

## Higher pitch in BT is not universal: acoustic evidence from Quiche Mayan\*

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### ABSTRACT

Although higher pitch has been described as a universal feature of babytalk (BT) registers worldwide, analysis of a sample of three Quiche Mayan-speaking mothers addressing their infant children indicated that their BT register does not utilize this feature. Quiche mothers either make no pitch distinction in speech to young children, or actually lower pitch slightly in comparison with their Adult–Adult interaction style. A comparison group of American mothers raised pitch 35–70 Hz when addressing infants of the same age and language maturity. We posit that pitch-raising strategies may be sociolinguistically determined and may serve different functions across languages.

### INTRODUCTION

Of the many features of baby talk (BT) or caretaker register which have been described by researchers, perhaps the most commonly mentioned is higher pitch. As Sachs (1977: 53) reports:

Almost every researcher . . . has mentioned that adults seem to use overall a higher pitch, and these studies include a wide variety of languages. Such reports are found, for example . . . for Arabic, Spanish and English . . . for Marathi . . . for Latvian . . . It seems that we can safely assume that prelinguistic babies are spoken to with higher pitched voices.

In the same volume, Ferguson (1977) describes pitch elevation as ‘the most prominent expressive feature of pronunciation in BT’, and as ‘very likely universal’ (p.226).

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The assumption of universality in pitch modulations in speech addressed to young language-learning children has prompted Sachs, Ferguson and others (Garnica 1977, Lieberman, Ryalls & Rabson 1982, Stern, Spieker, Barnett & Mackain 1983, to name only a few) to hypothesize that higher pitch serves an adaptive function in adults' speech to infants. According to Garnica (1977), higher pitch is thought to be an integral factor in adults' attempts to attract and maintain children's attention in linguistic interactions. The pitch modification itself is not imbued with particular language-facilitating powers *per se*, according to this account, but acts solely to attract the child's attention to BT, which supposedly possesses other features (e.g. a simplified syntax and lexicon, repetition and paraphrase, restricted length and topic focus) that enable the infant to process and acquire language.

The evidence for higher pitch in BT appears so strong that few researchers appear to have questioned whether or not it is indeed a universal phenomenon. In this report, we present a post-hoc analysis of the pitch characteristics of Quiche Mayan BT, a language register which does not employ higher pitch, although it does share some other features with other BT registers described previously.

#### METHOD

Audiotapes compiled during a previous study of language acquisition in a Quiche Mayan-speaking community (Pye 1980) were subjected to fundamental frequency analysis (pitch extraction).

#### *Subjects*

Children and their parents were native speakers of Quiche, a Mayan language spoken in the western highland region of Guatemala. They were followed and taped by the second author over a nine-month period in 1977.<sup>1</sup> The children and their parents were recorded in play interaction at two-week intervals over the course of the study, using a Sony TC110B cassette recorder with condenser microphone to minimize equipment distraction. Data for the mother-child dyads are taken from the earliest tapes in the study. Al Tiya:n, who was 2;0, had essentially holophrastic expressive ability with an MLU of 1.31. Al Cha:y, 2;9, was using 1- 2-word utterances with an MLU of 1.57. A To:n, age 1;10, used only one-word utterances (MLU 1.0), and had an expressive lexicon of less than a dozen items.

[1] Research grants from the Wenner-Gren Foundation and the Organization of American States helped support the collection of the Quiche data. We would like to thank both the American and Guatemalan parents and children for their co-operation in the original studies. It is our hope that the Guatemalan government will halt its campaign of terror and permit its indigenous peoples to raise their children without fear of murder or starvation.

*Procedure*

Because these tapes were originally gathered for syntactic and morphological analysis, and because the need for acoustic analysis of the tapes was not foreseen, the naturally noisy recording conditions encountered during taping in a rural village environment (chickens, threshing machines, etc.) limited us to some of the 'cleaner' and clearer tapes made during the study. Out of a larger corpus of mother-child dyadic interactions, and a more extended time frame, only the three children at the ages specified above had tapes capable of being acoustically analysed.

By simultaneously following written transcriptions of the interactions and the audiotapes, it was possible to isolate noise-free conversation directed to the children by their mothers. It was also possible to isolate instances in which the mothers conversed with either the first author (for Al Ch:ay and A To:n's mothers) or a native assistant (for Al Tiya:n's mother). Thus we were able to obtain samples of mother-child (M-C) conversation to pair for pitch analysis with samples of the mother's speech to an adult A-A condition).

A total of 20 utterances was obtained for each mother for each condition. These 120 utterances were primarily declaratives; however, a small number of questions appeared in both the M-C and A-A corpora. Sentence type was matched within each mother's data for the two listener conditions.

Utterances were subjected to fundamental frequency extraction utilizing a PM100 frequency-intensity analyser marketed by Voice Identification, Inc.<sup>2</sup> This instrument is capable of extracting and plotting fundamental frequency values, contours and averages for utterances ranging in duration from 1 to 9 seconds. Data are displayed on a c.r.t. screen. Microprocessor capacity enables the machine to sum automatically each plotted  $F_0$  value and average the values across the utterance.

