

CROSS-CULTURAL & CROSS-GENDER SPEAKING FUNDAMENTAL FREQUENCY STUDY: JAPANESE & ENGLISH

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1.0 INTRODUCTION

Mean speaking fundamental frequencies (SFF) of Japanese and Canadian subjects were obtained in both Japanese-speaking and English-speaking conditions. The collected SFF data were correlated with socio-linguistic, anatomical and language proficiency factors. The findings for females in this study coincides with the results reported by Yamazawa and Hollien (1992): the Japanese exhibited higher SFFs than did the Americans for all speaking conditions, and both Japanese and American females used higher pitch when reading in Japanese than reading in English. Yamazawa and Hollien suggested that the differences in level result primarily from differences in the structure of the two languages. In this research, in addition to the female subjects, the SFF of male subjects was examined since the author had the impression that Japanese males use rather higher pitch level when speaking English than when speaking Japanese.

2.0 CROSS-CULTURAL SFF DIFFERENCE

The speaking fundamental frequency (SFF) represents habitual pitch. It is a vocal characteristic (a single pitch or narrow range of pitches) of an individual or group who use it most of the time.

Yamazawa and Hollien (1992) found that young Japanese women (32 subjects) exhibited a significantly higher mean SFF than did their American counterparts (24 subjects). The reason for Japanese-American SFF difference is not completely understood. In their study, Yamazawa and Hollien suggest a language-dependent explanation. That is, Japanese is a syllable timed, pitch accent language, wherein the syllable is the basic prosodic unit and pitch has a phonemic function whereas English is a language of stress accent. The 'tone' aspect of Japanese could account for the addition of a group of higher frequencies to the SFF distributions for these speakers. These frequencies would, in turn, tend to raise the mean SFF level.

3.0 EXPERIMENT

3.1. Procedure

Recordings were all carried out in the sound-treated recording room at the Phonetics Laboratory of University of Victoria. All speech samples were recorded on Digital Audio Tape (Sony DT120). A microphone (Sony ECM-220T) was used for capturing the speech samples. The distance from the microphone (Sony ECM-220T) was maintained at approximately 10 cm.

Prior to recording, subjects were requested to complete a questionnaire which asked about participant's personal information such as weight and height, dialect, and duration of L2 study.

After stating their identification number, the participants were asked to read their first language passage, and then to read their second language passage. They are requested to read the passages as though to an audience of about five people, and to practice reading the passages until they became accustomed to them before recording.

3.2. Subjects

Participants in this study consisted of twelve subjects: three Japanese males (JM), three Japanese females (JF), three Canadian males (EM), and three Canadian females (EF). They were either ESL students or university students at UVic. The Japanese subjects can speak or are studying English, and Canadian students are studying Japanese as a foreign language. In order to correlate measured acoustic values with their anatomical information, and other personal concerns, a questionnaire (Chart 9) was conducted prior to recording. Although participants are from various region in Japan, and in Canada, the Japanese subjects speak Tokyo dialect (so-called standard Japanese), and the Canadian subjects speak Canadian English. All subjects do not smoke, and did not report any kind of illness affecting the throat at the time of recording.

3.3 Speech Samples

The Japanese speech material was taken from 'Donguri to Yamaneko' (children's story: 88 words) by Kenji Miyazawa. The English sample was the first paragraph of the 'Rainbow Passage' (semi-scientific material: 99 words) from Fairbanks (1960). The 'Rainbow Passage' has been commonly used in SFF investigations. For instance, Coleman and Markham (1991) investigated the amount of SFF variation in a series of samples (Rainbow passage) taken over an extended period of time; short- and long-term sampling. Leder & Spitzer (1993) used the Rainbow passage to examine F0, intensity, and rate of adventitiously profoundly hearing-impaired adult women, and to compare the results with normal-hearing control subjects. In order to compare the present results with the findings of Yamazawa and Hollien's investigation, identical materials were used.

