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Preference for Infant-Directed Speech in Preverbal Young Children

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The influences of infant-directed and adult-directed speech on child preference for either type of speech were examined in 34 studies including 840 preverbal infants 2 to 270 days of age. Three types of infant-directed and adult-directed speech were the focus of analysis: naturalistic, simulated, and filtered or synthesized speech. Naturalistic speech included mothers talking to infants or adults as they normally would. Simulated speech included adults being asked to speak preselected sentences or phrases to infants or adults. Filtered speech included either naturalistic or simulated speech where the higher-frequency components of the speech were removed whereas synthesized speech included digitized speech signals that extracted fundamental frequency and amplitude information from natural speech samples. Results showed that naturally spoken infant-directed speech more than 8 to 10 seconds in length was associated with more infant attention and preference and more social responsiveness compared to adult-directed speech. Results also showed that infant-directed speech had attention-enhancing effects regardless of the age of the infants. Implications for practice are described.

Adults, and especially parents, often adopt a distinctive manner of talking when interacting with infants known as infant-directed speech (Sickert, 2005). Infant-directed speech, or parentese, "tends to consist of short, well-formed utterances, to contain fewer false starts and hesitations, and includes fewer complex sentences and subordinate clauses" (Pine, 1994, p. 15). This type of speech is high-pitched and is characterized by a slower rhythm and inflated tone spoken to infants by parents and other adults (Baron, 1989; Sickert, 2005). It is generally believed that infant-directed speech exists universally in cultures where adults spend time interacting with young infants with the intent of eliciting social responsiveness (Bryant & Barrett, 2007; Grieser & Kuhl, 1988).

Commonly cited effects of infant-directed speech spoken to preverbal children (less than 9 months of age) include, but are not limited to, increased attention to and preference for this type of speech when compared to adult-directed speech (e.g., Cooper & Aslin, 1994; Schachner & Hannon, 2011; Werker & McLeod, 1989). These effects have been most often measured in terms of infants' differential preference for or social responsiveness to the two types of speech. One purpose of child-directed speech is "to gain and maintain the child's attention" (Sickert, 2005, p. 6) which presumably makes it easier for children to attend to linguistic input.

According to Cooper et al. (1997), infant-directed speech plays a role in regulating infant arousal and attention, infants' interpretation of the emotional state of adult speakers, and making linguistic input more apparent and salient to infants. The effects of speaking infant-directed speech to preverbal infants and toddlers is hypothesized to be related to the acquisition of more complex language capabilities (e.g., Kilani-Schoch, Balciuniene, Korecky-Kroll, Laaha, & Dressler, 2009; Ma, Golinkoff, Houston, & Hirsh-Pasek, 2011; Singh, Nestor, Parikh, & Yull, 2009).

This research synthesis is one of two meta-analyses of infant- and child-directed speech conducted at the *Center for Early Literacy Learning* (www.earlyliteracylearning.org). The purpose of this synthesis is to discern whether infant-directed speech spoken to preverbal infants has the preference-enhancing consequences that are hypothesized to be

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associated with this type of speech (e.g., Cooper et al., 1997; Papousek & Papousek, 1991; Sickert, 2005). The other research synthesis includes analyses of the relationship between child-directed speech and language acquisition among older toddlers (Dunst, Simkus, & Hamby, in preparation).

A characteristics-consequences framework was used to conduct the research synthesis where the focus of analysis was identifying the conditions under which infant-directed speech had optimal attention-enhancing effects (Dunst & Trivette, 2009; Dunst, Trivette, & Cutspec, 2007). Different characteristics of infant-directed speech were examined to isolate which characteristics matter most in terms of understanding how and in what manner this type of speech influences infant attention and preferences (e.g., Przednowek, 2009).

SEARCH STRATEGY

Studies were located using *motherese* or *parentese* or *fatherese* or *infant directed speech* or *infant-directed speech* or *infant directed talk* or *child directed speech* or *child-directed speech* or *child directed talk* or *child-directed talk* or *baby talk* AND *infant** or *neonate** or *toddler** as search terms. Both controlled-vocabulary and natural-language searches were conducted (Lucas & Cutspec, 2007). Psychological Abstracts (PsychInfo), Educational Resource Information Center (ERIC), MEDLINE, Academic Search Premier, CINAHL, Education Resource Complete, and Dissertation Abstracts International were searched. These were supplemented by Google Scholar, Scirus, and Ingenta searches as well as a search of an extensive EndNote Library maintained by our Institute. Hand searches of the reference sections of all retrieved journal articles, book chapters, books, dissertations, and unpublished papers were also examined to locate additional studies. Studies were included if the effects of infant-directed speech on child behavior were compared to the effects of adult-directed speech on child behavior. Studies that intentionally manipulated word boundaries (e.g., Hirsh-Pasek et al., 1987; Nelson, Hirsh-Pasek, Jusczyk, & Cassidy, 1989) or used nonsense words or phrases (e.g., Mattys, Jusczyk, Luce, & Morgan, 1999; Thiessen, Hill, & Saffran, 2005) were excluded.

SEARCH RESULTS

Thirty-four studies were located that included 840 infants (Appendix A). The infants were, on average, 138 days old (Range = 2 to 270). Fifty-three percent were male and 47% were female. The participants in all the studies except one (Glenn & Cunningham, 1983) were described as healthy, full-term, healthy full-term, or typically developing. The infant-directed speech in all but one study was spoken in English (Werker, Pegg, & McLeod, 1994).

