It's not what she says, it's the way that she says it: the influence of speaker-sex on pitch and intonational patterns

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Abstract

In this paper I discuss the relationship between speaker-sex and pitch and intonational features of language. I examine the spontaneous speech of male and female adults and children and pay specific attention to (i) pitch movements on nuclear syllables (what Halliday (1966) refers to as *tone*); (ii) pitch range; and (iii) maximum pitch. Results show that particular patterns of tone and pitch are characteristic of male and female speech.

1. Introduction

Over the past fifteen or twenty years considerable attention has been paid to the linguistic features which distinguish between the speech of men and women: research has detailed the segmental (phonological), lexical and syntactic features which characterise the linguistic behaviour of males and females. However, far less attention has been paid to the non-segmental - specifically, pitch and intonational - features which characterise men's and women's speech styles. Furthermore, it seems fair to say that the little information which is to be found in the literature is largely of an anecdotal rather than empirical nature[2].

The aim of the research which informs this paper was to investigate empirically the relationship between speaker-sex and the use of particular non-segmental linguistic features. I concentrate on proposing and providing evidence for three points. Firstly, and most fundamentally, I show that non-segmental features vary systematically according to speaker-sex in a way similar to that which has been observed for other levels of language use. Secondly, by detailing how children display similar patterns of sex-related variation as adults, I highlight the important role of non-segmental linguistic features in children's acquisition of sex-appropriate speech styles. Finally, I give evidence of patterns of stylistic shifting which strongly suggest that pitch of voice cannot be fully explained by reference only to physiological factors, but is also conditioned by the social factors which influence linguistic behaviour.

2. Methodology

The spontaneous speech produced by male and female adults and children was recorded: 5 men, 5 women, 5 boys and 5 girls. The adults were work colleagues aged between 27 and 32 years. All had attended private school, were university educated, and were speakers of Southern British English. The children were classmates (private fee-paying school) aged between 6.6 and 7.6 years. All were native Southern British English speakers of British English-speaking parents who were of a similar social class[3].

The investigation was designed in such a way as to allow the elicitation of the spontaneous speech used by informants within two different social settings: a casual conversation with a friend, and a formal interview.

2.1 Recording adults

Recordings of adults (men and women) were made in the informants' place of work. The two settings were created in the following way:

Conversation: two informants were asked to arrive for an interview at precisely the same time. They were then ostensibly "kept waiting" outside the interview room. In every case the two informants engaged in conversation. The conversations were surreptitiously recorded[4].

Interview: individual informants were brought into the interviewer's office where they were first asked a number of casual/social questions. The informants were then told that the interview "proper" was about to begin and a video camera was focused upon them. Questions in the interview were on the topic of the informants' previous employment and current work projects. Subjects' responses to these formal questions were openly recorded on the video soundtrack.

2.2 Recording children

Recordings of children were made in their classroom and in an adjoining music room. As with adults, two samples of speech were elicited from each child. The two settings were created in the following way:

Conversation: recordings were made of pairs of children conversing while making a collage. In the course of this activity children chatted together both about the picture they were making, and about other topics: e.g. the ballet they were due to perform, green "mutant" turtles, and world cup football. These conversations were surreptitiously recorded.

Interview: each child was brought into a small room adjoining their classroom where they were shown the tape-recorder and told how it worked and was used. Each child had a turn at recording and hearing a play-back of their voices before the interview started. The children were then shown the tape recorder being switched on and running. During the interview I asked each child questions about school, home, friends and family.

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[2]Notable exceptions to this include the work of Local (1978, 1982), Pellowe and Jones (1978) and Graddol and Swann (1983, 1989).
[3]By using these methods of selection, it was hoped that adults and children could be justifiably said to be speakers of the same or at least a similar variety (discussed at length in Woods 1992).
[4]After the conversational data had been elicted, informants were advised about the surreptitious recordings and were given the opportunity to refuse permission for the tapes to be used. No such refusals occurred.

Once a sample of each informant's speech in each situation had been collected the task of transcribing and analysing the data was begun (both impressionistic and instrumental techniques of transcription were employed). Amongst other non-segmental features, the use of pitch movements on nuclear tones, pitch range and maximum pitch were detailed. Repeated-measures analyses of variance were employed (using the Statistical Package for the Social Sciences - SPSS) in order to assess the significance of male-female differences in the use of pitch and tonal linguistic features. Significance was set at $p<.05$.

3. Results

The following presentation of results is divided into four parts. In the first section I detail the statistical results of the analysis of male and female speech (results refer to both adults and children). In the second section I discuss the pitch and intonational features used by adult men and women. Thirdly, I examine children's use of non-segmental linguistic features. And finally, in the fourth section, I present results which indicate that aspects of pitch of voice are socially as well as physically conditioned.

3.1 Statistical analysis of male-female differences

3.1.1 Tone

Results showed that the use of three tones distinguished between the speech of men and women: a 3-factor repeated-measures analysis of variance (sex x age x situation) showed highly significant between-subjects effects of speaker-sex on the use of (i) rising tones ($F = 8.98$; $df = 1,16$; $p = .009$); (ii) high fall tones ($F = 12.09$; $df = 1,16$; $p = .003$); and (iii) level tones ($F = 9.68$; $df = 1,16$; $p = .007$). These statistics reveal that females use more rising and high falling tones than males, and males more level tones than females.

