temperament?

He/She becomes more fussy after I have been singing a while

He/She becomes more fussy as soon I start singing

He/She does not change much when I sing

He/She becomes more calm as soon as I start singing

He/She becomes more calm after I have been singing a while

I do not sing to my baby

4: If you sang a particular song to your baby during pregnancy, what effect does singing that song now have on your baby's temperament?

He/She becomes more fussy after I have been singing a while

He/She becomes more fussy as soon I start singing

He/She does not change much when I sing

He/She becomes more calm as soon as I start singing

He/She becomes more calm the after I have been singing a while

I did not sing a particular song to my baby during pregnancy, or I do not sing to my baby

Regarding the particular song you sang to your baby during pregnancy, do you find that singing it now is more effective, less effective, or the same as any other songs that you sing to your baby now?

More effective

Same

Less effective

Thank you!

You are now finished with the questionnaire.

APPENDIX C
RAW DATA

Subject	2: Your Age	3: Your Baby's Age	4: Your Baby's Gender	5: Your Highest Education Level Completed	6: Your Annual Household Income
1	35	3.5	male	Some college	50,001-75,000
2	24	1	female	Some college	20,001-50,000
3	36	11 weeks	Female	Bachelors degree	75,001-100,000
4	27	3 months	female	Bachelors degree	20,001-50,000
5	27	4 months	Male	Graduate degree	20,001-50,000
6	31	3 months	female	Bachelors degree	More than 100,000
7	32	7 weeks	male	Graduate degree	50,001-75,000
8	29	1 mth	female	Bachelors degree	20,001-50,000
9	30	3 weeks	female	Bachelors degree	50,001-75,000
10	31	10 weeks	Male	Bachelors degree	75,001-100,000
11	40	4 weeks	male	Some college	More than 100,000
12	25	days	Male	Bachelors degree	20,001-50,000
13	30	12	Male	Bachelors degree	20,001-50,000
14	26	2 months	Male	Graduate degree	75,001-100,000
15	30	2	male	Some college	75,001-100,000
16	31	6 weeks 4 days	female	Graduate degree	More than 100,000
17	38	11 months	f	Graduate degree	50,001-75,000
18	22	6 weeks	Male	Bachelors degree	20,001-50,000
19	23	6 months	Female	Bachelors degree	20,001-50,000
20	32	9 months	female	Bachelors degree	Less than 20,000
21	32	11 months	Female	Bachelors degree	50,001-75,000
22	31	9 months	Female	Bachelors degree	More than 100,000
23	33	11 months	male	Graduate degree	50,001-75,000
24	36	8.5 months	female	Bachelors degree	50,001-75,000
25	30	12 months	Female	Graduate degree	20,001-50,000
26	33	8 months	male	Bachelors degree	Less than 20,000
27	32	7 months	female	Bachelors degree	50,001-75,000
28	36	4 weeks	Male	Graduate degree	More than 100,000
29	37	10.5 months	female	Bachelors degree	75,001-100,000
30	32	23days	Female	Some college	More than 100,000
31	26	2 months	Female	Graduate degree	50,001-75,000
32	34	1yr	Girl	Some college	Less than 20,000
33	26	11 1/2 weeks	male	Graduate degree	50,001-75,000
34	38	7 months	Female	Graduate degree	75,001-100,000
35	23	2 weeks	Female	Some college	20,001-50,000
36	31	3 months	Female	Bachelors degree	More than 100,000
37	34	15 weeks	Boy	Bachelors degree	More than 100,000
38	22	5 months	Boy	Some college	20,001-50,000
39	37	9 months	female	Graduate degree	More than 100,000
40	29	3 weeks	Female	Graduate degree	75,001-100,000
41	32	8 weeks	Male	Graduate degree	More than 100,000
42	27	6 months	Female	Bachelors degree	More than 100,000
43	34	4weeks	Male	Bachelors degree	50,001-75,000
44	27	3 weeks	female	Some college	Less than 20,000
45	25	1 month old	Male	Bachelors degree	50,001-75,000
46	30	3 months	Female	Bachelors degree	50,001-75,000
47	31	4 weeks	Female	Bachelors degree	More than 100,000
48	37	3weeks	M	Graduate degree	More than 100,000
49	26	6 months	male	Bachelors degree	Less than 20,000
50	39	3w	female	Graduate degree	More than 100,000
51	37	9 months	male	Some college	20,001-50,000
52	45	11 months	female	Graduate degree	More than 100,000

