ABSTRACT
        In order to study signs of stress in speech directed
to children at risk for abuse, sentences matched on content were
collected from audio recordings of adult-child interactions. The
children were audiotaped during an unstructured interaction with both
their own mother and an unrelated mother. A total of 40 sibling
pairs, each including one sibling who was at relatively greater risk
for abuse, were drawn from families involved in counseling. It was
predicted that the interactions involving the child at greater risk
would be perceived as more stressful by both maternal groups, and the
prosodic features of the adult's voice would illustrate the
heightened stress they experienced. In 61 of the interactions, the
adult spontaneously uttered the target sentence: "I don't know."
Among related mothers, 20 target utterances were directed to the more
difficult child and 18 to the other child. Among unrelated mothers,
10 target utterances were directed to the difficult child and 13 to
the other. Sentences were acoustically analyzed in terms of the
speaker's mean fundamental frequency (MFF) level, MFF range, and MFF
variability. Analysis revealed that for both unrelated and related
mothers, speech directed toward children at greater risk for abuse
was characterized by higher MFF, wider range, and larger MFF
variability. (RH)

Speech to children at risk for abuse:

An acoustical analysis

Jeffrey Lewis

University of California, Santa Barbara

Running Head: Speech to children at risk

Abstract

In order to study signs of stress in speech directed to
children at risk for abuse, sentences matched in terms
of their content were isolated from audio recordings of
adult/child interactions. The children were audio
taped during an unstructured interaction with both
their own mother and an unrelated mother. 40 sibling
pairs (one of whom was at relatively greater risk for
abuse) were drawn from families involved in counseling.
It was predicted that the interactions involving the
child at greater risk for abuse would be perceived as
more stressful by both maternal groups, and the
prosodic features of the adult's voice should
illustrate the heightened stress they experienced.
Within 61 of the interactions, the adult spontaneously
uttered the target sentence ("I don't know"). These
sentences were acoustically analyzed in terms of the
speaker's mean fundamental frequency (F_0) and range and
variablity of their F_0. The analysis revealed that for
both the unrelated and related mother , speech directed
towards children at greater risk for abuse was
characterized by higher F_0, wider range and larger F_0
variability.

Speech to children at risk for abuse:

An acoustical analysis

The interaction between children and their caretakers has become a major focus of research involving the socialization process. While parents play a large role in the growing process, recently social developmentalists have recognized the importance of the child's own characteristics on this two-way system. Socialization is viewed as a result of a pattern of reciprocal influence, running not only from the parent to the child but also from the child to their caregiver (Bell, 1979).

Child characteristics and their possible effects have received increasing attention in the context of the multiple reciprocal influences present in abusive families (e.g., Belsky, 1984; Burgess & Conger, 1978). Children at risk for abuse have been observed to possess a variety of traits such as prematurity (Elmer & Gregg, 1967), physical and learning disabilities (de Lissovoy, 1979), and mature facial features (McCabe, 1984). In addition, they were more likely to have medical problems and in some cases these problems precede later incidents of parental abuse (Sherrod,

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O'Connor, Vietze, & Altemeier, 1984). The possession
of these difficult characteristics places further
strain on the caregiving system, and the parent's
beliefs regarding the cause of the stress may determine
whether the adult reacts in a positive or negative way
to the child (Bugental, Mantyla, & Lewis, 1989).

The present study investigated patterns of
interaction between children at risk for abuse and
adults. Of interest here are signs of stress detected
in the acoustical patterns of the adult's speech that
may be related to difficult child behaviors. Upward
changes in the level and variability of fundamental
frequency (F_O) have been found to correlate with higher
levels of stress in speakers (Williams & Stevens, 1972;
Streeter, MacDonald, Apple, Krause, & Galotti, 1983).
Measures of F_O may also act as a cue t ' changes in
one's emotional experience and physiological arousal
(see Scherer, 1986, and Frick, 1985, for a review of
the pertinent literature). Acoustical measures, in
general, are attractive in that they offer a non-
reactive yet high yield method of assessing a person's
emotional state. If the characteristics of a difficult
child do act as a strain on the caregiving system, the

higher stress felt by the parent should be reflected in acoustical measures of their voice recorded during an interaction.