This recently developed, commercially available instrument does not appear to have been used in prior investigations of M-C pitch modulation. Rather, previous investigations were limited to more time-consuming and laborious computer programs (Garnica 1977, Bernstein & Jeje 1978), which did not have the capacity to compute an utterance-average  $F_0$ .

Because we employed a new analytical technique, and because the Quiche conversational interactions were less constrained and more naturalistic than those used by Garnica (1977), we sought to obtain an additional corpus of data from two English-speaking mother-child dyads in which the children were of similar ages and linguistic abilities to the Quiche-learning children.

Data for English-speaking mothers were obtained from recordings made by the second author in a longitudinal study of the acoustic characteristics

[2] We wish to acknowledge the facility support provided to the acoustic analysis portion of our study by Howard University, particularly Abraham Tishman, Department of Communication Sciences.

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of English mother-child speech (Bernstein Ratner 1984). From a larger sample, two mother-child dyads matching the age and language ability characteristics of the two holophrastic and additional more advanced children were selected.

Using transcriptions, 20 declarative utterances were randomly selected from both M-C and A-A conditions for each English-speaking mother, and were subjected to the same frequency analysis as the Quiche data.

TABLE I. *The mean fundamental frequencies (Hz) used by mothers in the two language communities*

Name	Age	MLU	Mother-adult	Mother-child
Quiche mothers				
A To:n	1;10	1.0	246	251.9
Al Tya:n	2;0	1.3	228 <sup>a</sup>	198
Al Cha:y	2;6	1.5	288	271.3
American mothers				
Cindy	1;8	1.0	197.4	232.1 <sup>b</sup>
Annie	1;9	1.5	176.1	219.6 <sup>c</sup>

<sup>a</sup>  $t = 2.174, P < 0.05$ , 2-tailed (d.f. = 19).

<sup>b</sup>  $t = 2.93, P < 0.01$ , 2-tailed (d.f. = 19).

<sup>c</sup>  $t = 3.28, P < 0.01$ , 2-tailed (d.f. = 19).

## RESULTS

Table 1 displays the mean fundamental frequencies for mothers' conversational speech to adults and language-learning children in Quiche and English.

All three Quiche-speaking mothers used a LOWER pitch when addressing their children than when addressing an adult listener. A *t*-test for related measures (d.f. = 19) shows that, for the mother of Al Tiya:n, pitch to the child was significantly lowered ( $t = 2.174, P < 0.05$ , 2-tailed) relative to her pitch to the adult; for Al Cha:y's mother, average pitch to the child was more than 15 Hz lower than her average pitch to an adult listener (although this difference was not statistically significant); and, for Al To:n's mother, pitch to the child was lowered by 5 Hz (again, a non-significant adjustment).

These results do not appear to be an artifact of either our analysis procedures or the fact that we used spontaneous utterances as the basis for our analysis. Both of our American mothers show the expected effect of higher pitch in the child listener condition, both significantly so. While not as dramatic as the average 70 Hz increase noted in Garnica's study of speech to 2-year olds (1974, 1977), our two English-speaking mothers' increases of 35 and 45 Hz to their children are both substantial, significant, and in the same direction as previous descriptions of BT registers. Because the American mothers' data were similar in conversational format, and in the manner in

which they were analysed to the Quiche mothers' data, we are confident that the lack of pitch increase we see in Quiche BT reflects a real and valid distinction between Quiche and other language communities' BT registers.

#### DISCUSSION

Four major explanations of higher pitch in BT are prominent in the language acquisition literature. Ferguson (1977) speculates that its origins lie in the tendency of adults to adapt their pitch to that generated by the immature infant vocal tract (see also Brown 1977:10, Lieberman *et al.* 1982). The 'pitch-matching' hypothesis does not account for non-existent pitch alterations in male–female interaction (Bernstein & Jeje 1978), or for the other environments where BT has been observed (in speech to dogs, for example, whose fundamental frequencies are often much lower than those of the human adults addressing them). The existence of a speech community such as Quiche Mayan suggests that pitch matching cannot be an innate characteristic of speech to human infants.

Sachs (1977) suggests that higher pitch to pre-linguistic infants, at least, can be accounted for by infants' preferences for relatively high-pitched tones. She cites Kearsley's (1973) study showing preferential orienting responses by infants to tones at 500 and 2000 Hz, rather than to those at 250 and 1000 Hz. While Sachs concludes that 'frequencies close to this (500 Hz) would be what they (infants) would hear in adults' speech to them', it is in fact true that Garnica (1974) found the mean fundamental frequency of phonation to her youngest group of child listeners to be of the order of 267 Hz (a value closer to the non-preferred 250 Hz tone). Thus, although infants may show a preference for tones generated at 500 Hz, it is unlikely that they are, in fact, the recipients of speech pitched at this frequency. Thus we do not feel strongly persuaded by the argument that adults unconsciously attempt to pitch their speech towards an abstract 'preferred' range in order to obtain and maintain the child's attention. Since this preference for a particular type of tone might plausibly reflect maturational characteristics of the infant auditory system, one might also expect to find that all language communities resorted to the modulation to enhance interaction with young children.

