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How are the Features of Infant Directed Speech Related to Cradling Bias?

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NORTHERN ILLINOIS UNIVERSITY

How are the Features of Infant Directed Speech Related to Cradling Bias?

A Capstone Submitted to the

University Honors Program

In Partial Fulfillment of the

Requirements of the Baccalaureate Degree

With Honors

Department Of

Allied Health and Communicative Disorders

By

Tiffany Jacob

DeKalb, Illinois

May 14, 2022

University Honors Program

Capstone Faculty Approval Page

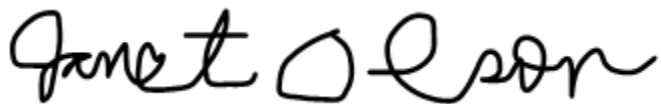
Capstone Title

How are the Features of Infant Directed Speech Related to Cradling Bias?

Student Name: Tiffany Jacob

Faculty Supervisor: Dr. Janet Olson

Faculty Approval Signature _

A handwritten signature in black ink that reads "Janet Olson". The signature is written in a cursive style with a large, looped initial "J".

Department of: Allied Health and Communicative Disorders

Date of Approval (print or type)

5/5/2022

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Abstract

The current study explored whether the cradling bias observed in mothers of very young infants is related to acoustic features of infant directed speech. Six mothers were asked to set their 4-month-old infants down and pick them up to determine which side mothers used to cradle their infants. Mothers were placed in two groups: left-sided cradling bias and right-sided cradling bias. The mothers were then recorded as they talked to their infants while they shared books and simple toys designed to elicit the vowels /i/, /a/, and /u/. Vowel fundamental frequency (/i, a, u/) and word length (i.e., “*sheep, shop, shoe*”) were obtained and compared across and within mothers to determine if mothers who have a left-sided cradling bias also use more acoustic features of infant directed speech. There was no significant difference in vowel fundamental frequencies or the length of the target words dependent on cradling bias. Within mother analyses based on which side they cradled their infant on could not be evaluated because mothers never said the target words when they held their infants on their non-bias side.

Introduction

There is a left sided cradling bias when we hold very young infants (Almerigi, 2002). About 80 percent of newly delivered mothers, irrespective of the sex of their infant and their handedness, hold their newborn babies to the left of midline (Chateau, 1983). This bias has been shown to be stronger in women than men and is stronger in right-handed than left-handed adults (Almerigi, 2002). There is evidence that cradling biases are absent in mothers who are depressed and that the speech they use with infants has fewer features of infant directed speech (Kaplan, Bachorowski, Smoski, & Zinser, 2001; Wetherill, Almerigi, Levendosky, Bogat, von Eye, & Harris, 2004). There is also evidence that mothers with autism spectrum disorders do not show a

cradling bias (Pileggi, Malcolm-Smith, & Solms, 2015). There are many explanations for why this holding bias has been found. One explanation is that mothers primarily hold their child within proximity of their heart. Infants are used to the sound of their mother's heartbeat during their prenatal phase, so being on the left side can calm them down (Negayama, 2010). A second more obvious reason is that mothers are free to use their right hand to do manual things (Bolton, 1978). However, the left-sided cradling bias is also strong in individuals who are left-handed so handedness cannot fully explain the cradling bias. The most widely accepted current explanation for the left-sided cradling bias (Kaplan-Solms, 1985; Manning & Chamberlain, 1990, 1991), suggests that it could be due to the specialization of the right brain hemisphere for the perception and expression of emotion. Thus, an infant cradled to the left will be preferentially "seen" by the mother's right hemisphere, which might allow the mother to better perceive infants' emotions and states. In those with normal brain asymmetry, the right hemisphere is primarily involved in the control of speech prosody which is intonation, stress patterns, loudness variations and the rhythm in language (Turnbull & Bryson, 2001).

It is also known that mothers talk differently to very young infants than they do to adults. Many cross-cultural studies have shown that infant-directed speech is produced with a higher fundamental frequency (pitch), exaggerated intonation contours, and a slower cadence which helps direct infant's attention to speech and helps them learn language (Kuhl, Andruski, Chistovich, Kozhevnikova, Ryskina, Stolyarova, Lacerda, 1997). Because mothers are directing this type of emotionally laden speech to infants at the same time as they exhibit a left-sided cradling bias, the current study will explore links between the two. Therefore, the current study will investigate the following research questions: Will mothers who have a left sided cradling bias show more acoustic characteristics of infant directed speech than mothers who have a right

sided cradling bias? And does mothers' speech have different acoustic characteristics when they cradle their infant on the left versus the right side?