In order to study this hypothesis, appropriate speech samples from parent-child interactions need to be isolated. As part of a larger project (Bugental, Blue, and Lewis, 1989), 40 familes participating in counseling were asked to take part in the research investigating interactional patterns in abusive families. Mothers were asked to interact individually with two of their children (matched as closely as possible in terms of age and gender) in an unstructured setting. In each of the pairs, one child was categorized as relatively "difficult" in comparison to their sibling. These children were not only perceived as harder to get along with by their mothers but were also more likely to be the target c.' more frequent and severe punishment. Differences in the mother's interactional behavior during their conversations with the two children could then be connected to the perceived child difficulty. In addition, unrelated mothers were also asked to interact with the same children. In this way, the change in stress due to the

child's behavior could be assessed in adults who had no previous contact with the children, controlling for the influence of interaction history.

During unstructured conversations, a variety of messages can be produced by the participants and content varies widely between dyads. Some sentences do occur frequently in conversations, and from these matched messages, a comparison between dyads can be made. One such message is "I don't know", a rather generic statement that occurs frequently in conversations between strangers and acquaintances. In the present study, this target sentence occurred in 61 out of the 160 total interactions, making it a good choice for the basis of our acoustical analysis. If the difficult child behaviors do act to increase the strain on a relationship, evidence of higher stress levels should be present in the sample messages recorded during conversations between the "difficult" child and mothers.

Method

Overview

The project is divided into two separate but parallel studies. In the first study, a comparison is

made between the speech samples of the natural mothers
recorded during conversations with their two children.
In the second study, the samples are from interaction
involving the same children paired with unrelated
mothers. The subjects (natural and unrelated mothers,
difficult and comparison children) were drawn from a
larger pool of 80 mothers (40 natural and 40 unrelated)
and 80 children (again, 40 of each) used in the
research described in Bugental et al. (1989). Their
inclusion in this analysis is based on whether the
target sentence was said during their interaction. The
descriptions of the subjects that follows reflects only
those used in the present analysis. A detailed
description of the entire subject population in the
larger project is available in Bugental, Blue, and
Cruzcosa (in press).

Subjects

Natural Mothers. The families used in the project
were recruited from a non-profit agency that provides
services to abusive families and families seeking help
with parenting skills. All the families were enrolled
in counseling at the agency, and of the 41 mothers
asked, 40 agreed to participate in a recorded

interaction. The mothers were reimbursed $20 for their trouble and participation was voluntary. In the sample used for the present study, all of the mothers were white, spoke English as their first language, and had an average of 13.2 years of education (s.d. = 2.7). In the 40 natural mother-difficult child dyads, 20 occurrances of the target sentence were identified (when the target was found more that once in a given dyad, one message was randomly chosen to represent that dyad). Within the 40 natural mother-other child dyads, 18 "I don't know" statements were recorded.

Unrelated mothers. The sample of unrelated mothers consisted of 40 women recruited from the community by publicly-placed advertisements in newspapers and laundry rooms, and all were paid $20 to participate. All mothers spoke English as their first language and were white. Their mean education level was 16.3 years (s.d. = 3.2). All of these mothers had at least one child between the ages of 4 and 12, and their mean number of children was 2.7 (s.d. = 1.3). In the 40 unrelated mother-difficult child dyads, 10 occurrences of the target sentence were identified, while in the 40 unrelated mother-comparison child dyads, 13 "I don't

know" statements were recorded.

Difficult and Comparison Children. In the
larger study, each family had at least two children
between the ages of 4 and 13 years (mean number of
children in each family = 2.7; s.d. = 0.7). Two
children were selected from each family, and child
difficulty ratings were obtained for each. The child
classified as the "difficult" sibling was the one that
(a) received more frequent or more severe discipline as
measured by the Conflict Tactics Scale (Straus, Gelles,
& Steinmetz, 1980) and also (b) was rated as more
difficult by the mother[1]. In families with more than
two children, an effort was made to select those that
were more similar in terms of age and gender. In the
analyses using the natural mother's speech, children
ranged in age from 4 to 13 years old. Mean age of the
difficult group was 8.4 (s.d. = 3.19); mean of the
comparison group was 7.78 (s.d. = 3.06). The difficult
child group consisted of 19 boys and 1 girls, while the
less difficult group was made up of 10 boys and 8

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1. In cases where the two measures of difficulty were
in conflict, the opinion of the family's counselor was
used to determine the classification.

girls. For the analysis using the unrelated mother's
speech, children ranged in age from 4 to 13 years old.
Mean age of the difficult group was 8.0 (s.d. = 3.23);
mean of the comparison group was 7.46 (s.d. = 2.53).
The difficult child group consisted of 9 boys and 1
girls, while the less difficult group was made up of 8
boys and 5 girls. Although there was an uneven
distribution of gender across the groups in both sets
of analyses, sex was not included as a factor as there
were too few "difficult" girls represented in the
sample. Therefore conclusions can not rule out the
possiblity that gender may have a significant effect.

