HHS Public Access

Author manuscript

First Lang. Author manuscript; available in PMC 2017 July 13.

Published in final edited form as:

First Lang. 2001 October ; 21(63): 219–243. doi:10.1177/014272370102106302.

The transition from affective to linguistic meaning*

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Abstract

This paper reports a transition from affective to linguistic meaning in 15-month-old infants. Behaviour regulation in the context of a social referencing procedure is used as a measure of the meaning of stimulus messages for infants. Of particular interest is the extent to which receptive vocabulary predicts behaviour regulation by language and paralanguage. Approving and disapproving lexical content was completely crossed with approving and disapproving facial and vocal paralanguage to produce stimulus messages. At the group level, the behaviour of 15-month-olds was better regulated by paralanguage than by lexical content. However, receptive vocabulary was a significant predictor of the relative primacy of language and paralanguage: infants who understood the lexical content of stimulus messages were better regulated by lexical content than by paralanguage. These data suggest a transition from affective to linguistic meaning in comprehension that parallels the transition from affective expression to expression that integrates affect and language.

The infant's earliest communicative experiences have been described as 'primordial sharing encounters' which progress toward ever greater differentiation between the infant and the external world (Werner & Kaplan 1963/1988: 8). This process of differentiation makes it possible for the infant to comprehend the referential function of language. With the comprehension of reference comes the acquisition of a receptive vocabulary and this acquisition represents a watershed in the bases of meaning. This paper explores a transition from affective to linguistic meaning in the second year of life.

This transition is conceived of as parallel to a transition in productive communication from expression that is predominantly affective to expression that integrates affect and language (Bloom 1993, Bloom Beckwith & Capatides 1988). Children reach this transition in expression concomitantly with a rapid increase in productive vocabulary. The analyses of Bloom *et al.* (1988) and Bloom (1993) reveal the difficulty with which children first co-ordinate expression in the affective and linguistic modes simultaneously: when children begin producing their first words, affect expression falls below baseline just prior to articulation. Also, for children identified as late word learners, there is a decrement in the overall frequency of affect expression during the period from about 17 to 21 months as they undergo a rapid increase in vocabulary production. Bloom's (1993) interpretation is that, for reasons of processing limitations, there is a period of transition in the co-ordination of these

*A portion of this research was presented at the International Conference on Infant Studies, 1998.

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two forms of expression. Following this line of reasoning, one might expect a similar transition in comprehension. It is clear that the acquisition of a receptive vocabulary necessitates a shift in the bases of meaning; however, until recently it has been less clear how such a transition might be realized behaviourally. Social referencing provides a paradigm for assessing the meaning of a stimulus to an infant by measuring the effect of that stimulus on behaviour regulation. Decrements observed in infant behaviour regulation by affective messages in the second year of life correspond to a period of rapid receptive vocabulary acquisition and point to the possibility of a developmental transition in the bases of receptive communication. That is, as infants are acquiring a receptive lexicon, there may be predictable changes in the relative strength of affective and linguistic meaning for regulating infant behaviour.

During the first two years of life, infant receptive communication moves from the comprehension of sensorial, affective and pragmatic meanings to the comprehension of referential meaning (Franco 1997). The perceptual co-ordination of spoken language with other forms of expression to form a single, coherent meaning is fundamental to communicative development. Franco (1997) describes the development of meaning in infancy as progressing from sensorial to affective (in the newborn), from affective to pragmatic (in the 3- to 4-month-old), and from pragmatic to referential (late in the first year).

Importantly, prelinguistic meanings are often conveyed paralinguistically. For example, to prevent her infant touching a sharp object, a parent may utilize a staccato vocal intonation contour (Fernald 1991), coupled with a distinctive facial expression associated with fear or prohibition (Klinnert 1984, Sorce, Emde, Campos & Klinnert 1985). Implicit in this expressive configuration is a pragmatic intent *(Don't touch)* and a reference *(that sharp object)*. It is just this rich conjunction of levels of meaning (affective, pragmatic, referential) that is exploited in social referencing paradigms late in the first year and early in the second year of life. Prior to the acquisition of language proper, facial and vocal expressions (hereafter referred to as paralanguage) serve affective as well as pragmatic functions (Fernald 1991) and are the media through which meaning is communicated to the infant. Evidence from the social-referencing literature indicates that facial paralanguage is an effective regulator of infant behaviour in the laboratory (Klinnert 1984, Sorce *et al.* 1985) and that vocal paralanguage serves a similar behaviour-regulatory function (Mumme, Fernald & Herrera 1996). These effects obtain even when an unfamiliar adult produces the facial and vocal paralanguage in standardized videotape format (Mumme & Fernald, in review).

Across numerous social referencing studies, infants are responsive to the paralanguage of parental messages late in the first year of life (Walden 1991). In addition, Barrett, Campos & Emde (1996) found that infants are sensitive to the presence of affective conflicts in parental messages and demonstrate uncertainty in their behaviour in response to these conflicts. This sensitivity to parental messages corresponds to the period in which infants are acquiring, on average, the first 50 words of their receptive vocabularies (Fenson, Dale, Reznick *et al.* 1994) and is consistent with Franco's (1997) assertion that social referencing is especially marked during the transition from affective to referential meaning. It suggests, further, that

paralanguage is an important aspect of parent-infant communication during early vocabulary acquisition. Curiously, however, infant behaviour is less well regulated, on the average, by the paralanguage of messages late in the second year (Walden 1991) following substantial, documented, variation among infants in receptive vocabulary (Fenson *et al.* 1994).

Individual differences are a recent focus in the social referencing literature (Blackford & Walden 1998). Walden (1991: 75) has argued that the decrement in responsiveness to parental messages in the second year reflects a 'negotiation' between parents and children about the interpretation of ambiguous situations. Indeed, Blackford & Walden (1998) have presented evidence that infant temperamental differences influence both the quality of parental messages and behaviour regulation by those messages. The complementary account of individual differences in social referencing in the second year presented in this paper focuses on the role of receptive language acquisition. Specifically, it is argued that the bases of meaning are shifting in the second year, such that facial and vocal paralanguage are less effective elicitors of behaviour regulation than is the explicit, linguistic content of parental messages. Standard social referencing experiments do not assess this hypothesis, since the focus of those experiments is largely on infants' utilization of nonverbal cues and lexical content is not systematically manipulated.

