A longitudinal study of a father and his daughter examined pitch-variation of "real" and "rhetorical" questions. Although the father asked "real" and "rhetorical" questions from the start of the recordings, he did not distinguish them through differential pitch height until the baby was 15 months old.

One feature of Infant-directed language (IDL) is the consistently reported finding that parents use a high frequency of questions when speaking to their infants, ranging from 25% to 60% of the utterances sampled (Stern, Speiker & MacKain, 1982; Sullivan & Horowitz, 1983). Questions fulfill various functions. At the simplest level, when interpreted directly, the utterance of a question is a request for information. Although questions addressed to young infants are in one sense always rhetorical because the infant cannot respond, one can still differentiate between those questions which, if addressed to an older child or adult, might be called "real" and those which might be called "rhetorical." Green (1989: 154–155) argued that one can distinguish "sincere questions," which indicate that the speaker wants some information which the addressee is believed to have, from "rhetorical questions," in which the speaker either assumes everyone knows or no-one knows the answer. According to Green (1989) there is, however, another level at which one can analyze the functions questions have in conversations, namely that of indicating when there is a switch of roles.

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Infant-directed language yes-no questions pitch longitudinal case study

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from speaker to addressee and vice versa. A question will usually indicate a switch of roles (Schlegloff, 1979), "although by definition, rhetorical questions so understood will not do this" (Green, 1989: 153).

Infant-directed language has been analyzed with special attention to the prosodic forms that often express the pragmatic or social interactional functions (Fernald & Kuhl, 1987; Papousek, 1992; Reissland & Snow, 1996; Snow & Goldfield, 1983; Snow, 1994;). For example, Papousek (1992) suggested that prosody can signal "rewarding," "discouraging" and "soothing" contexts, and that the pitch contour is an especially salient aspect of caregivers' speech that supports the child's conceptualization of these social meanings in the first months of life.

Prosody consists of variations in the pitch, length and loudness of utterances. Their corresponding acoustic correlates respectively are the fundamental frequency (F₀) measured in Hz, timing (ms), and amplitude (db) of the signal (Lehiste, 1970; Cruttenden, 1986). Many studies have confirmed the claim that pitch is the most important aspect of prosody that parents use to mark different pragmatic and social situations. For example, Fernald and Kuhl (1987) found that fundamental frequency, rather than timing or amplitude, was the aspect of IDL that four-months-old children responded to differentially. Accordingly, pitch is the variable most often identified in vocalizations by infants (e.g., D'Odorico & Franco, 1991) and by adults (e.g., Cooper, Abraham, Berman, & Staska, 1997; Fernald, Taeschner, Dunn, Papousek, Boysson-Bardies, & Fukui, 1989; Warren-Leubecker & Bohannon III, 1984).

In summary, IDL contains many questions and the pitch of speech directed to the child is seen as especially important for the child to understand what is being communicated, not only semantically but also in terms of their roles in conversational exchanges. Although it is acknowledged that pitch carries the meaning of the message, and that different types of questions carry different meanings (Snow, 1977), it is has not been ascertained whether parents differentiate types of questions. It is not clear whether parents distinguish between questions which require the child to take her turn in the conversation and questions which do not require an answer nor give leave for the child to speak.

The purpose of the present study is to examine the hypothesis that pitch variations in parental speech provide context-specific cues that mark for children the difference between different types of questions. If pitch variation gives a clue then one would expect that the clue would be age specific, namely at the time when the child understands the real question and is potentially capable of answering it with a word or specific babbling (e.g., Blake & Fink, 1987; Tomasello, 1992; Waterson, 1978).

In order to examine this hypothesis, the variation in mean pitch height of paternal speech, when asking an infant two types of yes-no questions, was examined at different ages.

One girl and her father, a University Professor, participated in this study. The infant was first-born with no siblings. The white American father spoke American English to his daughter. The pair was recorded over a period of 15 months starting from the age of 1 month. The father was asked to audiotape his daughter's vocalizations while he was playing with her and while he changed her nappy and dressed her. The recordings were done 2 to 3 times a week mostly in the mornings for 10-15 min. The tape recorder and microphone were situated approximately at an equal distance between father and child, and out of reach of the child.

All utterances spoken by the father during the recorded sessions at 1-, 5-, 10-, 15- and 16-months were transcribed orthographically. Each yes-no question was identified. Sentences that were candidates for acoustic analysis were free from excessive background noise or overlapping speech. Eight judges were given different parts of the transcripts of the context in which yes-no questions were asked with the question to be rated highlighted in the
The judges were given dictionary definitions of rhetorical questions as well as two examples of real and rhetorical yes-no questions. They were asked to judge whether a question could be classified as either rhetorical or real.

Real questions were those to which the father wanted the child to give him information, such as “do you want red socks?” An example of a real question at 1 month in the context of getting dressed was: “So we want to put a T-shirt underneath. The yellow one. Do you like that?” or in the context of getting ready to feed her: Are you hungry? At 5 months a real question was: Is it tasty? and at 15 months: Do you want to come down? (from the changing table after having dressed her, rather than stay and read a book).

Rhetorical questions, in contrast, are questions that the speaker never intended to be answered. They are used to make a point rather than to get information. For example a rhetorical question at 1 month was asked in the following context of changing the nappy: “A bit cool. One giant sized nappy..... of containing it all. I need three hands. Can I borrow one of yours?” Or in the context of having to get ready to meet her uncle: “And we’ve got to walk there (the station). You can’t even crawl yet, let alone walk. Do you think you’re going to make it?” An example of a rhetorical question at 5 months is: “Mrs. B. has gone but she’ll be back in 7 hr. Are we going to manage that?” and at 15 months is: “Shall we turn off the Watergate tape?” when Toto is dressed and ready to go out.