Procedure

The dyads were individually audio-taped as the
children interacted separately with their own mother
and an unrelated mother (the order was randomly
determined). The conversations took place in a
comfortably furnished room with the participants seated
in chairs a few feet from each other. Microphones were
placed in the ceiling above the interactants and also
in a plant located midway between the two chairs. The
children would enter the room where the adult was
waiting and both were instructed to "talk to each

other" while they waited to play a game. These unstructured interactions lasted four minutes, followed later by a structured "game" interaction and then the conversation with the other adult (see Bugental, et al., 1989, for a complete description of the procedure). After the recording was complete, the conversation from the unstructured interaction was replayed to identify occurrences of the target message ("I don't know"). All of the target samples were then copied onto a separate tape and digitally stored on a computer for later analysis.

The fundamental frequency patterns were then analyzed using the ILS speech analysis system (Signal Technologies, 1983). The program uses a Linear Predictive analysis to extract the acoustic parameters from a digital record of a speech sample. After analysis was complete, the mean fundamental frequency level, range and variability were available for comparison between the groups. In all, 61 adults said the target sentence during the interaction, with 38 of the messages from the related mothers (20 to the more difficult child, 18 to the other child) while 23 messages were taken from the unrelated mothers (10 to

the difficult child and 13 to the other child).

Results

A multivariate analysis of variance was used to test differences on three dependent measures: mean F_O level, F_O range, and F_O variablity. The analysis was repeated for both groups of mothers (natural and unrelated) using child difficulty as the independent measure.

Insert Table 1 about here

The results of the acoustical analysis show that for <u>both</u> related and unrelated mothers, the mean F_O level of the target message was significantly higher when talking to the difficult child ($\underline{F}$ (1, 36) = 6.00, $\underline{p}$ = .019 for the natural mothers; $\underline{F}$ (1, 21) = 9.03, $\underline{p}$ = .007 for the unrelated mothers). As predicted for the

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Insert Figure 1 about here

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unrelated mothers, F_O variability was also higher when speaking to the difficult child ($\underline{F}$ (1, 21) = 4.45, $\underline{p}$ = .047), while F_O range showed a trend towards the

Insert Figure 2 about here

predicted patterns ($\underline{F}$ (1, 21) = 3.49, $\underline{p}$ = .076).
However, the range and variablity of the natural
mother's F_O did not show a significant difference.

Insert Figure 3 about here

Discussion

The higher level (and, to some extent the larger
variability) of the target message fundamental
frequency is believed to be a sign of higher stress in
both the natural mothers (who have a long history of
interactions with the children) and the unrelated
mothers (who are illustrating this difference during
their first conversation with the difficult child).
Taken together, this observed difference supports the
belief that conversations with "difficult" children are
more stressful, and that this may be a result of
differences in the child's behavior. Specific
characteristics in abused children do place a strain on
the caregiving system (de Lissovoy, 1979), and these

characteristics may play a role in the child's eventual development. These results do not suggest, however, that there is a direct connection between the child characteristics and the later occurrence of abuse. Difficult behaviors by themselves can not explain the patterns of interactions observed in abusive families. The role that these characteristics play must be viewed in context with other important influences, namely parental characteristics and other factors present in the child's environment.

Bugental and her colleagues (Bugental & Shennum, 1984; Bugental et al., 1989) propose a transactional model of caregiving interactions where child characteristics do not have a direct causal influence on behavioral outcomes, but instead interact with the causal beliefs of the adult. The parent's belief systems will influence the perceptions of a child's behaviors and act to amplify or attenuate the implications of the child's actions. Bugental et al. (1989) demonstrated that adults with low levels of perceived control over caregiving outcomes react with negative affect when confronted with difficult child behaviors. This reaction then leads to the maintenance

of the difficult child behaviors and further negative
reactions from the adult. Eventually, the ineffective
behavior could be replaced by abusive reactions to the
child if the difficult behavior continued.