Method

Participants

Six mothers and their four-month-old infants (2 boys) were recruited from the community as part of a pilot study in a laboratory at the NIU Speech-Language-Hearing Clinic. We then gathered demographic information such as the birthdate of the infant and the mother, the ethnicity, the birth order, the mother's education, gender, handedness (which is their dominant hand), marital status, family history of speech/language/learning difficulties, their native language and the languages spoken at home. See Appendix B. Four of the six mothers identified themselves as Anglo-American/Caucasian and two mothers identified themselves as Asian. Two mothers reported that Mandarin and Malayalam were spoken in their homes and one mother said that some Spanish was spoken in the home. Every mother reported that English was also spoken in their households. Two mothers had a graduate degree, one mother completed a college degree, and one mother completed high school/GED. Three of the six mothers had older children other than the infant in this study. Five of the six mothers lived with their spouse/parent of their child. One mother lived with her spouse. The mean age of the mothers was 31 years old. The mean age for the infants was 131 days. All the mothers were right-handed.

Procedure

After mothers signed a consent form describing the research project, they were asked to pick their babies up and move around the room to determine their cradling bias, to share simple books with their infants, and to play with a toy set to obtain samples of infant directed speech.

Researchers observed participants through a one-way observation mirror. See Appendix A for the consent form and Appendix C for participant instructions. This study was approved by the Northern Illinois University Institutional Review Board #HS20-0203.

Determining Cradling Bias

To determine cradling bias, mothers were asked to place their infants in a bassinet and pick them up and carry them along a taped path to get one of three picture books researchers created to obtain a speech sample. See more details about the books below. Mothers were then asked to sit back down with their infants in a chair and look at the books. Mothers were asked to do these actions a total of three times so that researchers could determine a side of bias for each mother. The mother's side of bias was defined as the side they picked their child up two out of the three times.

Speech Sampling Recording

To obtain samples of mothers' infant directed speech, participants were audio recorded in an 8X10 room at the NIU Speech-Language-Hearing Clinic as they shared three simple books or played with a simple toy set. An iPhone 7 was attached to the bassinet mothers placed their babies in during the cradling bias procedures so researchers could audio record mother's speech using the Voice Memo app. All recordings were saved for later acoustical analysis.

Speech Sampling Stimuli

Three picture books and a simple toy set were created by researchers to obtain a sample of infant directed speech that included the vowels /i/ in sheep, /a/ in shop, and /u/ in shoe. Each book contained the three target words along with picture exemplars of each word. See Figure 1. The toy set contained exemplars of the same three target words. It included sheep, shopping carts

and shoes for the infant to play with. See Figure 1. Mothers were asked to share the books and play with the toys as they would at home.

Figure 1



Acoustic measurements of Infant Direct Speech

The recordings of mothers' infant directed speech were analyzed using Speech Filing System (SFS) (Seminaroti & Haus, 2019) software to extract two acoustic variables from the three target words, sheep, shop, and shoe. The fundamental frequency of vowels for /u, i, a/ and word length was extracted when mothers said, "*sheep*," "*shop*," and "*shoe*" to their infants (i.e., infant directed speech). Mean vowel fundamental frequency and word length were obtained for each participant and for the left side bias group and the right-side bias group.

Mothers always held their infants on their side of bias when they used the target words, 'sheep, shop and shoe', in this sample. Therefore, means could not be obtained for vowel fundamental frequency or word length within mothers when they held their infants on their left and right side.

Results

Research question 1:

Will mothers who have a left sided cradling bias show more acoustic characteristics of infant directed speech than mothers who have a right sided cradling bias?

