TR-I-0196

A Bilingual Dialogue Database for Automatic Spoken Language Interpretation between Japanese and English

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ABSTRACT

This report presents a bilingual Japanese-English dialogue database that is presently constructed at ATR for research in spoken language interpretation via telephone. Ten subjects participated in the recording of the dialogues, five of which are native speakers of Standard Japanese (2 female, 3 male), the other five native speakers of British (1 male) and American (2 female, 2 male) English. The material consists of seven short dialogues that were chosen from the ATR Linguistic Database and represent typical conversations that may reasonably be expected to occur in conference registration by telephone. The Japanese data were spoken both in continuous and isolated phrase (Bunsetsu) modes, the English data in continuous mode only. The material was recorded in an anechoic, sound-insulated studio at the ATR Auditory and Visual Perception Research Laboratories, using high-quality digital recording equipment. The entire material comprises a total of approximately five hours of recorded dialogues. It is aimed to be used for dedicated study of prosodic transfer in spoken language interpretation, and for training continuous speech recognition systems within the field of interpreting telephony.

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1. INTRODUCTION

The scientific purpose of speech databases is essentially two-fold: (1) to provide the raw-material for investigative speech research; (2) to provide the reference-material for simulative speech research and for the evaluation and assessment of commercial computer speech systems. Ideally, the same speech database serves both purposes simultaneously. In addition to that, it should also permit systematic comparison and exchange of speech data and analysis parameters between different databanks both nationally and internationally.

To acheive these purposes, three basic requirements have to be fulfilled:

Standardization at all levels of data collection, registration, sampling and quantization, analysis, transcription, statistical and linguistic evaluation, database management, etc.

Integration of signal processing, analysis, and synthesis routines on the one hand, and between different levels of acoustical, statistical and linguistic analysis and evaluation on the other. Ideally, the same data used for speech processing purposes should also be subjected to linguistic analyses within the field of natural language processing (NLP) in order to unearth possible interrelations, correlations and time-alignments between different levels of linguistic, phonetic and signal analysis.

Adaptability, i.e. the speech material once collected and analysed to study one aspect of speech communication (e.g. the phonetic characteristics of certain speech sounds) should also be accessible for research on different aspects (e.g. long-time spectral properties) , at different levels (e.g. prosodic variations) , over different domains (e.g. complete texts), and from different points of view (i.e. auditory evaluation).

It is today widely acknowledged that spoken discourse (both monologues and dialogues) differs in several important respects from the kind of orally read material (phonemes, diphones, syllables, words, "bunsetsu" phrases, semantically unrelated sentences, etc) commonly collected in many of today's speech databases. Earlier studies have indicated, for example, that discourse is characterised by on the average longer sentences, more variable sentence durations, more frequent pauses, often fragmentary or "ungrammatical" sentence structures, and the occurrence of various non-word events (mouth clicks, filled pauses, hesitation phenomena, breath noise, etc). A detailed, cross-linguistic study of the inherent differences between discourse intonation (both narrative texts and simulated telephone dialogues) and the kind of pitch contours typically found in isolated sentences, based on equivalent samples of Swedish, English and Japanese speech, has been published in Huber (1990b).

Clearly, the simulated telephone dialogues used for the construction of the bilingual dialogue database described in this report are not to be confounded with spontaneous speech in the true sense of the word, i.e. engaging people in unprepared conversation without any script. For example, in spontaneous dialogues, i.e. involving two or more conversants, various kinds of turn taking cues and accommodation phenomena have to be taken into account for a full description and representation of the speech material. Furthermore, if the conversation takes place in the form of a face-to-face interaction, part of the total meaning will typically be transmitted through nonverbal means of communication.

The collection and analyses of the dialogue data described in this report thus serves the dual purpose (1) to gain a better understanding of the structure and variability of dialogue speech conducted within the limited applications domain of conference registration, and (2) to accumulate experience with respect to the collection and evaluation of a larger corpus of spontaneous speech planned for future extensions of the ATR speech database (cf. Sagisaka et al, 1990).

2. MATERIAL

The material collected in this database comprises seven simulated telephone dialogues conducted within the applications domain of conference registration. Each dialogue exists in an equivalent Japanese and English version, with the latter constituting the "target translation" of the Japanese original, adopted as intermediate goal for the initial stage of the interpreting telephony system presently developed at ATR. The composition of the dialogues is based on earlier linguistic analyses of a large sample of spontaneous telephone conversations held within the same applications domain (cf. references) .

The seven conversations taken together consist of 924 running words in the Japanese version and of 747 running words in the corresponding English equivalent. Average sentence length was calculated to 6.70 words per sentence for the Japanese, and 5.41 words per sentence for the English material. The frequency distribution of sentence durations (in number of words per sentence) separately for each language is summarized in the bar charts in figures 1 and 2 below.

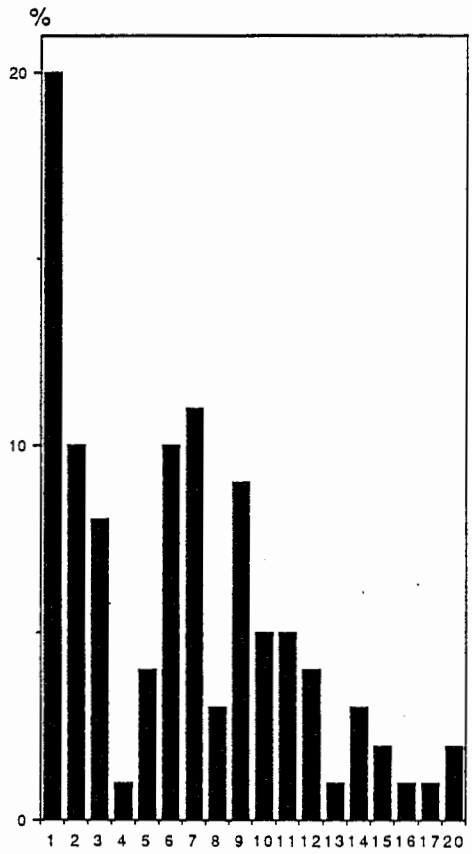


Figure 1 Bar chart for sentence length (measured in number of words per sentence) in the seven Japanese dialogues.

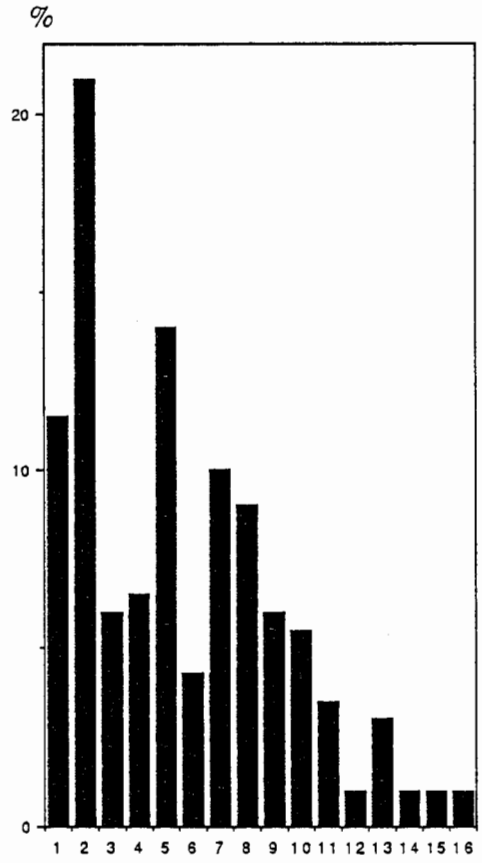


Figure 2 Bar chart for sentence length (measured in number of words per sentence) in the equivalent English dialogues.

Full orthographic transcriptions of each of the seven dialogues, both in the Japanese original and in the equivalent English translation, are listed on the following pages.

Dialogue_A (Japanese Version)

役割	日本語
質問者	もしもし。 そちらは会議事務局ですか?
事務局	はい。 そうです。
質問者	会議に申し込みたいのですが。
事務局	登録用紙は既にお持ちでしょうか。
質問者	いいえ。 まだです。
事務局	分かりました。 それでは、登録用紙をお送り致します。 ご住所とお名前をお願いします。
質問者	住所は大阪市北区茶屋町 二十三です。 名前は鈴木真弓です。
事務局	分かりました。 登録用紙は至急送らせて頂きます。 分からない点がございましたら、いつでもお聞き下さい。
質問者	有難うございます。 それでは失礼します。
事務局	どうも失礼致します。

Dialogue_A (English Version)

Speaker	Utterance
Questioner	Hello. Is this the Conference office?
Office	Yes. That's right.
Questioner	I would like to apply for the conference.
Office	Do you already have a registration form?
Questioner	No. Not yet.
Office	All right. We'll send you a registration form. Your name and address, please?
Questioner	My address is 23 Chayamachi, Kita-ku, Osaka. My name is Mayumi Suzuki.
Office	All right. We'll send you the registration form immediately. If there are any questions, please ask us at any time.
Questioner	Thank you. Good-bye.
Office	Good-bye.

Dialogue_B (Japanese Version)

役割	日本語
質問者	もしもし。
事務局	こちらは会議事務局です。
質問者	会議に参加したいのですが。 どうすればよろしいですか。
事務局	先ず、登録用紙で手続をしていただかなくてはなりませんが。 もう登録用紙はお持ちでしょうか。
質問者	まだです。 用紙を送ってください。
事務局	では、ご住所とお名前をお願いします。
質問者	住所は大阪市東区徳井町一の二です。 名前は清水太郎です。
事務局	分かりました。
質問者	参加料は要るのでしょうか。
事務局	はい。 登録費としてお一人三万五千円が必要です。
質問者	そうですか。 どうも有難うございました。
事務局	失礼致します。

Dialogue_B (English Version)

Speaker	Utterance
Questioner	Hello.
Office	This is the Conference office.
Questioner	I'd like to attend the conference. What should I do?
Office	First, you should fill in a registration form. Do you already have a registration form?
Questioner	Not yet. Please send me a form.
Office	Your name and address, please?
Questioner	My address is 1-2 Tokui-machi, Higashi-ku, Osaka. My name is Taro Shimizu.
Office	All right.
Questioner	Is the attendance fee necessary?
Office	Yes. 35,000 yen per person is the registration fee.
Questioner	All right. Thank you very much.
Office	Good-bye

Dialogue_1 (Japanese Version)

役割	日本語
質問者	もしもし。 そちらは会議事務局ですか?
事務局	はい。 そうです どのようなご用件でしょうか?
質問者	会議に申し込みたいのですが。 どのような手続をすればよろしいのでしょうか。
事務局	登録用紙で手続きをして下さい。 登録用紙は既にお持ちでしょうか。
質問者	いいえ。 まだです。
事務局	分かりました。 それでは、登録用紙をお送り致します。 ご住所とお名前をお願いします。
質問者	住所は大阪市北区茶屋町二十三です。 名前は鈴木真弓です。
事務局	分かりました。 登録用紙を至急送らせて頂きます。
質問者	よろしくお願いします。 それでは失礼します。

Dialogue_1 (English Version)

Speaker	Utterance
Questioner	Hello. Is this the Conference office?
Office	Yes. That's right. May I help you?
Questioner	I'd like to apply for the conference. How can I apply?
Office	Please apply with a registration form. Do you already have a registration form?
Questioner	No. Not yet.
Office	All right. We'll send you a registration form. Your name and address, please?
Questioner	My address is 23 Chayamachi, Kita-ku, Osaka My name is Mayumi Suzuki.
Office	All right. We'll send you a registration form immediately.
Questioner	Thank you very much. Good-bye.