Due to the limited sample in the present project,
the causal belief systems of the adults could not be
included in the analysis. In future research, larger
samples and/or a more controlled situation might yield
support for the moderating influence of adult
cognitions as well as evidence of strong child effects.
In addition, other acoustical parameters, such as voice
perturbations (Lieberman, 1961), measures of spectral
energy (Scherer, 1986), and vocal quality (Laver,
1980), could be used to describe the nature of speech
to children at risk for abuse. Further investigations
might clarify patterns of influence and causative
factors mediated in the interactional behavior observed
in abusive families.

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Natural Mothers

Dependent Measures

	Fo mean	Range	Variance
Difficult	228.61	93.6	859.85
Other	₁92.42	72.5	588.62

Child Status

Unrelated Mothers

Dependent Measures

	Fo mean	Range	Variance
Difficult	241.38	106.50	1846.4
Other	199.23	68.61	301.97

Child Status

Table 1. Group Means
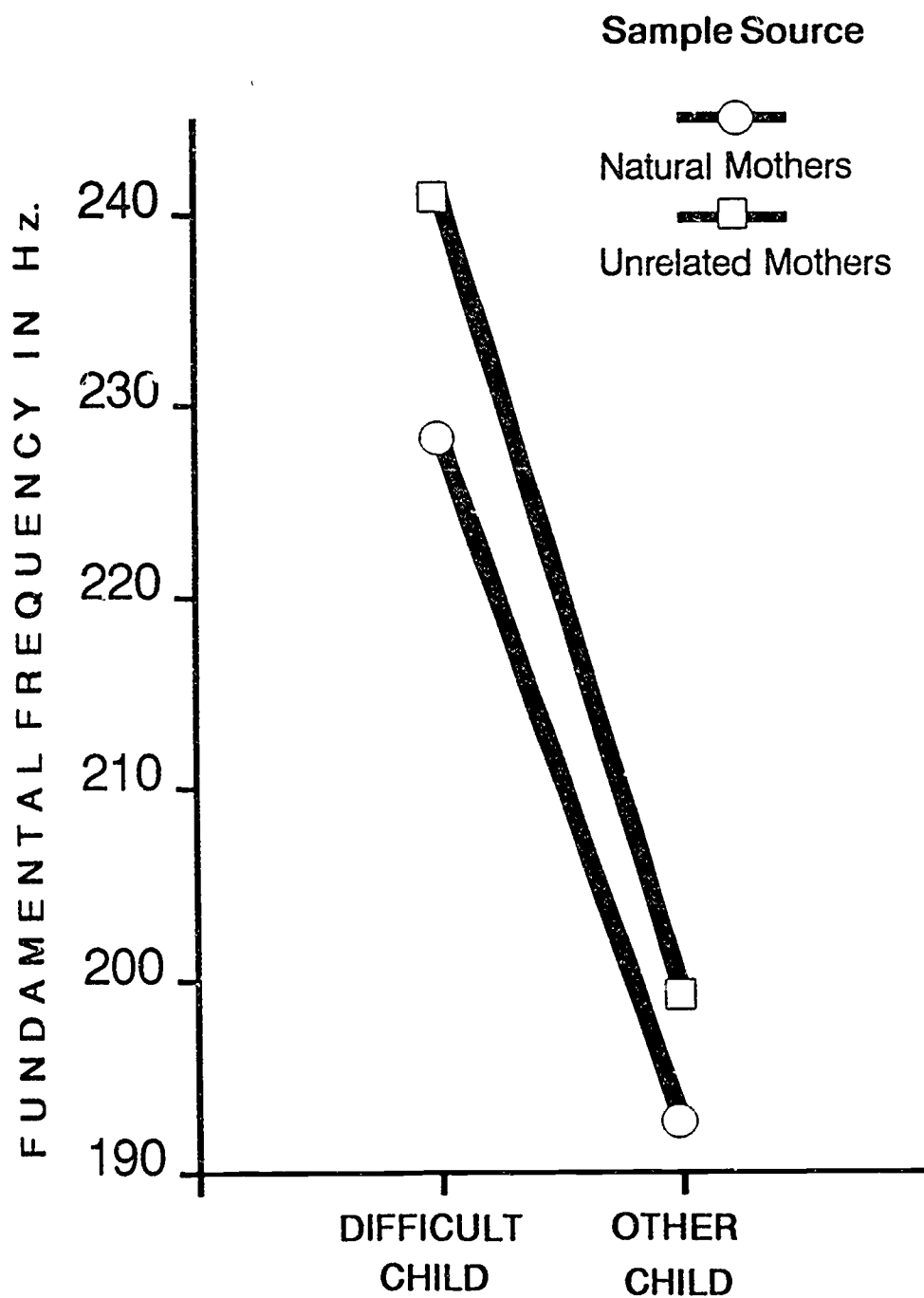
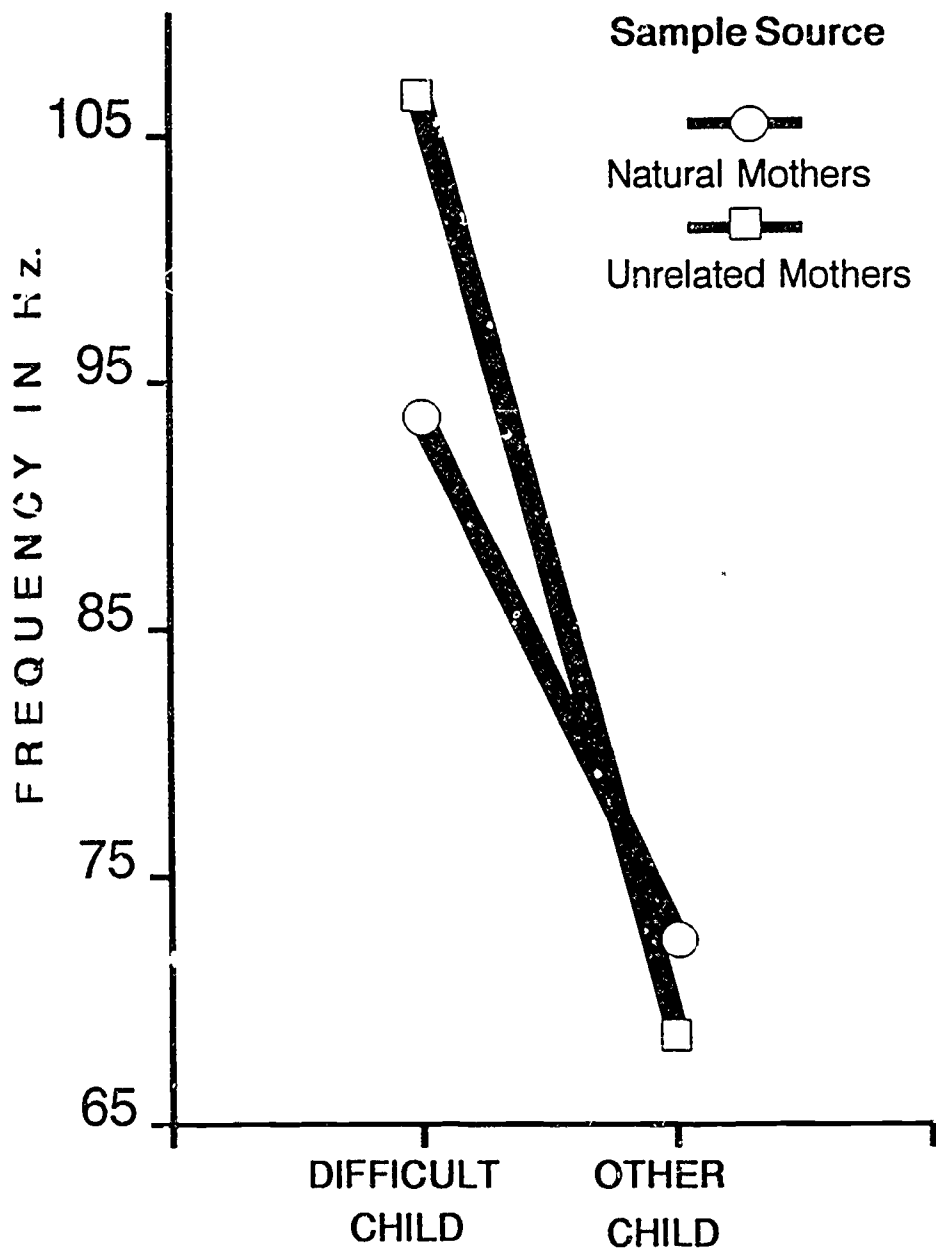Fig. 1:Mean Fundamental Frequency in Speech samples to children at risk