3.4. Analysis

After transferring the speech samples recorded on the Digital Audio tape to the computer, the digitized speech data were analyzed by the CSL program (Speech Technology Research Ltd.). Analysis pitch range was set from 50 Hz to 450 Hz. The Japanese passage was divided into six sentences (JS1-6), and the English passage was divided into nine sentences (ES1-9). Both an average SFF and the standard deviation, which is considered appropriate for measuring habitual pitch (Coleman and Markham, 1991), were obtained from the divided sentences.

4.0 RESULTS

4.1. Female Mean SFF Across Languages

Both Japanese and Canadian females used almost the same pitch level (Chart 2). All subjects except for EF3 used a higher pitch level when speaking in Japanese than when speaking in English. EF3 used an extremely high pitch in her mother tongue (English-speaking) condition. The Canadian females' standard deviation is rather high when reading the English passage compared with reading the Japanese passage.

4.2 Male Mean SFF Across Languages

Overall, Japanese males used a higher pitch level than Canadian males did (Chart 1). All subjects except for JM1 used higher pitch when speaking English than when speaking Japanese. The standard deviations between Japanese and Canadian male subjects were not significantly different.

4.3 Male/Female Mean SFF in Japanese

Although both Japanese and Canadian males kept their own habitual pitch level (chart 4) consistently across the sentences, the female pitch (chart 5) among sentences showed great variations. Mean pitch value between Japanese and Canadian females had almost no difference. The Japanese males, however, read the Japanese sentences in higher pitch than the Canadian males did (chart 3).

4.4 Male/Female Mean SFF in English

The Canadian females read the English passage with a higher pitch than the Japanese females except for the sentence seven (chart 6). As in the Japanese reading condition, the Japanese males used higher pitch constantly across sentences than the Canadian males when reading English. Pitch variation between sentences for women are greater than for men (chart 7 and 8).

5.0 DISCUSSION

The individual SFF charts, especially for the male subjects, support the existence of the individual or group habitual pitch level. Although the Japanese and Canadian females exhibited the same result that Yamazawa and Hollien (1992) reported, it was found that the male groups showed the opposite trend. That is, both Japanese and Canadian males used higher F0 when they read the English passage than when they read the Japanese passage. Alternative or additional explanations will be required in order to explain the current results. The males' results cannot be explained solely by the language-dependent explanation suggested by Yamazawa and Hollien.

The following factors can be considered as major contributors to the pitch difference between L1 and L2.

5.1 Physical size

The SFF variation could be partly explained by the anatomical size difference. It may be expected that anatomical conditions such as the geometry of the vocal tract (particularly its length), shape and mobility of the articulatory organs and of the larynx delimit certain ranges for average F0, formant bandwidths, aperiodic spectral components and other parameters (Laver and Trudgill, 1979; Laver, 1980).

Chart 9 shows the participants' average age, height and weight. The males' height and weight can be related with the SFF differences between Japanese and Canadian subjects. The Canadian males had higher SFF than the Japanese since they have larger physical size (and probably a larger/longer vocal tract). Although the Canadian females also had the larger physiological size than the Japanese, the SFF between Japanese and Canadian subjects, however, had no significant differences.

5.2 Socio- and Psycholinguistic Attributes (e.g., politeness)

The SFF variation might be linked to the prosodic aspect of politeness. It is known that Japanese language has far more complex politeness system than English (Hill et al., 1986). Japanese women use politeness forms more frequently than Japanese men (Shibatani, 1990). Loveday (1981) reports that Japanese speakers use higher pitch than English speakers when expressing politeness in each language. These higher F0 levels of Japanese speakers would have become habitual pitch for them. Thus, Japanese women especially tend to use a higher pitch level when reading Japanese than when reading English.

Also L2 learners may have a stereotype of understanding the prosodic characteristics of the target language. That is, English female speakers already have an image that the Japanese female speakers use higher pitch when speaking Japanese. Therefore, the subjects used higher pitch when reading the Japanese passage. However, the Canadian male subjects did not appear to have such an impression of Japanese males. They did not apply the higher pitch when reading the Japanese text. This is only my inference. Thus, in future research, the subjects' impression of the target language should also be surveyed after completing all recordings.