Appendix B includes selected characteristics of the infant-directed speech and the experimental conditions of the studies. Three types of infant-directed and adult-directed speech were used in the studies: naturalistic, simulated, and filtered or synthesized speech. Naturalistic speech included mothers talking to infants or adults as they normally would (e.g., Fernald, 1985; Trainor, 1996). Simulated speech included adults being asked to speak preselected sentences or phrases to infants or adults (e.g., Pegg, Werker, & McLeod, 1992; Singh et al., 2009). Filtered speech included either naturalistic or simulated infant-directed and adult-directed speech where the "filtering manipulation effectively removed the higher frequency components of the speech recordings while preserving most of the fundamental frequency, duration, and amplitude patterns" of the two types of speech (Cooper & Aslin, 1994, p. 1665). Whereas synthesized speech included digitized speech signals that extracted fundamental frequency and amplitude information from natural speech samples (Fernald & Kuhl, 1987).

Both types of speech were spoken mostly by unfamiliar adult females, presented mostly on audio tapes, and conducted mostly in laboratory settings. The length of the audio or video recordings of infant-directed speech ranged between 5 and 65 seconds (M = 26.13, SD = 23.69). In most studies, the recordings of infant-directed speech (as well as adult-directed speech) were repeated several times when the length of the recordings was less than 20 seconds.

The differences between infant-directed and adult-directed speech were most often assessed in terms of their acoustical or prosodic features. The two features most often examined were the frequencies and duration of infant-directed and adult-directed speech. The prosodic mean frequency of the two types of speech were 301.37 Hz (SD = 72.86) and 214.77 Hz (SD = 35.71) respectively, $t(25) = 5.74$, $p = .000$, Cohen's $d = 1.51$. The prosodic mean duration of the two types of speech were 1.82 seconds (SD = 0.80) and 1.40 seconds (SD = 0.98) respectively, $t(15) = 2.23$, $p = .04$, $d = 0.47$.

The focus of analysis for this research synthesis was the comparisons of the effects of infant-directed vs. adult-directed speech on child behavior. Twenty nine studies were between condition investigations where the same group of infants could choose between the two different types of speech where their behavioral preferences were the dependent measures. The other five studies were between group investigations where one group heard infant-directed speech and the other group heard adult-directed speech. The dependent measures of infant attention and preference in the studies included visual fixation on targeted stimuli, head turns, and positive affect in response to either type of speech. Infant preference for infant-directed or adult-directed speech was most often measured in terms of the amount of child visual fixation and attention to visual displays where looking was associated with either of the two types of speech. The infants' social responsiveness (positive affect) was the second-most-used outcome measure in the studies.

Cohen's *d* effect sizes (ES) for the between condition or between group differences were used as the size of effects in the studies. The average weighted effect sizes and 95% confidence intervals were used for substantive interpretation. A confidence interval not including zero indicates that the average effect differs significantly from zero at the $p < .05$ level. The *Z*-statistic was used to assess the strength of the relationship between the two types of speech and the child outcome measures.

SYNTHESIS FINDINGS

The average weighted effect size for infant-directed vs. adult-directed speech for all studies combined was 0.67 (95% CI = 0.57 to 0.76), $Z = 3.75$, $p = .0002$. The results showed a preference for and increased social responsiveness for attending and listening to infant-directed speech.

Figure 1 shows the results for the different types of infant-directed speech. Although the effect sizes for all three types of speech were significantly related to a preference for infant-directed speech, naturalistic speech was associated with the largest average effect size compared to either simulated or filtered/synthesized infant-directed speech. The difference between the average effect sizes for the naturalistic vs. simulated speech was 0.22, and the difference between the average effect sizes for the naturalistic vs. filtered/synthesized speech was 0.36. The results indicate that naturalistic infant-directed speech was associated with the largest differences in the children's preference for infant-directed compared to adult-directed speech.

The extent to which the differences in the prosodic features of infant-directed and adult-directed speech were related to infant preferences was determined by computing the differences in the mean frequencies of the two types of speech and examining the effect sizes for varying degrees of difference. The results are shown in Figure 2. The effect sizes for all mean frequency differences were significantly related to a preference for infant-directed compared to adult-directed speech. However, the larger the differences between the frequencies of the two types of speech, the larger the average effect size showing a preference for infant-directed speech.

The extent to which the length of the infant-directed speech segments in the studies was associated with larger effect size differences was determined for three different segment lengths. Figure 3 shows the results from the analyses. The results showed a trend toward larger effect sizes when the length of the infant-directed speech was longer although the effect sizes for different lengths of speech were all statistically significant.