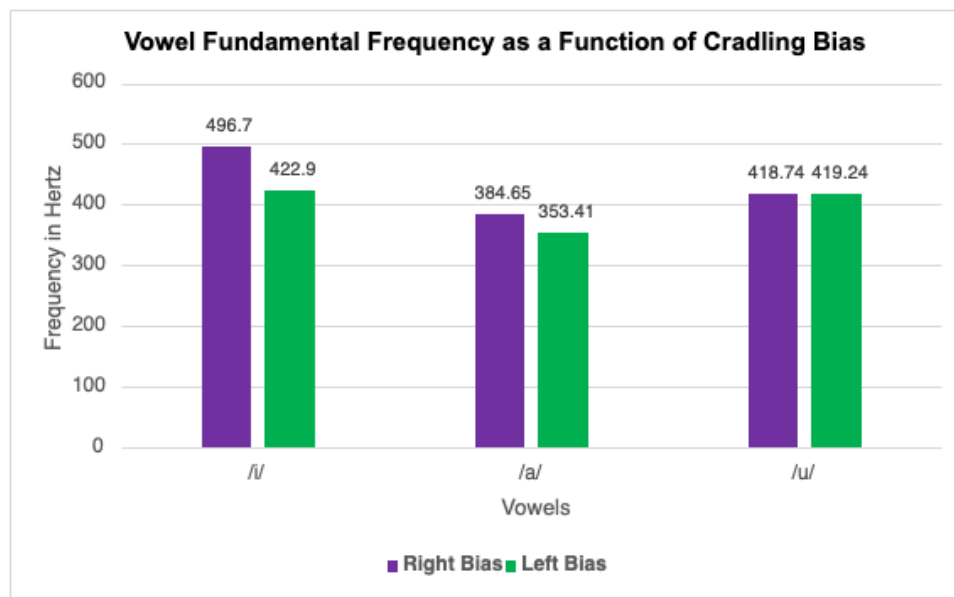
Hypothesis 1a:

It was hypothesized that mothers who have a left sided cradling bias will have vowels that are higher in frequency when they talk to their infants than mothers who have a right sided bias.

To test this hypothesis, we extracted the fundamental frequencies of /i/ in "sheep", /a/ in "shop", and /u/ in "shoe" for mothers with a left sided cradling bias and for mothers with a right

sided cradling bias and compared them using independent t-tests. The vowel fundamental frequencies were not significantly different across groups ($/i/ t(3) = -.446, p = .686$, $/a/ t(3) = -.120, p = .912$, and $/u/ t(3) = .004, p = .997$). The vowel, $/i/$ in sheep, had the highest fundamental frequency for both groups and the vowel, $/a/$ in shop, had the lowest fundamental frequency. See Figure 2.

Figure 2



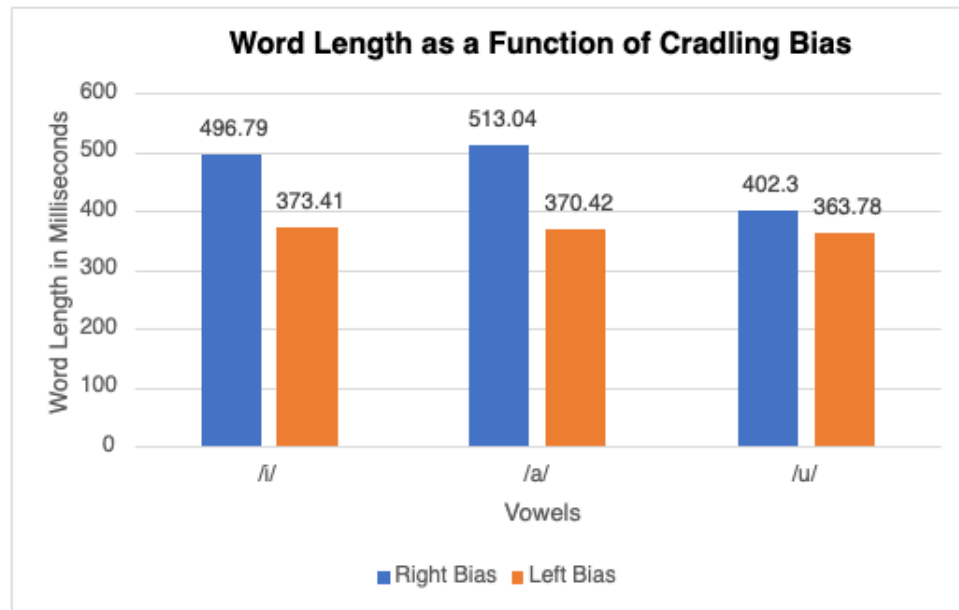
Hypothesis 1b:

It was hypothesized that mothers who have a left sided cradling bias will have words that are elongated when they talk to their infants compared to mothers with a right-side cradling bias.