Dialogue_2 (Japanese Version)

役割	日本語
事務局	はい。 こちらは会議事務局です。
質問者	会議の参加料について教えて頂きたいのですが。 いま会議に申し込めば、参加料はいくらですか?
事務局	はい。 参加料は現在お一人3万5千円です。 来月お申込みになりますと4万円です。 参加料には、予稿集代と歓迎会費が含まれています。
質問者	わたしは情報処理学会の会員なのですが。 参加料の割引はないのですか?
事務局	今回は割引を行っておりません。
質問者	そうですか。 参加料はどのようにお支払いしたらよいのですか?
事務局	参加料は銀行振り込みです。 案内書に記載されている口座番号に振り込んで下さい。 また期限は今年いっぱいです。
質問者	分かりました。 どうもありがとうございました。
事務局	どういたしまして。 分からない点がございましたらいつでもお聞き下さい。 失礼致します。

Dialogue_2 (English Version)

Speaker	Utterance
Office	Yes, hello. This is the Conference office.
Questioner	I'd like you to tell me the attendance fee for the conference? How much is the attendance fee if I apply for the conference now?
Office	Well. The attendance fee is 35,000 yen per person right now. If you apply next month, it is 40,000 yen. The attendance fee covers the proceedings and the reception
Questioner	I am a member of the Information Processing Society. Is there any discount in the attendance fee?
Office	We are not making any discount this time.
Questioner	All right. How can I pay the attendance fee?
Office	The attendance fee is paid by bank-transfer. Please transfer to the bank account which is written in the announcement. And the deadline is the end of this year.
Questioner	All right. Thank you very much.
Office	You're welcome. If there are any questions, please ask us at any time. Good-bye.

Dialogue_3 (Japanese Version)

役割	日本語
事務局	はい。 こちらは会議事務局です。
質問者	会議に論文を発表したいと思っているのですが。 会議の内容について教えて下さい。
事務局	今回の会議は通訳電話に関連する広範な研究分野を含んでいます。 言語学や心理学を専攻する方にも参加して頂く予定です。
質問者	分かりました。 ところで、会議での公式言語は何ですか?
事務局	英語と日本語です。
質問者	わたしは日本語が全然分からないのですが。 発表が日本語で行われる場合英語への同時通訳はあるのですか?
事務局	はい。 英語への同時通訳を用意しております。
質問者	分かりました。 どうもありがとうございました。 さようなら。

Dialogue_3 (English Version)

Speaker	Utterance
Office	Yes, hello. This is the Conference office.
Questioner	I'd like to present a paper at the conference. Please tell me about the content of the conference?
Office	The conference covers various fields of research related to Interpreting Telephony. It is expected that those who major in linguistics and psychology will attend.
Questioner	All right. By the way, what is the official language at the conference?
Office	English and Japanese.
Questioner	I don't understand Japanese at all. Is there simultaneous interpretation into English when the presentation is made in Japanese?
Office	Yes. We are preparing simultaneous interpretation into English.
Questioner	All right. Thank you very much. Good-bye.

Dialogue_4 (Japanese Version)

役割	日本語
事務局	こちらは会議事務局です。
質問者	会議について詳しいことを教えて下さい。
事務局	会議の案内書はお持ちですか?
質問者	いいえ。 持っていません。
事務局	そうですか。 会議は8月22日から25日まで京都国際会議場で開催されます。 参加料は4万円です。 発表を希望されるのでしたら3月20日までに要約を提出して下さい。 会議の案内書をお送り致しますので、それをご覧下さい。 失礼ですがお名前とご住所をお願い致します。
質問者	アダム･スミスです。 住所は大阪市東区玉造2丁目27の7です。
事務局	分かりました。 電話番号もお聞きしたいのですが。
質問者	はい。 372の8018です。
事務局	372の8018でございますね。
質問者	はい。 そうです。 それではよろしくお願いします。 失礼します。

Dialogue_4 (English Version)

Speaker	Utterance
Office	This is the Conference office.
Questioner	Could you please tell me the details about the conference.
Office	Do you have an announcement of the Conference?
Questioner	No. I don't.
Office	All right. The conference will be held at the Kyoto International Conference Center from August 22nd to 25th. The fee for participation is 40,000 yen. If you'd like to make a presentation, please submit a summary by March 20th. We'll send you the announcement of the conference, so please refer to it. Your name and address, please?
Questioner	Adam Smith. My address is 2-27-7 Tamatsukuri, Higashi-ku, Osaka.
Office	All right. We'd like to ask your phone number also.
Questioner	Yes. 372-8018.
Office	372-8018, right?
Questioner	Yes. That's right. Thank you very much. Good-bye.

Dialogue_5 (Japanese Version)

役割	日本語
事務局	はい。 こちらは会議事務局でございます。
質問者	ちょっとお願いがあるのですが。 私は会議に申込みをした者です。 参加を取り消したいのですが。
事務局	お名前をお伺いできますでしょうか?
質問者	はい。 ベル研のジム・ワイベルです。
事務局	既に登録料の8万5千円を振り込まれておられますね?
質問者	はい。 そうです。 登録料を払い戻して頂けますか?
事務局	ぉ気の毒ですができません。 案内書にも書いていますが。 9月27日以後の取り消しに対する払い戻しはできません。 後日プログラムと予稿集をお送り致します。
質問者	では、誰かが私の代わりに参加することはできますか?
事務局	それは別に問題ありません。 代理人が参加する場合は、あらかじめこちらまでお知らせ下さい。
質問者	分かりました。 代理人が決まりましたら、お知らせ致します。 では失礼します。

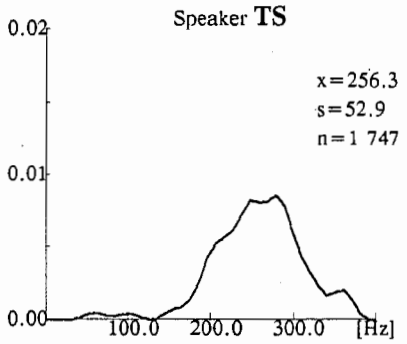
Dialogue_5 (English Version)

Speaker	Utterance
Office	Yes, hello. This is the Conference office.
Questioner	I have a request. I have applied for the conference. I'd like to cancel the application.
Office	Could I ask your name?
Questioner	Yes. Jim Waibel of Bell Labs.
Office	You have already transfered 85,000 yen as the registration fee, right?
Questioner	Yes. That's right. Is it possible for you to refund the registration fee?
Office	I am sorry that it is not possible. We have written it in the announcement. Refunds for cancellation after September 27th are not possible. We'll send you the program and proceedings later.
Questioner	Then, is it possible that somebody attends instead of me.
Office	That does not matter particularly. Please inform us in advance if a substitute will attend.
Questioner	All right. I'll inform if the substitute is decided. Good-bye.

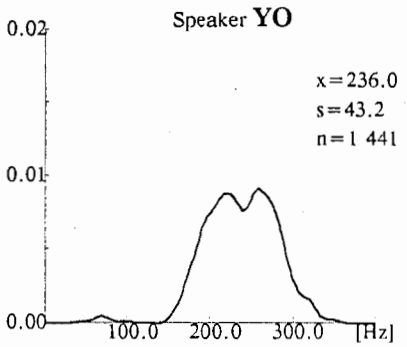
3. SPEAKERS

Ten speakers participated in the recording of the material: five native speakers of Standard Japanese (2 female, 3 male) and five native speakers of British (1 male) and American (2 female, 2 male) English. The speakers were selected from the research staff presently employed at ATR, including their families. None of the subjects reported any history of speech or hearing disorder. The individual speakers are identified in the DBMS by stating their name label (e.g. **JB**), sex, age, language, and regional descent, together with their histographic F_0 frequency distributions (FFD) and the calculated values for F_0 mean ($\bar{x}$) and standard deviation (s), F_0 mode ($\bar{m}$) and average speech rate in words per minute (r) based on n voiced 16-ms frames of continuous speech. It must be appreciated in this context that the speech rate data include turn-internal pauses but exclude the pauses between turns and between coherent conversations.

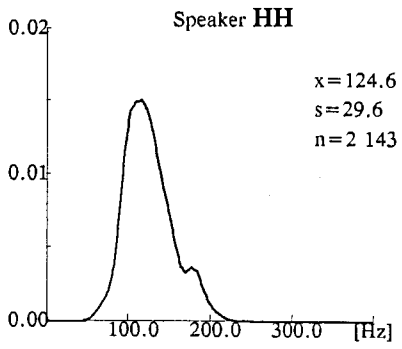
Speaker **TS** is a Japanese female, 34 years of age, originating from Nagano Prefecture. Her fundamental frequency distribution (FFD) is shown beside. Modal frequencies were established at 253.4 and 289.1 Hz, with a weak third modal at 378.3 Hz. Her average speech rate was calculated to 145.9 words per minute.



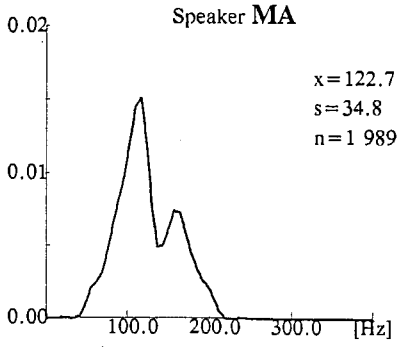
Speaker **YO** is a Japanese female, 35 years of age, originating from Kanagawa Prefecture. Her fundamental frequency distribution (FFD) displays modal frequencies at 217.7 and 259.8 Hz. Her average speech rate was calculated to 145.0 words per minute.



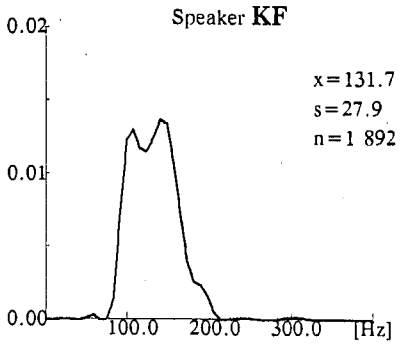
Speaker **HH** is a Japanese male, 29 years of age, originating from Hokkaido. His fundamental frequency distribution (FFD) is shown beside. His main modal frequency is 112.6 Hz, with a weak second modal 182.1 Hz. His average speech rate was calculated to 160.7 words per minute.



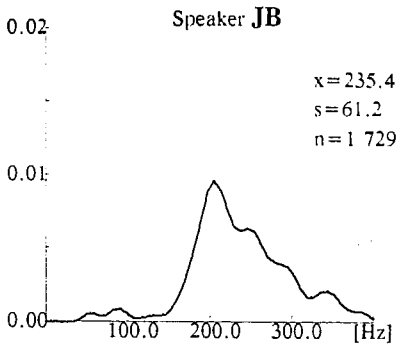
Speaker **MA** is a Japanese male, 31 years of age, originating from Gumma Prefecture. His fundamental frequency distribution (FFD) displays two clearly defined modal frequencies, the first (stronger one) at 118.3 Hz and the second (weaker one) at 162.8 Hz. His average speech rate was calculated to 155.1 words per minute.



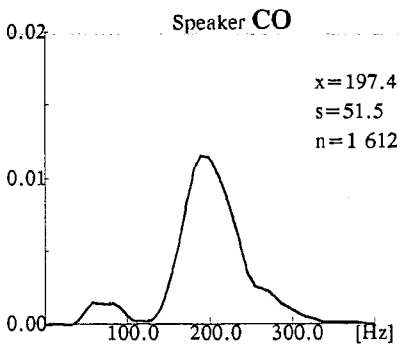
Speaker **KF** is a Japanese male, 29 years of age, originating from Yokohama. His fundamental frequency distribution (FFD) is shown beside. Modal frequencies were established at 106.1 and 148.4 Hz. His average speech rate was calculated to 152.7 words per minute.



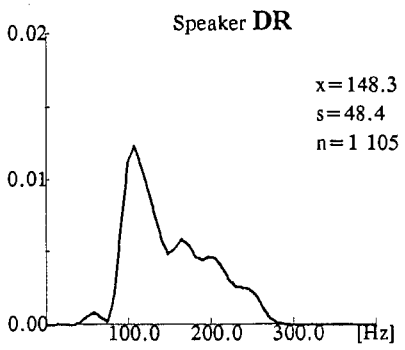
Speaker **JB** is an American female, 26 years of age, originating from Iowa (USA). Her fundamental frequency distribution (FFD) shows a principle modal frequency at 201.7 Hz, with additional, progressively weaker modals at 254.3, 298.7 and 342.2 Hz. Her average speech rate was calculated to 225.4 words per minute.