The relationship between child age and the sizes of effect for the preference indicators is shown in Figure 4. The infants, regardless of their ages, demonstrated a preference for infant-directed speech as evidenced by statistically sig-

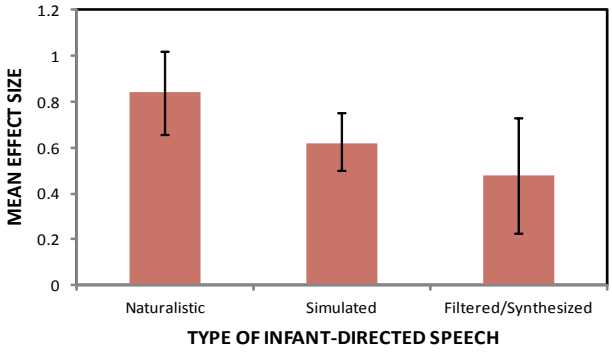

Figure 1. **Average effects and 95% confidence intervals for the three types of infant-directed speech. (NOTE. All effect sizes are significant at the $p = .0000$ level)**

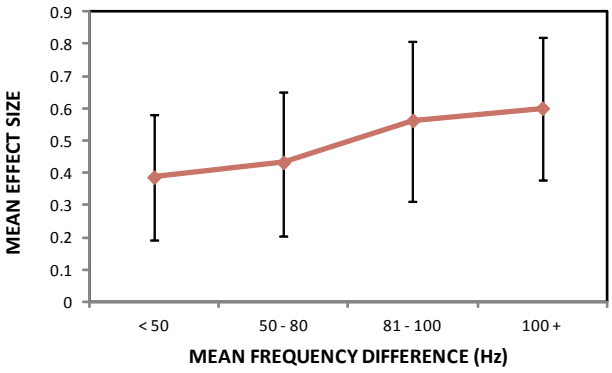

Figure 2. **Average effect sizes and 95% confidence intervals for the differences in the mean frequencies of infant-directed compared to adult-directed speech. (NOTE. The effect sizes for mean frequency differences of 80Hz or less are significant at the $p = .0001$ level, whereas the effect sizes for mean frequency differences of more than 80Hz are significant at the $p = .0000$ level.)**

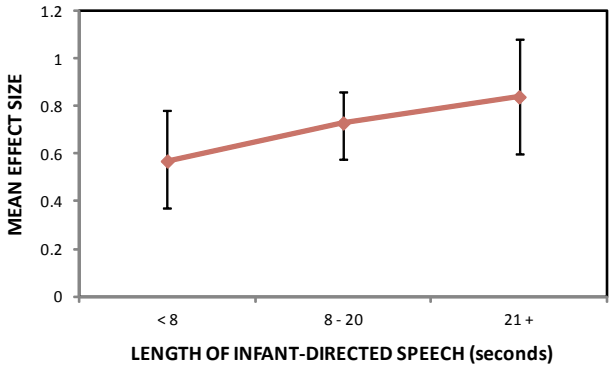

Figure 3. **Average effect sizes and 95% confidence intervals for the relationship between length of infant-directed speech and infant preference for this type of speech. (NOTE. All effect sizes are significant at the $p = .0000$ level.)**

nificant Z-tests although the degree of preference generally increased with age. This presumably reflects an increase in the infants' ability to attend to and detect the differences between the two types of speech.

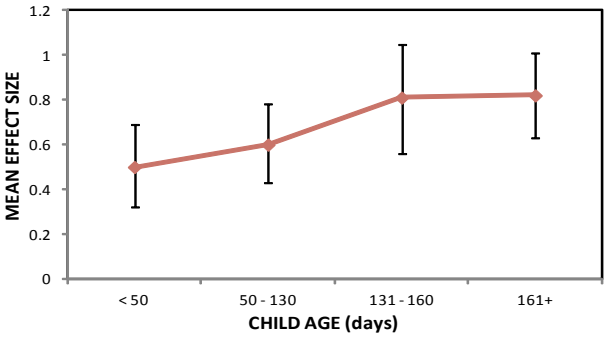

Figure 4. **Average effect sizes and 95% confidence intervals for the relationship between child age and preference for infant-directed speech. (NOTE. All effect sizes are significant at the $p = .0000$ level.)**

The infant-directed and adult-directed speech were spoken to the infants by either mothers or unfamiliar adults and by audio recordings only or by both audio and video recordings. The child outcome measures included either visual preference indicators or child positive affect. Table 1 shows the influences of those conditions on the children's preference for infant-directed speech. All of the effect size differences were highly significant although the differences were larger for speech presentation that included video recordings and for social responsiveness (positive affect) compared to other preference measures.

The extent to which a preference for infant-directed speech was moderated by different study variables is shown in Table 2. Although all of the moderator measures were significantly related to a preference for infant-directed compared to adult-directed speech, there were several variables that moderated the study outcomes. Studies published before 1991 were associated with larger effect sizes mostly as a function of the fact that more recently published papers were studies that manipulated the prosodic features of the speech which

Table 1
Average Weighted Cohen's d and 95% Confidence Intervals for Different Speech Conditions

Condition	Number Studies	Number Effect Sizes	Average Effect Size	95% Confidence Intervals	*Z*	*p*-value
Speaker						
Mothers	20	30	0.61	0.48-0.74	8.97	.0000
Unfamiliar Adults	14	21	0.73	0.58-0.87	10.06	.0000
Speech Presentation						
Audio Recordings Only	26	36	0.62	0.51-0.73	11.14	.0000
Audio + Video	8	15	0.82	0.61-1.03	7.67	.0000
Child Outcome						
Preference Measure	33	44	0.64	0.54-0.75	12.33	.0000
Positive Affect	7	7	0.87	0.56-1.18	5.49	.0000