Subject	1: Have you had at least 4 years of music classes, either in school or in a private music organization?	1a: Did you take Band, Choir, or Both	1b: How many years of Band	How many years of Choir
1	No			
2	No			
3	No			
4	Yes	Both	3	1
5	Yes	Choir	0	12
6	No			
7	No			
8	Yes	Choir	0	12
9	No			
10	Yes	Both	3	2
11	No			
12	Yes	Both	8	12
13	No			
14	Yes	Choir	0	2
15	Yes	Both	4	8
16	Yes	Both	10	7
17	No			
18	No			
19	No			
20	No			
21	No			
22	No			
23	No			
24	Yes	Band	1	0
25	Yes	Band	7	0
26	No			
27	Yes	Choir		6
28	No			
29	No			
30	No			
31	No			
32	No			
33	No			
34	Yes	Both	7	6
35	No			
36	Yes	Choir	0	7
37	No			
38	Yes	Both	3	10
39	No			
40	No			
41	Yes	Both	6	3
42	Yes	Choir		8
43	No			
44	Yes	Band	7	0
45	No			
46	No			
47	No			
48	Yes	Both	2	3
49	No			
50	No			
51	No			
52	Yes	Choir	0	1

Subject	2: Have you had at least 4 years of music lessons, either in school or in a private music organization?	2a: Instrument, Voice, or Both	2b: How many years of Instrument lessons	How many years of Voice lessons
1	No			
2	No			
3	No			
4	Yes	Instrument	4	0
5	Yes	Voice	0	4
6	No			
7	No			
8	Yes	Voice	0	7
9	No			
10	Yes	Instrument	4	1
11	No			
12	Yes	Instrument	10	
13	No			
14	Yes	Instrument	5	0
15	Yes	Instrument	4	0
16	Yes	Instrument	7	
17	No			
18	No			
19	No			
20	No			
21	No			
22	No			
23	No			
24	No			
25	Yes	Instrument	8	0
26	Yes	Instrument	4	0
27	Yes	Both	5	3
28	No			
29	No			
30	No			
31	No			
32	No			
33	No			
34	Yes	Instrument	7	1
35	No			
36	Yes	Instrument	4	0
37	No			
38	Yes	Both	4	1
39	No			
40	Yes	Instrument	13 years	0
41	Yes	Instrument	12	0
42	Yes	Voice		1
43	No			
44	Yes	Instrument	7	0
45	No			
46	No			
47	No			
48	No			
49	No			
50	No			
51	No			
52	Yes	Instrument	3	

Subject	1c: When did you take classes?	2c: When did you take Lessons?
1		
2		
3		
4	Middle School, High School, College	Middle School, High School, College
5	Middle School, High School, College, Community organization as an adult	High School
6		
7		
8	Middle School, High School, College	High School, College
9		
10	Middle School, High School	High School
11		
12	Middle School, High School, College, Community organization as an adult	Middle School
13		
14	Middle School	Middle School, Elementary School
15	Middle School, Elementary	Middle School, Elementary
16	Middle School, High School, College, Community organization as an adult	Middle School, Elementary School
17		
18		
19		
20		
21		
22		
23		
24	Middle School	
25	Middle School, High School	Middle School, High School
26		Middle School, High School
27	Middle School, elementary	Middle School, elementary school
28		
29		
30		
31		
32		
33		
34	Middle School, High School	Middle School, High School
35		
36	Middle School, Church	Middle School
37		
38	Middle School, High School, College	Middle School, High School
39		
40		Middle School, High School, Elementary School
41	Middle School, High School	Middle School, High School, Elementary
42	Middle School, High School, Community organization as an adult, Church	High School, Church
43		
44	Middle School, High School	Middle School, High School
45		
46		
47		
48	Middle School, High School	
49		
50		
51		
52	Middle School	Middle School