5.3 Reading style difference

The speech sample analyzed in this study were all reading materials, not naturally spoken materials. Thus, the reading style would be slightly different among languages and different sexes. The females might have used the pitch they usually use to children when reading the Japanese passage because of the nature of the text (children's story). On the other hand, males applied different reading styles and consequently different pitch level when reading the same material. The English passage is semi-scientific material, so the subjects probably used a different style.

The Japanese passage was given to the subjects in the form of Japanese characters. The different subject groups (cultures and sexes) might have used unique mental processing systems. It is reported that the mental processing of pictographic and syllable-based characters is assumed to be processed in different hemispheres of the brain (Robeck, & Wallace, 1990).

5.4 Language proficiencies

Although it was attempted to correlate SFF difference and target language proficiency level, a significant relationship could not be found. This is mainly because the language proficiency might not coincide with the duration of the subject's L2 study and of staying in the country where his or her target language is spoken.

The language-dependent explanation is one of the possible explanations to the SFF difference, but other factors which have been described above have to be considered to explain the present result more fully.

6.0 IMPLICATIONS

It is often reported that carrying over the speaker's L1 prosodic characteristics to the L2 speaking condition would impede the communication (Shibatani, 1990; Holden & Hogan, 1993). Therefore, understanding the habitual pitch commonly used by the target language population

may help in avoiding possible miscommunication, or it may help elucidate socio- and psychological attributes (eg., self-image).

7.0 FUTURE INVESTIGATION

In future research, the number of subjects would have to be increased to verify the present results. Moreover, in order to find salient reasons of the SFF variation, groups who have various physical sizes, and target-language proficiency levels should be analyzed. Also the cross-cultural and cross-gender reading style differences should be investigated in detail including sociological and psychological aspects.

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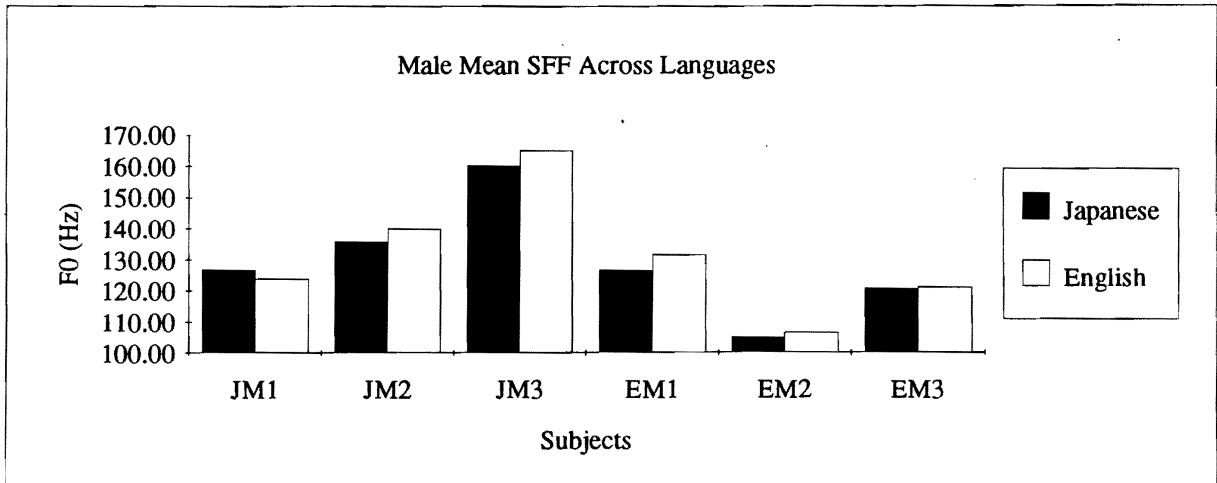