The 8 judges were paired; each pair read and rated the same script. Only those questions which were classified by both judges as rhetorical or real were used in the analysis.

With regard to acoustic measurements, Fast Fourier Transformation (FFT) analysis was used. This analysis performs successive 512-point FFT’s, and frequency information from both F0 and its harmonic frequencies are combined to determine the F0 contour. The combining algorithm proceeds as follows: parabolic cones are calculated around each of the fundamental and harmonic frequency responses in the FFT output and their forms are cumulated. F0 frequency is given by the peak of the largest cumulative cone. The advantage of this Fast Fourier Transformation which takes the harmonics into account, is that when the fundamental is missing or very low the harmonic gives an estimate of the fundamental. All sentences selected for analysis were digitized using Synthesize. For each sentence, the following measures were obtained: minimum, maximum, and mean F0 values, measured in Hz and length of the utterances measured in seconds.

The pitch extraction algorithm reported fundamental frequency (F0) values for each 5 msec of voiced speech. The mean values were averaged for each question type-age category. “Pitch height” was defined as the mean F0 that the father used in a given question type-age setting. “Pitch range” was defined as the difference between the average minimum and maximum F0 values.

The mean fundamental frequency and range as well as the numbers of sentences in each question type category can be seen in Table 1.

A 2 x 5 repeated measures ANOVA of mean frequency by question type (real, rhetorical) and age-category (1, 5, 10, 15, 16 months) showed a significant interaction of question type by age-category [F(4,128) = 3.20 p < .01] and a significant main effect for question type [F(1,128) = 7.94 p < .005]. A posthoc Neuman-Keuls test (p < .05) showed that there was a significant difference between the mean pitch for real (mean = 138.36 Hz) and rhetorical (mean=168.01 Hz) questions at 15 months and that this significant difference persisted at 16 months (real questions:mean = 143.60 Hz and rhetorical questions:mean = 167.87 Hz), but was absent at earlier ages.

The mean length of the questions in ms was longer for rhetorical than real yes-no questions. In order to establish whether there was a correlation between the pitch (mean F0) in which the question was asked and the length of the question, a Pearson’s product-moment
Table 1
The mean fundamental frequency and range measured in Hertz of real and rhetorical questions asked from 1 to 16 months

<table>
<thead>
<tr>
<th>question type</th>
<th>real</th>
<th>rhetorical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no of sentences</td>
<td>mean freq (Hz)</td>
</tr>
<tr>
<td>age (months):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>147.30</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>151.12</td>
</tr>
<tr>
<td>10</td>
<td>22</td>
<td>138.76</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
<td>138.35</td>
</tr>
<tr>
<td>16</td>
<td>15</td>
<td>143.60</td>
</tr>
</tbody>
</table>

The correlation coefficient was calculated \( r = .117, p > .1 \). Since there was no significant correlation between mean pitch and utterance length, it was concluded that the length of the utterance did not contribute to the difference in mean pitch for rhetorical and real questions.

The results showed that from the time the child was 15 months old, her father differentiated real from rhetorical yes-no questions by speaking in a significantly higher mean pitch when asking rhetorical questions compared to the mean pitch when asking real questions. When asking real questions at 1, 5, 10, 15 and 16 months, the mean fundamental frequency of paternal speech was 143 Hz, which is similar to that recorded by other researchers (e.g. Siegel, Cooper, Morgan & Brenneise-Sarshad, 1990) with regard to a global measure of paternal IDL. They found that the mean fundamental frequency of paternal speech to infants was 154 Hz and their mean fundamental frequency to adults was 121 Hz. Specifically, Warren-Leubecker & Bohannon III (1984), found that declaratives were spoken by fathers with a mean pitch of 150 Hz and questions with a mean of 156 Hz to 2 year old children. The pitch of fathers speech to adults was a mean of 114.25 Hz.

By the time the child was 15 months old the father used a higher mean fundamental frequency than at 10 months and younger, in order to differentiate rhetorical questions (mean = 167 Hz) from real questions (mean = 140 Hz). It is around this age that infants start to map certain babbling sounds onto specific meanings (Blake & Fink, 1987). Furthermore, at around 15–16 months of age, children start to answer yes-no questions such as “Do you want some more?” with “more,” or “Do you want to get down?” with “down” (Tomasello, 1992).

Although children at 10 months or younger might understand certain questions, it is only at the time when children start to use language by either using specific babbling sounds or specific words, that in the present study real and rhetorical questions were distinguished through pitch height. Furthermore, it is at that time that questions are used by parents as tutorial devices (Snow, Arlman-Rupp, Hassing, Jobsc, Joosten & Voster, 1976), as requests for actions (Newport, Gleitman, & Gleitman, 1977) or as requests for clarification (Cherry, 1976).

In summary, only at the older age of 15 months did the father distinguish questions which should be answered from questions which should not be answered. Hence, although at the younger age one could argue that all questions are rhetorical because the
infant cannot answer (Fernald, personal communication, April, 1998) or conversely that all questions are real because parents behave as if children do understand all questions (e.g., Kaye, 1982), in the present study, the father did only distinguish in his pitch between real and rhetorical questions when his daughter was 15 months old. Hence it is suggested that by 15 months, not only do parents take into account the child’s ability to understand what is said by modifying their infant-directed speech (e.g., Ferrier, 1978), but also more specifically, the father in the present study varied the pitch of the questions he asked. At this age rhetorical questions are asked more playfully, indicated by the higher pitch. Given that a question will usually indicate a switch of roles (Schlegloff, 1979), “although, by definition, rhetorical questions so understood will not do this” (Green, 1989: 153), one function of the difference in pitch between real and rhetorical questions at 15 months, might be to indicate turns or non-turns in conversations.

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REFERENCES


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