To test this hypothesis, we extracted word length for “sheep”, “shop”, and “shoe” for mothers with a left sided cradling bias and for mothers with a right sided cradling bias and

compared them using independent t-tests. The word lengths were not significantly different across group (*sheep* $t(3) = -.574, p = .606$, *shop* $t(3) = .297, p = .786$, and *shoe* $t(3) = -.134, p = .902$). Shop had the longest word length and shoe had the shortest word length for both groups. See Figure 3.

Figure 3



Research Question 2:

Does mothers' speech have different acoustic characteristics when they cradle their infant on the left versus the right side?

Hypothesis 2

It was hypothesized that mothers' speech would have different acoustical characteristics when they cradled their infants on the left versus right side.

This hypothesis could not be evaluated because mothers never said the target words when they held their infants on their non-bias side. Mothers consistently held their infants on their side

of bias when they used the target words, “sheep, shop and shoe”, in this sample. Mothers did shift infants to their non-bias side, but they said utterances that did not contain the study’s target words.

Conclusion

The current study found that mothers with a left side cradling bias did not use more characteristics of infant directed speech than mothers with a right sided cradling bias. There was no significant difference in vowel fundamental frequencies or the length of the target words dependent on cradling bias. This was contrary to other studies who found acoustical differences in infant directed speech based on cradling bias. A study conducted by Reissland (2000) with 45 mothers reported that mean fundamental frequency was higher for mothers who cradled on the left side compared to mothers who cradled on the right side while they played with their infants. Results in the current study might have been different if there were more participants to the study. For example, the current study only had one mother who had a right-side cradling bias. This is not surprising and is consistent with past studies that showed that 75% of mothers who participated had a left-sided cradling bias (Todd and Bannerjee, 2016). Because 75 to 85% of mothers in the general population have a left sided cradling bias, future studies evaluating the impact of cradling bias on mothers’ speech to their infants would need large sample sizes to have enough mothers with a right-side cradling bias to make a valid comparison (Todd & Bannerjee, 2016). Results of the current study also are not surprising based on a previous study by Jacob and Olson (2020). They found that there was no difference in the linguistic features of mothers’ infant directed speech based on whether they were cradling their infant on the left or right side or if they showed a left sided bias.

Another limitation of the study is that a sample of mothers' adult directed speech was not obtained. That made it difficult to determine if the baseline acoustical characteristics of mothers' adult directed speech masked any changes that occurred in their infant directed speech. Future studies should include samples of adult directed speech so that a baseline measure of fundamental frequency and word length can be obtained for comparison with each mothers' infant directed speech.

Not being able to evaluate research question 2 because mothers did not say the target words on their unbiased side was unexpected. Researchers expected mothers to say target words with infants on the left and right side, but this did not happen. In the future, researchers should instruct mothers to cradle on the right side and the left side as they share stimuli designed to elicit target words with their infants. By doing this, differences in mothers' speech when they cradle on the left and on the right can be evaluated since mothers would have to use their right and left side.

Another step that can be taken to further this study would be to compare cradling bias and its effect on infant direct speech in mothers who are depressed and in mothers who are not depressed. There is evidence that mothers who are depressed use fewer features of infant directed speech and signs of a cradling bias are absent. Infants of nondepressed mothers readily learned that their mothers' speech signaled look at my face, whereas infants of depressed mothers failed to learn that their mothers' speech signaled look at my face (Kaplan, Bachorowski, Smoski, & Zinser, 2001). Examining cradling bias with mothers' infant directed speech might help inform interventions for mothers who are depressed or are at risk for depression.

References

- Almerigi JB, Carbary TJ, Harris LJ. (1970). Most adults show opposite-side biases in the imagined holding of infants and objects. *Brain and Cognition*, 48(2-3), 258-263. PMID: 12030447.
- Kaplan, P. S., Bachorowski, J. A., Smoski, M. J., & Zinser, M. (2001). Role of Clinical Diagnosis and Medication Use in Effects of Maternal Depression on Infant-Directed Speech. *Infancy*, 2(4), 537–548. https://doi.org/10.1207/S15327078IN0204_08
- Kuhl, P., Andruski, J., Chistovich, I., Chistovich, L., Kozhevnikova, E., Ryskina, V., Stolyarova, E., Sundberg, U. and Lacerda, F. (1997). Cross-Language Analysis of Phonetic Units in Language Addressed to Infants. *Science*, 277(5326), 684-686.
- Negayama, K., Kawai, M., Yamamoto, H., Tomiwa, K., Sakakihara, Y., & Japan Children's Study Group (2010). Behavioral development of infant holding and its laterality in relation to mothers' handedness and child-care attitude. *Infant behavior & development*, 33(1), 68–78. <https://doi.org/10.1016/j.infbeh.2009.11.001>
- Negayama, K., Delafield-Butt, J. T., Momose, K., Ishijima, K., Kawahara, N., Lux, E. J., Murphy, A., & Kaliarntas, K. (2015). Embodied intersubjective engagement in mother-infant tactile communication: a cross-cultural study of Japanese and Scottish mother-infant behaviors during infant pick-up. *Frontiers in psychology*, 6, 66. <https://doi.org/10.3389/fpsyg.2015.00066>
- Nishimura, Y., Kanakogi, Y. and Myowa-Yamakoshi, M. (2016). Infants' emotional states influence maternal behaviors during holding. *Infant Behavior and Development*, 43, 66-74.

