The role of positive affect in the acquisition of word-object associations

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Abstract

Learning to associate words to their meaning is a difficult task. Early word learning may be aided by the way in which adults talk to infants. Infants prefer infant-directed speech (IDS) over adult-directed speech (ADS) [1]–[3], and evidence suggests the positive affect inherent to IDS drives this preference [4]. Infants can form word-object associations in IDS [5], [6], but we do not know what role affect plays on word learning. We tested 19-month-olds' learning of word-object pairings when words were taught in a positive or neutral affect in ADS. No evidence of word learning was found. Results and future research implications are discussed.

Index Terms: word learning, infancy, eyetracking

1. Introduction

It appears that early word learning is aided by the way in which adults talk to infants. When parents and caregivers speak to infants they spontaneously modify the way they talk. This form of speech is referred to as infant directed speech (IDS). A number of studies have shown that infants demonstrate a preference for IDS over adult directed speech (ADS;[1]–[3]); however, what drives this preference is less understood. Characteristics of IDS include shorter sentences, longer pauses, greater pitch variation, slower tempo, a higher fundamental frequency, and increased repetitions [7]–[9] Trainor, Austin, and Desjardins [10] argue that emotional expression is the primary determinant of IDS, suggesting that as infants cannot understand the words, emotional prosody is an important aspect of what is communicated. They suggest that reported differences between IDS and ADS are in part the result of comparing more positive IDS with less positive ADS.

Singh, Morgan, and Best [4] attempted to disentangle infants' preferences for IDS, ADS, and affect over a number of experiments and found that when affect was held constant, 6-month-old infants did not show a preference for IDS over ADS. Importantly, infants demonstrated a preference for ADS when it was presented with more positive affect than the IDS. These results provide strong evidence that it is the positive affect inherent within IDS that underlies infants' preference.

Not only do infants prefer IDS but it also seems to help them learn. IDS facilitates infants' speech perception performance at 6–8 months and 10–12 months [11], word segmentation at 6.5–8.5 months [12], word recognition at 7.5 months [13], and phoneme categorisation at 12 months [14]. More recently, it has been demonstrated that infants at 17 months [5] and 21 months [6] can make accurate word-object associations when familiarised in IDS; however, they cannot do the same when familiarised in ADS.

Infants' preference for IDS has also been demonstrated to extend to individuals who have been seen previously speaking in IDS. In their study, Schachner and Hannon [15] presented 5-month-old infants with two videos, one in which a woman spoke using IDS, and another with a different woman speaking with ADS. A visual preference test was then presented to the infants, with a static photo of one of the familiar faces the infant had just viewed, presented side by side on the screen with the photo of a novel woman's face. When the familiar face presented was the one that used IDS, infants preferred to look at the familiar face over the novel face. When the familiar face presented was the one that had used ADS, a preference was shown for the novel face. These results suggest that the pairing of IDS and an individual can lead to a change in the preference for the individual by infants. Therefore, if it is the positive affect within IDS that draws infants' attention, affect may also aid in learning and/or forming other associations.

Affect has also been shown to aid memory and attention in infants, and specifically to promote language acquisition. Infants at 7.5-months can recognise words in positive and neutral affect only when affect is matched across familiarisation and testing, while infants at 10.5-months are able to recognise words across variations in affect [16]. When a word was familiarised in varied affect (happy, sad, neutral, angry, and fearful), 7.5-month-old infants' are capable of recognising the word in fluent speech [17].

The aim of the current study was to determine if positive affect can aid infants' learning of word-object associations. To answer this question, infants were familiarised to four novel objects and their associated novel words, two of which were named using positive affect, and two named with neutral affect. As previous studies have demonstrated that infants at 17- [5] and 21- [6] months can learn word-object associations in IDS but not in ADS, 19-month-olds were used in this study. Ability to form associations between the words and objects was assessed using preferential looking at the named object. Following this, infants' preferences for the novel objects was measured using an object-reaching task. Due to infants' preference for positive affect, we hypothesised that infants would attend more to the objects named with positive affect, than those named with neutral affect. Therefore, it was also hypothesised that infants would form more accurate word-object associations for objects named with positive affect than those named with neutral affect. It was further hypothesised that the pairing of objects with positive affect will result in a change of preference for these objects, and that infants will

therefore prefer to play with objects named with positive affect than those named with neutral affect.

2. Method

2.1. Participants

Participants were twenty-one 19-month-olds (M = 18.8 months, 11 males), born full-term, from Australian English (AusE)-speaking households in Sydney, Australia. Exposure to non-native languages and non-AusE accents ranged from 0 to no more than 12 hours per week, as indicated by parental report. All parents provided informed consent in accordance with the Western Sydney University Human Research Ethics Committee, and were recruited via pregnancy and baby fairs and magazine advertisements.