Subject	How often did you sing to your baby (that is, with the intention of your baby hearing you) during pregnancy?	1: At what point did you start to sing to your baby?	2: How often do you sing to your baby now?
1	3-6 Days a Week	First Trimester	Daily
2	Never		3-6 Days a Week
3	Less than once a week, but not Never	Second Trimester	Daily
4	3-6 Days a Week	Second Trimester	3-6 Days a Week
5	Daily	First Trimester	Daily
6	3-6 Days a Week	Third Trimester	Daily
7	Daily	Second Trimester	Daily
8	Daily	First Trimester	Daily
9	3-6 Days a Week	Second Trimester	Daily
10	1-2 Days a Week	Third Trimester	3-6 Days a Week
11	Never		never
12	Daily	First Trimester	Daily
13	1-2 Days a Week	Second Trimester	3-6 Days a Week
14	Daily	First Trimester	3-6 Days a Week
15	Less than once a week, but not Never	First Trimester	Daily
16	Daily	First Trimester	Daily
17	Less than once a week, but not Never	Second Trimester	never
18	1-2 Days a Week	Second Trimester	3-6 Days a Week
19	1-2 Days a Week	First Trimester	Daily
20	3-6 Days a Week	Second Trimester	Daily
21	3-6 Days a Week	Second Trimester	Daily
22	Less than once a week, but not Never	First Trimester	Daily
23	1-2 Days a Week	First Trimester	Daily
24	3-6 Days a Week	First Trimester	Daily
25	Never		Daily
26	Never		Daily
27	3-6 Days a Week	First Trimester	3-6 Days a Week
28	3-6 Days a Week	First Trimester	3-6 Days a Week
29	Daily	Second Trimester	Daily
30	Less than once a week, but not Never	Second Trimester	1-2 Days a Week
31	1-2 Days a Week	Second Trimester	3-6 Days a Week
32	Daily	Second Trimester	Daily
33	3-6 Days a Week	Second Trimester	3-6 Days a Week
34	1-2 Days a Week	Second Trimester	Daily
35	Daily	Second Trimester	Daily
36	Daily	First Trimester	3-6 Days a Week
37	Never		3-6 Days a Week
38	1-2 Days a Week	First Trimester	Daily
39	Less than once a week, but not Never	Third Trimester	Daily
40	Never		3-6 Days a Week
41	3-6 Days a Week	First Trimester	3-6 Days a Week
42	1-2 Days a Week	Second Trimester	Daily
43	3-6 Days a Week	Second Trimester	3-6 Days a Week
44	3-6 Days a Week	First Trimester	Daily
45	1-2 Days a Week	Second Trimester	Daily
46	1-2 Days a Week	First Trimester	3-6 Days a Week
47	Less than once a week, but not Never	Second Trimester	Daily
48	1-2 Days a Week	Second Trimester	1-2 Days a Week
49	1-2 Days a Week	Second Trimester	Daily
50	Never		Daily
51	Never		Daily
52	Less than once a week, but not Never	Third Trimester	Daily