In a variation of the standard social referencing experiments, Lawrence & Fernald (1993) presented 9- and 18-month-old infants with messages whose paralinguistic and linguistic meaning conflicted. For example, infants heard messages like, 'No, no, don't touch' in approving intonation, and 'Oh yeah, that's right' in disapproving intonation. The 9-month-olds, but not the 18-month-olds, regulated their behaviour on the basis of paralinguistic information, and the 18-month-olds regulated their behaviour on the basis of the explicit lexical content of the messages. This finding suggests that, during the second year, infants may undergo a transition in the bases of meaning such that language achieves relative primacy over paralanguage for regulating behaviour.

This is consistent with research with older children documenting a lexical bias in the interpretation of messages in which language and paralanguage conflict. Children from 4 to 7 years of age place greater weight on the lexical content of messages when lexical and paralinguistic content are discrepant (Friend 2000, Friend & Bryant 2000, Morton & Trehub 2001). Of interest is the extent to which the acquisition of a receptive lexicon facilitates a shift in the relative salience of language and paralanguage.

Friend (2000) suggests that selective attention to language may account, in part, for the dominance of language in influencing affective judgements in early childhood. The acquisition of language as a communicative medium may also contribute to the reduction in infant responsiveness to facial and vocal paralanguage in social referencing paradigms in the second year (Walden 1991) and for the primacy of language over paralanguage reported by Lawrence & Fernald (1993) at 18 months. Of particular interest in the present research is the extent to which infants' comprehension of the lexical content of stimulus messages influences the relative primacy of paralinguistic and linguistic meaning for regulating behaviour.

Infants in this study saw and heard videotaped messages in the context of a social referencing procedure. Paralinguistic and linguistic meaning were completely crossed so that each infant received either consistent or discrepant messages. The consistent condition provided a baseline for comparison with previously published research (Klinnert 1984, Mumme *et al.* 1996, Sorce *et al.* 1985), and the discrepant condition extended this research by assessing the relative influence of language and paralanguage. The amount of time that infants manipulated a novel toy was the dependent measure of the meaning assigned to the messages by infants. When infants perceived messages as approving, manipulation times were expected to be longer than when infants perceived messages as disapproving. Of particular interest was the extent to which infants' understanding of the lexical content of messages predicted a transition in the relative primacy of language and paralanguage for regulating infant behaviour. To this end, an age-held-constant design was employed and the MacArthur Child Development Inventory: Words and Gestures (CDI) was used to estimate which lexical items infants understood. The number of stimulus items that infants understood was derived from the full CDI and was taken as an independent measure of infant receptive vocabulary.

As in social referencing studies conducted with younger infants (Klinnert 1984, Mumme & Fernald in, review, Mumme *et al.* 1996, Sorce *et al.* 1985) it was expected that, on the average, infant behaviour would be regulated by facial and vocal paralanguage. Consistently approving messages were expected to facilitate play, and disapproving messages were expected to attenuate play. Similarly, it was expected that approving paralanguage paired with disapproving lexical content (e.g., 'Bad stop') would facilitate play, and disapproving paralanguage paired with approving lexical content (e.g., 'Nice play') would attenuate play. Whereas this pattern was expected to characterize infant performance at the group level, individual variation was also expected. As Walden (1991) points out, the second year is a period during which a reduction in the classic social-referencing/behaviour regulation effect is observed.

The presence of substantial variability in both social referencing and receptive vocabulary in the second year of life is especially relevant to this research. This period of variability follows Franco's (1997) proposed transition from pragmatic to referential meaning. Of interest, then, is the extent to which individual differences in behaviour regulation by paralanguage can be explained by the acquisition of a receptive lexicon, a development predicated on the comprehension of reference.

Specifically, it was expected that some infants would be in transition from utilizing paralanguage as a primary basis for behaviour regulation to becoming increasingly reliant on spoken language. The discrepant condition provides a test of this hypothesis. The performance of these infants would contrast with the predicted dominant pattern: they were expected to play more when lexical content was approving, even when it was paired with disapproving paralanguage, and to play less when lexical content was disapproving, even when it was paired with approving paralanguage. The extent to which individual infants' behaviour was better regulated by words than by paralanguage was expected to correlate positively with the number of stimulus words in their receptive vocabularies.

METHOD

Participants

Infants were part of a larger study of social referencing in late infancy. The 83 participants in the present report were 15- to 16-month-old infants and their parents recruited from a database of parents interested in having their children participate in research at the University of California, Berkeley. There was no compensation for participation. Of the initial sample, 20 participants were excluded for the following reasons: 5 for experimenter/equipment error, 7 for parental cueing, 3 for climbing out of the chair, 1 for becoming distracted during testing, and 4 for fussiness sufficient to preclude completion of the experimental session. The final sample included 63 infants: 32 females (*M* age 15 months, 20 days; range 14 months, 20 days to 16 months, 25 days), and 31 males (*M* age 15 months, 24 days; range 14 months, 29 days to 17 months, 3 days).

Stimuli

Audio/video messages were recorded on high quality videotape using a JVC BR-S810E High Fidelity Editing Recorder and a Panasonic SVHS NV-MS95 Camera. The audio component of the messages was recorded from a Sennheiser MD422U Dynamic Studio Microphone placed approximately 65 cm from the speaker, a female graduate student and native speaker of American English. The messages were designed either to encourage or to prohibit infants' approach to a novel object. In each recording the speaker shifted her gaze referentially from the camera to the apparatus where the novel object appeared while delivering an approving (e.g., 'Good look') or a disapproving message (e.g., 'Bad stop'). Four phrases were selected, two approving and two disapproving, based on their normative age of appearance in infants' receptive vocabularies: 'Good look', 'Nice play', 'Bad stop', and 'Don't touch'. Frequency of comprehension data from the CDI suggests that the items in these phrases are understood by approximately 50% of 15-month-olds (Dale & Fenson 1996).