2.2. Stimuli and Apparatus

Four novel objects were created from polystyrene and felt. For instructional purposes, two objects familiar to infants were also used: images of a baby and a cat (see *Figure 1*). These are words that occurred in the expressive vocabulary of 75% and 66%, respectively, of 19-month-old infants according to the MacArthur-Bates Communicative Development Inventory (MCDI): Words and Sentences form designed to be used with children aged 16- to 30-months-old [18]. Four novel words were used: a minimal consonant pair, "bon" and "pon", and a minimal vowel pair, "deet" and "dit".

Eight familiarisation videos consisted of an AusE-speaking female adult speaking directly to the camera, with positive affect in facial expression and voice (cf., [19]). In another set of eight videos, the same adult woman is seen speaking with neutral affect and neutral expression (see *Figure 2*). Two carrier sentences were used (one per video): "This is the [word]" and "Look at the [word]" (cf., [20]), while the woman held up the associated novel object. The audio for each video was edited to ensure the novel word was the same across all videos within each affect, and the intensity scaled to 65dB.

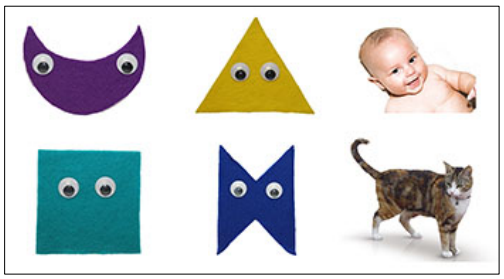

Figure 1: *The four novel objects and two familiar objects*

The videos were rated by undergraduate students for affective valence using a 7-point Likert scale ranging from 1 (*very negative*) to 7 (*very positive*) with neutral emotion represented by the intermediate point. The difference between the positive and neutral videos was found to be highly significant ($p < .001$).

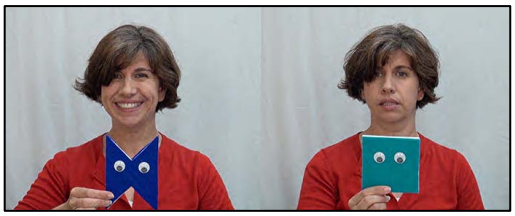

Figure 2: *Screen shots from videos used during familiarisation. Two objects were named using obvious positive affect in facial expression and voice (left), and two objects named using neutral facial expression and voice (right).*

2.3. Procedure

Infants were tested individually in three phases: a familiarisation phase, a test phase, and behavioural choice test phase. During the familiarisation and test phases, infants were seated on their parent's lap approximately 60-70 cm from the screen, with a Tobii X120 eyetracker positioned below the screen to record infants' eye gaze on the screen. The parent wore headphones playing words over music to mask the audio from the experiment. Using Tobii Studio, the experimenter, located in an adjacent control room, performed a 9-point calibration. E-Prime 2.0 was used to present the stimuli for the familiarisation and testing phases.

During the familiarisation phase, an "attention-getter" – a short video containing an animated character with a non-linguistic sound – was used before each trial to ensure the infant's gaze was fixated on the centre of the screen. The experimenter commenced each trial once the infant's gaze was fixed on the attention-getter. Infants were presented with a total of 24 trials containing eight different videos, presented in three sets in pseudo-randomised order. During each set, videos containing the same object, affect, or carrier sentence were presented no more than twice in a row.

During the testing phase, objects were presented side-by-side on the screen, and the infant was instructed to look at one of the objects with three repetitions of the sentence "Look at the [word]" (see *Figure 3*). The first two trials contained a picture of a cat on one side and a baby on the other, to teach the infants the task and to ensure they could perform the word-object association with a familiar word (cf., [21]). Following this, two sets of 10 trials were presented, with each novel word and one familiar object presented as the target once on each side during each set.

During the behavioural choice phase, a second experimenter who was blind to the conditions entered the testing room and requested that the parent close his or her eyes to ensure that he or she did not guide the infant's preference. The experimenter then presented two of the objects on a tray to the infant. The auditory word referring to each object formed a minimal pair, in which one object was named previously with positive affect, and the other named with neutral affect. The infant was then asked to choose which object they would like to play with. This procedure was repeated with the second pair of novel objects. Preference was measured based on which object was reached for first, as noted by the experimenter.