Table 2
Moderator Analyses of the Relationship Between Infant-Directed Speech and the Child Preference Measures

Moderators	Number Studies	Number Effect Sizes	Average Effect Size	95% Confidence Intervals	*Z*	*p*-value
Year of Publication						
< 1991	13	16	0.92	0.72-1.09	10.38	.0000
1991 – 1995	12	20	0.56	0.41-0.72	7.09	.0000
1995 +	9	15	0.53	0.35-0.71	5.83	.0000
Type of Design						
Between Conditions	29	42	0.71	0.60-0.81	12.87	.0000
Between Group	5	9	0.49	0.26-0.71	4.19	.0000
Type of Study						
Journal Article	33	49	0.66	0.55-0.76	12.87	.0000
Other	1	2	0.84	0.42-1.26	3.92	.0001
Setting						
Child's Home	2	2	2.47	1.65-3.29	5.88	.0000
Laboratory	32	49	0.64	0.54-0.72	12.82	.0000

resulted in less differences between the two types of speech. Between condition design studies were associated with larger effect sizes compared to between group design studies. This was the case, in part, because of the experimental conditions the former type of design studies. When a preference for infant-directed speech was high then the dependent measure for adult-directed speech had to be low thus accounting for the larger effect size differences. Too few nonpublished studies and too few studies conducted in the children's homes permitted between condition comparisons.

DISCUSSION

Results from the meta-analysis showed a clear preference for infant-directed speech compared to adult-directed speech. That preference was demonstrated by fixation on or head turns toward visual targets that produced infant-directed (as opposed to adult-directed) speech or by increased social responsiveness (positive child affect) while listening to infant-directed compared to adult-directed speech.

The conditions under which infant-directed speech had the largest preference effects included: (a) speaking infant-directed speech in a naturalistic manner, (b) situations where the prosodic differences in infant-directed and adult-directed speech were large, (c) the length of the infant-directed speech was eight or more seconds before it was repeated, and (d) infants had considerable opportunity listening to infant-directed speech throughout the infancy period. The effects of infant-directed speech were further enhanced by presenting the speech via video recordings which provided infants the opportunity to have additional information to make their preference choices. The latter mirrors how most adults would speak to very young infants in an infant-directed manner.

One of the important functions of infant-directed speech is enhancing attention to linguistic input and especially input that is accompanied by positive adult social affect (Sickert, 2005). Infant-directed speech, or parentese, helps infants detect and attend to differences in speech spoken by adults to older children and other adults. This type of speech has attention-enhancing consequences. As noted in the Introduction, a second *Center for Early Literacy Learning* synthesis includes analyses of the relationship between infant-directed speech and child language learning and production.

Implications for Practice

A recently published study by Schachner and Hannon (2011) included the following conclusion about the effects of infant-directed speech: "Use of infant-directed speech may act as an effective cue for infants to select appropriate social partners, allowing infants to focus their attention on individuals who will provide optimal care and opportunity for learning" (p. 19). Interspersing infant-directed speech into infant-adult conversations would therefore seem one strategy for optimizing social attention and responsiveness to adult initiations. Many of the *Center for Early Literacy Learning* (www.earlyliteracylearning.org) practice guides include ways in which infant-directed speech can be incorporated into language and literacy learning activities. These should prove useful for enhancing infant attention and setting the stage for language acquisition.

REFERENCES

Baron, N. S. (1989, December). *The uses of baby talk*. Washington, DC: ERIC Clearinghouse on Languages and Linguistics. (ERIC Document Reproduction Service No. ED318230).

Bryant, G. A., & Barrett, H. C. (2007). Recognizing intentions in infant-directed speech: Evidence for universals. *Psychological Science, 18*, 746-751. doi:10.1111/j.1467-9280.2007.01970.x.

Cooper, R. P., Abraham, J., Berman, S., & Staska, M. (1997). The development of infants' preference for motherese. *Infant Behavior and Development, 20*, 477-488.

Cooper, R. P., & Aslin, R. N. (1990). Preference for infant-directed speech in the first month after birth. *Child Development, 61*, 1584-1595.

Cooper, R. P., & Aslin, R. N. (1994). Developmental differences in infant attention to the spectral properties of infant-directed speech. *Child Development, 65*, 1663-1677.

Dunst, C. J., & Trivette, C. M. (2009). Using research evidence to inform and evaluate early childhood intervention practices. *Topics in Early Childhood Special Education, 29*, 40-52. doi:10.1177/0271121408329227.

Dunst, C. J., Trivette, C. M., & Cutspec, P. A. (2007). *Toward an operational definition of evidence-based practices* (Winterberry Research Perspectives Vol. 1, No. 1). Asheville, NC: Winterberry Press.

Fernald, A. (1985). Four-month-old infants prefer to listen to motherese. *Infant Behavior and Development, 8*, 181-195.

Fernald, A., & Kuhl, P. K. (1987). Acoustic determinants of infant preference for motherese speech. *Infant Behavior and Development, 10*, 279-293.

Glenn, S. M., & Cunningham, C. C. (1983). What do babies listen to most? A developmental study of auditory preferences in nonhandicapped infants and infants with Down's syndrome. *Developmental Psychology, 19*, 332-337.

Grieser, D. L., & Kuhl, P. K. (1988). Maternal speech to infants in a tonal language: Support for universal prosodic features in motherese. *Developmental Psychology, 24*, 14-20.