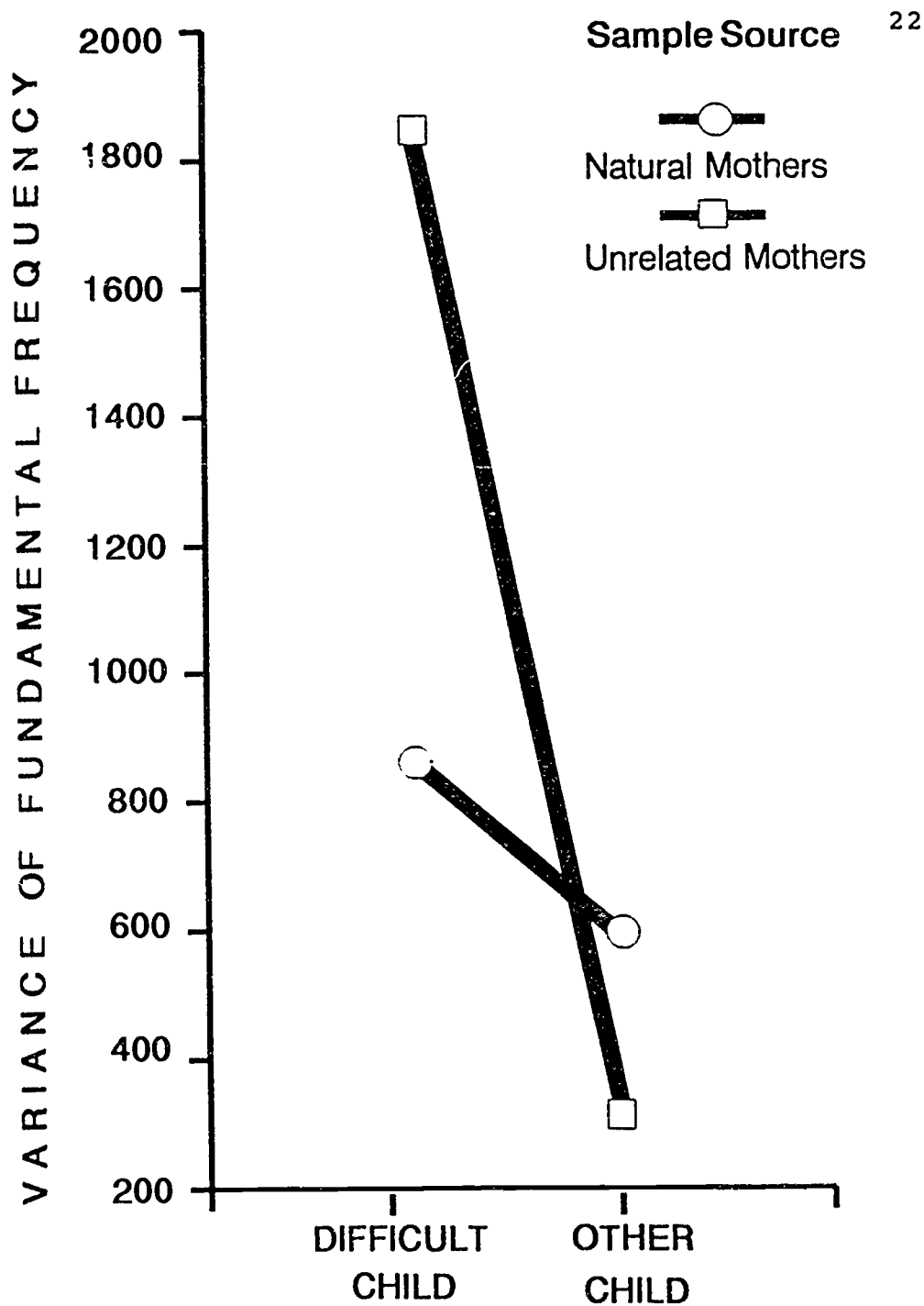Fig. 2:Range of Fundamental Frequency
in speech samples to children at risk

Fig. 3:Fundamental Frequency Variability
in speech samples to children at risk