No interactions were observed in the use of rising and high fall tones. This indicates that the influence of speaker-sex was consistent in both age groups in both social situations (women used more rise and high fall tones than men, and girls used these tones significantly more frequently than boys in both the conversational and more formal interview speech settings). An interaction between speaker-sex, situation and the use of level tones was observed. This interaction showed that as well as males using more level tones than female speakers, both sexes use more level tones in the formal context than in the informal/casual conversational setting (interaction: $F = 9.68$; $df = 1,16$; $p = .007$).

3.1.2 Pitch

Instrumental analysis showed that females typically use a greater fundamental frequency (Fo) range than males[1]. A 3-factor repeated-measures analysis of variance (sex x age x situation) showed a highly significant between-subjects effect of speaker-sex on informants' Fo range characteristics ($F = 13.29$; $df = 1,16$; $p = .002$). No interactions between speaker-sex and the other independent variables - age and social situation - were observed. The influence of speaker-sex on Fo range was thus shown to be consistent for both adult and child informants in both social settings: in both the conversational and interview situations females used a significantly wider range of fundamental frequencies than males.

3.2 The pitch and intonational patterns of adult men and women

> "It is generally thought that ... there are some intonation patterns, impressionistically the "whining, questioning, helpless" patterns, which are used predominantly by women". (Eble, C. 1972: 246)

(i) Rise tones

In support of previous research[2], results showed that women used more rising tones than men. This was a finding consistent in both social situations studied. In the first instance, this result seems to provide empirical evidence for anecdotal observations on male-female differences. For example, Brend (1975), in a study of American English, claims that women are the "sole" users of simple rising tones; tones which she argues reflect women's "polite" and "cheerful" natures. And Lakoff (1975) as well as claiming that women use more rise tones than men, also argues that women use rises in, if not a grammatically, then at least a pragmatically ill-formed way. That is, although the use of rise tones has been linked to the use of interrogative structures[3], Lakoff claims that women use rises when **answering** questions; a tendency which Lakoff attributes to women's "insecurity" and "lack of confidence".

However, when the category of rise tones was broken down into its component parts - complex fall-rise[4] tones and simple rise tones - I found that women's greater use of rises was a consequence of their significantly more frequent use of the former (complex fall-rise), rather than the latter (simple rise) tones. Figures 1 and 2[5] detail men's and women's use of complex fall-rise tones in the conversational and interview speech encounters. In the case of simple rises no significant difference (in either context studied) between men and women was observed. This result from British English is thus in contrast to the proposals of Brend and Lakoff, both of whom have claimed that it is the use of simple rises which characterises the speech of women.

[1] In this paper I equate Fo and pitch. However, in my thesis I discuss in detail the complex relationship which holds between these two.
[2] See Pellowe and Jones' (1978) research into the speech patterns used on Tyneside, and Elyan's (1978) study of students in Bristol.
[3] Although analysis of my spontaneous speech data showed, in line with many others (e.g. Kenworthy 1978, Gelykens 1988), that the relationship between rise tones and interrogative syntax was not predictable.
[4] I use this term to refer both to compound fall+rise and complex fall-rise tones. I acknowledge that in a phonological description of English it is necessary to distinguish between these two.
[5] Figures show the use of particular tones as a percentage of informants' total use of tones. Mean scores are detailed.

FIGURE 1

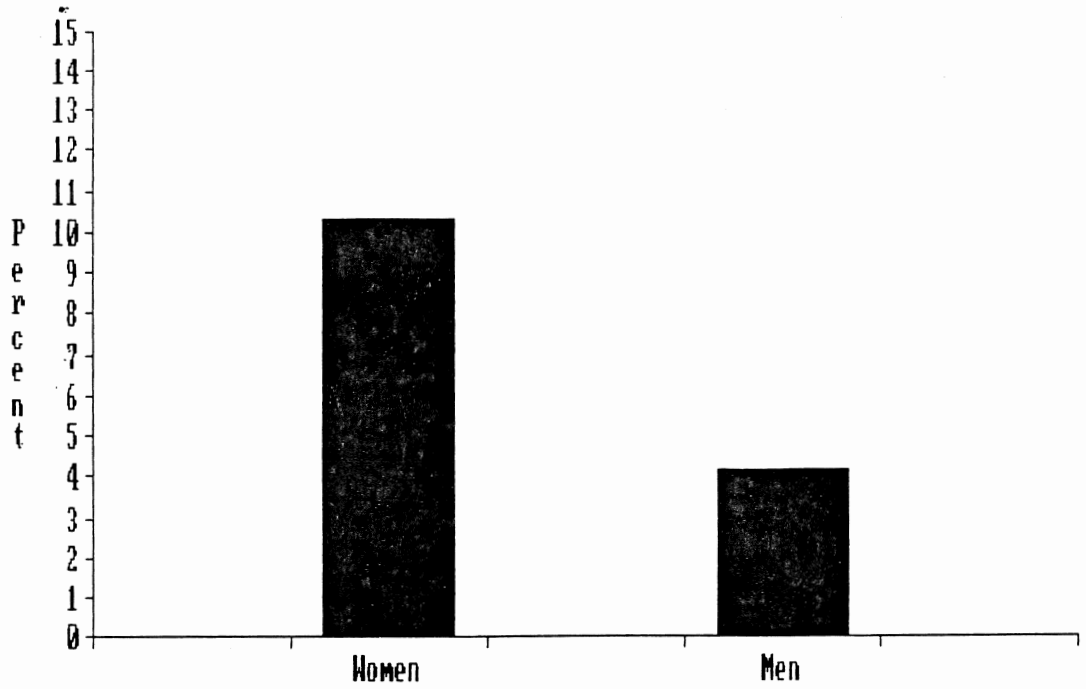
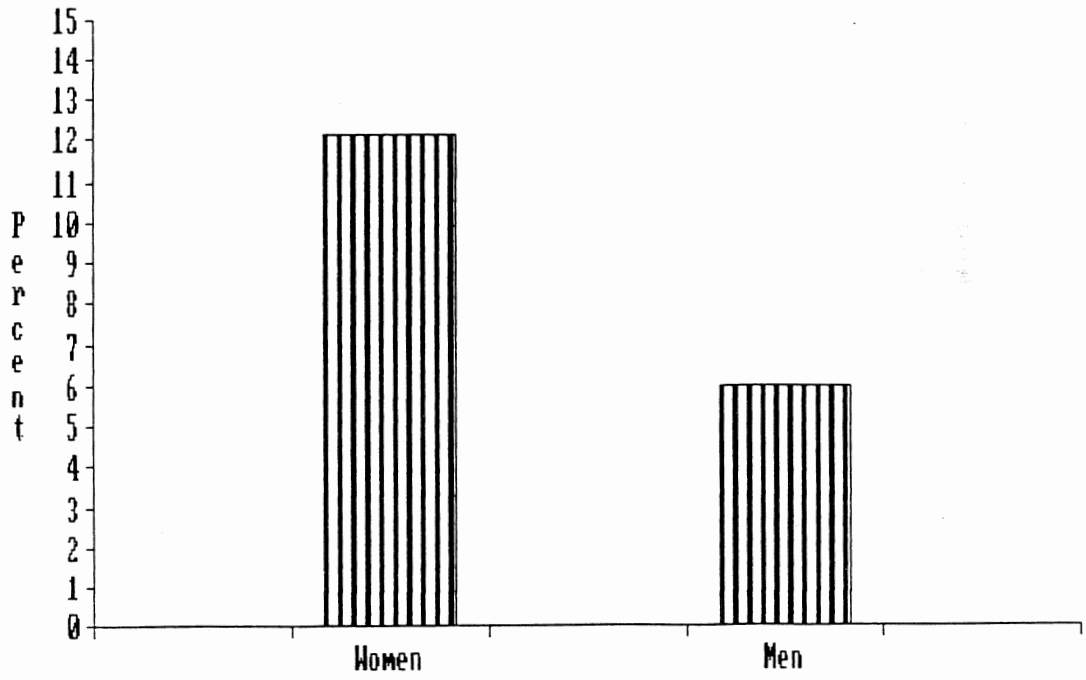