Hirsh-Pasek, K., Nelson, D. G. K., Jusczyk, P. W., Cassidy, K. W., Druss, B., & Kennedy, L. (1987). Clauses are perceptual units for young children. *Cognition, 26*, 269-286.

Kaplan, P. S., Goldstein, M. H., Huckeby, E. R., & Cooper, R. P. (1995). Habituation, sensitization, and infants' responses to motherese speech. *Developmental Psychobiology, 28*, 45-57.

Kaplan, P. S., Goldstein, M. H., Huckeby, E. R., Owren, M. J., & Cooper, R. P. (1995). Dishabituation of visual attention by infant- versus adult-directed speech: Effects of frequency modulation and spectral composition. *Infant Behavior and Development, 18*, 209-223.

Kilani-Schoch, M., Balciuniene, I., Korecky-Kroll, K., Laaha, S., & Dressler, W. U. (2009). On the role of pragmatics in child-directed speech for the acquisition of verb morphology. *Journal of Pragmatics, 41*, 219-239.

Lucas, S. M., & Cutspec, P. A. (2007). *The role and process of literature searching in the preparation of a research synthesis* (Winterberry Research Perspectives Vol. 1, No. 10). Asheville, NC: Winterberry Press.

Ma, W., Golinkoff, R. M., Houston, D. M., & Hirsh-Pasek, K. (2011). Word learning in infant- and adult-directed speech. *Language Learning and Development, 7*, 185-201.

Mattys, S. L., Jusczyk, P. W., Luce, P. A., & Morgan, J. L. (1999). Phonotactic and prosodic effects on word segmentation in infants. *Cognitive Psychology, 38*, 465-494.

Nelson, D. G. K., Hirsh-Pasek, K., Jusczyk, P. W., & Cassidy, K. W. (1989). How the prosodic cues in motherese might assist language learning. *Journal of Child Language, 16*, 55-68.

Papousek, M., & Papousek, H. (1991). The meanings of melodies in motherese in tone and stress languages. *Infant Behavior and Development, 14*, 415-440.

Pegg, J. E., Werker, J. F., & McLeod, P. J. (1989, April). *Infants discriminate between adult directed and infant directed talk in both males and females*. Paper presented at the biennial meeting of the Society for Research in Child Development, Kansas City, MO. (ERIC Document Reproduction Service No. ED306007).

Pegg, J. E., Werker, J. F., & McLeod, P. J. (1992). Preference for infant-directed over adult-directed speech: Evidence from 7-week-old infants. *Infant Behavior and Development, 15*, 325-345.

Pine, J. M. (1994). The language of primary caregivers. In C. Gallaway & B. J. Richards (Eds.), *Input and interaction in language acquisition* (pp. 15-37). Cambridge, UK: Cambridge University Press.

Przednowek, M. (2009). *Uncovering the scope of infant-directed action: Are mother-infant interactions unique?* Unpublished doctoral dissertation, McMaster University, Hamilton, Ontario, Canada. Retrieved from http://digitalcommons.mcmaster.ca/opendissertations/.

Schachner, A., & Hannon, E. E. (2011). Infant-directed speech drives social preferences in 5-month-old infants. *Developmental Psychology, 47*, 19-25.

Sickert, S. (2005). *What is 'motherese' and how important is it for language acquisition?* Brighton, United Kingdom: University of Brighton.

Singh, L., Morgan, J. L., & Best, C. T. (2002). Infants' listening preferences: Baby talk or happy talk? *Infancy, 3*, 365-394.

Singh, L., Nestor, S., Parikh, C., & Yull, A. (2009). Influences of infant-directed speech on early word recognition. *Infancy, 14*, 654-666.

Thiessen, E. D., Hill, E. A., & Saffran, J. R. (2005). Infant-directed speech facilitates word segmentation. *Infancy, 7*, 53-71.

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

Werker, J. F., & McLeod, P. J. (1989). Infant preference for both male and female infant-directed talk: A developmental study of attentional and affective responsiveness. *Canadian Journal of Psychology, 43*, 230-246.

Werker, J. F., Pegg, J. E., & McLeod, P. J. (1994). A cross-language investigation of infant preference for infant-directed communication. *Infant Behavior and Development, 17*, 323-333. doi:10.1016/0163-6383(94)90012-4.