Subject	2: What sort of songs did you sing to your baby during pregnancy?	3: Did you have a particular song that you sang to your baby during pregnancy? What was it?
1	Country, Hard Rock/Classic Rock	
2		
3	Lullabies, Country, Adult Contemporary, We make up songs	You are my sunshine
4	Lullabies, Classical songs, or songs I learned in Choir, Hymns	Be Thou My Vision
5	Lullabies, Classical songs, or songs I learned in Choir, Hard Rock/Classic Rock, Show tunes	I love you a bushel and a peck (I was directing guys and dolls)
6	Country, Adult Contemporary	Divine Romance
7	songs	amazing grace
8	Lullabies, Rap/Hip Hop, Country, Adult Contemporary, Hard Rock/Classic Rock	Sweet Child of Mine, Guns and Roses
9	Lullabies	I Love you Lullaby
10	Country	I'm Not Afraid to Die
11		
12	Lullabies, Classical songs, or songs I learned in Choir, Jazz, Country	"baby I love your way" - my wedding song
13	Lullabies	Nonw
14	Lullabies, Country, Adult Contemporary	The Lord Has A Will
15	Lullabies, Sing along with Radio	Summertime
16	Lullabies, Classical songs, or songs I learned in Choir, Country	You Are My Sunshine
17		jesus loves me
18	Classical songs, or songs I learned in Choir, Musicals	No
19	Country, Christian	Legacy
20	Lullabies	"la la lu" - the lullaby from Lady and the Tramp
21	Jazz, Country, Adult Contemporary, Hard Rock/Classic Rock	"Green" by Sister Hazel
22	Hard Rock/Classic Rock	
23	Lullabies, Hard Rock/Classic Rock	"You Are My Sunshine"
24	Lullabies, Adult Contemporary, Hard Rock/Classic Rock, love songs	
25		
26		
27	Rap/Hip Hop, Adult Contemporary, Hard Rock/Classic Rock	
28	Lullabies, broadway	Baby Mine
29	Lullabies, Adult Contemporary	Make you feel my love
30	Lullabies	Twinkle twinkle little star and you are my sunshine
31	Jazz, Country, Hard Rock/Classic Rock	JJ Gray and Mofro Orange Blossoms
32	Lullabies, Rap/Hip Hop, Adult Contemporary, Hard Rock/Classic Rock	
33	Country, Adult Contemporary, Hard Rock/Classic Rock	no particular song
34	Lullabies, Adult Contemporary, Hard Rock/Classic Rock	No
35	Lullabies, Rap/Hip Hop, Country, Hard Rock/Classic Rock, reggae	Bob Marley- No Woman, No Cry
36	Lullabies, Classical songs, or songs I learned in Choir, Country, Adult Contemporary	Several different ones
37		
38	Lullabies, Classical songs, or songs I learned in Choir, Country, Hard Rock/Classic Rock	Mine by Taylor Swift
39	Adult Contemporary	
40		
41	Lullabies, Adult Contemporary, Praise and worship	
42	Country, Adult Contemporary, Christian	
43	Edith piaf	Seaside Rendezvous by Queen
44	Lullabies, Country	away in a manger
45	One that my husband made up	Yes we called it Baby Noah
46	christian contemp	no
47	Lullabies	
48	Country, Hard Rock/Classic Rock	
49	Lullabies	you are my sunshine
50		
51		
52	Adult Contemporary	