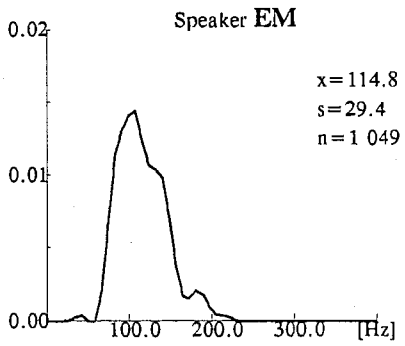
Speaker **CO** is an American female, 24 years of age, originating from Missouri (USA). Her fundamental frequency distribution (FFD) reveals a modal frequency is 188.3 Hz, with an additional, clearly delimited and almost equally distributed modal area of frequencies below 100 Hz. Her average speech rate was calculated to 204.2 words per minute.



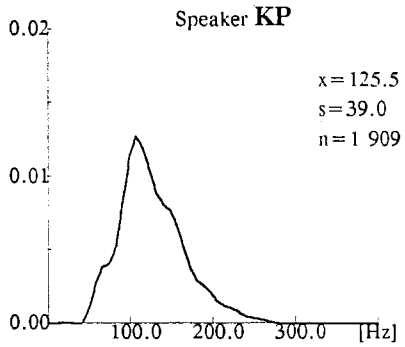
Speaker **DR** is a British male, 26 years of age, originating from Cambridge (UK). His fundamental frequency distribution (FFD) displays a strong modal at 109.4 Hz. with additional, progressively weaker modal frequencies at 171.2 and 202.3 Hz. His average speech rate was calculated to 202.1 words per minute.



Speaker **EM** is an American male, 24 years of age, originating from California (USA). His fundamental frequency distribution (FFD) is shown beside. Modal frequency is 103.1 Hz, with an additional weaker modal at 183.4 Hz . His average speech rate was calculated to 211.3 words per minute.



Speaker **KP** is an American male, 26 years of age, originating from California. His fundamental frequency distribution (FFD) reveals a single modal frequency at 109.6 Hz. His average speech rate was calculated to 208.8 words per minute.



4. RECORDING PROCEDURES

The dialogue material was recorded in an anechoic, sound-insulated chamber at the ATR Auditory and Visual Perception Research Laboratories. During the recordings, the dialogues were conducted monolingually, engaging all possible pairwise combinations of speakers within one language group. Printed versions of the dialogues were handed to the subjects upon arrival at the recording studio. Only minimal instructions were given on how to render the material during the continuous speech recordings. Speakers were encouraged to deliver the dialogues in a relaxed, conversational style, and to avoid as much as possible falling into a normal text reading mode. The English subjects were permitted to choose for themselves the names and addresses (English or Japanese) they wanted to use in the dialogues, in order to avoid any potential pronunciation problems. No instructions were given concerning the inclusion of pauses or the placement of stress (emphatic or contrastive) at any place in the utterances. If speakers produced false starts, hesitations, or departed from their intended rendering of the conversation in any way, they were free to decide themselves whether and how to include any corrections.

For the phrase-wise (bunsetsu) recordings of the Japanese material, phrase boundary markers "/" were included in the hand-outs.

During the recording sessions, the two subjects participating in the respective dialogue were seated together in the anechoic room with their backs turned to each other, in order to avoid visual contact or any other kind of nonverbal/nonvocal communication. Separate condenser microphones (SONY C-350, set for digital recording) were mounted in front of each of the two conversants, and connected via a SONY AC-148F power supply placed inside the chamber. The recording system, consisting of a SONY MU-X051 audio mixer and a SONY DTC-1000ES digital audio tape deck set to 16-bits quantization and a sampling rate of 48 kHz, was located in an adjacent control room.

The author would like to take this opportunity to thank Ms. Hiroko Kida and the members of her staff for their kind assistance in operating the recording equipment.

The speech of the two subjects was recorded on two separate bands of standard SONY DT-120 digital audio tapes. At the beginning of each recording session the subjects read a short passage in order to get familiarized with the experimental surroundings and to allow the experimenter to adjust the levels on the recording equipment. The conversations were then recorded in one single sitting.

5. DATA TRANSFER AND DOWNSAMPLING

For purposes of analysis and storage, the original recordings on the DAT mastertapes were downsampled from 48 kHz to 8 kHz (maintaining 16-bits quantization) and transfered to auxiliary disk storage running under a DEC GPX workstation at the Department of Information Theory, Chalmers University of Technology, in Gothenburg, Sweden.

Downsampling was performed in two steps:

(1) from 48 kHz to 16 kHz by digital filtering using the linear-phase transfer filter in the processing unit of the OROS.AI interface;

(2) from 16 kHz to 8 kHz by employing a specially designed high-order (256 point) FIR-filter.

The transfer function and impulse response of this filter is shown in figure 4 below.

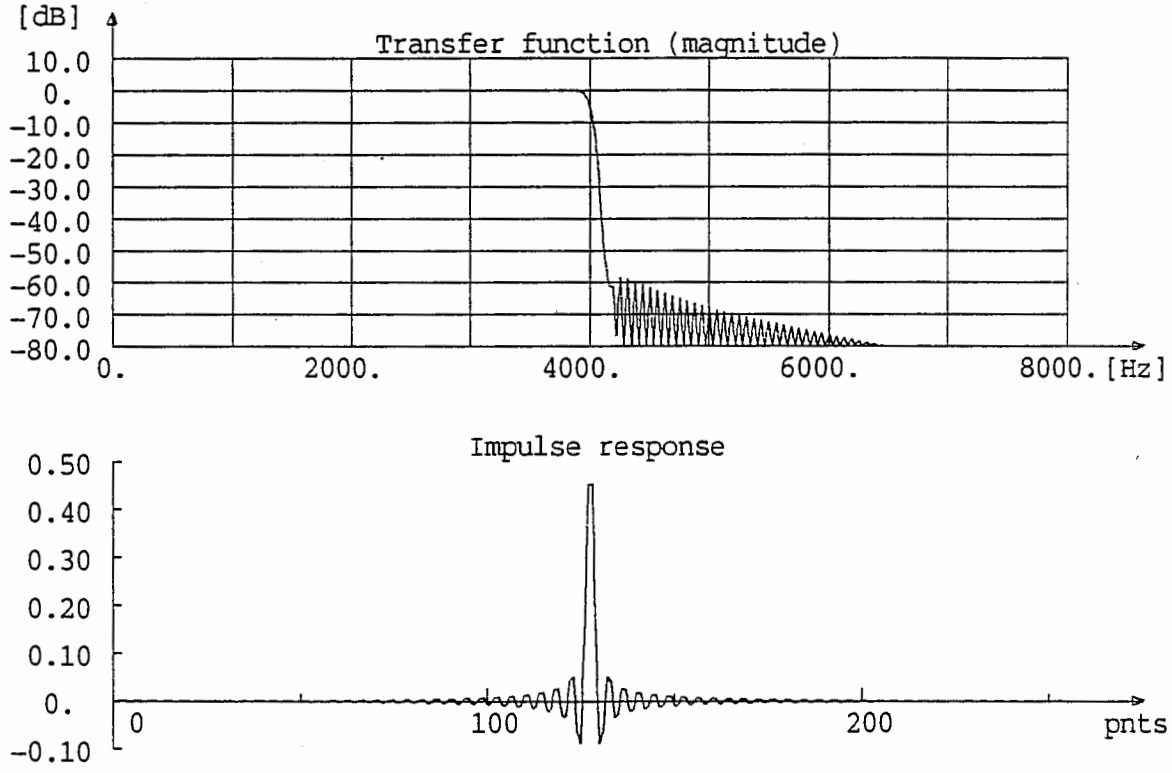


Figure 4 High-order (256 points) FIR-filter used for downsampling from 16 kHz to 8 kHz.

6. FILTERING

Subsequent filtering was performed in order to compensate for the relatively low cut-off frequency inherent in the recording system. Moreover, DC-drift problems were found to occur in the A/D-system. For this reason the digital processing includes two high-order (257 points) FIR-filters designed to suppress frequencies below first 40 Hz and then 70 Hz. The spectral properties (cut-off frequencies) and impulse responses of these two filters are illustrated in figures 5 and 6 respectively.

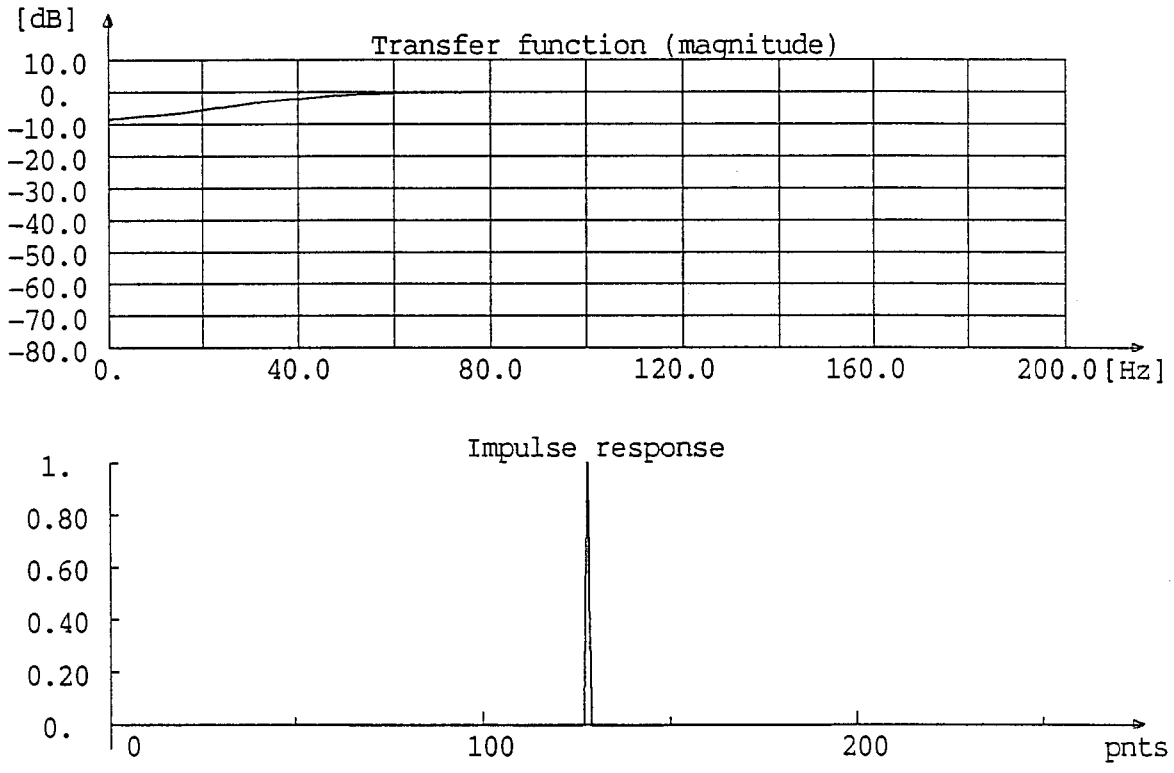


Figure 5 High-order (257 points) FIR-filter used for suppressing frequencies below 40 Hz.