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Appendix A

Background Characteristics of the Study Participants

Study	Number	Age (Days)		Gender		Participants	Infant-Directed Language
		Mean	Range	Male	Female		
Cooper et al. (1997) (Study 1)	20	39	NR[a]	12	8	Healthy Full term	English
Cooper et al. (1997) (Study 2)	20	43	NR	16	4	Healthy	English
Cooper et al. (1997) (Study 3)	23	126	NR	12	11	Healthy Full term	English
Cooper & Aslin (1990) (Study 1)	12	34	NR	5	7	Full term	English
Cooper & Aslin (1990) (Study 2)	16	2	2-3	9	7	Healthy Full term	English
Cooper & Aslin (1994) (Study 1)	12	35	NR	4	8	Healthy Full term	English
Cooper & Aslin (1994) (Study 2)	20	35	NR	9	11	Healthy	English
Cooper & Aslin (1994) (Study 3)	20	35	NR	12	8	Healthy	English
Fernald (1985)	48	123	118-128	27	21	Full term	English
Fernald & Kuhl (1987) (Study 1)	20	124	119-129	11	9	Full term	English
Fernald & Kuhl (1987) (Study 2)	20	122	117-127	10	10	Full term	English
Fernald & Kuhl (1987) (Study 3)	20	125	122-128	10	10	Full term	English
Glenn & Cunningham (1983) (Study 1 & 2 – Sample 1)	10	279 (CA[b]) 285(MA[c])	NR NR	5	5	Typically developing	English
Glenn & Cunningham (1983) (Study 1 & 2 – Sample 2)	10	372 (CA) 279 (MA)	NR NR	5	5	Down syndrome	English
Kaplan et al. (1995a) (Study 1a)	77	124	110-138	NR	NR	Healthy Full term	English
Kaplan et al. (1995a) (Study 2a)	26	126	109-136	NR	NR	Healthy Full term	English
Kaplan et al. (1995b) (Study 1b)	30	124	117-132	12	18	Healthy Full term	English
Kaplan et al. (1995b) (Study 2b)	40	121	115-132	18	22	Healthy Full term	English
Pegg et al. (1989)	48	49	NR	NR	NR	Healthy Full term	English
Pegg et al. (1992) (Study 2)	48	49	NR	NR	NR	Healthy Full term	English
Schachner & Hannon (2011)	20	156	125-180	10	10	Full term	English
Singh et al. (2002) (Study 2)	36	179	155-201	22	14	Full term	English
Singh et al. (2002) (Study 2A)	24	189	173-209	11	13	Typically developing	English
Singh et al. (2002) (Study 3)	28	187	171-202	16	12	Typically developing	English
Singh et al. (2009)	32	224	211-243	20	12	Not reported	English

Appendix A, continued

Study	Number	Age (Days)		Gender		Participants	Infant-Directed Language
		Mean	Range	Male	Female		
Trainor et al. (1996) (Study 2)	60	179	158-209	NR	NR	Healthy Full term	English
Werker & McLeod (1989) (Study 1)	12	154	126-210	NR	NR	Full term	English
Werker & McLeod (1989) (Study 2) (Sample 1)	16	132	120-165	NR	NR	Healthy Full term	English
Werker & McLeod (1989) (Study 2) (Sample 2)	16	249	225-270	NR	NR	Healthy Full term	English
Werker & McLeod (1989) (Study 3)	16	142[d]	120-165	NR	NR	Healthy Full term	English
Werker et al. (1994) (Sample 1A)	10	142[d]	135-150	NR	NR	Healthy Full term	English
Werker et al. (1994) (Sample 1B)	10	262[d]	255-270	NR	NR	Healthy Full term	English
Werker et al. (1994) (Sample 2A)	10	142[d]	135-150	NR	NR	Healthy Full term	Cantonese
Werker et al. (1994) (Sample 2B)	10	262[d]	255-270	NR	NR	Healthy Full term	Cantonese

[a] Not reported.
[b] Chronological age.
[c] Mental age.
[d] Estimated.

Appendix B

Selected Characteristics of the Child-Adult Interactions

Study	Research Design	Speech Type	Speaker	Method of Speech Presentation	Setting
Cooper et al. (1997) (Study 1)	Between conditions	Infant-directed and adult-directed speech	Child's mother	Tape recording	Laboratory
Cooper et al. (1997) (Study 2)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar mother	Tape recording	Laboratory
Cooper et al. (1997) (Study 3)	Between conditions	Infant-directed and adult-directed speech	Child's mother	Tape recording	Laboratory
Cooper & Aslin (1990) (Study 1)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar female	Tape recording	Laboratory
Cooper & Aslin (1990) (Study 2)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar female	Tape recording	Hospital room
Cooper & Aslin (1994) (Study 1)	Between conditions	Low-pass filtered infant-directed and adult-directed speech	Unfamiliar mother	Tape recording	Laboratory
Cooper & Aslin (1994) (Study 2)	Between conditions	Low-pass filtered infant-directed and adult-directed speech	Unfamiliar mother	Tape recording	Laboratory
Cooper & Aslin (1994) (Study 3)	Between conditions	Infant-directed sine-wave and adult-directed sine-wave	Unfamiliar female	Tape recording	Laboratory
Fernald (1985)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar mother	Tape recording	Laboratory
Fernald & Kuhl (1987) (Study 1)	Between conditions	Computer synthesized infant-directed and adult-directed fundamental frequency contours	Unfamiliar mother	Tape recording	Laboratory
Fernald & Kuhl (1987) (Study 2)	Between conditions	Computer-synthesized infant-directed and adult-directed amplitude values	Unfamiliar mother	Tape recording	Laboratory
Fernald & Kuhl (1987) (Study 3)	Between conditions	Computer-synthesized infant-directed and adult-directed duration characteristics	Unfamiliar mother	Tape recording	Laboratory
Glenn & Cunningham (1983) (Study 1 & 2 – Sample 1 & 2 – Phase 2)	Between conditions	Infant-directed and adult-directed speech	Child's mother	Tape recording	Home
Kaplan et al. (1995a) (Study 1)	Between groups	Spontaneous and previously recorded infant-directed speech and adult-directed speech	Unfamiliar mother and unfamiliar female	Tape recording	Laboratory
Kaplan et al. (1995a) (Study 2)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar female	Tape recording	Laboratory
Kaplan et al. (1995b) (Study 1)	Between groups	Spontaneous infant-directed speech and adult-directed speech	Unfamiliar mother	Tape recording	Laboratory
Kaplan et al. (1995b) (Study 2)	Between groups	Infant-directed and adult-directed speech	Unfamiliar female	Tape recording	Laboratory
Pegg et al. (1989)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar female and male	Tape recording	Laboratory
Pegg et al. (1992) (Study 2)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar female and unfamiliar father	Tape recording	Laboratory
Schachner & Hannon (2011) (Study 1)	Between conditions	Infant-directed and adult-directed	Unfamiliar females	Video recording	Laboratory
Singh et al. (2002) (Study 2)	Between conditions	Happy, neutral, or sad infant-directed and adult-directed speech	Unfamiliar mother	Tape recording	Laboratory
Singh et al. (2002) (Study 2A)	Between conditions	Happy infant-directed and adult-directed speech	Unfamiliar mother	Tape recording	Laboratory
Singh et al. (2002) (Study 3)	Between groups	Happy or neutral infant-directed and adult-directed speech	Unfamiliar mother	Tape recording	Laboratory