FIGURE 2



(ii) High fall tones

My research reveals that high fall tones also distinguish between men's and women's spontaneous speech styles: in both social situations studied, women used significantly more high fall tones than men. See figures 3 and 4.

(iii) Level tones

Finally, men were noted to use significantly more level tones than women. Again, as shown in figures 5 and 6, this was a finding consistent in both the conversational and interview speech encounters.

Significant differences were thus observed in men's and women's use of three types of nuclear tone; this clearly suggests that the intonational feature of tone is socially indexical of speaker-sex. However, before drawing this conclusion it is worth considering alternative hypotheses which may explain the patterns of variation. Particularly, it is important to consider whether any of the approaches which have been traditionally taken towards intonational function - grammatical, attitudinal and discourse-based - propose accounts which explain the apparently sex-related variation. A full consideration of each of these approaches is provided in my doctoral thesis (Woods, forthcoming 1992). Here I will just give an example of a hypothesis which seems to offer a persuasive explanation of the patterns of tonal variation observed.

The grammatical approach to intonation suggests that the use of tones functions to characterise various syntactic types: specifically, as I mentioned above, it is suggested that falling tones mark declarative structures, and that rising tones characterise the use of polar interrogatives. Since rises have been linked to interrogative syntax, then a possible explanation of women's greater use of rise tones could be that women ask more questions than men. Indeed, precisely this characterisation of women's speech has been proposed by a number of researchers (e.g. Lakoff 1975). If this were the case, then the difference noted between men's and women's use of rise tones would have its basis in essentially syntactic rather than tonal variation.

Given this possible interpretation, an analysis of the syntactic structures used by informants was carried out. This analysis showed that women did not use more interrogative forms than men. In fact, in the interview setting, men were observed to ask more questions than women. Added to this, I also found that 48% of the polar interrogative forms which occurred in the data did not carry any type of rising tone. Thus women's frequent use of fall-rising tones can not be attributed to their (alleged) preference for using interrogative syntax.

It thus seems fair to conclude that in certain settings particular tones are characteristic of men's and women's speech. Specifically, the result that the same patterns of sex-related variation are displayed in the data elicited from two entirely different contexts of interaction at two different times may be taken as strong evidence to suggest the significant influence of speaker-sex on the use of the intonational feature of tone.

3.2.2 Pitch

> "Her voice was ever soft, gentle and low, an excellent thing in woman"
> (*King Lear*, V.iii)

The average pitch of voice of men and women is clearly very different. This is largely, although as I show in section 3.4 not solely, a consequence of their different laryngeal anatomy: men have longer and thicker vocal folds which vibrate at lower frequencies than those of women.

However, it is not nearly so clear that pitch range is determined by larynx anatomy. It is therefore significant that my research showed differences in the range of frequencies used by men and women. Essentially, women were found to employ a far greater part of their potential pitch range than men[1]. As figures 7 and 8 show, this was a finding consistent in both the conversational and interview settings.

Thus pitch range, like the feature of tone, distinguished between men's and women's linguistic behaviour in two different speech encounters. This provides further evidence for the claim that non-segmental aspects of speech are socially indexical of speaker-sex.

Having noted these differences in men's and women's speech, the further question of whether male and female children use different patterns of pitch and intonation was addressed[2].

