Maternal depression and the learning-promoting effects of infant-directed speech: Roles of maternal sensitivity, depression diagnosis, and speech acoustic cues

Peter S. Kaplan[*], Christina M. Danko[1], Anna M. Cejka, Kevin D. Everhart

University of Colorado Denver, , United States

ARTICLE INFO

ABSTRACT

The hypothesis that the associative learning-promoting effects of infant-directed speech (IDS) depend on infants' social experience was tested in a conditioned-attention paradigm with a cumulative sample of 4- to 14-month-old infants. Following six forward pairings of a brief IDS segment and a photographic slide of a smiling female face, infants of clinically depressed mothers exhibited evidence of having acquired significantly weaker voice–face associations than infants of non-depressed mothers. Regression analyses revealed that maternal depression was significantly related to infant learning even after demographic correlates of depression, antidepressant medication use, and extent of pitch modulation in maternal IDS had been taken into account. However, after maternal depression had been accounted for, maternal emotional availability, coded by blind raters from separate play interactions, accounted for significant further increments in the proportion of variance accounted for in infant learning scores. Both maternal depression and maternal insensitivity negatively, and additively, predicted poor learning.

© 2015 Elsevier Inc. All rights reserved.

1. Introduction

Parents increase the salience of their speech to infants by slowing its rate, exaggerating changes in pitch, hyper-articulating vowels, and repeating key words and phrases (Fernald, 1984). For young infants, infant-directed speech (IDS) is more effective than adult-directed speech (ADS) at altering infant state, eliciting infant responding, and promoting infant attention and rudimentary cognitive-linguistic processes (Cooper & Aslin, 1990; Fernald, 1984; Ma, Golinkoff, Houston, & Hirsh-Pasek, 2011). Importantly, IDS may be particularly effective at inducing social preferences: relative to a novel face, infants prefer to look at the face of a woman they had seen and heard talking in IDS intonation (Schachner & Hannon, 2011). In contrast, infants prefer a novel face to that of a woman they had seen and heard talking in ADS intonation. Thus, IDS is a powerful promoter of infant attention and learning, and stimuli correlated with it may acquire greater interest.

However, depressed mothers produce IDS that is deficient in perceptual salience, infant focus, and degree of contingency on infant behavior (Bettes, 1988; Kaplan, Bachorowski, & Zarlengo-Strouse, 1999; Murray, Kempton, Woolgar, & Hooper, 1993). Social factors may be particularly influential in cognitive and language development. According to Kuhl (2007) "social gating" hypothesis, parents use of IDS, and the arousal and attention generated by contingent parental responding, increases

---

* Corresponding author at: Department of Psychology, University of Colorado Denver, P.O. Box 173364, Denver, CO 80217, United States.
  E-mail address: peter.kaplan@ucdenver.edu (P.S. Kaplan).

[1] Department of Psychology, DePaul University, Chicago, IL, United States.

Conditioned Attention Paradigm

Phase 1: Pairing Phase (6 pairings over 180 s)

Forward Pairings: IDS followed by Face

Backward Pairings: Face followed by IDS

Phase 2: Summation Test Phase (4 checkerboards over 70 s)
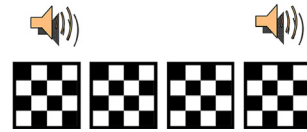
Fig. 1. Schematic diagram of the conditioned-attention paradigm.

the robustness and durability of stimulus–stimulus (e.g., word-object) associations acquired during joint attentional states (see also Ma et al., 2011). Various aspects of rudimentary language development can be facilitated by contingent interaction with live partners, above and beyond mere exposure video and audio stimulation (Kuhl, Tsao, & Liu, 2003; Roseberry, Hirsh-Pasek, Parish-Morris, & Golinkoff, 2009).

Research has revealed that, in comparison to IDS produced by non-depressed mothers, IDS produced by depressed mothers is less effective at promoting a basic kind of learning in infants (Kaplan et al., 1999). But given that deficits in the salience of IDS are highly correlated with deficits in its degree of contingent delivery (Bettes, 1988), and further given evidence that maternal depression and maternal insensitivity each adversely affect the kinds of joint mother–infant attention that promotes infant learning (Raver & Leadbeater, 1995), questions remain about relative roles of low perceptual salience and low contingency as determinants of learning deficits in infants of depressed mothers. The purpose of the present research was to evaluate these alternative explanations for effects of IDS on infant learning in a conditioned-attention paradigm using a cumulative sample of infants of non-depressed and depressed mothers.

Originally motivated by evidence that IDS is particularly effective at increasing an infant's state of arousal (i.e., sensitization and dishabituation effects; Kaplan, Goldstein, Huckeby, & Cooper, 1995), Kaplan and colleagues performed a series of experiments to test whether IDS can facilitate the acquisition of an association with a visual stimulus that soon follows it (Kaplan, Jung, Ryther, & Zarlengo-Strouse, 1996). The rationale was that the increase in central arousal elicited by IDS would persist after the presentation of the visual stimulus, and promote the formation of a stimulus–stimulus association. Analogous effects have been documented in non-human animals.

To test this hypothesis, the researchers developed a laboratory model of associative learning, a conditioned-attention paradigm, diagrammed in Fig. 1. In the pairing phase, a 10-s segment of IDS (the nominal conditioned stimulus or CS) preceded the presentation of a 10-s face reinforcer (the nominal unconditioned stimulus or UCS; forward pairings). In a control condition, a 10-s presentation of a face reinforcer preceded the presentation of a 10-s segment of IDS, such that the IDS did not predict the visual stimulus (backward pairings). To test whether the IDS segment acquired the ability to control infant attention, all infants were tested with 4 10-s presentations of a novel 4×4 checkerboard pattern. The IDS segments from the pairing phase were played simultaneously with the first and fourth checkerboard presentations, whereas the second and third checkerboard presentations occurred in the absence of sound. The extent to which the IDS stimuli increased looking at the checkerboard pattern ("positive summation") in a forward-pairing condition, above that in a backward-pairing condition (and in other studies, random and "no CS" control conditions, Kaplan, Fox, & Huckeby, 1992), comprised the measure of associative learning. Associative learning is important because it is a phylogenetically old and ubiquitous mechanism for infants to learn "what goes with what" in the environment (Rovee-Collier, 1986). Results showed that when an unfamiliar non-depressed mother's IDS signaled the occurrence of a face (forward pairing condition), it acquired the ability to significantly increase looking at the checkerboard pattern in 4-month-old infants of non-depressed mothers. In contrast, when an unfamiliar non-depressed mother's IDS occurred after the face (backward pairing condition), it had no effect on looking at the checkerboard. Similarly, an unfamiliar non-depressed mothers ADS had no effect on looking