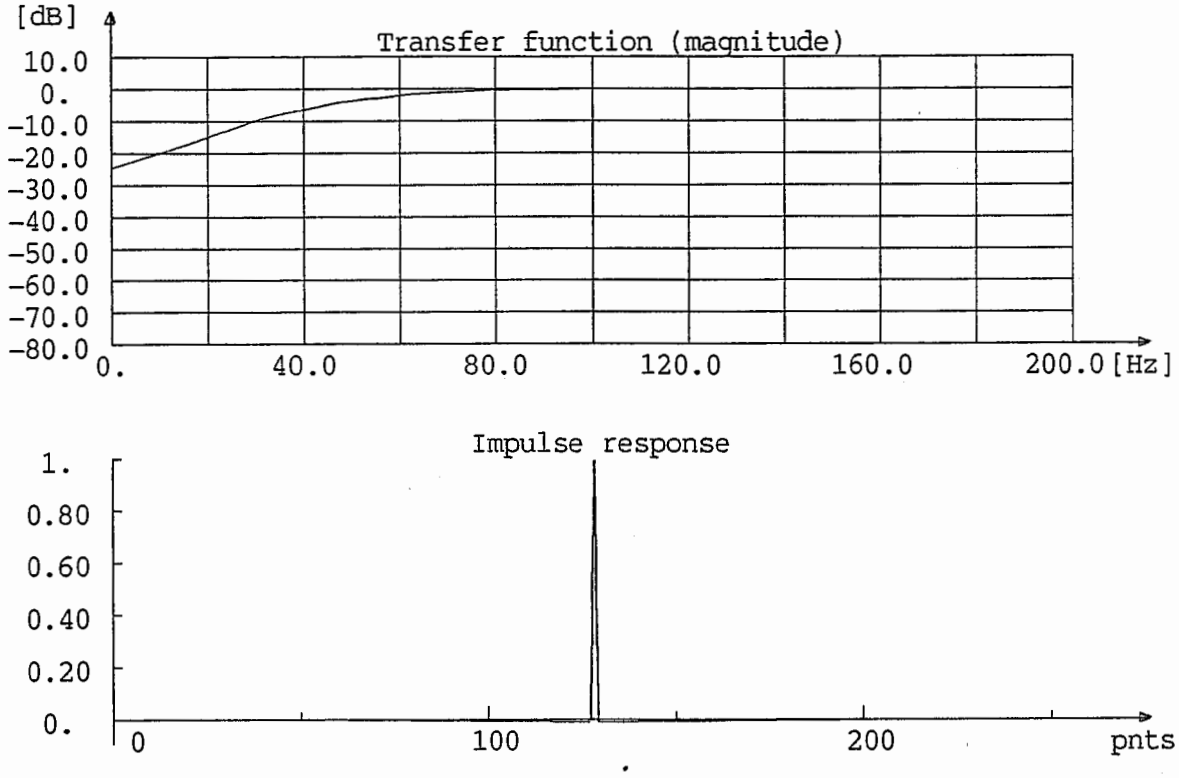


Figure 6 High-order (257 points) FIR-filter used for suppressing frequencies below 70 Hz.

7. LPC - ANALYSIS

LPC-analysis is performed using the LPCAYZ subroutine in the SAP signal analysis package (Hedelin 1986). This algorithm follows an auto-correlation approach with frame overlapping and adaptive (first order) pre-emphasis. Frame size is defined to 16 ms. Windowing is performed using a 45 ms Hamming window and the order of the a-polynomial is set to 16.

The prediction parameters, i.e. the LPC-coefficients and the prediction error (residual energy), are stored separately for each frame in the analysis (coefficient) file. A short extract of the complete listing for the LPC parameters computed over the first 20 frames (corresponding to 320 ms of continuous speech) of the Japanese version of Conversation_1 recorded by the two male speakers **HH** and **MA** (compare chapter 3) is shown on the following pages for illustration purposes. The a-parameters are listed in the third column (positions 2 to 17), the prediction error in position 64 of the same column. Further details concerning the contents and organization of the data analysis files are described in chapter 10.

It must be appreciated in this context that various additional programs are provided in the SAP signal analysis package which allow the user to perform further signal analyses, including e.g.

- Cepstrum analysis
- Inverse filtering
- Area functions
- Formant structure
- Reflection coefficients

based on the a-parameters obtained by the LPCAYZ program. The listings on the following pages thus include in the right (fourth) column even the cepstrum parameters for the same set of data, i.e. the first 10 frames of the Japanese version of Conversation 1 recorded by two male speakers.

1	1	1.00000	-0.18790
1	2	0.18790	-0.14649
1	3	0.16414	0.16790
1	4	-0.13927	0.14768
1	5	-0.16586	0.29522
1	6	-0.34835	-0.04000
1	7	-0.02971	0.24521
1	8	-0.26507	0.05730
1	9	-0.04013	0.18774
1	10	-0.19007	0.11651
1	11	-0.07408	-0.02568
1	12	0.01838	-0.00567
1	13	0.11037	0.03986
1	14	0.02811	-0.01850
1	15	0.12335	0.02264
1	16	0.01619	0.12036
1	17	-0.07765	0.00000
1	55	1.00000	0.00000
1	56	16.00000	0.00000
1	57	0.00000	0.00000
1	58	0.00000	0.00000
1	59	0.00000	0.00000
1	60	0.00000	0.00000
1	61	1.00000	0.00000
1	62	0.88278	0.00000
1	63	-2.00000	0.00000
1	64	16123.25879	0.00000
2	1	1.00000	-0.25733
2	2	0.25733	-0.03230
2	3	0.06541	0.16907
2	4	-0.15792	-0.02346
2	5	-0.01827	0.14694
2	6	-0.15173	0.03267
2	7	-0.05651	0.11224
2	8	-0.13059	0.15047
2	9	-0.15809	0.10359
2	10	-0.14264	0.11453
2	11	-0.12108	0.12078
2	12	-0.12555	-0.02258
2	13	0.02225	0.06222
2	14	-0.01644	0.01224
2	15	0.02616	0.05974
2	16	-0.02695	0.06550
2	17	-0.02221	0.00000
2	55	1.00000	0.00000
2	56	16.00000	0.00000
2	57	0.00000	0.00000
2	58	0.00000	0.00000
2	59	0.00000	0.00000
2	60	0.00000	0.00000
2	61	1.00000	0.00000
2	62	0.88927	0.00000
2	63	-2.00000	0.00000
2	64	17754.81641	0.00000
3	1	1.00000	-0.36314
3	2	0.36314	-0.02491
3	3	0.09084	0.10626
3	4	-0.08923	0.10171
3	5	-0.13762	0.10082

3	7	-0.07474	0.12804
3	8	-0.13825	0.19532
3	9	-0.22649	0.02294
3	10	-0.08599	0.12963
3	11	-0.13001	0.02000
3	12	-0.02756	-0.02341
3	13	0.05300	0.08915
3	14	-0.03080	0.07281
3	15	-0.05746	0.07089
3	16	-0.05694	0.05656
3	17	-0.04538	0.00000
3	55	1.00000	0.00000
3	56	16.00000	0.00000
3	57	0.00000	0.00000
3	58	0.00000	0.00000
3	59	0.00000	0.00000
3	60	0.00000	0.00000
3	61	1.00000	0.00000
3	62	0.85905	0.00000
3	63	-2.00000	0.00000
3	64	16568.29102	0.00000
4	1	1.00000	-0.31719
4	2	0.31719	0.03044
4	3	0.01986	0.07675
4	4	-0.08109	0.05434
4	5	-0.07933	0.10534
4	6	-0.12408	0.01752
4	7	-0.04873	0.19332
4	8	-0.19558	0.14316
4	9	-0.19339	0.01680
4	10	-0.05581	0.13080
4	11	-0.11456	0.05848
4	12	-0.06983	-0.00815
4	13	0.02388	0.12056
4	14	-0.08078	-0.01767
4	15	0.02221	0.10762
4	16	-0.05205	0.02849
4	17	-0.02057	0.00000
4	55	1.00000	0.00000
4	56	16.00000	0.00000
4	57	0.00000	0.00000
4	58	0.00000	0.00000
4	59	0.00000	0.00000
4	60	0.00000	0.00000
4	61	1.00000	0.00000
4	62	0.86074	0.00000
4	63	-2.00000	0.00000
4	64	20518.82813	0.00000
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5	4	-0.08875	0.11698
5	5	-0.13808	0.12691
5	6	-0.15691	0.06116
5	7	-0.08944	0.14366
5	8	-0.14658	0.08976
5	9	-0.10707	0.03426
5	10	-0.03133	0.11211
5	11	-0.08721	-0.02694
5	12	0.03527	0.05611

5	14	-0.13542	-0.03447
5	15	0.02706	0.07880
5	16	-0.03338	0.01559
5	17	-0.00401	0.00000
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5	56	16.00000	0.00000
5	57	0.00000	0.00000
5	58	0.00000	0.00000
5	59	0.00000	0.00000
5	60	0.00000	0.00000
5	61	1.00000	0.00000
5	62	0.88359	0.00000
5	63	-2.00000	0.00000
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6	2	0.27147	0.02133
6	3	0.01552	0.20974
6	4	-0.21220	0.13617
6	5	-0.19344	0.12317
6	6	-0.16338	0.18313
6	7	-0.19616	0.16719
6	8	-0.18388	0.08542
6	9	-0.09010	0.02795
6	10	0.01032	0.08973
6	11	-0.01855	0.05370
6	12	-0.00138	0.04316
6	13	0.00469	0.00043
6	14	0.05306	-0.09885
6	15	0.15582	0.11653
6	16	-0.04555	0.04464
6	17	-0.04571	0.00000
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6	56	16.00000	0.00000
6	57	0.00000	0.00000
6	58	0.00000	0.00000
6	59	0.00000	0.00000
6	60	0.00000	0.00000
6	61	1.00000	0.00000
6	62	0.88011	0.00000
6	63	-2.00000	0.00000
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7	4	-0.38815	0.27400
7	5	-0.22151	0.26362
7	6	-0.13466	0.29300
7	7	-0.13675	0.23160
7	8	-0.06386	-0.02688
7	9	0.22499	0.08189
7	10	0.13532	0.00153
7	11	0.11200	0.03516
7	12	0.02792	0.01610
7	13	0.00789	-0.03730
7	14	0.03889	-0.08636
7	15	0.06439	-0.03160
7	16	-0.01427	-0.02231
7	17	-0.03906	0.00000
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8	2	-0.45175	0.51148
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8	4	-0.19359	0.21756
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8	6	0.10303	0.14722
8	7	-0.02215	0.21061
8	8	-0.11893	0.11181
8	9	0.01868	0.12926
8	10	0.00440	0.04433
8	11	0.07785	-0.05598
8	12	0.12341	-0.07971
8	13	0.06828	-0.02882
8	14	-0.03850	-0.07907
8	15	0.01359	-0.07103
8	16	0.00732	0.01392
8	17	-0.07267	0.00000
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8	64	43162.48047	0.00000
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9	2	-0.64796	0.38498
9	3	-0.17506	0.41041
9	4	-0.20630	0.19766
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9	7	-0.03067	0.23562
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9	11	0.10921	-0.06744
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9	62	0.91518	0.00000
9	63	135.11627	0.00000

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10	2	-0.72220	0.40276
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10	4	-0.14721	0.18930
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10	7	-0.11968	0.30344
10	8	-0.27696	0.13631
10	9	0.05177	0.06360
10	10	0.08329	0.16368
10	11	-0.03807	-0.09311
10	12	0.20481	-0.18113
10	13	0.07027	-0.01808
10	14	-0.10603	-0.06747
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10	57	0.00000	0.00000
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10	62	0.91460	0.00000
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11	2	-1.07926	0.60904
11	3	-0.02664	0.42152
11	4	0.02627	0.05444
11	5	0.28779	-0.26311
11	6	0.24833	-0.09931
11	7	-0.24499	0.18809
11	8	-0.34321	0.03955
11	9	0.17693	0.01561
11	10	0.12369	0.07454
11	11	0.00166	0.00459
11	12	-0.00957	-0.14577
11	13	0.05148	-0.01168
11	14	-0.12272	-0.06900
11	15	0.09884	0.08233
11	16	-0.16463	-0.00215
11	17	0.12738	0.00000
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11	57	0.00000	0.00000
11	58	51232.19141	0.00000
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11	62	0.91019	0.00000
11	63	147.81116	0.00000
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12	5	0.33713	-0.36616