Subject	1: How would you describe your baby's current overall temperament?	3: What effect does singing now have on your baby's temperament?
1	Neutral	He/she becomes more calm as soon as I start singing
2	Calm	He/she becomes more calm as soon as I start singing
3	Somewhat Fussy	He/she becomes more calm as soon as I start singing
4	Very Calm	He/She becomes more calm after I have been singing for a while
5	Somewhat Calm	He/she becomes more calm as soon as I start singing
6	Calm	He/She becomes more calm after I have been singing for a while
7	Neutral	He/She becomes more calm after I have been singing for a while
8	Calm	He/she becomes more calm as soon as I start singing
9	Somewhat Fussy	He/She does not change much when I sing
10	Somewhat Fussy	He/she becomes more calm as soon as I start singing
11	Very Calm	He/She does not change much when I sing
12	Very Fussy	He/she becomes more calm as soon as I start singing
13	Somewhat Calm	He/she becomes more calm as soon as I start singing
14	Calm	He/She becomes more calm after I have been singing for a while
15	Very Calm	He/she becomes more calm as soon as I start singing
16	Very Calm	He/She does not change much when I sing
17	Calm	He/she becomes more calm as soon as I start singing
18	Fussy	He/She becomes more calm after I have been singing for a while
19	Calm	He/She becomes more calm after I have been singing for a while
20	Neutral	He/she becomes more calm as soon as I start singing
21	Calm	He/she becomes more calm as soon as I start singing
22	Somewhat Fussy	He/She does not change much when I sing
23	Very Calm	He/she becomes more calm as soon as I start singing
24	Very Calm	He/she becomes more calm as soon as I start singing
25	Calm	He/she becomes more calm as soon as I start singing
26	Calm	He/she becomes more calm as soon as I start singing
27	Calm	He/she becomes more calm as soon as I start singing
28	Somewhat Calm	He/she becomes more calm as soon as I start singing
29	Calm	He/she becomes more calm as soon as I start singing
30	Calm	He/She does not change much when I sing
31	Calm	He/she becomes more calm as soon as I start singing
32	Neutral	He/She becomes more calm after I have been singing for a while
33	Calm	He/she becomes more calm as soon as I start singing
34	Somewhat Fussy	He/she becomes more calm as soon as I start singing
35	Calm	He/she becomes more calm as soon as I start singing
36	Fussy	He/She becomes more calm after I have been singing for a while
37	Calm	He/She does not change much when I sing
38	Fussy	He/she becomes more calm as soon as I start singing
39	Somewhat Calm	He/she becomes more calm as soon as I start singing
40	Calm	He/She does not change much when I sing
41	Somewhat Fussy	He/She does not change much when I sing
42	Very Calm	He/She does not change much when I sing
43	Very Calm	He/she becomes more calm as soon as I start singing
44	Somewhat Calm	He/she becomes more calm as soon as I start singing
45	Neutral	He/She becomes more calm after I have been singing for a while
46	Somewhat Calm	He/She does not change much when I sing
47	Very Calm	He/she becomes more calm as soon as I start singing
48	Somewhat Fussy	He/She does not change much when I sing
49	Somewhat Fussy	He/she becomes more calm as soon as I start singing
50	Calm	He/She does not change much when I sing
51	Calm	He/She becomes more calm after I have been singing for a while
52	Neutral	He/she becomes more calm as soon as I start singing

Subject	4: If you sang a particular song to your baby during pregnancy, what effect does singing that song now have on your baby's temperament?	Regarding the particular song you sang to your baby during pregnancy, do you find that singing it now is more effective, less effective, or the same as any other songs that you sing to your baby now?
1	I did not sing a particular song to my baby, or I do not sing to my baby now	
2	I did not sing a particular song to my baby, or I do not sing to my baby now	
3	He/she becomes more calm as soon as I start singing	Same
4	He/She becomes more calm after I have been singing for a while	Same
5	He/she becomes more calm as soon as I start singing	Same
6	He/She becomes more calm after I have been singing for a while	Same
7	He/She becomes more calm after I have been singing for a while	Same
8	He/she becomes more calm as soon as I start singing	Same
9	He/She does not change much when I sing	Same
10	He/she becomes more calm as soon as I start singing	More effective
11	I did not sing a particular song to my baby, or I do not sing to my baby now	
12	He/she becomes more calm as soon as I start singing	Same
13	I did not sing a particular song to my baby, or I do not sing to my baby now	
14	He/She becomes more calm after I have been singing for a while	Same
15	He/she becomes more calm as soon as I start singing	More effective
16	He/She does not change much when I sing	More effective
17	He/She does not change much when I sing	Same
18	I did not sing a particular song to my baby, or I do not sing to my baby now	
19	He/she becomes more calm as soon as I start singing	More effective
20	He/she becomes more calm as soon as I start singing	More effective
21	He/She does not change much when I sing	Same
22	He/She does not change much when I sing	More effective
23	He/she becomes more calm as soon as I start singing	Same
24	I did not sing a particular song to my baby, or I do not sing to my baby now	
25	I did not sing a particular song to my baby, or I do not sing to my baby now	
26	I did not sing a particular song to my baby, or I do not sing to my baby now	
27	I did not sing a particular song to my baby, or I do not sing to my baby now	
28	He/she becomes more calm as soon as I start singing	Same
29	He/She does not change much when I sing	Same
30	He/She does not change much when I sing	Same
31	He/She does not change much when I sing	Less effective
32	He/she becomes more calm as soon as I start singing	Same
33	I did not sing a particular song to my baby, or I do not sing to my baby now	
34	I did not sing a particular song to my baby, or I do not sing to my baby now	
35	He/she becomes more calm as soon as I start singing	Same
36	He/she becomes more calm as soon as I start singing	Same
37	I did not sing a particular song to my baby, or I do not sing to my baby now	
38	He/she becomes more calm as soon as I start singing	More effective
39	I did not sing a particular song to my baby, or I do not sing to my baby now	
40	I did not sing a particular song to my baby, or I do not sing to my baby now	
41	I did not sing a particular song to my baby, or I do not sing to my baby now	
42	I did not sing a particular song to my baby, or I do not sing to my baby now	
43	He/she becomes more calm as soon as I start singing	Same
44	He/she becomes more calm as soon as I start singing	More effective
45	He/she becomes more calm as soon as I start singing	More effective
46	He/She does not change much when I sing	Less effective
47	I did not sing a particular song to my baby, or I do not sing to my baby now	
48	I did not sing a particular song to my baby, or I do not sing to my baby now	
49	He/she becomes more calm as soon as I start singing	More effective
50	I did not sing a particular song to my baby, or I do not sing to my baby now	
51	I did not sing a particular song to my baby, or I do not sing to my baby now	
52	I did not sing a particular song to my baby, or I do not sing to my baby now	