3.3 The pitch and intonational characteristics of boys and girls.

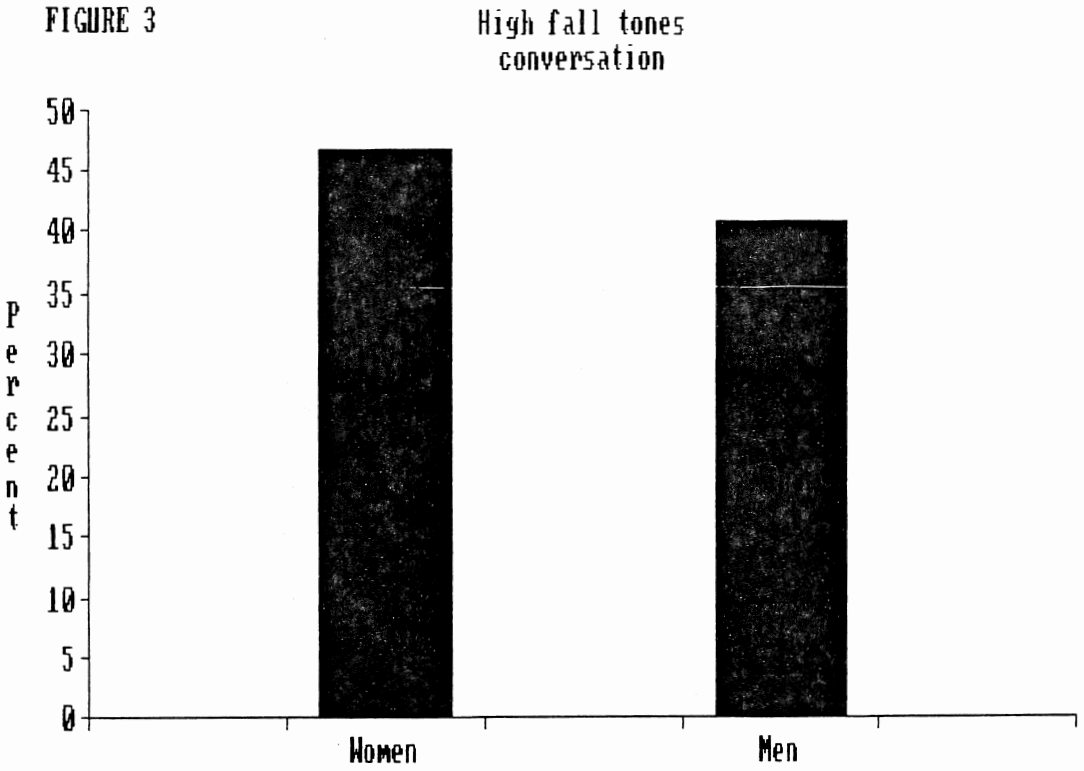
3.3.1 Tone

Just as three tones distinguished the speech of men and women, similarly the differential use of three tonal contours characterised the speech of girls and boys. Most significantly, the tones which showed sex-related variation in children's speech were essentially the same as those which were observed as indexical of speaker-sex in adults: that is, rise, high fall and level tones. In similar patterns of sex-related variation to that observed in adults, I found that girls used rise and high fall tones significantly more frequently than boys, and boys used level tones significantly more frequently than girls.

[1] A result which supports the incidental findings of Johns-Lewis (1986) and Graddol (1986), both of whom were concerned primarily with charting variation in aspects of Fo according to changes in discourse mode.

[2] Local (1982) observes the acquistion of dialect specific tonal forms in children as young as 4 & 5 years of age. Also, Local suggests that two rather different varieties are acquired by male and female children.

FIGURE 3



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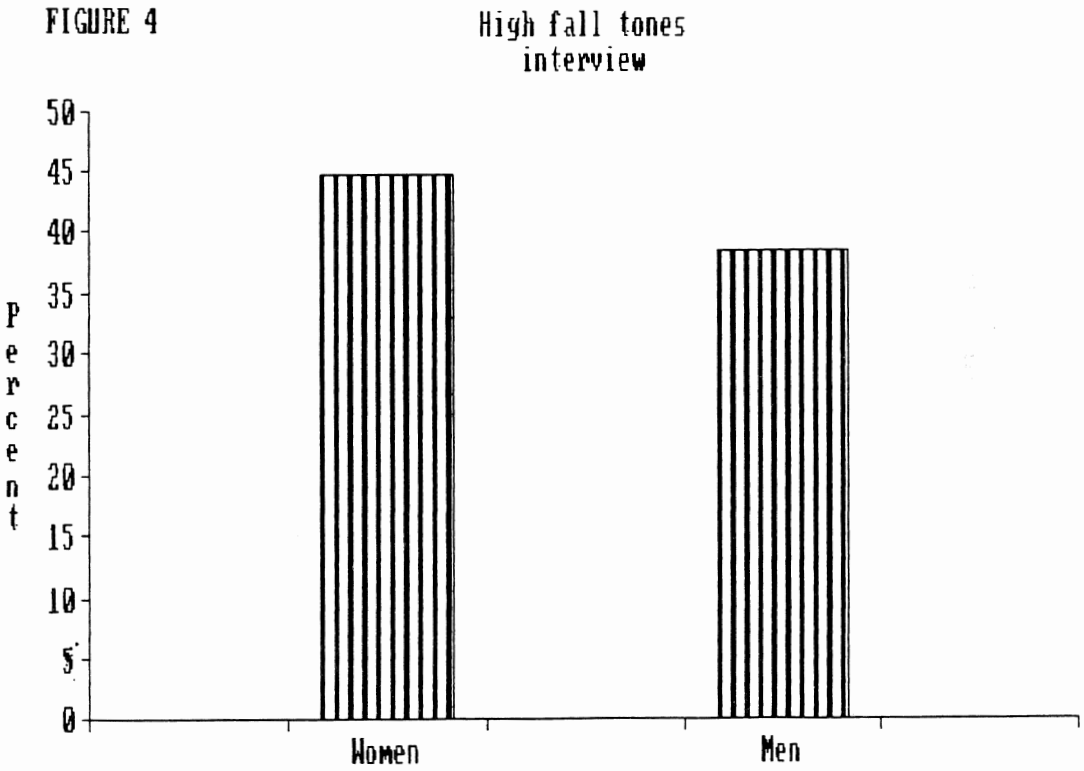