Appendix B, continued

Study	Research Design	Speech Type	Speaker	Method of Speech Presentation	Setting
Singh et al. (2009)	Between groups	Infant-directed and adult-directed sentences	Unfamiliar mother	Tape recording	Laboratory
Trainor et al. (1996) (Study 2)	Between conditions	Playsongs and lullabies with infant present (infant-directed) and infant absent (adult-directed)	Unfamiliar mother	Tape recording	Laboratory
Werker & McLeod (1989) (Study 1)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar female and male	Video recording	Laboratory
Werker & McLeod (1989) (Study 2 – Sample 1 & 2)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar female and male	Video recording	Laboratory living-room-like setting
Werker & McLeod (1989) (Study 3)	Between conditions	Infant-directed and adult-directed speech	Unfamiliar female	Tape recording	Laboratory
Werker et al. (1994)	Between conditions	Cantonese infant-directed and adult-directed speech	Unfamiliar mother	Video recording	Laboratory living-room-like setting

Appendix C

Effect Sizes for the Difference Between Infant-Directed vs. Adult-Directed Speech

Study	Type of Adult Speech	Outcome Measure	Type of Child Behavior	Cohen's *d* Effect Size
Cooper et al. (1997) (Study 1)	Naturalistic	Amount of time looking at checkerboard while listening to either Infant-Directed Speech (IDS) or Adult-Directed Speech (ADS)	Visual fixation	-0.36
Cooper et al. (1997) (Study 2)	Naturalistic	Amount of time looking at checkerboard while listening to either IDS or ADS	Visual fixation	0.45
Cooper et al. (1997) (Study 3)	Naturalistic	Amount of time looking at colored concentric circles while listening to either IDS or ADS	Visual fixation	0.34
Cooper & Aslin (1990) (Study 1)	Simulated	Amount of time looking at checkerboard while listening to either IDS or ADS	Visual fixation	0.72
Cooper & Aslin (1990) (Study 2)	Simulated	Amount of time looking at checkerboard while listening to either IDS or ADS	Visual fixation	0.72
Cooper & Aslin (1994) (Study 1)	Filtered	Amount of time looking at checkerboard while listening to either IDS or ADS	Visual fixation	-0.04
Cooper & Aslin (1994) (Study 2)	Filtered	Amount of time looking at checkerboard during the first 3 trials while listening to either IDS or ADS	Visual fixation	0.27
Cooper & Aslin (1994) (Study 3)	Filtered	Amount of time looking at checkerboard while listening to either IDS or ADS with IDS heard first	Visual fixation	1.24
Cooper & Aslin (1994) (Study 3)	Filtered	Amount of time looking at checkerboard while listening to either IDS or ADS with IDS heard first	Visual fixation	-0.28
Fernald (1985)	Naturalistic	Number of trials in which head turn was in the direction required to produce either IDS or ADS	Head turns	0.65
Fernald & Kuhl (1987) (Study 1)	Synthesized	Number of trials in which head turn was in the direction required to produce either IDS or ADS	Head turns	1.54
Fernald & Kuhl (1987) (Study 2)	Synthesized	Number of trials in which head turn was in the direction required to produce either IDS or ADS	Head turns	0.00
Fernald & Kuhl (1987) (Study 3)	Synthesized	Number of trials in which head turn was in the direction required to produce either IDS or ADS	Head turns	0.80
Glenn & Cunningham (1983) (Phase 2 –Sample 1)	Naturalistic	Amount of time child choose to listen to either IDS or ADS by activating a manipulanda	Auditory preference	2.39
Glenn & Cunningham (1983) (Phase 2 – Sample 2)	Naturalistic	Amount of time child choose to listen to either IDS or ADS by activating a manipulanda	Auditory preference	2.56
Kaplan et al. (1995a) (Study 1)	Simulated	Amount of time looking at checkerboard while listening to either IDS or ADS	Visual fixation	0.76
Kaplan et al. (1995a) (Study 2)	Simulated	Amount of time looking at checkerboard while listening to alternating IDS and ADS with either IDS heard first or ADS heard first	Visual fixation	0.82
Kaplan et al. (1995b) (Study 1)	Simulated	Amount of time looking at check pattern before hearing either IDS or ADS	Visual fixation	0.44
	Simulated	Amount of time looking at check pattern after hearing either IDS or ADS speech	Visual fixation	0.88
Kaplan et al. (1995b) (Study 2)	Simulated	Amount of time looking at check pattern before hearing either IDS or ADS	Visual fixation	0.14
	Simulated	Amount of time looking at check after hearing either IDS or ADS	Visual fixation	0.36
Pegg et al. (1989)	Simulated	Amount of time looking at checkerboard while listening to female IDS or ADS speech during the criterion-setting trials	Visual fixation	0.56
	Simulated	Amount of time looking at checkerboard while listening to male IDS or ADS speech during the criterion-setting trials	Visual fixation	1.15