Chart 1

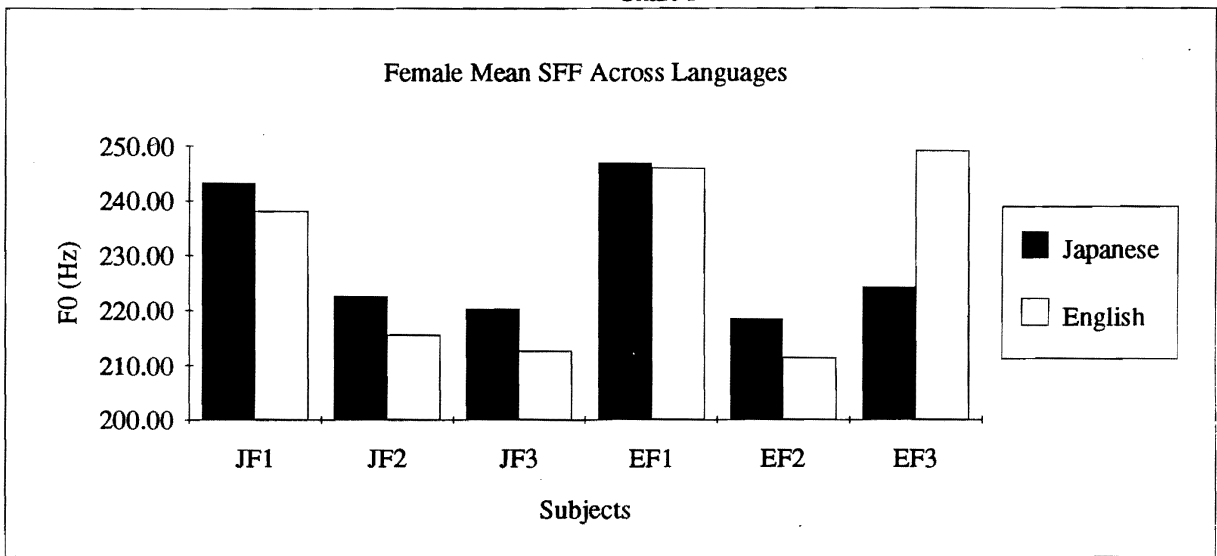


Chart 2

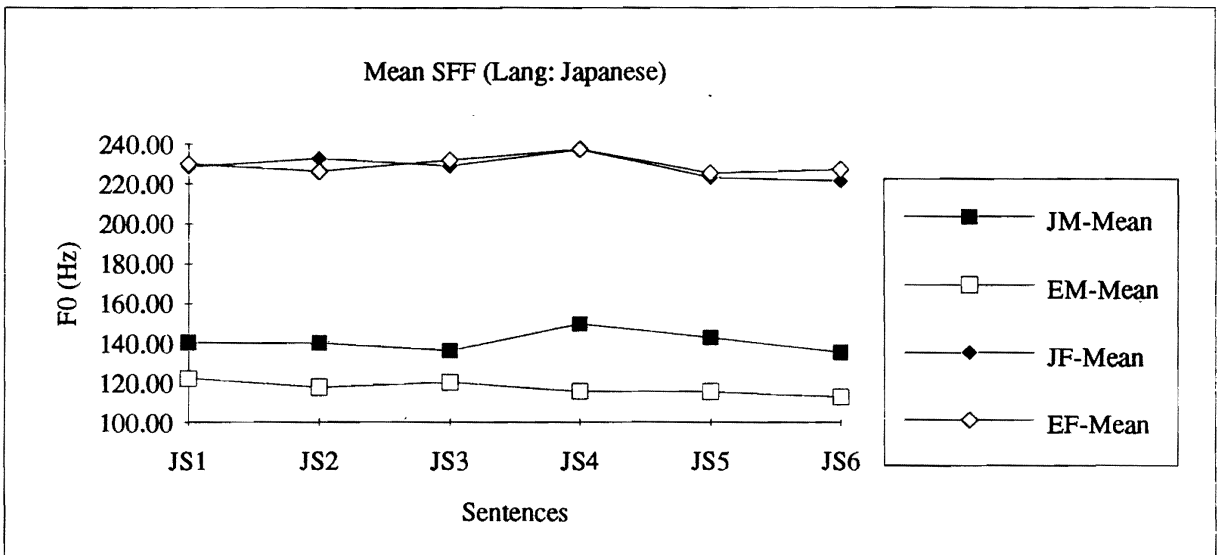