The functional intent (approving or disapproving) of facial and vocal paralanguage was always consistent; however, facial and vocal paralanguage was completely crossed with the functional intent of the phrases. In this way, eight unique stimulus messages were generated: two consistently approving, two consistently disapproving, two approving paralanguage paired with disapproving lexical content, and two disapproving paralanguage paired with approving lexical content. Still-frame representations of the facial expressions accompanying each stimulus were digitized from the Master videotape (Fig. 1). The audio component of each stimulus was digitized during production and these digital files were used to develop acoustic descriptions of the stimuli. The acoustic characteristics (amplitude waveform and pitch contour) of the stimulus messages are presented graphically in Figs 2a and 2b. Facial and vocal paralanguage were independently validated as conveying either approval or disapproval by twelve undergraduate psychology students who received course credit for their participation.

Apparatus

The experimental apparatus was a table on which a monitor stand and a 21-in. video monitor were mounted. Below the monitor was a curtained enclosure housing a tray that moved via a pulley system and a small camera that recorded the infants' responses. Each session was recorded on high-quality VHS tape with vertical timecode inserted on the tape during filming to facilitate subsequent analysis. Prior to the onset of each stimulus, the experimenter moved the tray to reveal a novel toy from behind the curtain. When the infant oriented to the toy, a stimulus message was presented and the tray was moved toward the infant so that he/she could reach the novel toy (see Fig. 3).

Novel toys

Five novel toys were used in this procedure. They were cobbled from assorted plumbing parts, hardware and pet toys and were painted with colourful, nontoxic paint. One toy, the 'whirlygig', was a brightly painted plastic lawn sprinkler that appeared on the tray during the practice trial for each infant. The presentation of the other four toys was randomized across the four test trials individually for each infant. Following the social-referencing procedure, all parents were asked if they or their infants had seen toys like these before. Of 63 participants, 4 (6%) said that at least one of these toys was familiar and 59 (94%) said that all the toys were novel.

Independent measure

The experiment utilized an age-held-constant design to explore the transition from affective to linguistic meaning as a function of changes in receptive vocabulary. The period of 15–16 months of age was chosen because it is a time of substantial variability in receptive vocabulary (Fenson, Dale, Reznick *et al.* 1993) that predates both the effect of lexical content reported by Lawrence & Fernald (1993) and the decrement in behaviour regulation reported by Walden (1991). It is an age at which the earliest evidence of a transition in the bases of receptive meaning is likely to be observed. The CDI, a respected instrument for the comprehensive assessment of infant receptive vocabulary, was used as an independent measure of language development in this study. Of particular interest was the extent to which infants' comprehension of the specific lexical items used in the study was related to the primacy of language relative to paralanguage for regulating infant behaviour.

Procedure

A research assistant contacted interested parents by telephone and scheduled testing appointments. Approximately one week prior to testing, parents were mailed a copy of the CDI with instructions to complete the instrument at home. Upon arrival at the laboratory, parents gave the experimenter the completed CDI and each infant was randomly assigned to either the consistent (lexical content = paralanguage) or discrepant (lexical content ≠ paralanguage) condition. Within each condition, infants were randomly assigned to one of four stimulus orders. Both order and condition were completely counterbalanced across participants.

A 10-minute warm-up period was conducted in a large laboratory room that also housed the testing apparatus. Following the warm-up the experimenter (E1) assisted the parent in

placing the infant in a highchair in front of the apparatus. Each parent was instructed to hold a magazine over his/her face to avoid cueing the infant. A second experimenter (E2), not visible to the parent or infant, remained seated behind the apparatus and controlled the presentation of the stimulus messages and the novel toys. When the infant was quiet and alert, E2 initiated a practice trial to familiarize the infant with the testing situation. At the beginning of the practice trial a brightly painted plastic lawn sprinkler was displayed via the tray and pulley system from behind the curtain. When the infant oriented to the object, E2 played the following standardized, auditory message in infant-directed speech:

> Hi! This is a very special table. Would you like to see how this table works? See, an object comes out from behind the curtain. Then it comes so close (E2 moves tray and toy within infant's reach) that you can reach it. Or you can just leave it on the table. Okay? Are you ready?

The purpose of this introductory message was to familiarize the infant with several features of the testing situation: the appearance of objects from behind the curtain, the opportunity to manipulate these objects, and the association of these objects with the stimulus messages.

Following the practice trial each infant completed four test trials. In each test trial E2 placed a randomly selected novel toy on the tray and, when the infant was alert and attentive, moved the toy beyond the curtain where it was visible to the infant. When the infant oriented to the object, E2 played the first videotaped stimulus. Following the first stimulus presentation, the tray and novel toy were moved within the infant's reach. As the tray approached the infant, the stimulus message was repeated. During both stimulus presentations for this and all subsequent trials, the speaker appeared to shift her gaze between the infant and the novel toy so that the stimulus message appeared to be directed *toward* the infant *about* the toy. Following the second presentation of the stimulus, the toy remained within the infant's reach for approximately 15 s. The infant could play with the novel toy during this period. At the end of this period E2 began withdrawing the tray. If the infant was still playing with the toy, E2 moved the tray back and forth to cue the parent to place the toy on the tray. This procedure was followed for four trials. At the end of the final trial E2 placed all the toys on the tray and moved them within the infant's reach. At this point, E1 joined the parent and infant, invited the infant to play with all the toys and conducted a brief exit interview with the parent.

Coding

Three dependent measures were coded from videotapes of the experimental sessions: referential looks, delay to approach, manipulation time.

Referential looks—A key assumption of social-referencing is that infants perceive a relation between an informative stimulus (the stimulus message) and an ambiguous or novel situation (the novel toy). One measure of infants' appreciation of this relation is the presence of referential looks (i.e., looks between the stimulus and the novel toy). As a manipulation check, the number of times that infants alternated their gaze between the stimulus and the novel toy was recorded in each trial. The present data reveal the classic social-referencing response: alternate reference between the stimulus and the toy across trials (*M* referential

looks per trial 3.75, SD 1.65). A more stringent criterion is that infants engage in alternate reference on *every* trial; this criterion was met by 82% of infants in this study. This suggests that the relation between the stimulus messages and the novel toy was perceived by the infants.

Delay to approach—The length of time (in seconds) following the second stimulus presentation until the infant touched the toy was recorded. If the infant never touched the toy, then the delay to approach was set to equal the trial duration. In order for an approach to be recorded, the infant had to touch the toy *following* the offset of the second stimulus. This insured that infants received both presentations of the stimulus message before any inferences were drawn about the relation between the message and infants' approach behaviour. If the infant touched the toy before the offset of the second stimulus and continued manipulating the toy after the offset of the second stimulus, the approach was set to equal the offset of the second stimulus.