Turnbull, O. and Bryson, H. (2001). The leftward cradling bias and hemispheric asymmetry for speech prosody. *Laterality: Asymmetries of Body, Brain and Cognition*, 6(1), 21-28.

Pileggi, L. A., Malcolm-Smith, S., & Solms, M. (2015). Investigating the role of social-affective attachment processes in cradling bias: the absence of cradling bias in children with autism spectrum disorders. *Laterality*, 20(2), 154–170.

<https://doi.org/10.1080/1357650X.2014.948449>

Reissland, N. (2000). The cradling bias in relation to pitch of maternal child-directed language. *British Journal of Developmental Psychology*, 18(2), 179-186.

Seminaroti, M., & Haus, U.U. (2019). *Package 'SFS' - cran.r-project.org*. Retrieved April 4, 2022, from <https://cran.r-project.org/web/packages/SFS/SFS.pdf>

Weatherill, R. P., Almerigi, J. B., Levendosky, A. A., Bogat, G. A., von Eye, A., & Harris, L. J. (2004). Is maternal depression related to side of infant holding? *International Journal of Behavioral Development*, 28, 421-427.

Todd, B. and Banerjee, R. (2015). Lateralization of infant holding by mothers: A longitudinal evaluation of variations over the first 12 weeks. *Laterality: Asymmetries of Body, Brain and Cognition*, 21(1), 12-33.

Appendix A

Informed Consent Form for participating in the study

“Holding and Interacting with Young Infants”

You and your son/daughter, _____, have been invited to participate in a study organized by Dr. Janet Olson, Associate Professor in the School of Allied Health and Communicative Disorders at Northern Illinois University. This study is designed to gain knowledge about how mothers and young infants interact. Your infant will participate with you and the investigator in a room at the NIU Speech-Language-Hearing Clinic where you will be video recorded. You will be asked to do the following activities:

1. Complete a background questionnaire.
2. Wear a microphone to enhance the recording of any vocalizations and/or words either of you might produce.
3. Pick your infant up and put them down.

You will be asked to pick your infant up and walk along a taped path to place your infant in an infant seat or on a blanket on the other side of the room while you sit down in a chair next to your infant. You will then be asked to pick your infant up again and now sit with them in the chair while you interact for a minute. This will be repeated two additional times by following a second and third taped path to a two more areas where you will be asked to put your child down on a blanket or in an infant seat and sit in a chair next to them. You will then be asked to pick them up again while you sit in the chair and interact with them for a minute.

4. Look at simple picture books.
5. Play with your infant with a few soft toys.

You will be asked to interact with your infant, stuffed toys, and a teething toy for 5 minutes as you would at home.

6. Talk about one of the picture books with the experimenter.

These activities will last approximately 15 minutes and you will remain with your infant at all times. At any time, you can stop the activities and/or withdraw from the study. All materials will be sanitized before each session.

The potential risks to your infant are believed to be minimal. You will remain with your infant at all times. There is no direct benefit to you or your infant, however, the findings of this study may help parents and professionals better understand how mothers and infants interact. All of the information obtained from your participation will be kept confidential and anonymous. Your consent form will be kept separate from the data and

the data will not be available to anyone other than the experimenters conducting the study.

You are reminded that your participation is voluntary. This means you can choose whether or not to participate. You can terminate participation in the study at any time. You can also choose to withdraw from the study at any time and request that none of your data be used. If you have any questions or concerns related to your participation in this study, please call Dr. Janet Olson, School of Allied Health and Communicative Disorders at 815-753-1484. Any questions about your rights as a research participant can be addressed to the NIU Office of Research Compliance, Integrity, and Safety (815-753-8588). If you agree to participate please sign the bottom portion of this consent form.