Appendix C, continued

Study	Type of Adult Speech	Outcome measure	Type of Child Behavior	Cohen's *d* Effect Size
Pegg et al. (1992) (Study 2)	Simulated	Differences in looking time of female IDS or ADS during 2 longest of first three trails (criterion mean) of habituation phase	Visual fixation	0.46
	Simulated	Differences in looking time of male IDS or ADS during 2 longest of first three trails (criterion mean) of habituation phase	Visual fixation	1.15
Schachner & Hannon (2011) (Study 1)	Simulated	Looking time during familiarization phase of a woman speaking either IDS or ADS	Visual fixation	0.31
	Simulated	Preference for familiar face during test phase for IDS or ADS	Visual preference	1.26
Singh et al. (2002) (Study 2)	Simulated	Amount of time looking at flashing light while listening to either happy IDS or happy ADS	Head turns/visual fixation	-0.16
	Simulated	Amount of time looking at flashing light while listening to either neutral IDS or neutral ADS	Head turns/visual fixation	-0.30
	Simulated	Amount of time looking at flashing light while listening to either sad IDS or sad ADS	Head turns/visual fixation	-0.54
Singh et al. (2002) (Study 2A)	Simulated	Amount of time looking at flashing light while listening to either happy IDS or happy ADS	Head turns/visual fixation	0.24
Singh et al. (2002) (Study 3)	Simulated	Amount of time looking at flashing light while listening to either happy IDS or happy ADS	Head turns/visual fixation	0.50
	Simulated	Amount of time looking at flashing light while listening to either neutral IDS or neutral ADS	Head turns/visual fixation	0.61
Singh et al. (2009)	Simulated	Amount of time looking at flashing light while listening to passages containing words familiarized in IDS	Visual fixation	0.29
	Simulated	Amount of time looking at flashing light while listening to passages containing words familiarized in ADS	Visual fixation	0.29
Trainor et al. (1996) (Study 2)	Naturalistic	Amount of time looking at light and illuminated toy while listening to ID or AD playsongs	Head turns/visual fixation	2.27
	Naturalistic	Amount of time looking at light and illuminated toy while listening to ID or AD lullabies	Head turns/visual fixation	1.94
Werker & McLeod (1989) (Study 1)	Simulated	Amount of time looking at videos of a female or a male speaking in either IDS or ADS	Visual fixation	3.15
Werker & McLeod (1989) (Study 2 – Sample 1)	Simulated	Amount of time looking at videos of a female or a male speaking in either IDS or ADS	Visual fixation	0.66
	Simulated	Affective responsiveness while listening to a female or a male speaking either IDS or ADS	Positive affect	0.54
Werker & McLeod (1989) (Study 2 – Sample 2)	Simulated	Amount of time looking at videos of a female or a male speaking either IDS or ADS	Visual fixation	1.27
	Simulated	Affective responsiveness while listening to a female or a male speaking either IDS or ADS	Positive affect	1.17
Werker & McLeod (1989) (Study 3)	Simulated	Affective responsiveness while looking at a neutral nodding female face while listening to either IDS or ADS	Positive affect	1.15
Werker et al. (1994) (Sample 1A)	Naturalistic	Amount of time looking at videos of a female speaking either IDS or ADS in Cantonese	Visual fixation	0.62
	Naturalistic	Affective responsiveness while listening to a female speaking either IDS or ADS in Cantonese	Positive affect	0.72

Appendix C, continued

Study	Type of Adult Speech	Outcome measure	Type of Child Behavior	Cohen's *d* Effect Size
Werker et al. (1994) (Sample 1B)	Naturalistic	Amount of time looking at videos of a female speaking either IDS or ADS in Cantonese	Visual fixation	0.73
	Naturalistic	Affective responsiveness while listening to a female speaking either IDS or ADS in Cantonese	Positive affect	0.53
Werker et al. (1994) (Sample 2A)	Naturalistic	Amount of time looking at videos of a female speaking either IDS or ADS in Cantonese	Visual fixation	0.24
	Naturalistic	Affective responsiveness while listening to a female speaking either IDS or ADS in Cantonese	Positive affect	0.74
Werker et al. (1994) (Sample 2B)	Naturalistic	Amount of time looking at videos of a female speaking either IDS or ADS in Cantonese	Visual fixation	0.40
	Naturalistic	Affective responsiveness while listening to a female speaking either IDS or ADS in Cantonese	Positive affect	1.23