Manipulation time—The length of time (in seconds) that the infant's hand remained in continuous contact with the toy following the initial approach was recorded. If the infant released the toy for less than 2 s before re-establishing contact, this was coded as a single continuous manipulation. If the infant continued manipulating the toy beyond the end of the trial, the end of the manipulation time was set to equal the end of the trial.

The dependent measures were recorded by three trained and independent coders who each coded approximately one-third of the experimental sessions. Each session was coded in a series of three passes. In the first pass the author coded the timing of the stimulus and novel toy presentations and the duration of the trials.

Because stimulus and novel toy presentations were controlled manually, there was variability in the absolute duration of trials both within and across participants. One solution to this problem was to utilize proportions for the temporal measures in the study (i.e., approach and manipulation). However, review of the videotapes indicated that trials extended beyond the 15-s limit for reasons unrelated to the task itself, such as the parent failing to respond to the E2's cue to replace the toy on the tray. Infant manipulations in these cases were no longer a function of the behaviour regulatory effects of the stimulus but rather of other extraneous factors. For these reasons a minimum trial length of 15.44 s was established empirically by reviewing all the tapes, and all trials for all infants were truncated at the minimum trial length.

The second and third passes were coded without sound and using microanalytic, frame-by-frame, as well as real-time, analysis by trained coders who were blind to experimental condition and order of stimulus presentation. In the second pass, referential looks were coded for each trial. In the third and final pass, approach and manipulation times were coded for each trial.

Agreement—One-third of the experimental sessions were coded a second time to establish consistency of measurement. Each coder was the primary coder on one-third of the experimental sessions. For referential looks, agreement was assessed on the absolute number

of looks coded during each trial. For the approach and manipulation time measures, a criterion window of 200 ms was established. Estimates of approach and manipulation that fell within this window for both primary and secondary coders were considered reliable. Inter-rater agreement was calculated as no. agreements/(no. agreements + no. disagreements) for each measure. Average inter-rater agreement was 0.93 for each measure with a range across experimental sessions of 0.71 to 1.00 for referential looks, 0.75 to 1.00 for approaches, and 0.75 to 1.00 for manipulation times.

RESULTS

Receptive vocabulary

CDI comprehension scores conformed well to the range of scores reported by Fenson *et al.* (1993) for 15- to 16-month-olds in their normative sample. These data are presented separately by gender to correspond to the normative data for the instrument. The mean number of words in girls' receptive vocabularies was 198.16 words (SD 86.29) with a range from 51 to 370 words. The mean number of words in boys' receptive vocabularies was 162.68 words (SD 69.53) with a range from 18 to 285 words. For both girls and boys, the average number of words comprehended corresponds to about the 70th percentile for the normative sample, and the range of comprehension represents a spread from roughly the 5th to the 95th percentile.

Lexical item comprehension

Of particular interest in the present study was the extent to which infants' comprehension of the specific lexical content of stimulus messages influenced their behaviour regulation. Each stimulus message was comprised of two words for a total of eight lexical items (see Table 1). Parent report on the CDI indicated that girls and boys knew about the same number of stimulus words (M 5.13 and 4.35, SD 2.20 and 2.47, respectively). The number of stimulus words understood ranged from 1 to 8 for girls and from 0 to 8 for boys.

Behaviour regulation

ANCOVA was the most appropriate data analysis procedure for the delay to approach and manipulation time measures. However, multivariate data screening revealed two violations of assumptions. First, two outliers were observed on the delay to approach measure, and one of these was also an outlier on the manipulation time measure. Because these data were likely to exert a disproportionate influence, analyses were conducted with and without outliers, and both sets of results are reported. Second, heterogeneity of regression was encountered in the relation between receptive vocabulary and manipulation times for approving and disapproving lexical content. The most statistically appropriate solution to this problem is to use a difference score as the dependent measure (Tabachnick & Fidell 1996). For clarity of presentation, identical omnibus analyses were conducted for both approach and manipulation time measures.

To assess the appropriateness of collapsing across item level data to construct a difference score, descriptive data on delay to approach and manipulation time were reviewed for each stimulus message (see Table 1). Because there were no apparent item level effects, data were

collapsed across items to form a single dependent measure associated with each level of lexical content (approving and disapproving) for both delay to approach and manipulation time. Next, difference scores were constructed by subtracting infants' responses to messages with disapproving lexical content from their responses to messages with approving lexical content. These difference scores became the dependent measures for two ANCOVAs. Omnibus significance tests were performed at $\alpha = 0.05$. With the ANCOVA approach the covariate (Lexical Comprehension) is interpreted as a high-priority, continuous, independent variable, the significance of which is evaluated before the other, discrete, independent variables enter the equation (Tabachnick & Fidell 1996). This permits an evaluation of the influence of receptive vocabulary on the primacy of language in behaviour regulation and of the relative primacy of language and paralanguage when pre-existing differences in receptive vocabulary are held constant.

Delay to approach

Delay to approach was defined as the amount of time (in seconds) from the offset of the second stimulus presentation to the time that the infant touched the toy. A difference score reflecting the amount of time infants delayed touching the toy for messages with approving lexical content minus the time delayed for messages with disapproving lexical content served as the dependent measure in this analysis. In the consistent condition, negative values reflect behaviour regulation by the functional intent of messages whereas, in the discrepant condition, negative values reflect a primacy of lexical content and positive values reflect a primacy of paralanguage.

A Condition (consistent or discrepant) × Order (4) × Sex (2) between-subjects ANCOVA was conducted with difference in delay to approach for approving and disapproving lexical content as the dependent measure and Lexical Comprehension as the covariate. This analysis, conducted with outliers, revealed no significant effects. However, when the analysis was repeated with the two outliers identified in data screening removed, a significant effect of Condition was obtained ($F(1,44) = 4.22$, $p < 0.05$) and there were no effects of Order or Sex. An ANCOVA conducted with infants' full-scale receptive vocabulary on the CDI as the covariate yielded an identical pattern of findings.