12	7	-0.20095	0.20798
12	8	-0.47103	0.06960
12	9	0.42853	-0.03190
12	10	0.10540	0.04256
12	11	-0.05169	-0.05281
12	12	0.00528	-0.13083
12	13	-0.08428	-0.08458
12	14	-0.03138	-0.04853
12	15	0.11595	0.11099
12	16	-0.15902	0.10062
12	17	0.08382	0.00000
12	55	1.00000	0.00000
12	56	16.00000	0.00000
12	57	0.00000	0.00000
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12	60	0.00000	0.00000
12	61	1.00000	0.00000
12	62	0.88849	0.00000
12	63	146.91153	0.00000
12	64	237408.06250	0.00000
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13	2	-1.69148	0.44040
13	3	0.99015	0.24240
13	4	-0.30405	-0.18703
13	5	0.40508	-0.36933
13	6	-0.11123	-0.24346
13	7	-0.14493	0.28121
13	8	-0.39854	-0.02957
13	9	0.70461	0.00678
13	10	-0.32501	0.04012
13	11	0.10317	-0.07563
13	12	-0.04983	-0.19784
13	13	0.05935	0.08604
13	14	-0.27769	-0.10695
13	15	0.50296	0.06133
13	16	-0.48957	0.16254
13	17	0.20164	0.00000
13	55	1.00000	0.00000
13	56	16.00000	0.00000
13	57	0.00000	0.00000
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13	64	483744.62500	0.00000
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14	2	-1.60031	0.45036
14	3	0.83014	0.20357
14	4	-0.16592	-0.10483
14	5	0.22862	-0.30538
14	6	0.02649	-0.18186
14	7	-0.19186	0.27778
14	8	-0.33559	-0.10534
14	9	0.67456	-0.00386
14	10	-0.37877	0.15188
14	11	-0.01392	-0.14287
14	12	0.27211	-0.12237

14	14	-0.08565	-0.10520
14	15	0.36385	0.02686
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14	17	0.18588	0.00000
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15	2	-0.88396	0.39019
15	3	0.00051	0.23857
15	4	-0.00878	-0.01620
15	5	0.17621	-0.04878
15	6	0.00747	-0.03595
15	7	-0.02295	0.19218
15	8	-0.23543	-0.15157
15	9	0.32898	0.15672
15	10	-0.28135	0.17459
15	11	-0.02879	-0.07790
15	12	0.19474	-0.18241
15	13	0.13810	0.13937
15	14	-0.32167	-0.03489
15	15	0.14943	-0.10039
15	16	0.03075	0.00296
15	17	0.01974	0.00000
15	55	1.00000	0.00000
15	56	16.00000	0.00000
15	57	0.00000	0.00000
15	58	51232.19141	0.00000
15	59	0.00000	0.00000
15	60	0.00000	0.00000
15	61	1.00000	0.00000
15	62	0.90701	0.00000
15	63	162.63182	0.00000
15	64	280451.09375	0.00000
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16	2	0.08007	0.02892
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16	4	-0.05777	0.20304
16	5	-0.20716	0.13273
16	6	-0.14753	0.15405
16	7	-0.15779	0.14664
16	8	-0.14372	-0.05756
16	9	0.07885	0.35094
16	10	-0.30484	0.10752
16	11	-0.08681	0.06721
16	12	-0.01844	-0.22081
16	13	0.25735	0.10149
16	14	0.00665	-0.12947
16	15	0.18812	0.02753
16	16	0.04015	-0.11417
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16	55	1.00000	0.00000
16	56	16.00000	0.00000

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16	61	1.00000	0.00000
16	62	0.86689	0.00000
16	63	-1.00000	0.00000
16	64	117944.42969	0.00000
17	1	1.00000	-0.36845
17	2	0.36845	0.17508
17	3	-0.10720	0.01105
17	4	-0.06722	0.25075
17	5	-0.25061	-0.02793
17	6	-0.05904	0.16035
17	7	-0.12249	0.22414
17	8	-0.26960	0.10048
17	9	-0.13642	0.32932
17	10	-0.32831	0.16126
17	11	-0.22215	0.22304
17	12	-0.17589	-0.03852
17	13	0.03879	0.07338
17	14	0.09409	-0.18477
17	15	0.27046	-0.00701
17	16	0.21067	0.05300
17	17	0.04738	0.00000
17	55	1.00000	0.00000
17	56	16.00000	0.00000
17	57	0.00000	0.00000
17	58	51232.19141	0.00000
17	59	0.00000	0.00000
17	60	0.00000	0.00000
17	61	1.00000	0.00000
17	62	0.58351	0.00000
17	63	-1.00000	0.00000
17	64	113566.65625	0.00000
18	1	1.00000	-0.37247
18	2	0.37247	0.29708
18	3	-0.22772	-0.00495
18	4	-0.09709	0.15155
18	5	-0.12538	-0.08196
18	6	0.03832	0.04780
18	7	0.01520	0.08404
18	8	-0.10693	0.21330
18	9	-0.23404	0.22485
18	10	-0.28838	0.20151
18	11	-0.22506	0.18510
18	12	-0.17657	0.05211
18	13	-0.03163	-0.07846
18	14	0.14039	-0.10935
18	15	0.18692	0.11968
18	16	-0.05639	-0.02210
18	17	-0.00788	0.00000
18	55	1.00000	0.00000
18	56	16.00000	0.00000
18	57	0.00000	0.00000
18	58	51232.19141	0.00000
18	59	0.00000	0.00000
18	60	0.00000	0.00000
18	61	1.00000	0.00000
18	62	0.50058	0.00000
18	63	-1.00000	0.00000

19	1	1.00000	-0.31480
19	2	0.31480	0.35906
19	3	-0.30951	0.00699
19	4	-0.11483	0.13793
19	5	-0.09305	0.09848
19	6	-0.12128	0.10770
19	7	-0.09990	0.04931
19	8	-0.03932	0.05028
19	9	-0.01764	0.19343
19	10	-0.17211	0.17592
19	11	-0.20089	0.07815
19	12	-0.05331	-0.12223
19	13	0.18705	0.08073
19	14	0.02739	-0.07683
19	15	0.06435	0.19380
19	16	-0.11244	0.03061
19	17	-0.08551	0.00000
19	55	1.00000	0.00000
19	56	16.00000	0.00000
19	57	0.00000	0.00000
19	58	51232.19141	0.00000
19	59	0.00000	0.00000
19	60	0.00000	0.00000
19	61	1.00000	0.00000
19	62	0.48013	0.00000
19	63	-1.00000	0.00000
19	64	124425.92969	0.00000
20	1	1.00000	-0.24484
20	2	0.24484	0.07435
20	3	-0.04437	0.00936
20	4	-0.02511	0.17480
20	5	-0.17641	0.26559
20	6	-0.30747	0.02154
20	7	-0.07862	0.19710
20	8	-0.18620	-0.15003
20	9	0.12495	0.07766
20	10	0.01879	0.09158
20	11	-0.06282	0.07096
20	12	-0.04617	0.02500
20	13	-0.00440	0.17893
20	14	-0.20204	-0.07685
20	15	0.07383	0.07079
20	16	-0.02985	0.06939
20	17	-0.04253	0.00000
20	55	1.00000	0.00000
20	56	16.00000	0.00000
20	57	0.00000	0.00000
20	58	51232.19141	0.00000
20	59	0.00000	0.00000
20	60	0.00000	0.00000
20	61	1.00000	0.00000
20	62	0.64456	0.00000
20	63	-1.00000	0.00000
20	64	116785.22656	0.00000
21	1	1.00000	0.20517
21	2	-0.20517	-0.23142
21	3	0.25246	-0.10351
21	4	0.05459	0.20083
21	5	-0.19035	0.45886

8. PITCH EXTRACTION

Pitch extraction is performed using the DWAPIT pitch determination algorithm presented in Hedelin & Huber (1990a). Pitch estimates are obtained at 16-ms intervals and calculated to the first decimal. Considerable effort has been invested in designing a fast, accurate and robust pitch determination algorithm (PDA). Several approaches have been tested and systematically evaluated, including both time-domain and short-term analysis PDAs such as the Gold-Rabiner algorithm, the SIFT algorithm, and the cepstrum method. The PDA finally adopted for pitch extraction constitutes an extended and improved version of the SIFT algorithm, i.e. following a basic autocorrelation approach.

As a result, high precision pitch estimates are obtained with only a slight increase in computational complexity. In the evaluation, the pitch extractor thus designed outperformed the other methods included in the tests, in particular with respect to incorrect voicing decisions and pitch doubling.

Remaining pitch detection errors are mostly of the segmentation type and are obviously caused by the incongruity between the segment boundaries and the analysis frame size. These errors are hand-edited during transcription by marking a frame as voiced if more than one third of its total duration contains a periodic speech signal. Thus an inherent segmentation error of approximately ± 10 ms has to be taken into account in all further analyses involving durational properties of the speech wave.

Pitch estimation errors are either of the "octave error" type, i.e. the F_0 values are wrong (or correct!) by a factor of 2 due to "jitter" in the voice source, or they are caused by irregular, aperiodic vibrations (both in period duration and waveform) at the onset or offset of phonation. These voicing "errors" are not corrected as their detection, classification and function as potential boundary cues in speech communication is to be investigated in a series of studies conducted at Chalmers University of Technology in Sweden.

All pitch estimates are stored in the signal analysis file (position 63). Frames without pitch are set to either "-1" (marking voiceless stretches of speech) or "-2" (marking silence in pauses). Separate listings of the pitch values obtained in 16-ms intervals for conversation_1 in one Japanese and one English version (both versions involving two male speakers) are exemplified on the following pages for illustration purposes. Figures 7 and 8 show the pitch contours of the corresponding speech material in their entire lengths. More detailed displays of the beginning of each conversation, including time-aligned amplitude displays, are shown in figures 9 and 10.