REFERENCES

- Abrams, R. M., Griffiths, S., Huang, X., Sain, J., Langford, G., & Gerhardt, K. (1998). Fetal music perception: The role of sound transmission. *Music Perception, An Interdisciplinary Journal*, 15 (3), 307-317.
- Bergeson, T. R., & Trehub, S. (2002). Absolute pitch and tempo on mothers' songs to infants. *Psychological Science*, 13 (1), 72-75.
- Bergeson, T., & Trehub, S. (2007). Signature tunes in mothers' speech to infants. *Infant Behavior & Development*, 20 (4), 648-654.
- Blum, T. (1993). *Prenatal Perception Learning and Bonding*. Berlin, Hong Kong, Seattle: Leonardo Publishers.
- Brand, M. (1985). Lullabies that awaken musicality in infants. *Music Educators Journal*, 71 (7), 28-31.
- Brand, M. (1986). Relationship between home musical environment and selected musical attributes of second-grade children. *Journal of Research in Music Education*, 34 (2), 111-120.
- Carolan, M., Barry, M., Gamble, M., Turner, K., & Mascarenas, O. (2011). Singing lullabies in pregnancy: What benefits for women? *Women and Birth*, 24 (Supplement 1), S29.
- Cassidy, J. W., & Ditty, K. (2001). Gender differences among newborns on a transient otoacoustic emissions test for hearing. *Journal of Music Therapy*, 38 (1), 28-35.
- Cevasco, A. M. (2008). The effects of mothers' singing on full-term and preterm infants and maternal emotional responses. *Journal of Music Therapy*, 45 (3), 273-306.
- Csibra, G. (2010). Recognizing communicative intentions in infancy. *Mind & Language*, 25 (2), 141-168.
- Custodero, L. A. (2006). Singing Practices in 10 Families with Young Children. *Journal of Research in Music Education*, 54 (1), 37-56.