The main effect of Condition indicated that the difference in infants' delay to approach for messages with approving and disapproving lexical content was significantly greater in the discrepant condition. Infants were more likely to delay their approach when paralanguage conveyed disapproval than when it conveyed approval (see Table 2). This is consistent with the expectation that, on average, paralanguage is a primary medium of behaviour regulation in late infancy. Lexical Comprehension was not a significant predictor of infants' delay to approach the novel toy.

Manipulation time

Manipulation time in each trial was defined as the amount of time (in seconds) that the infant remained in continuous contact with the toy following the offset of the second stimulus presentation. A difference score reflecting the amount of time infants played with the toy for messages with approving lexical content minus the time infants played for

messages with disapproving lexical content served as the dependent measure in this analysis. In the consistent condition, positive values reflect behaviour regulation by the functional intent of messages whereas, in the discrepant condition, positive values reflect a primacy of lexical content and negative values reflect a primacy of paralanguage.

A Condition (2) × Order (4) × Sex (2) between-subjects ANCOVA was conducted with difference in play for approving and disapproving lexical content as the dependent measure and Lexical comprehension as the covariate. The analysis, conducted with outliers, revealed a marginally significant effect of Lexical Comprehension ($F(1,46) = 3.22$, $\beta = 0.536$, $p < 0.08$) and no significant effect of any between-subjects factors. An identical analysis conducted with outliers excluded confirmed that Lexical Comprehension was a significant predictor of infant play ($F(1,46) = 8.53$, $\beta = 0.794$, $p < 0.05$). The same pattern of effects was obtained when infants' full-scale receptive vocabulary scores on the CDI were entered as the covariate. The greater the number of lexical items that infants comprehended, the more likely their behaviour was to be regulated by the lexical content of stimulus messages (see Fig. 4). For every additional stimulus word in infants' receptive vocabularies, there was an increase in behaviour regulation by lexical content, and this effect obtained even when lexical content and paralanguage were discrepant.

The analysis also yielded a main effect of Condition ($F(1,46) = 5.18$, $p < 0.05$) and no effect of Order or Sex. The main effect of Condition supported the hypothesis that, on the average, behaviour in late infancy would be better regulated by facial and vocal paralanguage than by lexical content. As predicted, the difference in infants' play for approving relative to disapproving lexical content was significantly greater when lexical content and paralanguage were consistent than when they were discrepant (see Table 3 and Fig. 5). When lexical content and paralanguage carried the same instrumental message, both were good predictors of infant behaviour. When lexical content and paralanguage were discrepant, however, the functional intent of paralanguage better predicted infant behaviour than did lexical content. This is consistent with previous research suggesting that paralanguage serves a primary behaviour regulatory function in late infancy. However, as indicated by the significant positive regression coefficient associated with infant language comprehension, messages that draw from infants' receptive lexicons exert greater behaviour regulatory influence through language than through paralanguage.

Both analyses revealed the predicted primacy of paralanguage over lexical content in regulating infant behaviour at 15 months of age. However, it was also hypothesized that receptive vocabulary would predict individual differences in the primacy of paralanguage and lexical content for regulating infant behaviour. This hypothesis was supported for the manipulation time but not for the delay to approach measure of behaviour regulation. When infants understood the lexical content of messages, language proper held communicative primacy in regulating the duration of play with a novel toy.

DISCUSSION

One contribution of these analyses is that they take into account the relative behaviour regulation by approving and disapproving messages for individual infants. To illustrate,

individual infants may vary in their predisposition to play with the novel toy in this experimental context. Of primary interest is the extent to which this predisposition is influenced by the different instrumental messages. One infant may tend, overall, to play very little with the novel toys in any trial but still may play more in some trials than in others. Similarly, an infant who plays with the novel toy extensively in all the trials may show some differential response to approving and disapproving messages that is not captured by analysing these messages independently. In the present analyses the relative effect of approving and disapproving messages for individual infants was taken into account.

As predicted infant behaviour was better regulated by facial and vocal paralanguage than by lexical content at 15 months of age. This is consistent with previous research with younger infants (Mumme & Fernald in review, Mumme *et al.* 1996, Sorce *et al.* 1985). This was true for both the delay to approach and the manipulation time measures. Infants approached a novel toy more rapidly when paralanguage was approving rather than disapproving, regardless of the lexical content with which it was paired. Similarly, infants played longer with a novel toy when paralanguage was approving than when it was disapproving. Again, this effect obtained across conditions suggesting that, in general, paralanguage was a better predictor of infant behaviour regulation than was lexical content. However, consistent with Walden's (1991) interpretation of the social referencing literature, the differences in delay to approach and in manipulation time, in terms of the raw data, were rather small, and standard deviations were large, reflecting extensive variability.

This variability in the case of the manipulation time measure was captured largely by infants' receptive vocabularies as measured by parental report on the CDI. The general size of infants' receptive vocabularies as well as the number of stimulus words that infants comprehended were significant predictors of whether their behaviour was better regulated by language or by paralanguage. This result has practical implications for studies of social referencing in late infancy and theoretical implications for the role of language acquisition in promoting a shift in the bases of meaning.

The variability observed in social referencing tasks in the second year may indeed reflect the 'negotiation' between infant and parent as described by Walden (1991: 75). The current research points to a potential facilitator of that negotiation: the acquisition of a receptive lexicon. The rapid acquisition of receptive vocabulary in the second year provides infants with a new tool for understanding parental messages. In a sense this ushers in a new stage in the fine-tuning of parent-infant communication in which infants are beginning to attend as much to what is said as to how it is said.

Earlier research on infant-directed speech suggested that 'the melody [is] the message in the first year of life' (Fernald 1989: 1497). The present research extends our understanding of the developmental trajectory of parent-infant communication to include the period of transition from affective to linguistic meaning. The data reveal three important aspects of this transition. First, 15-month-olds show extensive variability both in language acquisition and in behaviour regulation. Second, like younger infants, 15-month-olds' behaviour is, on the average, regulated by the paralanguage of messages. However, variations in behaviour regulation by paralanguage can be predicted by the extent of an infant's receptive lexicon.

Finally, when infants understand the words in parental messages, language exerts greater influence on behaviour than does paralanguage.