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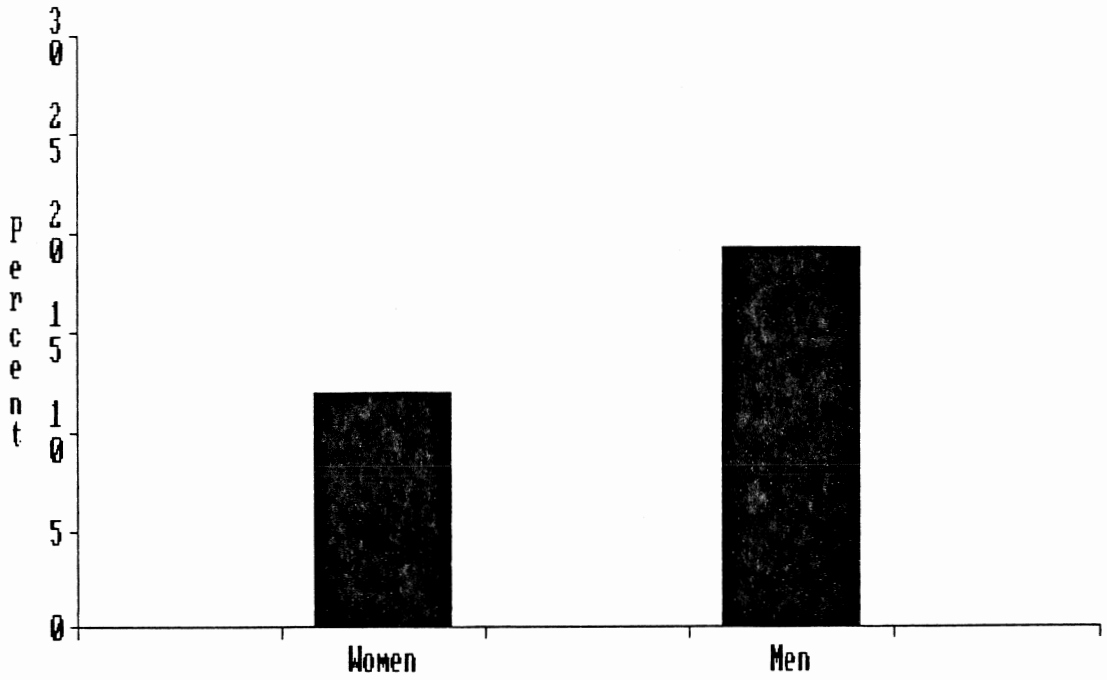

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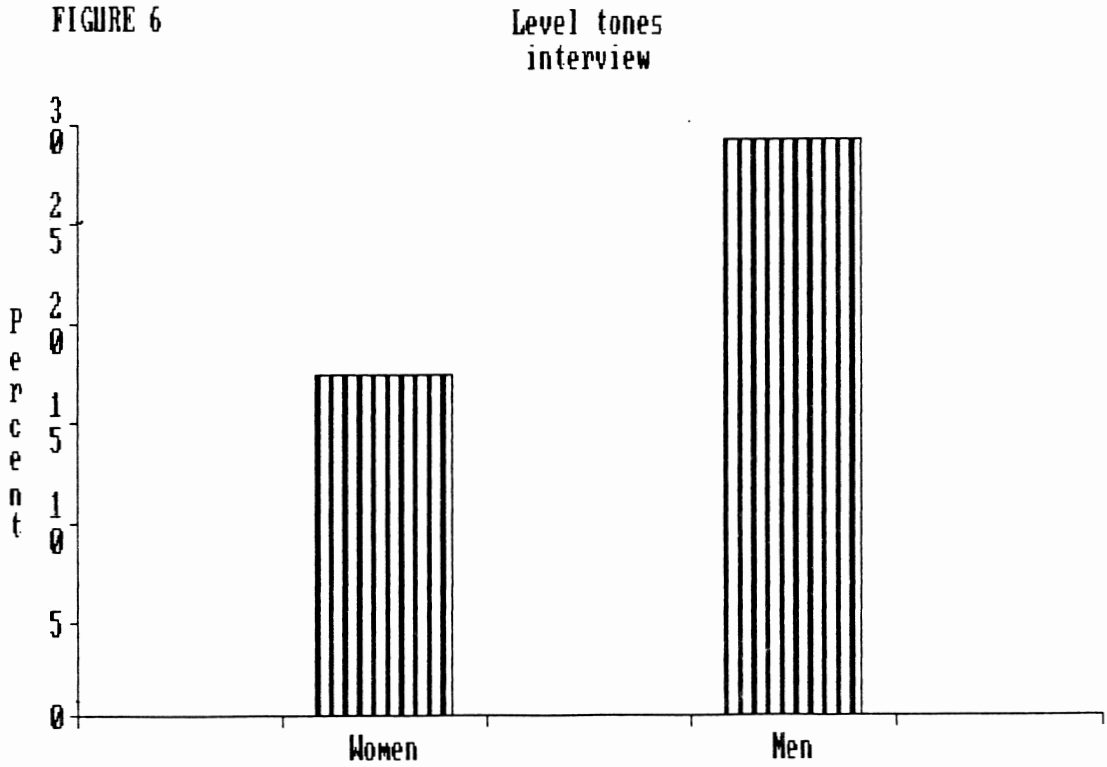