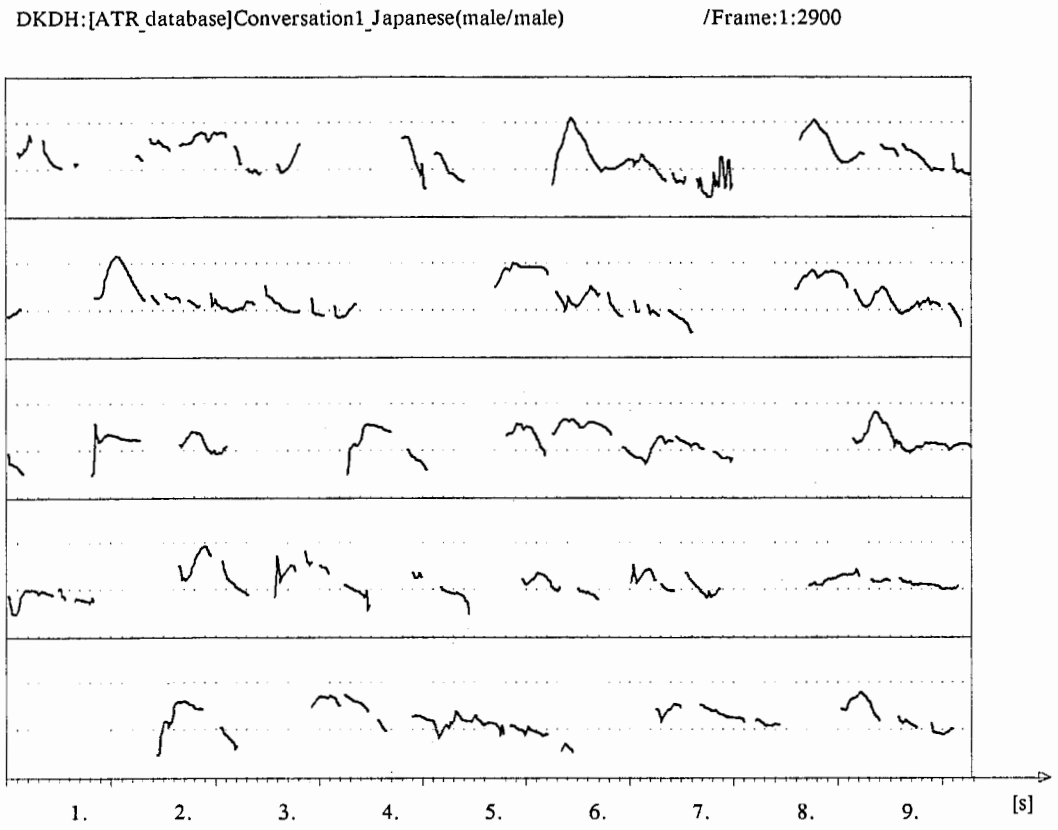

Figure 7 Pitch contour of conversation 1 (Japanese version), involving the two male speakers MA and HH.

```
*** Task LSTPIT ***                                  4-FEB-91
=,DKDH:[DIETER.TEXT]D4.COF;1 /Frame:1:2900
    1                                        140.5 131.5 135.1 138.8  10
   11 147.8 146.9 163.1 176.4 162.6                                    20
   21       167.0 142.2 136.9 128.5 123.6 118.6 114.1 112.0 110.9      30
   31 109.0 107.2 106.2 106.6                                          40
   41 116.1 111.1 114.4                                                50
   51                                                                  60
   61                                                                  70
   71                                              133.2 133.7 128.3   80
   81 123.8 121.2                   170.3 162.2 159.9 159.6 158.6      90
   91 165.7 160.9 157.0 154.9 153.8 153.2 148.5 142.8                  100
  101                   155.7 156.4 158.2 158.3 159.2 159.4 160.1     110
  111 160.8 163.7 173.1 177.3 178.4 180.8 182.7 180.8 179.5 169.5     120
  121 163.5 166.4 174.7 181.3 181.6 178.9 179.4 180.7 182.0 181.9     130
  131 180.2 171.7                        152.9 145.2 134.3 116.2     140
  141 114.2                   105.1  99.8  99.5  95.7 102.5  98.2     150
  151  95.3  92.7  96.1                                               160
  161             114.2 102.0  96.5  97.4  99.8 103.1 105.7 110.7     170
  171 115.8 124.3 132.9 143.2 153.8 157.3 157.3                       180
  181                                                                 190
  191                                                                 200
  201                                                                 210
  211                                                                 220
  221                                                                 230
  231                                              171.3 171.8 172.2  240
  241 172.4 168.8 159.8 146.5 133.1 119.3 108.4 100.8  89.2 112.9     250
  251  64.6  59.8                                  135.8 137.8 137.1  260
  261 134.0 127.1 118.9 111.6 103.3  95.5  94.8  94.2  93.0  89.0     270
  271  84.0  81.8  79.9  78.6  76.7  78.0                            280
  281                                                                 290
  291                                                                 300
  301                                                                 310
  311                                                                 320
  321                                                    71.0  96.6  330
  331 114.3 136.9 141.8 150.5 163.8 178.6 185.5 199.2 207.6 212.0     340
  341 208.3 200.8 192.0 185.7 181.1 176.6 170.6 165.1 157.0 145.7     350
  351 136.2 132.7 124.2 119.0 111.9 108.6 103.8  98.3  99.8 105.4     360
  361 106.1 105.7 105.0 104.7 104.2 104.7 105.7 107.2 109.6 111.6     370
  371 113.0 115.5 119.3 122.1 124.8 124.9 123.9 109.5 117.7 119.8     380
  381 119.8 132.5 133.8 124.7 121.6 118.8 115.4 110.7 111.7 107.7     390
  391 102.4  97.2  90.9  86.8  82.3  81.6  75.4                       400
  401  93.5  83.6  76.1  74.5  76.4  78.1  75.9  71.9  84.2          410
  411                              82.1  62.0  82.9  57.2  52.0      420
  421  52.0  45.0  45.0  45.0  45.0  93.6  65.0  76.3  63.6 125.8     430
  431 128.2  85.0  62.3 117.1 121.0  60.1  71.2                       440
  441                                                                 450
  451                                                                 460
  461                                                                 470
  471                                              166.5 179.9 182.6  480
  481 185.2 190.1 194.8 198.1 204.0 207.7 205.8 200.7 194.9 189.5     490
  491 185.1 182.2 179.6 173.7 163.9 155.9 147.0 138.5 132.3 125.9     500
  501 122.4 119.4 117.6 119.3 119.1 118.3 119.5 121.6 122.4 125.2     510
  511 127.4 131.4 135.3 138.6 136.7 133.7                             520
  521                              156.0 152.7 147.4 146.1 147.1      530
  531 148.1 148.0 147.4 144.5 138.2 130.4              157.7 151.8    540
  541 146.7 145.5 144.7 141.7 139.0 138.0 136.9 135.0 129.4 126.1     550
  551 124.8 118.2 113.7 108.9 105.1 101.5  99.0 105.1 103.9 103.9     560
  561 104.2 100.3 101.3 101.7                       135.8 103.4       570
  571  99.9  96.1  97.6 100.5  96.5  94.7  94.7  93.3  91.6  92.4     580
  581  91.8  90.4  91.7  93.5  97.6  98.8 100.9 105.9 103.6           590
  591                                                                 600
  601                                                                 610
  611                                                                 620
  621                                                                 630
  631             131.2 129.4 129.6 130.2 132.8 143.5 167.3 175.3     640
  641 189.2 197.2 205.4 210.5 215.5 219.8 219.5 214.2 207.8 202.2     650
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 651 195.3 188.5 182.7 177.2 167.9 160.9 155.4 148.6 142.9 138.6  660
 661 131.0 126.9 122.8                       135.2 128.9 125.7 121.2  670
 671 116.3                   139.4 133.0 132.1 130.0 129.0 128.7  680
 681 130.2 130.8 128.8 118.5                             124.8 123.1  690
 691 119.8 117.3 115.8 110.2 108.7 112.3                              700
 701       139.7 112.2 115.2 125.4 116.2 115.3 112.6 106.6 108.3  710
 711 109.5 109.4 104.5 102.6 100.6 100.8 102.5 104.8 105.7 106.7  720
 721 107.7 105.7 113.8 119.7 121.9 121.5 121.1 116.8 115.5        730
 731                   156.8 134.8 134.6 131.4 130.4 125.7  740
 741 119.8 119.4 118.3 114.2 109.4 106.9 104.1 103.5 102.3 100.9  750
 751 101.4 100.7 100.4 100.1  99.4 101.4                          760
 761             128.5 100.2  97.4  94.6  95.5  94.0  92.5  92.2  770
 771  91.6                             111.6  91.1  88.8  88.8  780
 781  89.0  89.9  89.1  92.0  95.7 103.9 105.3 109.7 115.3 115.9  790
 791 116.6                                                        800
 801                                                              810
 811                                                              820
 821                                                              830
 831                                                              840
 841                                                              850
 851                                                              860
 861                                                              870
 871                   153.8 154.0 160.6 168.0 178.1 185.9 190.4  880
 881 191.6 190.9 185.7 196.9 202.5 203.2 201.8 197.7 196.7 196.5  890
 891 196.7 195.7 195.1 195.2 195.4 196.2 195.8 195.4 195.9 196.6  900
 901 196.6 195.3 193.7 191.0 186.3 176.1                          910
 911 142.7 134.0 128.1 122.2 115.1  99.7 107.7 131.7 123.5 117.7  920
 921 114.8 113.2 109.7 111.3 114.0 119.0 124.7 129.7 138.7 138.9  930
 931 144.2 153.8 146.1 146.7 138.0 132.6 136.3                    940
 941       139.9 118.3 113.7 109.2 104.1  99.2  94.6  91.1  90.9  950
 951  87.4                                 121.2 100.3 100.0  960
 961  98.6                       113.8  98.5  94.1 101.5  98.2  970
 971  95.6  93.4  89.2                             101.8  99.7  980
 981  95.9  93.6  91.2  89.1  86.4  84.6  83.1  79.3  76.8  72.5  990
 991  64.6  55.3  53.9                                          1000
1001                                                             1010
1011                                                             1020
1021                                                             1030
1031                                                             1040
1041                                                             1050
1051                         149.5 147.4 156.6 163.2 170.2 174.2 1060
1061 175.7 175.7 180.9 185.4 187.1 184.4 178.9 171.4 173.3 175.5 1070
1071 177.7 180.9 184.6 184.6 185.0 185.5 186.1 184.4 184.3 183.0 1080
1081 181.4 178.8 175.1 168.5 163.0 149.1                   145.0 1090
1091 137.7 130.7 124.4 118.8 113.9 110.5 109.9 109.4 111.7 115.5 1100
1101 123.9 132.7 140.3 141.2 142.7 149.7 151.5 148.4 144.0 134.9 1110
1111 126.8 122.0 116.0 112.3 104.4  99.4  96.6  95.3  94.5  97.9 1120
1121  99.5 101.0 102.5 107.8 108.3 110.2 115.0 118.5 109.3 114.9 1130
1131 118.5 120.5 120.3 127.8 114.7 115.3 118.3 119.2 117.3 116.5 1140
1141 112.0 111.8                       115.8 112.4 106.0 100.3 1150
1151  92.9  88.1  80.4  67.3                                     1160
1161  97.5  76.2  75.1  73.3  70.6  69.0  65.7  59.4  56.6  51.0 1170
1171                                                             1180
1181                                                             1190
1191                                                             1200
1201                                                             1210
1211  52.0  52.0 160.6 136.8 122.4 122.9 124.8 130.1 133.7 136.0 1220
1221 137.8 137.9 137.2 136.2 135.2 133.7 131.8 130.6 130.0 129.2 1230
1231 128.4 127.6 127.2 126.3 125.4 126.6 127.6 126.2 126.2 123.4 1240
1241                                                             1250
1251                                                             1260
1261                   116.0 111.4 117.8 121.3 128.3 131.8 140.2 1270
1271 144.2 144.4 143.1 139.6 140.9 138.1 130.2 122.4 113.9 106.3 1280
1281 101.9  98.5  95.9 103.1  97.5  96.7  97.1  98.1  97.4 104.8 1290
1291 108.7 110.4                                                 1300
1301                                                             1310
1311                                                             1320
```

1321											1330
1331											1340
1341											1350
1351											1360
1361					51.6	104.8	108.2	114.1	117.5	113.7	1370
1371	112.9	118.5	124.2	147.6	154.5	157.4	159.7	158.6	158.7	159.4	1380
1381	157.8	157.7	154.9	154.3	152.9	149.6	147.4	146.6	146.2	144.5	1390
1391	140.9										1400
1401	105.6	98.0	93.1	89.4	87.8	83.7	81.8	81.9	77.9	74.9	1410
1411	69.1	61.8	59.6								1420
1421											1430
1431											1440
1441											1450
1451											1460
1461	135.4	137.6	140.3	139.7	141.6	152.8	159.8	160.8	159.8	152.8	1470
1471	147.5	151.2	154.2	154.9	153.9	149.0	142.1	136.7	128.6	121.7	1480
1481	111.3	107.2	103.9	90.1					140.1	138.7	1490
1491	144.6	151.5	159.8	164.8	167.9	170.2	170.2	167.8	164.9	168.3	1500
1501	169.8	166.6	163.3	160.9	153.4	151.9	153.6	153.9	157.1	160.2	1510
1511	162.9	163.9	163.9	163.5	162.2	160.8	158.8	157.5	155.1	153.5	1520
1521	149.9	146.7	142.4	133.7							1530
1531	109.6	110.0	104.9	100.1	96.2	94.2	91.4	89.0	87.3	87.2	1540
1541	87.5	86.4	82.9	77.4	72.9	81.1	92.3	103.9	109.8	116.4	1550
1551	122.4	127.5	131.5	132.4	129.4	120.7	118.0	121.1	124.4	122.9	1560
1561	122.2		132.8	129.6	126.3	125.0	123.2	121.2	119.4	118.1	1570
1571	116.2	110.0	114.6	116.1	117.6	115.9	109.6	107.5	106.4	104.3	1580
1581						100.3	98.7	95.9	93.5	88.3	1590
1591	86.2	85.9	86.4	87.4	87.0	77.8	84.1				1600
1601											1610
1611											1620
1621											1630
1631											1640
1641											1650
1651											1660
1661									128.0	122.0	1670
1671	119.5	118.5	120.8	123.7	123.6	136.6	138.5	143.0	163.5	167.9	1680
1681	178.4	183.5	185.5	181.9	174.7	168.3	163.7	162.6	161.0	152.2	1690
1691	144.5	134.2	126.9	108.8	124.5	116.8	120.2	111.3	106.6	103.0	1700
1701	101.7	100.6	97.7	100.7	102.4	104.1	108.8	111.0	109.4	110.3	1710
1711	111.2	117.0	119.2	118.3	118.2	118.6	118.9	119.3	118.9	116.7	1720
1721	116.5	116.8	116.7	115.8	111.8	107.8	104.4	105.6	109.7	112.3	1730
1731	113.0	114.8	116.6	117.6	117.8	118.0	117.1	116.6	113.8	107.4	1740
1741	90.2	75.6	53.0	51.0	51.0	51.0	59.0	85.0	88.2	95.3	1750
1751	100.0	102.4	101.3	101.6	103.1	103.3	100.7	97.1	93.0	97.2	1760
1761	100.5	99.2	97.3	95.8	94.5	94.5	91.6	90.2			1770
1771	102.6	104.9	90.5	88.4	80.5						1780
1781	78.9	83.4	83.5	81.3	79.6	80.0	79.7	79.3	79.3	73.4	1790
1791	84.9	76.7									1800
1801											1810
1811											1820
1821											1830
1831											1840
1841			154.4	148.5	123.2	127.3	123.1	125.0	130.7	134.0	1850
1851	148.8	155.0	166.7	176.8	182.1	189.1	192.3	195.0	195.6	191.0	1860
1861	181.6	173.7							164.2	147.5	1870
1871	136.5	127.3	123.2	120.4	117.8	114.7	109.3	106.8	105.1	102.0	1880
1881	100.3	98.8	96.9	92.5	90.8						1890
1891											1900
1901	87.3	174.6	158.2	117.4	128.7	133.9	139.0	143.9	147.7	152.6	1910
1911	155.4	155.0	141.7						185.1	164.2	1920
1921	158.8	154.4	161.1					154.9	151.6	151.8	1930
1931	150.4	147.0	135.0								1940
1941			113.2	110.4	109.8	106.1	105.1	102.1	101.8	100.1	1950
1951	99.2	95.6	92.6	89.4	85.4	100.4	58.0	67.9			1960
1961											1970
1971											1980
1981				139.3	129.4	128.8	127.5	138.8	129.5	128.9	1990