These results are consistent with Lawrence & Fernald's (1993) report of developmental differences in the behaviour regulation of 9- and 18-month-old infants. In that study, 9-month-olds were better regulated by paralanguage than by lexical content, and 18-month-olds were better regulated by lexical content than by paralanguage. By utilizing an age-held constant design in the present research, it was possible to predict and assess a specific period of developmental transition from behaviour regulation by paralanguage to behaviour regulation by language proper. The data support the presence of such a transition at 15 months of age. However, future research is required to elucidate this transition more fully with respect to the average age of onset of behaviour regulation by lexical content and the amount of time (or extent of vocabulary development) required for this effect to stabilize.

This transition between affect and language in receptive communication corresponds to Bloom's (1993) research on the transition between affect and language in expression. In that research, infants around the time of their first words produced affective and linguistic expressions in sequence but not simultaneously. Bloom argued that the sequencing of affect and language in production reflected processing limitations on the expression of meaning. In the present research, and in comprehension more generally, both affective and linguistic meaning occur simultaneously, and infants must integrate this information in assigning meaning to parental messages. In situations in which affect and language conflict, processing limitations would be realized in greater attention to one of these two sources of information. Specifically, an infant's newly emerging lexicon is given greater attention than paralanguage in assigning meaning and in regulating behaviour.

There are two limitations to the generalization of this research. The first limitation is the presence of outliers for both the approach and manipulation measures. There was no *a priori* reason to expect that these infants would perform differently from the rest of the sample. However, they constitute a very small proportion of the final sample and, consequently, the limitation to generalizability is minimal. A second limitation is that the role of receptive vocabulary in promoting a transition to language-based meaning was limited to the manipulation time measure. Infants' comprehension of specific lexical items in the stimuli influenced how long they played with a novel object but not how long it took them to approach the object. In general, infants' predisposition to play with the toys appeared to be independent of the instrumental intent of the messages. This was true in both consistent and discrepant message conditions. Since receptive vocabulary was associated with performance across conditions for the manipulation time measure, it can be inferred that infants were processing the linguistic meaning of messages in both conditions. Infants' processing of linguistic meaning is likely to be slower and less direct than the processing of affective meaning. As a result, manipulation time would be more susceptible to the influence of language comprehension than would approach time, because it is a more protracted measure. Infants may approach the novel toy without fully understanding the stimulus message, but the amount of time that they remain engaged with the toy is likely to reflect a more comprehensive assessment of meaning.

In conclusion, this research has identified a transition from affective to linguistic meaning in receptive communication around 15 months of age. These data are consistent with reports of extensive variability in social referencing in the second year of life (Blackford & Walden 1998, Walden 1991), and parallel a similar transition in expression around the time of first words (Bloom 1993, Bloom *et al.* 1988). Finally, these data complement research with 4- to 7-year-olds in whom a tendency toward greater weighting of linguistic, relative to paralinguistic, meaning has been reported (Friend 2000, Friend & Bryant 2000, Morton & Trehub 2001) and suggest that this bias emerges out of the process of language acquisition.

Acknowledgments

This research was supported, in part, by a postdoctoral fellowship awarded to the author by the National Institute of Child Health and Human Development (NICHD F32 HD07893). Grateful acknowledgement is extended to the Institute of Human Development at the University of California, Berkeley, the University of California, San Francisco, the University of Geneva, to San Diego State University for the provision of facilities for this research, and to Marcia Riley for serving as the model for stimuli. Gratitude is also extended to Joseph J. Campos, Paul Ekman, and Klaus Scherer for their mentorship of this project, to M. Jeffrey Farrar and Larry Fenson for comments on an earlier version of this manuscript, and to several research assistants: Lotte Korsholm, Alexis Perry, Maria Cuevos, Alana Frickel, Helen Heyming and Candi Fitzgerald.

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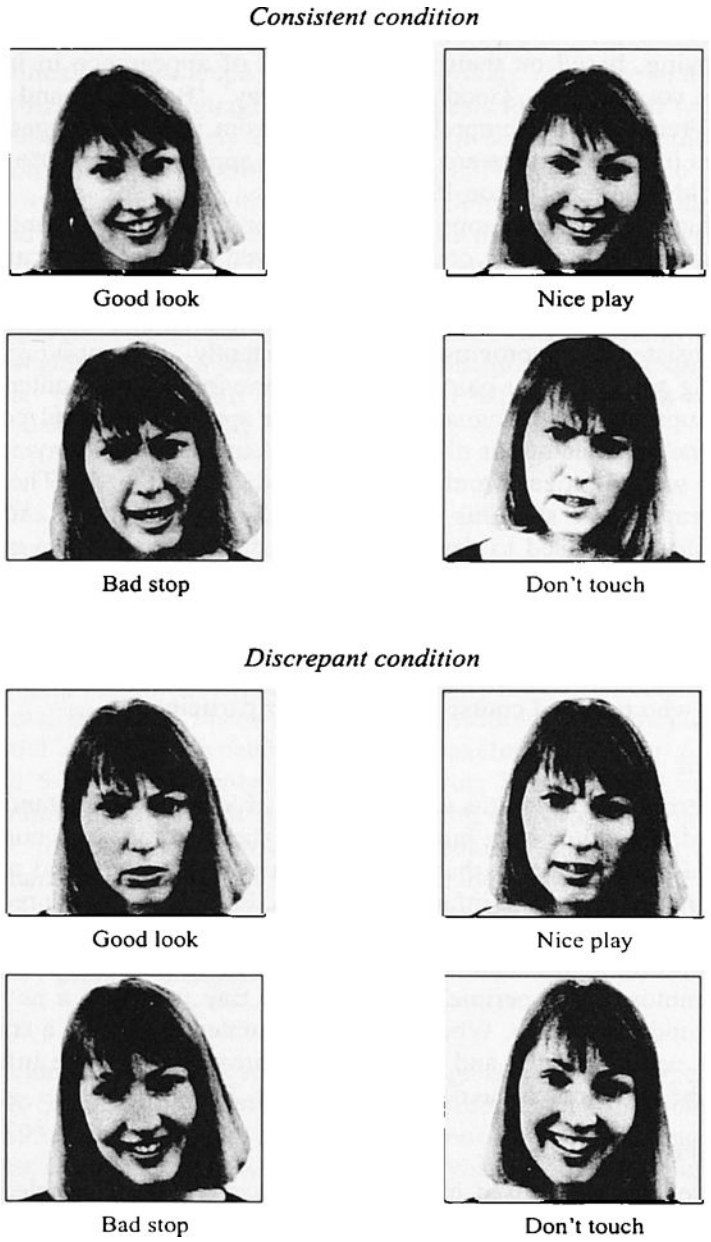
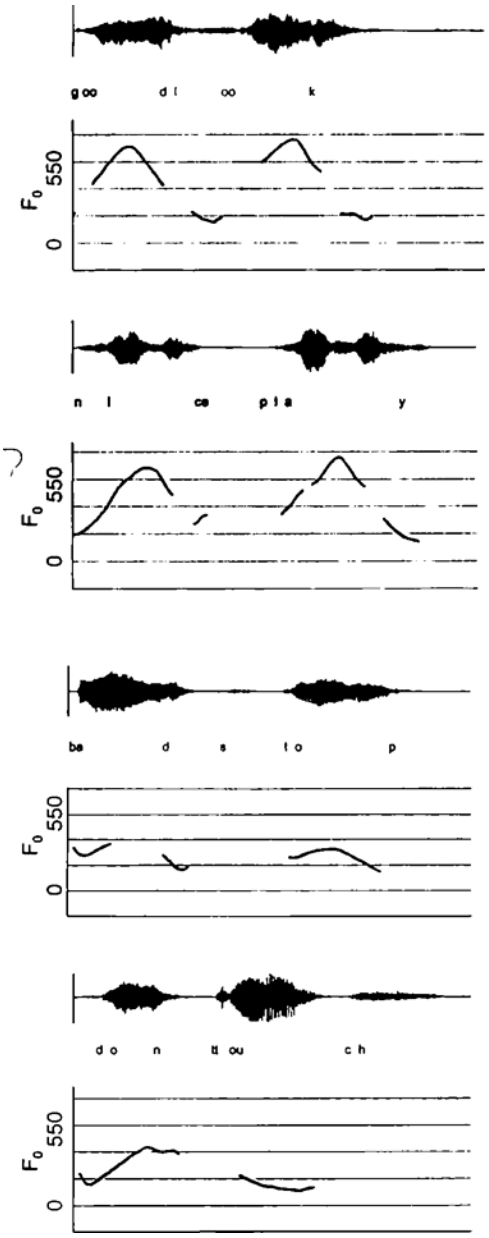