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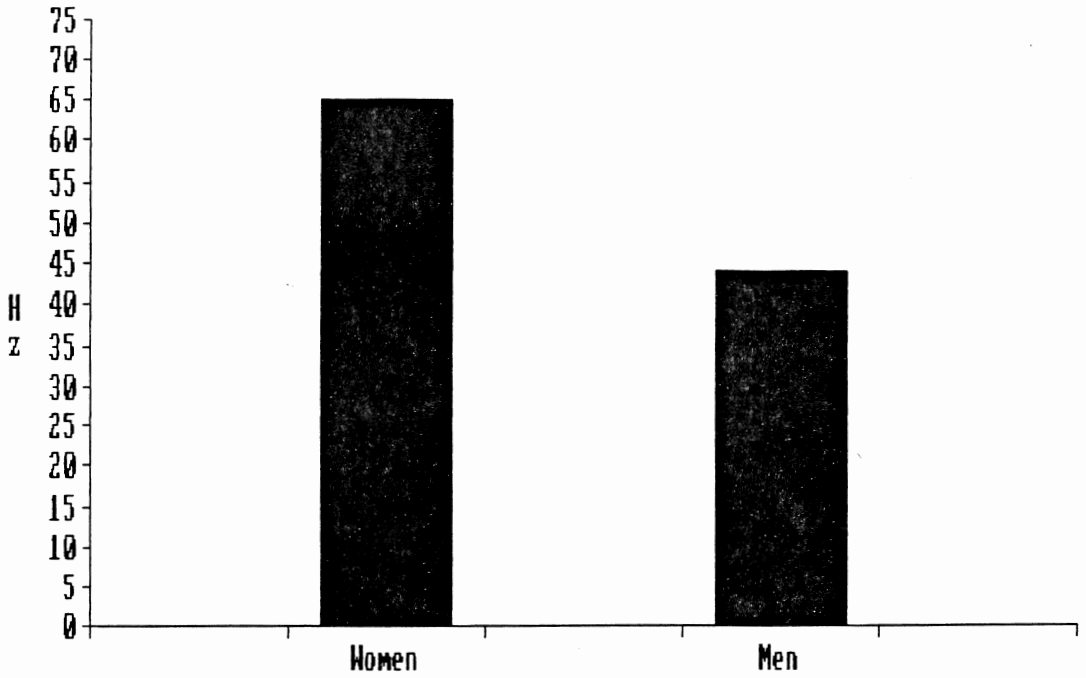
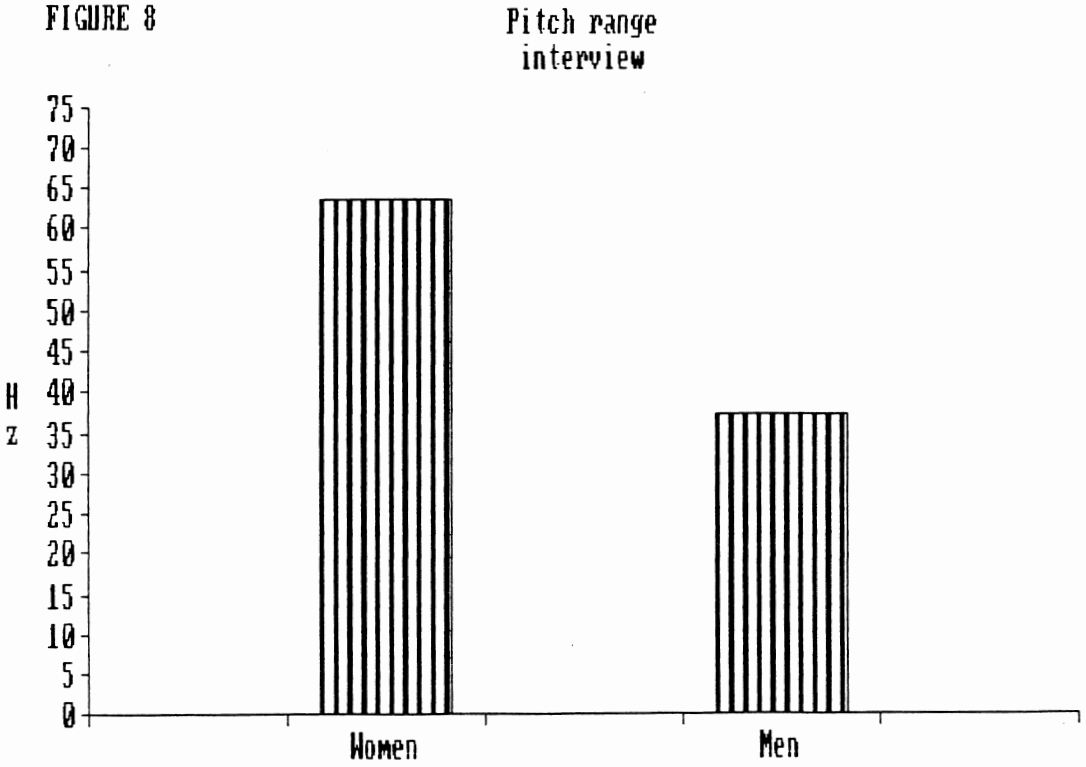


FIGURE 8



Detailed analysis of the data showed, however, that differences in girls' and boys' use of tones was only significant in one context: that is, the interview setting. A tendency towards the same patterns of sex-related variation was observed in the conversational data, but these differences were not significant at the level set[1].