3. Results

A paired-samples *t*-test compared percent fixation to the target (i.e., named) image for target objects between test trials in which target objects familiarised in positive affect ($M = 46.07$, $SD = 13.01$), and test trials in which target objects were familiarized in neutral affect ($M = 47.48$, $SD = 10.83$). There was no difference in target fixation between familiarization affect $t(20) = -.34$, $p = .740$.

One-sample *t*-tests compared all combinations of the target and distractor objects: familiar object vs familiar object; familiar object vs positive object; familiar object vs neutral object; positive object vs positive object; positive object vs neutral object; and neutral object vs neutral object. Target fixation was above chance only when both the target and distractor was a familiar object (i.e., the baby and cat), $t(20) = 3.06$, $p = .006$, indicating that although infants did not learn the novel word-object pairings, they could still perform the task. Means and standard deviations for all comparisons are presented in Table 1.

A chi-square test of goodness-of-fit was conducted on the behavioural choice test, and no statistical significant difference was found for preference for objects familiarised in positive affect over neutral affect for the first choice, $\chi(19) = 0.8$, $p = .371$ or the second choice $\chi(19) = 0$, $p = 1.000$.

Comparison	*M*	*SD*
Familiar object vs familiar object	62.21	18.30
Familiar object vs positive object	55.54	17.57
Familiar object vs neutral object	56.06	20.30
Positive object vs positive object	56.97	26.14
Positive object vs neutral object	46.03	7.80
Neutral object vs neutral object	50.92	15.32

Table 1. *Means and standard deviations of percent fixation to the target image for comparisons of all target and distractor combinations.*

4. Discussion

The purpose of the present study was to determine if positive affect could aid infants' acquisition of word-object associations. It was hypothesized that infants would show stronger learning of word-object associations for objects taught with positive affect than those taught with neutral affect. The hypothesis was not supported, as no evidence of word learning was found for objects familiarised in either positive or neutral affect. Infants' did demonstrate looking to the target for familiar objects, indicating that their inability to learn the novel objects was not a failure to perform the task at test. The failure of learning in either condition is in contrast with previous research that finds evidence of associative learning at 17 months [5] and 21 months [6].

Infants in the current study were required to learn four novel word-objects pairs. In contrast, Graf Estes and Hurley [5], taught infants only two novel objects, which is likely to have been less demanding. Further, the two words used in the Graf Estes and Hurley study formed a non-minimal word pair. Thus, infants did not need to encode fine phonological detail in order to succeed in the task. Requiring infants to do so in the present study may have made the task too challenging. However, the current study used a preferential looking task, which is known to be less cognitively demanding [22] than the switch task used by Graf Estes and Hurley.

Similar to the current study, Ma, Golinkoff, Houston, and Hirsh-Pasek [6] used a preferential looking task and infants in their study were able to make word-object associations in IDS at 21 months. However, in Ma et al. [6] as with Graf Estes and Hurley [5], infants were only taught two novel objects, and the two words formed a non-minimal word pair. Further, infants in Ma and colleagues' study were provided with reminder trials halfway through testing, in which the infants were shown each novel object and word pairing again prior to testing trials recommencing. Thus, this study is likely to have been less cognitively demanding for the infants than the current study.

It was further hypothesized that infants would demonstrate preferences for objects familiarised in positive affect over objects familiarised in neutral affect during the behavioural choice test, and there was no evidence to support this hypothesis. This indicates that the affect which was used to label the object did not influence infants' preferences.

The present study revealed that infants demonstrated strong preferences for the familiar images over novel objects. In particular, infants looked more when the target was familiar, both when the distractor was an object familiarised in positive affect and when it was familiarised in neutral affect. This suggests the infants found the familiar objects more interesting than the novel objects, which may provide another explanation for the failure of learning.

Based on the hypothesis that the present study was too cognitively demanding for the infants, a follow-up study is currently underway in our lab. In the new study, 19-month-old infants are exposed to a similar paradigm to the current study; however, only two novel objects and a non-minimal word pair are used, in order to ease the task demands on the infants. Also in this new study, infants' preferences for the novel objects are measured at baseline, with the objects presented side-by-side on the screen without audio prior to testing. As per the current study, the word-object pairings are presented with a clear referential status which has been shown to aid infants' mapping of novel words to objects [21].

In conclusion, the present study demonstrates that infants may be unable to learn word-object associations at 19 months when the task involves four novel word-object pairings comprising two minimal-word pairs. As infants at this age would be expected to be able to make word-object associations, these results suggest the task may have been too cognitively demanding for the infants. Further, infants demonstrate strong preferences for familiar images of a baby and a cat over novel objects and this should be considered when designing future experiments. Ongoing follow-up research aims to mitigate the cognitive demands that have confused the current findings in order to provide more answers on how positive affect is involved in infants' early word learning.

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