Fig. 1.
Still photographic representation of facial paralanguage



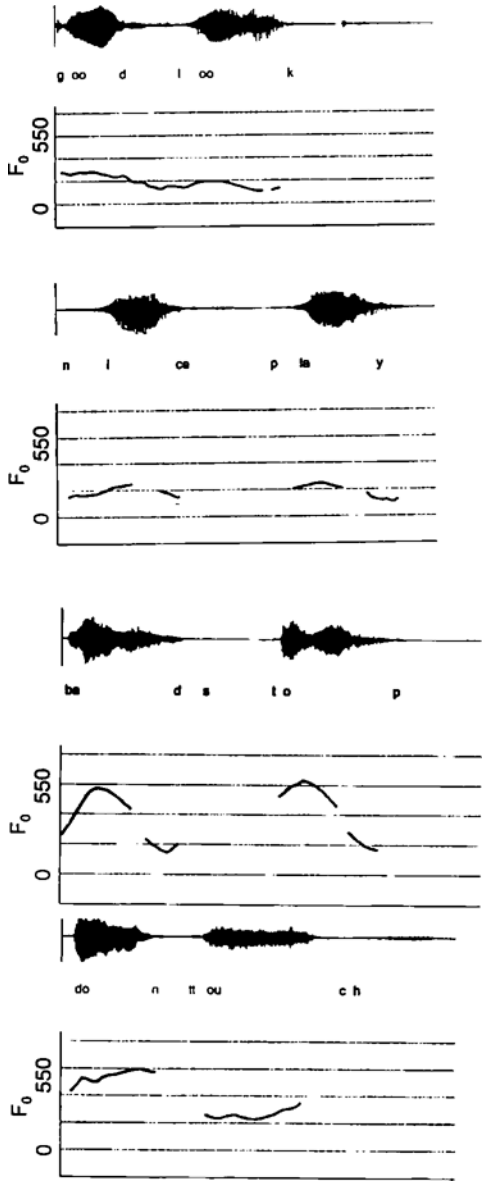


Fig. 2.

a. Amplitude waveforms and fundamental frequency (F_0) contours for consistent messages

b. Amplitude waveforms and fundamental frequency (F_0) contours for discrepant messages