- Custodero, L. A., & Johnson-Green, E. (2008). Caregiving in counterpoint: Reciprocal influences in the musical parenting of younger and older infants. *Early Child Development and Care, 178* (1), 15-39.
- Custodero, L. A., & Johnson-Green, E. (2003). Passing the cultural torch: Musical experience and musical parenting of infants. *Journal of Research in Music Education, 51* (2), 102-114.
- Custodero, L. A., Britto, P. R., & Brooks-Gunn, J. (2003). Musical lives: A collective portrait of American parents and their young children. *Applied Developmental Psychology, 24*, 553-572.
- DeCasper, A. J., & Fifer, W. (1980). Of human bonding: Newborns prefer their mothers' voices. *Science, 208* (4448), 1174-1176.
- DeCasper, A. J., & Spence, M. (1986). Prenatal maternal speech influences newborns' perception of speech sounds. *Infant Behavior and Development, 9*, 133-150.
- DeCasper, A. J., Lecanuet, J., Busnel, M., Granier-Deferre, C., & Maugeais, R. (1994). Fetal reactions to recurrent maternal speech. *Infant Behavior and Development, 17*, 159-164.
- Dirix, C. E., Nijhuis, J., Jongsma, H., & Hornstra, G. (2009). Aspects of fetal learning and memory. *Child Development, 80* (4), 1251-1258.
- Dureau, S. J. (2005). The effect of gender on one-day-old infants' behavior and heart rate responses to music decibel level. *Journal of Music Therapy, 42* (3), 168-184.
- Fernald, A. (1985). Four-month-old infants prefer to listen to motherese. *Infant Behavior and Development, 8*, 181-195.
- Fox, D. B. (2000). Music and the baby's brain: Early experiences. *Music Educators Journal, 87* (2), 23-27+50.

- Gates, J. T. (1991). Music participation: Theory, research, and policy. *Bulletin of the Council for Research in Music Education, 109*, 1-35.
- Gordon, E. (1979, pg 51). Primary Measures of Music Audiation. Chicago: G.I.A. Publications.
- Griffiths, S. K., Brown, W., Gerhardt, K., Abrams, R., & Morris, R. (1994). The perception of speech sounds recorded within the uterus of a pregnant sheep. *Journal of the Acoustical Society of America, 96*, 2055-2063.
- Hefer, M., Weintraub, Z., & Cohen, V. (2009). Musical cognition at birth: A qualitative study. *Early Child Development and Care, 179* (6), 769-783.
- Hepper, P. G., & Shahidullah, B. (1994). Development of fetal hearing. *Archives of Disease in Childhood, 71*, F81-F87.
- Hepper, P. G., Scott, D., & Shahidullah, S. (1993). Newborn and fetal response to maternal voice. *Journal of Reproductive and Infant Psychology, 11*, 147-153.
- Ilari, B. (2005). On musical parenting of young children: Musical beliefs and behaviors of mothers and infants. *Early Child Development and Care, 175* (7&8), 647-660.
- Ilari, B., & Sundara, M. (2009). Music listening preferences in early life. *Journal of Research in Music Education, 56* (4), 357-369.0
- Ilari, B., Moura, A., & Bourscheidt, L. (2011). Between interactions and commodities: Musical parenting of infants and toddlers in Brazil. *Music Education Research, 13* (1), 51-67.
- Keith, D. R., Russell, K., & Weaver, B. (2009). The effects of music listening on inconsolable crying in premature infants. *Journal of Music Therapy, 46* (3), 191-203.
- Kisilevsky, B. S., Hains, S. M., Lee, K., Xie, X., Huang, H., Ye, H. H., et al. (2003). Effects of experience on fetal voice recognition. *Psychological Science, 14* (3), 220-224.