1991										2000
2001	107.8	102.4	100.8	98.9	98.7	97.7	96.2	95.2	94.7	94.3	2010
2011	95.2	92.8	91.5	89.5	85.5	79.4	76.7	51.0	51.0		2020
2021											2030
2031											2040
2041										125.9	2050
2051	118.4	115.1	114.0	115.1	118.8	123.0	125.2	129.1	135.4	138.5	2060
2061	137.5	135.8	133.6	131.5	127.1	123.3	120.4	109.1	105.5	102.7	2070
2071	101.3	99.1	106.4								2080
2081				105.4	100.0	99.5	96.7	98.3	93.6	97.5	2090
2091	93.2	92.6	91.3	88.3	82.9	80.4					2100
2101											2110
2111						117.9	154.9	135.0	116.1	118.3	2120
2121	124.6	129.4	135.9	141.6	143.5	145.7	146.1	141.8	131.8	123.7	2130
2131	122.3			114.6	109.4	105.9	104.0	101.4	101.1	100.5	2140
2141	101.4	96.6							139.6	132.5	2150
2151	126.3	121.7	117.9	114.5	108.8	108.6	104.3	98.9	95.3	92.7	2160
2161	85.5	84.8	98.5	85.5	87.2	89.9	91.4	98.1	104.1	102.0	2170
2171											2180
2181											2190
2191											2200
2201											2210
2211											2220
2221			112.2	113.6	113.6	117.4	114.2	113.5	113.7	113.1	2230
2231	112.1	119.4	121.4	124.7	126.0	125.3	126.2	127.0	127.4	130.5	2240
2241	131.1	132.6	134.8	135.1	134.7	134.3	135.4	136.1	135.7	136.6	2250
2251	144.7	137.3	128.4							124.3	2260
2261	120.3	120.5	119.8	119.4	119.4	119.5	120.3	122.9	124.5	123.8	2270
2271	119.4						127.1	123.9	119.0	119.8	2280
2281	117.7	116.3	118.4	113.8	112.3	111.3	113.1	112.3	114.0	114.9	2290
2291	114.5	114.8	114.4	112.7	113.4	113.5	113.0	112.9	110.0	110.6	2300
2301	107.2	103.9	103.4	102.1	105.8	105.9	104.9	103.9	104.6	106.0	2310
2311	104.8	109.3									2320
2321											2330
2331											2340
2341											2350
2351											2360
2361											2370
2371											2380
2381											2390
2391											2400
2401										50.3	2410
2411	50.3	88.0	104.5	116.2	120.8	119.6	106.3	119.0	118.4	151.1	2420
2421	157.7	160.3	162.8	161.3	162.4	164.6	163.7	161.3	157.9	155.9	2430
2431	156.2	151.8	148.5	148.0	146.1	147.5	144.2				2440
2441								108.2	104.5	95.6	2450
2451	91.4	90.4	84.6	81.4	77.5	73.6	61.6	67.5			2460
2461											2470
2471											2480
2481											2490
2491											2500
2501			152.2	155.8	160.3	165.5	170.0	172.9	173.7	174.3	2510
2511	173.4	172.1	169.9	175.9	174.4	172.6	170.2	163.8	156.7	153.3	2520
2521			178.0	174.8	173.3	169.7	167.3	165.1	164.4	163.3	2530
2531	161.3	160.0	157.3	154.7	150.9	146.6	139.5				2540
2541			123.0	118.6	111.5	106.1	101.7	99.0			2550
2551											2560
2561				130.9	132.0	133.3	133.5	132.4	130.5	128.9	2570
2571	127.5	125.2	124.5	123.5	123.8	121.5	117.0	101.5	92.1	84.3	2580
2581	91.9	98.6	105.5	112.4	109.7	105.7	117.7	116.9	120.8	141.5	2590
2591	136.5	132.3	125.8	123.8	123.5	122.5	121.5	121.9	121.6	118.9	2600
2601	125.9	132.9	126.1	123.8	120.7	115.1	111.7	113.0	115.5	117.1	2610
2611	117.4	117.4	116.2	114.5	111.9	106.7	89.7	110.9	91.9		2620
2621			111.2	112.1	110.3	107.4	105.2	103.0	102.1	101.3	2630
2631	97.3	90.3	101.8	107.8	102.8	101.9	100.0	98.6	97.4	95.5	2640
2641	93.8	90.4	90.9	92.1	92.8	92.2					2650
2651				58.8	66.4	71.7	67.7	65.0	61.3	61.6	2660

```
2661  53.0                                                          2670
2671                                                                2680
2681                                                                2690
2691                                                                2700
2701                                                                2710
2711 146.7 146.7 136.3 119.6 127.1 132.7 137.6 143.4 145.0 146.1   2720
2721 153.0 157.1 155.9 156.1 155.5 148.6                            2730
2731                                       156.7 154.3 150.9        2740
2741 149.4 147.9 147.1 142.7 143.7 142.2 143.3 140.1 137.7 136.3   2750
2751 135.1 132.8 129.9 129.0 130.0 130.7 128.9 128.5 128.6 127.5   2760
2761 129.0 127.3 125.4 117.7                                        2770
2771 121.3 125.0 122.1 118.8 117.4 114.0 111.5 111.8 112.3 112.0   2780
2781 111.6 113.4 115.7 113.6 112.2                                  2790
2791                                                                2800
2801                                                                2810
2811                                                                2820
2821       147.5 145.6 145.4 143.3 154.7 165.2 165.7 168.6 170.0   2830
2831 171.2 174.3 179.1 183.0 178.9 174.1 169.5 164.4 159.9 150.8   2840
2841 139.6 133.6 130.8 126.1 118.9                                  2850
2851                           130.4 121.7 118.5 115.2 122.9        2860
2861 119.9 117.5 115.7 113.4 111.5 110.4 106.1 106.3                2870
2871                           116.2  99.0  97.3  96.2  96.1       2880
2881  94.2  93.7  92.5  93.6  95.6  97.8  98.6 103.4 102.7         2890
2891                                                                2900
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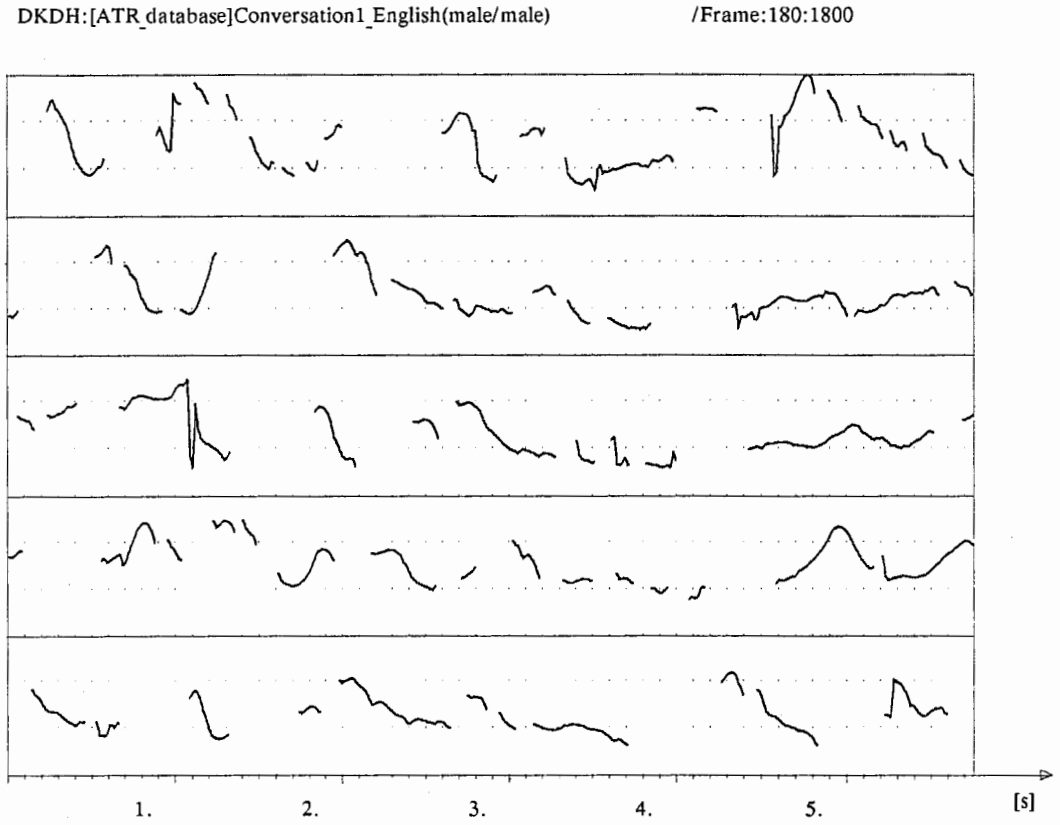

Figure 8 Pitch contour of conversation 1 (English version), involving the two male speakers **DR** and **EM**.