Chart 3

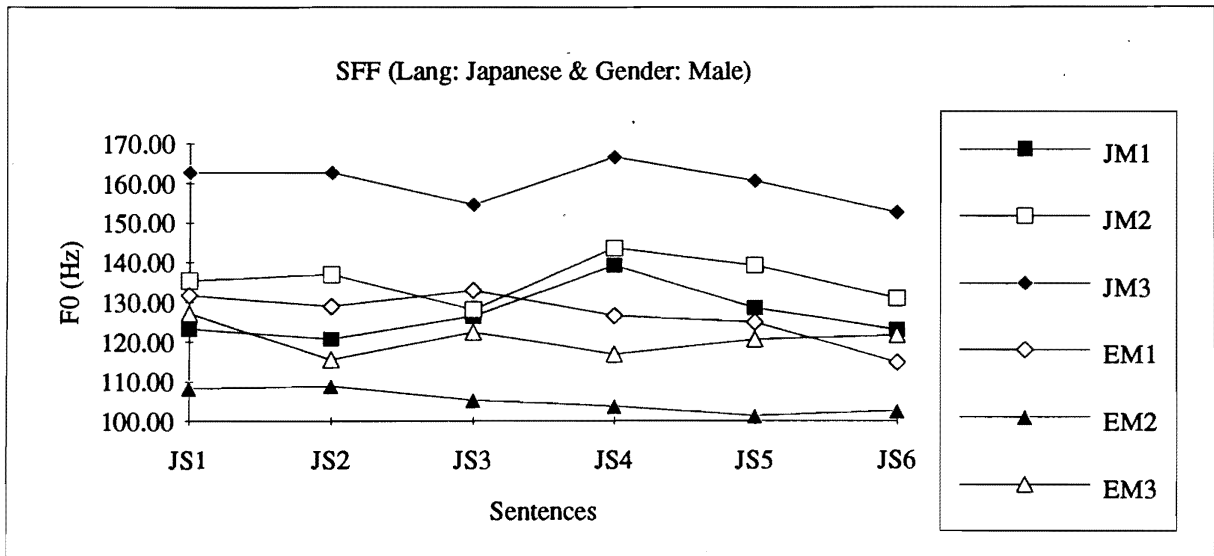


Chart 4

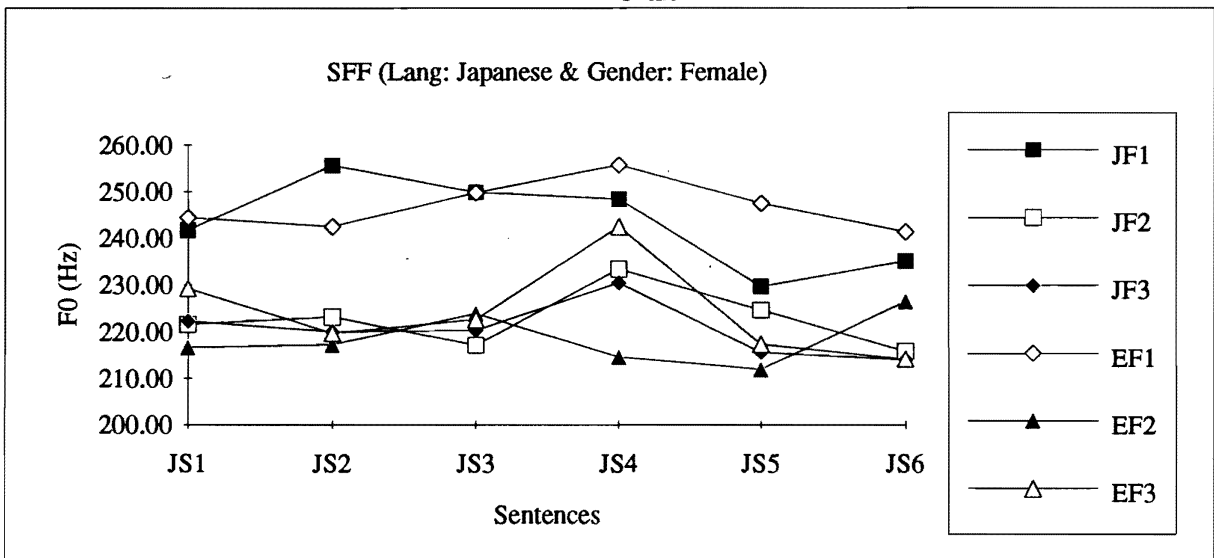