- Lecanuet, J. P., Granier-Deferre, C., Jacquet, A., Capponi, I., & Ledru, L. (1993). Prenatal discrimination of a male and female voice uttering the same sentence. *Early Development and Learning, 2*, 217-228.
- Lecanuet, J. P., Graniere-Deferre, C., Jacquet, A. Y., & DeCasper, A. J. (2000). Fetal discrimination of low-pitched musical notes. *Developmental Psychobiology, 36* (1), 29-39.
- Montemurro, R., & Rosario, N. (1996). Singing lullabies to unborn children: Experiences in village Vilamarxant, Spain. *Journal of Prenatal & Perinatal Psychology & Health, 11* (1), 9-16.
- Moon, C., Cooper, R., & Fifer, W. (1993). Two-day olds prefer their native language. *Infant Behavior and Development, 16*, 495-500.
- O'Neill, C. T., Trainor, L., & Trehub, S. (2001). Infants' responsiveness to fathers' singing. *Music Perception: An Interdisciplinary Journal, 18* (4), 409-425.
- Papousek, M. (1996). Intuitive parenting: A hidden source of musical stimulation in infancy. In I. Deliège, & J. A. Sloboda, *Musical Beginnings. Origins and Development of Musical Competence* (pp. 37-87). Oxford: Oxford University Press.
- Polverini-Rey, R. (1992). *Intrauterine musical learning: The soothing effect on newborns of a lullaby learned prenatally (Dissertation)*. Los Angeles: California School of Professional Psychology.
- Reimer, B. (1965). Effects of music education: Implications from a review of research. *Journal of Research in Music Education, 13* (3), 147-158.
- Rock, A. M., Trainor, L., & Addison, T. (1999). Distinctive messages in infant-directed lullabies and play songs. *Developmental Psychology, 35* (2), 527-534.
- Schaper, K. K. (1982). Towards a calm baby and relaxed parents. *Family Relations, 31* (3), 409-414.

- Shenfield, T., Trehub, S. E., & Nakata, T. (2003). Maternal singing modulates infant arousal. *Psychology of Music, 31* (4), 365-375.
- Shetler, D. J. (1985). Prelude to a musical life: Prenatal music experiences. *Music Educators Journal, 71* (7), 26-27.
- Standley, J. M., & Madsen, C. (1990). Comparison of infant preferences and responses to auditory stimuli: Music, mother, and other female voice. *Journal of Music Therapy, 27*, 54-97.
- Street, A., Young, S., Tafuri, J., & Ilari, B. (2003). Mothers' attitudes to singing to their infants. *Proceedings of the 5th Triennial ESCOM Conference* (pp. 628-631). Hanover University of Music and Drama, Germany.
- Szabo, L. (2009, January 27). Babies groove to a beat -- maybe even before birth. *USA Today*, p. 1a.
- Trehub, S. E. (2001). Musical predispositions in infancy. *Annals of the New York Academy of Sciences, 930*, 1-16.
- Trehub, S. E., Unyk, A. M., Kamenetsky, S. B., Hill, D. S., Trainor, L. J., Henderson, J. L., et al. (1997). Mothers' and fathers' singing to infants. *Developmental Psychology, 33* (3), 500-507.
- Trehub, S., Schellenberg, E., & Hill, D. (1997). The origins of music perception and cognition: A developmental perspective. In I. Deliège, & J. Sloboda, *Music Perception and Cognition* (pp. 107-132). East Sussex, UK: Earlbaum.
- Vouloumanos, A., & Werker, J. (2007). Listening to language at birth: Evidence for a bias for speech in neonates. *Developmental Science, 10* (2), 159-164.
- Walworth, D. D. (2009). Effects of developmental music groups for parents and premature or typical infants under two years on parental responsiveness and infant social development. *Journal of Music Therapy, 46* (1), 32-52.

Whitwell, G. E. (n.d.). *Center for Prenatal and Perinatal Music*. Retrieved from www.prenatalmusic.com

Wilkin, P. E. (1995/1996). A comparison of fetal and newborn responses to music and sound stimuli with and without daily exposure to a specific peice of muisc. *Bulletin of the Council for Research in Music Education* (127), 163-169.

Your Pregnancy: 19 Weeks. (n.d.). Retrieved from Babycenter: www.babycenter.com

BIOGRAPHICAL SKETCH

In the 2009 fall semester, Candice Sirak completed her Bachelor's degree in Music Therapy at the Florida State University. She enrolled in the master's program at FSU in the spring 2010 semester. Candice's research interests include prenatal music therapy, music therapy assisted childbirth, and music therapy to promote bonding between mothers and infants.