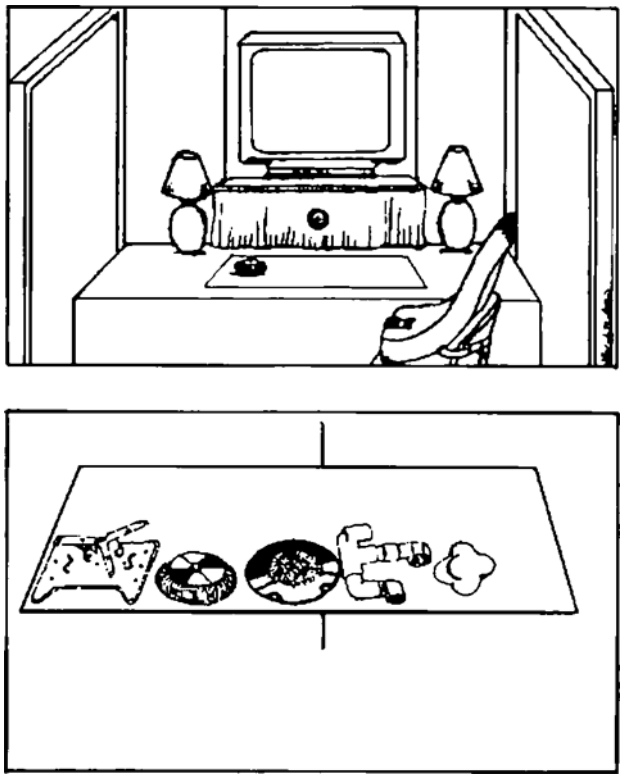


Fig. 3.
Social-referencing apparatus and novel toys

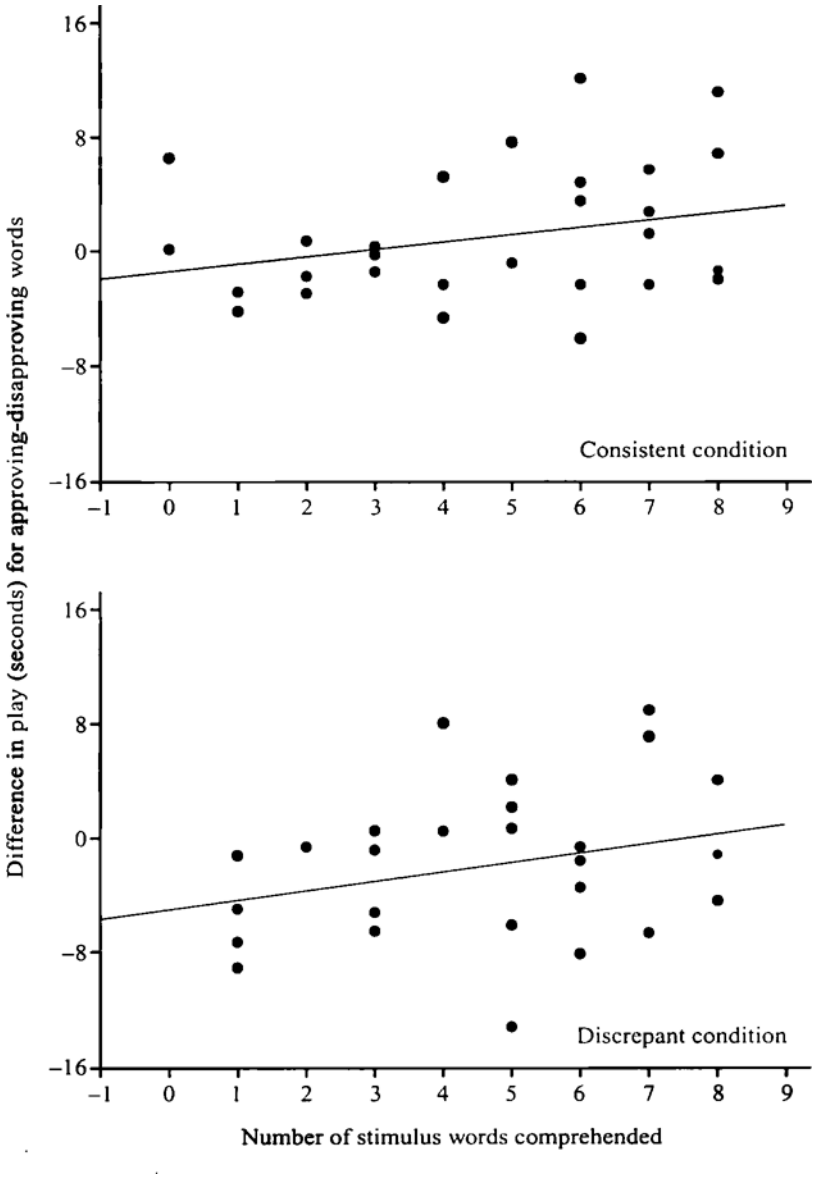


Fig. 4.

Individual differences in the effects of language and paralanguage on behaviour regulation at 15 months as a function of language comprehension

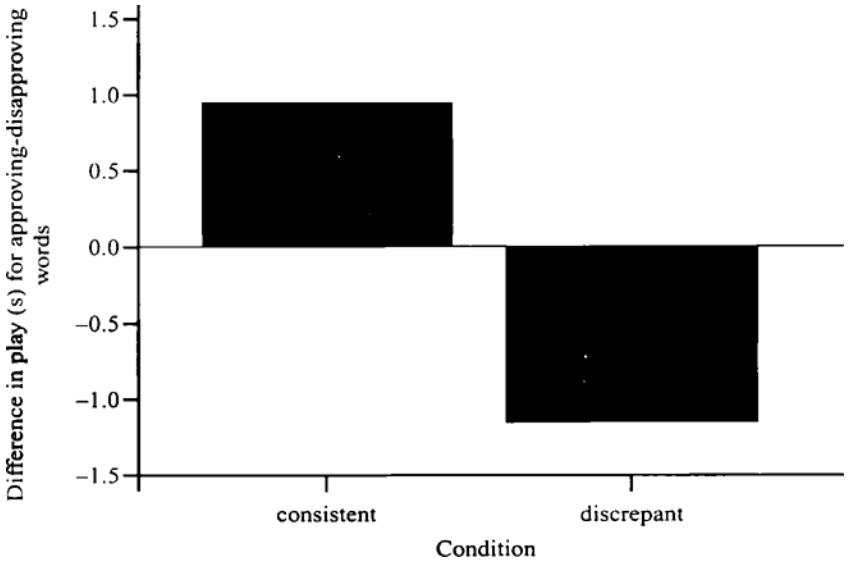


Fig. 5. Average effects of language and paralanguage on behaviour regulation at 15 months
(*Note*. In the consistent condition, positive values reflect behaviour regulation by lexical content and paralanguage in combination. In the discrepant condition, negative values indicate greater behaviour regulation by paralanguage than by lexical content.)

TABLE 1

Approach and manipulation time means and standard deviations (in seconds) as a function of lexical item

Lexical item	Delay to approach	Manipulation time
Bad stop	3.49 (6.31)	8.49 (6.44)
Don't touch	3.62 (5.88)	8.07 (6.05)
Good look	4.00 (5.78)	8.49 (6.20)
Nice play	3.89 (6.20)	7.94 (6.25)

TABLE 2

Infants' relative delay to approach for approving minus disapproving lexical content as a function of condition

Condition	Observed mean	SD	Adjusted mean	SE
Consistent	−0.1153	1.75	−0.1950	0.387
Discrepant	0.8856	2.43	0.9546	0.379

TABLE 3

Infants' relative manipulation times for approving minus disapproving lexical content as a function of condition

Condition	Observed mean	SD	Adjusted mean	SE
Consistent	0.861	4.08	0.885	0.778
Discrepant	−1.135	5.03	−1.293	0.778