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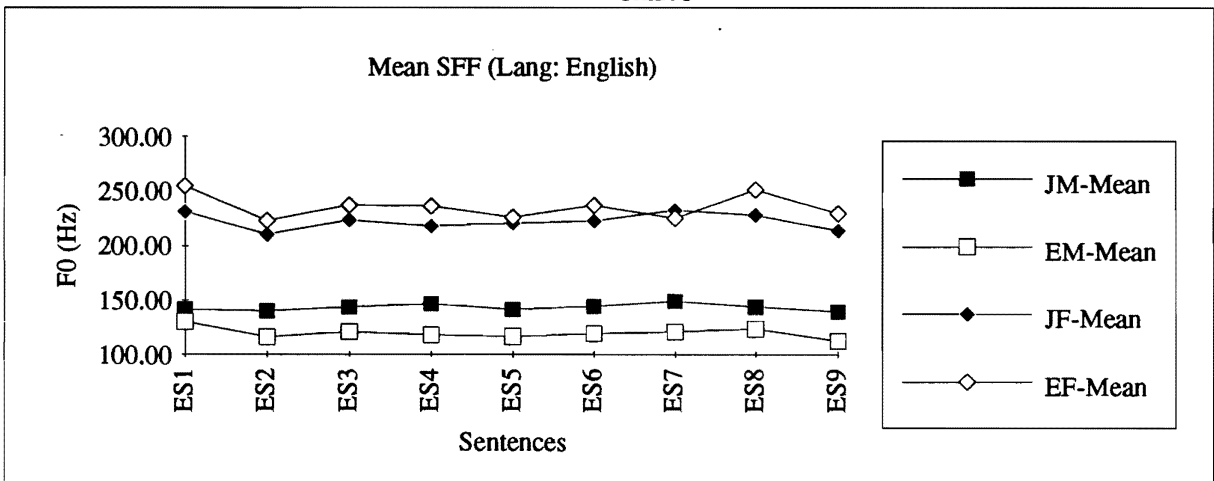