"I acknowledge that I received a copy of the Informed Consent Form. I agree to participate with my infant, Name: _____ in the study, "Holding and Interacting with Young Infants". I understand that I can withdraw from participation at anytime without penalty and I can request that none of our data be used."

Parent Signature: _____ Date: _____ "I give permission to videotape the sessions involving my infant and myself."

Parent Signature: _____ Date: _____

"I give Dr. Janet Olson permission to use the videotaped sessions in any future presentations. I understand that identifying information will be removed from any such presentations".

Parent Signature: _____ Date _____

Experimenter Signature: _____ Date: _____

Appendix B

Background Information Questionnaire

Code #: _____

Date of Session: _____

Child's D.O.B.: _____ Mother's D.O.B.: _____

Child's gender: _____

Mother's handedness RIGHT LEFT

Languages spoken in the home: _____

Mother's primary language: _____

Others living in the household:

_____ child's other parent _____ Other adult(s);give age(s): _____

_____ other child(ren); give age(s): _____

Mother's ethnicity: (optional)

_____ African-American _____ Asian _____ Hispanic

_____ Anglo-American/Caucasian Other (specify: _____)

Mother's education (highest level completed):

_____ less than high school _____ high school/GED _____ some college

_____ college degree _____ graduate degree

Appendix C

Cradling Bias Instruction:

Introduction:

Thank you for coming in today. We can sit in here for a few minutes while we take care of some paperwork and go over what we will be doing today.

Here are some papers that describe the study and let you know what your rights are as a participant. It is your right to stop participating at any time or ask any questions that you may have. All you have to do is let us know.

You can go ahead and read these. You will be given a copy to take home with you, as well. If you are okay with this information, you can sign at the bottom. We would like to videotape the session so if you are okay with this then you can go ahead and sign for that too.

Before we begin, we just wanted to give you a brief overview of what to expect today. You will remain with your child for the entirety session and will be asked to engage in various interactions with your child while looking at picture books. You will be given specific instructions as to what to do through the transmitter that is placed on the table. After looking at the books, you will be asked to play with your child for 5 minutes or so, just as you would at home. The session shouldn't take more than 30 minutes. You will be given contact information for an Institutional Review of Research representative if you any additional questions.

Pre-Session Instructions:

As you know from the flier we are interested in mother-infant interactions. When you enter the room, you will see a chair beside a bassinet. There will be a taped path leading from the chair to a table where 3 picture books are placed. During the session, you will be asked to stand up with your child, walk along a taped path to grab a book from the table, and then follow the taped path back to the chair and bassinet multiple times. Once you have returned back to the chair and bassinet, you will take a minute or two to look through the book together.

Instructions will be provided to you throughout the session to guide you. When you enter the room, you may sit on the chair and place your child in the bassinet. You will then wait for further instructions to be given to you through the transmitter. Do you have any questions before we begin? (no) Okay, let me walk you to the room.

Session Instructions:

You can go ahead and have a seat on the chair here (point to chair) and place your child in here (point to bassinet). Do you have any other questions before I go into the observation room? (no) Great! Sit tight while you wait for the instructions to be given.

Okay, XXX, you can go ahead and stand up, pick up your child from the bassinet, and walk along the taped path to the table to grab Book 1. Once you have it, walk on back to the chair and bassinet, place your child back into the bassinet and return to your seat. You can now pick your child up while in the chair and take some time to read through the picture book with your child, emphasizing the words provided on each page.

(1-2 minutes)

Great, thank you. Now you can go ahead and stand up again, pick up your infant, and walk along the taped path back to the table. You can put down Book 1 and pick up Book 2. Once you have it, walk back to the chair and bassinet, placing your child back into the bassinet and sitting back down in your seat. Pick them back up while sitting and read through the picture book again, in the same way you did with Book 1.

(1-2 minutes)

Thank you. You can now do the same thing with the last book. Go ahead and stand up, pick up your infant, and walk along the path to put down Book 2 and pick up Book 3. You can then walk back to the chair and bassinet, again, placing your child back into the bassinet and sitting back down into your seat. Pick your child back up and read through Book 3, just as you did with the previous books.

(1-2 minutes)

Perfect, thank you. You will now take 5 minutes to play with your child. You may sit on the blanket on the floor and play with any of the toys provided. Play with them just as you would at home.