Another feature noted in children's speech was that although, in a similar sex-related pattern to that observed in adults' speech, girls used more rising tones than boys, in the case of children it was **simple** rather than complex rise tones which distinguished males from females. A hypothesis which may explain this result emerges by taking into account Local's (1982) observation that children use complex tones significantly less frequently than adults. That is, it can be suggested that girls use simple rises because they are children and female (in contrast to women's use of complex rises (adult and female)).

In sum, although patterns of sex-related variation observed in children's speech are not precisely the same as those shown by adults, nevertheless the fact that the three tones showing sex-related patterns of variation in children's speech were of the same type as those used by adults strongly suggests that the system of tone is important in children's acquisition of sex-appropriate speech styles. Further evidence which supports this hypothesis emerges from a consideration of the pitch range features which characterise children's speech.

3.3.2 Pitch

> "Boy monsters are brave and gruff. Girl monsters are high-pitched and timid" (Pogrebin on "Sesame Street", 1972)[2]

Unlike men and women, boys and girls, given approximate similarity in height, weight and body-build, have the same or at least similar larynx physiology. However, despite the lack of relevant physical differences between young girls and boys, nevertheless research has found that hearers can identify children as male and female on the presentation of voice cues alone (cf. Sachs, Lieberman and Erikson (1973), Weinberg and Bennet (1971)). The actual linguistic features which hearers use as cues to identification may not, however, be concerned with fundamental frequency. Indeed, Sacks *et al* found that although hearers showed a high success rate in the identification of children's sex from samples of their speech, the fundamental frequencies used by girls were actually lower than those employed by boys. This is, of course, the opposite of what would be expected if Fo were used as a cue in the identification of children's gender identity.

My results (on children's **production** of Fo) suggest that one of the cues which may be used in the identification of children's sex is pitch range. That is, results showed that just as women use a significantly greater part of their potential pitch range than men, girls, in the conversational encounter at least, use a far wider range of fundamental frequencies than boys[3]. Thus aspects of pitch of voice as well as tone may play an important role in children's acquisition of sex-appropriate speech styles.

The observation that features of pitch vary in the speech of children (where no significant physical differences distinguish between males and females) may suggest the social indexicality of an aspect of language use which has generally been considered to be solely a consequence of anatomy[4].

3.4 The social conditioning of pitch of voice

As noted earlier, pitch of voice is considered to be a product or consequence of rate of vocal fold vibration which, in turn, is conditioned by features such as the length, thickness and tenseness of the vocal folds. However, a review of studies which, though from disparate areas of research, have all addressed the question of pitch, suggests that larynx physiology fails to fully explain patterns of pitch variation. For example, in a contrastive study of pitch in Polish and English, Majewski *et al* (1972) found that Polish men spoke with a consistently higher pitch than American males. Further, Mattingly (1966) observed that the formant frequencies used by men and women could not be explained by reference to male-female differences in larynx physiology alone. Commenting on Mattingly's findings, Sacks *et al* (1973) observe that men speak as though they are bigger than they really are and women as though they are smaller.

Added to this, the hypothesis that pitch of voice is determined by physical factors cannot explain Mount and Salmon's (1988) observation that an informant who had undergone male to female sex-reassignment surgery was able to make and maintain dramatic increases in his pitch of voice: as a result of training exercises the informant achieved a raising in Fo of 85 Hz (for the vowel /i/), 100 Hz (for /a/), and 100 Hz (for /u/); the informant also achieved similar raising in formant frequency levels. Finally, an explanation of pitch of voice purely in terms of laryngeal anatomy cannot explain how Margaret Thatcher was able to decrease her pitch of voice (Atkinson reports that Thatcher achieved a decrease in her average fundamental frequency of 46 Hz) at a time in her life when physical or developmental factors would predict an increase in Fo (cf. Dordaine et al, 1969[5]).

Thus it seems fair to conclude that if, as previous research suggests, pitch of voice is language specific, and if it is possible to change one's pitch of voice at will, then it seems highly likely that pitch is conditioned by more than just larynx physiology. Other explanations of variation in pitch thus need to be explored.