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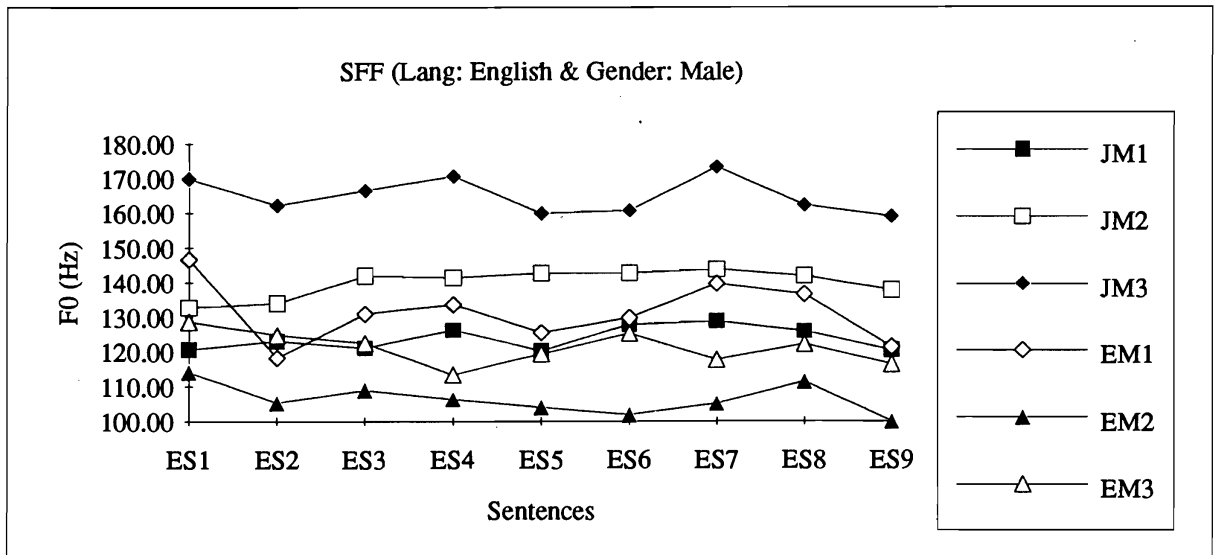


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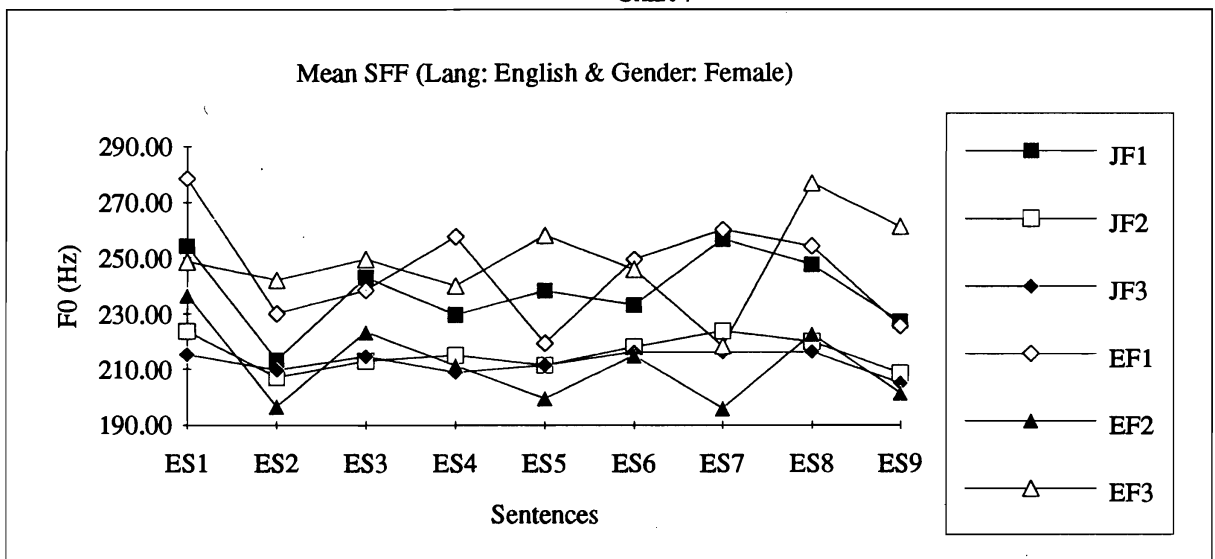


Chart 8

Summary of Questionnaire

Subjects	Age	Height (Cm)	Weight (Kg)
JM1	24	177	72
JM2	24	174	62
JM3	32	160	53
JF1	26	162	50
JF2	28	160	50
JF3	26	152	46
EM1	20	168	75
EM2	25	183	70
EM3	29	180	84
EF1	20	160	52
EF2	21	170	60
EF3	19	163	64

Chart 9