A third explanation of higher pitch in BT is that it is used to express affection (Brown 1977:4). Brown hypothesizes that 'persons, animals and things whose primary characteristic is the inspiration of affection will be addressed in a one-dimensional AFF (expressive–affective) register'. Stern *et al.* (1983) speculate that this allows 4- to 6-month-old infants to integrate the vocal and visual expression of emotion. Certainly this account will explain why BT is also seen in interactions involving adults and their lovers, pets and plants. However, the Quiche data demonstrate that affection is not inherently tied to higher pitch. Mayan parents are very affectionate and extremely

protective with their children (Bunzel 1959, Vogt 1969). It also appears that Quiche mothers employ alternate speech modifications to demonstrate their feelings towards their children. Some (whispering, a hypocoristic proclitic) are seen in other language communities; others (such as use of quotative verbs) are not recorded in other studies of BT (Pye, MS).

The fourth explanation of higher pitch in BT is that it attracts children's attention and aids them in distinguishing speech directed to them (Garnica 1974, 1977, Brown 1977:15, Stern *et al.* 1983). Garnica summarizes (1977:82):

The higher pitched voice used by subjects in this study to the two-year-olds can be viewed as serving primarily a social function. The higher pitch is unique to this function. It may in fact be the most salient characteristic that serves to mark and thus set apart speech directed to young children... It attracts the child's attention to verbal material directed to him.

Thus, the child is enabled to locate and attend to conversational interchanges in which syntax, lexicon and context have been tailored to suit his immature linguistic system.

While this hypothesis seems to us to be an extension of Sachs' hypothesis (and thus, perhaps, suspect for the same reasons), the Quiche data demonstrate that pitch raising cannot be an innately determined strategy for attracting children's attention. While pitch lowering could serve the same function in Quiche that pitch raising does in other languages, infants could not have any *a priori* knowledge of which pitch strategy was being directed to them. A second problem with this notion is that pitch was not lowered substantially to the Quiche children; we should not assume that the differences we found are either salient or preferred by young children. Last, pitch does not reliably differentiate speech to child listeners from speech to adult listeners in any language. As Brown (1977:16) notes, mothers 'always lapse in and out of the register, even though the addressee remains the same two-year-old child'.

One way of viewing both Brown's and Garnica's proposals is to note that both proffer a 'sociolinguistic' explanation of the phenomenon, rather than a more 'physiological' interpretation (Ferguson, Sachs). Without collapsing them, or choosing between them as the best account of the phenomenon in English-speaking communities, we would suggest that the overall view of pitch modulation in BT as an essentially pragmatic or sociolinguistic phenomenon is most intuitively satisfying, and aids us in interpreting the Quiche data.

As is true for other registers, the particular characteristics of BT, including its high pitch, probably vary from class to class, and from culture to culture, although data may not have been gathered or applied to confirm this evidentially. Such an explanation is also consistent with the variation in use of BT to various groups of addressees within the same community (as both Brown and Ferguson mention). While high pitch may frequently be used to convey feelings of affection, tenderness and intimacy, it may just as easily

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express fear, anger or frustration. Much of the linguistic and anthropological literature is mute in this regard. And, while high pitch may serve to mark category of addressee ostensibly, in the case of children and pets, to cue them as intended listeners, high pitch need not be inextricably directed to any particular class or classes of listeners.

In the case of the Mayan languages, there is the reported possibility that pitch alterations do indeed signify particular classes of intended addressees. However, the classes are determined by the relative status of speaker and hearer – high pitch being used to listeners of high status, and low pitch to listeners of lower status, at least with female speakers. While this is also only a hypothesis, we do note that infants come last in Mayan age-grading systems (Vogt 1969, Maxwell 1982), and thus should be the recipients of relatively low-pitched speech, just as we observed. Certainly, any tendency to raise pitch to infants, as is done in most other cultures, would find itself in diametrical opposition to a pragmatic function which raised pitch to speakers of high status. The finding that pitch to the adults was relatively higher would be consistent with their relatively higher, though not special, status. We believe that the particular cultural constraints of Quiche not only account for our findings, but also bolster a view of higher pitch in BT registers as an arbitrary linguistic feature which is free to serve different functions across languages and dialects.

## CONCLUSION

The Quiche Mayan mothers in our sample not only did not raise the pitch of their speech to their young language-learning children, they actually employed a somewhat lower pitch to the children than to an adult listener. This result may be accounted for by the sociolinguistic rules of deference expression in Quiche. At the same time, it calls into question both physiologically motivated interpretations of the role of higher pitch in BT, which presumably would be universal, and interpretations which presume that either affection or attention-seeking gestures can be simply equated with elevated pitch cross-linguistically. We feel that such explanations ultimately rest on an assumption of universality for higher pitch in BT. The Quiche data remind us that language is ultimately the product of social interaction within particular speech communities. The components of the BT register are probably quite arbitrary and free to vary from one community to the next.

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