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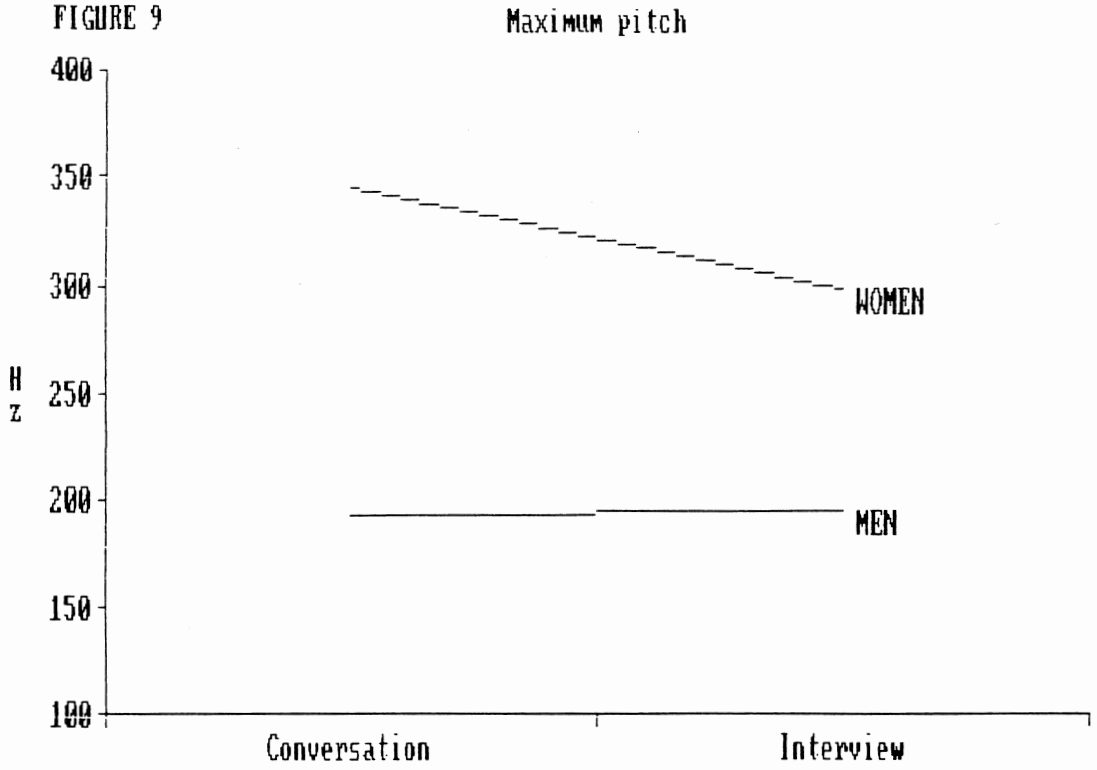
[1]In the analysis of pitch range the opposite pattern was observed: differences between boys and girls were only significant in their conversational speech (discussed in detail in my doctoral thesis).
[2]Cited in Kramer (1975).
[3]Girls also used a greater part of their potential pitch range in the interview setting, but the difference between girls and boys was not significant at the level set.
[4]Although, as mentioned above, it is average fundamental frequency rather than the range of frequencies used by a speaker which is most clearly linked to larynx anatomy.
[5]Cited in Laver and Trudgill (1979).

FIGURE 9



In attempting to explain pitch more adequately a number of insights can be gained by asking the question as to why Margaret Thatcher felt the need to take training sessions designed specifically to lower her pitch of voice. An answer to this may be that, traditionally, high pitched voices have been considered to have very low prestige. As Henessee notes,

> "Higher pitched voices are still associated with unpleasantness, evoking nagging mothers or wives, waspish schoolteachers, and acerbic librarians" (1974: 243)

Further, and perhaps more significantly, high pitched voices are often considered as inappropriate for the consideration and expression of serious issues; as Mannes (1969) points out, "people don't like to hear women's voices telling them serious things"[1]. That this is not just an attitude of the past is shown by Graddol and Swann's (1989) comment that, through personal experience of dealing with media personnel, they have found that "producers are notoriously circumspect about using women's voices for "serious" work" (p.39).

Given the considered inappropriacy of women's voices for expressing serious topics, the question arises as to whether women change aspects of their voice when they wish or need to consider serious issues. I have already mentioned that the procedure used in my research was to gain access to two different styles of speech: an informal conversational encounter and a formal interview in which, by definition (in my research at least), more serious issues were the topic of discussion. A number of differences in pitch and intonational patterning were noted across these two speech encounters (see also Woods 1991). In comparing specifically the speech of women across these two situations (in order to provide some answer to the question posed above), it was initially observed that women showed no stylistic shifting in their average pitch of voice, and similarly, no situation-related variation was noted in women's use of pitch range. However, in examining the use of maximum pitches employed by women[2] (the aspect of pitch which has been most overtly and consistently stigmatized) patterns of stylistic shifting were observed. As shown in figure 9, women used significantly lower maximum Fos in the interview than in the conversational setting: specifically, women lower their maximum pitches by an average of 53 Hz (mean figure) in the interview speech encounter. Notably, no similar patterns of stylistic shifting were displayed in the speech of men. It might therefore be concluded that because of the pervasive stereotype of high pitched voices, in certain formal speech encounters where serious issues are the topic of discussion, women supress the high pitches which they use in more casual conversational styles.

This result points to a further difference in men's and women's pitch characteristics: that is, their differing tendencies towards stylistic shifting in pitch range. Furthermore, it also provides evidence to suggest that the use of certain aspects of pitch are not determined solely by physical factors, but rather are also conditioned by social influences: in this case, the stigmatization and considered inappropriacy of high pitch for discussing serious topics.

[1]Cited in Kramer (1975).
[2]This refers to the maximum pitches used by women in their ordinary speaking voices; not to the most extreme high pitches which women are able to produce.

4. Conclusion

The speech of men and women is characterised by different frequencies of intonational (specifically tonal) and pitch features: rise, level and high fall tones, as well as range of pitch, are socially indexical of speaker-sex. Further, and perhaps more significantly, the same sex-differentiating patterns observed in adults' speech are also shown in children's use of pitch and intonational features. This demonstrates the importance of non-segmental features in children's development of sex-appropriate speech styles. That pre-adolescent children show sex-marking in certain aspects of their pitch of voice may suggest a social as well as physical conditioning of Fo. This conclusion is supported by the observation that, because of the social stereotype of high pitched voices, women systematically lower their use of high frequencies in formal styles in which serious topics are discussed. It may thus be concluded that an adequate description and explanation of pitch (as well as aspects of intonation) can only be achieved by making reference to the social as well as physical factors which influence language use.

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