```
*** Task LSTPIT ***                                  2-NOV-90
=,DKDH:[DIETER.TEXT]D1.COF;1 /Frame:180:1800
  180                                                                  189
  190                              225.9 242.5 248.5 231.9 225.7 216.5 199
  200 203.5 193.3 171.7 149.4 130.5 116.5 107.3  98.6  93.1  90.6  209
  210  89.0  91.7  96.9 106.6 105.9 121.4                             219
  220                                                                  229
  230                                   174.5 189.3 174.7 158.0 142.8 239
  240 137.7 260.6 244.8 240.7 239.0                             284.6 249
  250 273.1 271.2 263.6 247.9 238.2                                    259
  260       259.5 236.5 231.2 220.8 202.8                              269
  270 167.4 155.9 137.6 125.7 114.4 109.9 105.1  99.1 114.3 115.4 279
  280             103.9  97.0  92.9  91.4  86.3                       289
  290       114.6 102.9  99.7  96.4 116.2             165.6 166.0 299
  300 170.4 174.5 189.3 194.9 188.2                                    309
  310                                                                  319
  320                                                                  329
  330                                                                  339
  340             177.8 176.5 182.0 190.7 200.9 211.2 217.3 218.8 349
  350 218.5 214.5 203.4 182.8 182.8 115.4  93.6  86.1  84.8  81.0 359
  360  77.1  73.1  86.2                                               369
  370       169.3 173.0 172.9 174.1 180.7 184.9 187.0 185.2 171.5 379
  380 184.6                                             123.1  92.0 389
  390  82.6  75.9  72.7  70.8  68.3  69.2  74.3  79.1  68.1  55.0 399
  400 100.2 108.5  89.9  94.8  95.6  97.1 101.2  99.7 101.2 103.8 409
  410 106.4 109.8 109.7 111.1 112.2 111.5 107.7 108.2 106.6 105.7 419
  420 114.3 119.0 117.9 117.3 119.6 124.0 129.1 125.5 115.0       429
  430                                         228.6 226.7 229.2 439
  440 229.8 228.9 229.1 226.5 220.2                                    449
  450                                                                  459
  460                        215.3  86.1  91.9 189.2 190.6 211.6 469
  470 218.2 228.2 240.2 258.8 270.6 282.7 295.6 300.6 300.9 288.2 479
  480 260.8                   268.1 253.5 246.8 237.2 213.7 489
  490 200.5                         234.2 212.3 209.1 202.6 499
  500 199.6 196.1 195.7 191.6 176.4 162.5             180.5 157.2 509
  510 149.1 147.9 156.3 158.1 138.5                                    519
  520 174.7 151.1 142.6 136.1 132.7 131.1 129.7 125.0 113.9 100.3 529
  530                        118.4 101.7  97.5  91.8  88.9  86.5 539
  540  89.2  84.5  90.1  96.5                                         549
  550                                                                  559
  560                                                                  569
  570             215.5 216.8 220.9 228.7 238.1 234.2 199.4       579
  580                   196.3 193.9 178.4 172.8 164.8 143.3 127.4 589
  590 119.6 105.2 100.3  97.4  95.5  93.7  97.3  96.2             599
  600                        101.4  96.7  92.8  90.9  93.3  98.3 609
  610 109.6 124.8 135.7 155.8 171.5 193.6 212.9 220.8             619
  620                                                                  629
  630                                                                  639
  640                                                                  649
  650                                                                  659
  660       217.2 221.9 232.8 239.2 244.6 249.4 244.3 232.6 219.0 669
  670 214.9 223.3 218.8 204.2 192.0 162.4 146.2 130.2             679
  680                   163.7 160.8 156.9 153.1 150.1 147.4 145.8 689
  690 144.4 142.9 138.1 134.0 129.3 120.2 114.6 114.5 114.7 111.7 699
  700 108.6 103.9 101.3                   119.9 121.7 102.3  97.8 709
  710  94.3  87.3  86.4  90.6 104.5 107.9 106.7 104.0 101.6 100.7 719
  720  93.5  97.1  95.9  95.1 100.7  96.8  92.6  92.9  91.2       729
  730                                   137.3 139.8 140.9 143.2 739
  740 146.5 150.2 149.3 138.5 130.4                       119.2 749
  750 107.2  97.6  91.9  83.1  76.1  74.2  70.5  68.9             759
  760                        82.3  79.1  73.4  70.2  67.6  64.9 769
  770  63.5  59.7  60.3  61.8  59.5  59.4  55.0  61.2  57.3  65.3 779
  780  68.3                                                        789
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 790                                                                  799
 800                                                                  809
 810 104.6 110.2  58.3  82.1  85.0  83.3  87.1  92.2  79.1  78.1   819
 820  99.4 103.3 105.2 107.1 111.3 115.8 119.1 123.9 127.0 127.3   829
 830 126.1 122.8 120.4 120.4 119.3 119.6 118.6 119.2 121.0 124.9   839
 840 126.9 128.8 129.9 125.6 137.6 135.9 135.9 135.7 129.9 119.2   849
 850 108.2 100.8  84.9               86.8  98.8  98.5  96.0  95.0   859
 860  95.0  96.4  98.0 101.5 107.7 109.4 109.8 114.8 122.9 129.5   869
 870 131.3 132.5 131.0 129.1 129.3 134.0 137.2 135.5 135.4 137.1   879
 880 133.6 140.9 140.6 146.8 147.4 136.5 129.6                     889
 890             160.8 153.6 150.7 149.5 148.9 145.7 131.6 132.3   899
 900                   171.3 165.5 164.4 161.2 160.0 148.0 141.0   909
 910                         174.3 168.0 170.3 171.6 175.7 177.1   919
 920 180.4 187.7 191.9 190.9 193.6 197.0                           929
 930                                                               939
 940       190.8 189.1 185.4 191.5 201.0 209.9 211.6 214.0 215.1   949
 950 214.6 212.6 211.4 209.1 207.7 209.1 208.8 208.4 206.8 208.9   959
 960 211.8 217.9 229.5 236.5 238.3 237.7 248.9  85.0  60.1 196.3   969
 970 144.3 124.6 115.8 112.0 111.0 107.0 103.0  99.5  93.9  85.3   979
 980  76.3  80.5  92.6                                            989
 990                                                               999
1000                                                              1009
1010                         180.8 186.3 190.0 188.9 182.5 169.5  1019
1020 149.6 124.0 113.4  98.7  85.8  79.7  78.2  80.2  79.2  61.7  1029
1030                                                              1039
1040                                                              1049
1050       158.6 157.7 156.0 160.6 162.5 162.0 158.7 149.3 138.6  1059
1060 120.1                                     202.2 193.9 194.5  1069
1070 196.1 198.8 199.8 195.2 191.1 185.9 178.5 162.3 148.4 140.6  1079
1080 138.1 131.3 125.7 120.8 112.4 107.5 103.6  99.9  96.7  93.7  1089
1090  90.2  96.2  99.7  97.7  95.8  92.7  91.2  87.7  83.1  87.2  1099
1100  91.7  91.5  88.8  88.0  81.3                                 1109
1110             118.1  87.6  79.6  76.4  77.0  72.8  69.9  71.9  1119
1120                         119.4 124.7  67.8  66.3  66.6  1129
1130  80.3  67.3  66.8                           69.2  68.3  1139
1140  66.5  66.4  64.8  62.2  61.4  62.8  64.9  60.2  92.6  73.9  1149
1150                                                              1159
1160                                                              1169
1170                                     99.8 100.8 102.2 105.1  1179
1180 102.3 100.5 109.0 111.7 111.9 112.0 113.9 114.4 115.3 114.3  1189
1190 114.2 112.6 108.6 109.5 108.4 107.4 106.3 103.6 104.9 104.0  1199
1200 104.0 105.0 107.6 110.6 114.2 118.6 122.8 126.8 129.6 131.7  1209
1210 136.0 137.4 145.1 148.3 152.3 151.2 149.5 138.6 134.2 131.3  1219
1220 127.3 122.3 118.5 123.1 121.7 125.0 117.9 114.8 107.4 108.5  1229
1230 105.8 103.5 101.7 106.2 106.3 106.0 110.4 114.7 118.5 120.9  1239
1240 125.4 130.5 136.9 138.5 133.0                                1249
1250                         163.6 162.0 165.4 167.6 172.5        1259
1260 172.1 171.7 175.6 181.0 184.6 184.9                          1269
1270                                                              1279
1280                                                              1289
1290                         164.8 168.7 159.8 162.0 166.3 170.6  1299
1300 174.4 176.3 154.7 156.7 174.0 191.8 204.9 223.5 232.2 238.6  1309
1310 244.6 243.7 235.4 222.7 200.8                     208.1      1319
1320 193.5 189.9 179.4 168.5 162.8                                1329
1330                               248.3 233.7 236.2 244.1        1339
1340 248.8 246.5 243.8 237.1 222.4       250.1 233.6 225.1        1349
1350 219.7 215.1 196.3                                            1359
1360 137.4 123.4 116.9 113.9 112.0 109.9 110.0 111.2 112.7 117.1  1369
1370 121.3 130.1 142.1 155.8 169.9 181.9 183.9 187.9 186.9 180.8  1379
1380 172.0 161.9                                                  1389
1390                         179.3 178.1 178.1 179.1 180.8        1399
1400 182.8 185.8 186.1 186.0 183.5 177.9 172.3 158.7 154.5 140.6  1409
1410 128.8 123.6 116.4 113.7 110.6 108.0 106.1 102.7  99.4 107.6  1419
```

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1420                                                                126.6  1429
1430 127.7 131.2 135.3 139.4 147.9                                         1439
1440                                                          206.3 196.5  1449
1450 194.7 175.7 166.7 171.2 175.9 167.5 158.3 143.8 123.2               1459
1460                                                  121.6 119.3 116.8  1469
1470 116.3 116.8 118.5 120.7 123.1 125.0 124.9 119.9 119.5               1479
1480                                                  135.3 123.6 124.8  1489
1490 125.3 122.8 117.5 112.4                                             1499
1500 103.9 103.5  97.5  94.0  94.1  98.9 103.7                           1509
1510                        79.4  84.3  81.7  83.5 100.7 106.4           1519
1520 106.2                                                               1529
1530                                                                     1539
1540                                    115.5 121.5 121.6 122.0          1549
1550 124.0 127.1 129.9 130.3 139.5 142.3 146.6 151.0 158.1 162.4         1559
1560 167.1 174.6 181.6 189.7 199.0 209.1 220.7 228.6 233.7 236.7         1569
1570 232.6 228.5 221.8 211.3 199.4 189.6 176.9 166.8 160.2 153.6         1579
1580 147.6 148.1 149.4             173.4 130.6 122.3 123.6 126.4         1589
1590 127.5 128.1 130.1 131.0 130.3 129.0 129.0 128.8 129.4 130.2         1599
1600 131.0 133.0 137.0 142.9 148.3 152.8 158.2 164.6 170.2 176.3         1609
1610 179.8 182.9 188.8 192.1 197.6 202.0 205.2 204.3 200.5 195.1         1619
1620 187.2                                                    185.6 174.4  1629
1630 170.7 163.8 152.2 143.5 138.0 136.7 136.8 136.5 132.8 127.8         1639
1640 121.3 117.0 114.2 111.4 107.4 107.7 115.0 113.3 114.6               1649
1650             115.0  86.2  86.0  83.5  85.8 106.5 107.8 100.9         1659
1660 112.0 111.7                                                         1669
1670                                                                     1679
1680                                                  168.0 176.3 183.0  1689
1690 174.1 159.8 138.4 118.9 101.5  86.3  81.9  79.5  78.6  79.0         1699
1700  81.0  84.5  85.9                                                   1709
1710                                                                     1719
1720                                                          137.0 131.0  1729
1730 136.6 142.5 146.5 147.9 145.7 136.5 134.5                           1739
1740                   204.4 197.9 201.6 205.1 207.1 209.0 201.2         1749
1750 195.2 191.2 185.4 176.9 164.2 152.7 152.5 155.6 157.0 156.5         1759
1760 151.9 146.0 141.0 136.0 130.4 127.3 125.6 123.4 115.2 110.7         1769
1770 110.3 116.4 119.8 120.0 118.4 117.2 114.0 113.9 110.8 110.2         1779
1780 114.8 114.7 113.7 107.0 102.9 102.3                                 1789
1790       171.5 167.0 167.4 168.6 167.2 167.0 159.2 140.4               1799
1800                   134.1 121.8 115.4 110.1 106.1 102.1  97.0         1809
1810                                    109.2 106.4 103.7 101.4          1819
1820 100.0  99.2  98.8  97.5  97.5  99.6 100.2 102.1 106.4 106.4         1829
1830 107.9 109.8 109.9 105.6 106.3 103.7  99.7  98.6  99.0  97.6         1839
1840  96.1  94.5  91.6  88.0  82.1  75.0  71.8  73.8  75.9  72.8         1849
1850  67.4  62.7                                                       1859
1860                                                                     1869
1870                                                                     1879
1880                                    200.8 205.3 214.1 220.0          1889
1890 220.6 214.5 197.8 188.5 169.5                          183.3        1899
1900 175.8 158.3 137.6 129.8 127.7 126.8 121.5 117.2 111.2 106.6         1909
1910 105.2 103.3 101.7  98.0  95.0  96.1  92.9  90.8  86.3  80.7         1919
1920  69.0  61.2                                                       1929
1930                                                                     1939
1940                                    130.4 128.2 123.9 205.7          1949
1950 200.6 198.4 193.2 182.6 173.7 149.6 150.6 144.2 135.9 130.0         1959
1960 127.9 127.5 131.0 137.9 140.2 143.8 143.7 145.0 134.8 130.0         1969
1970                                                                     1979
```

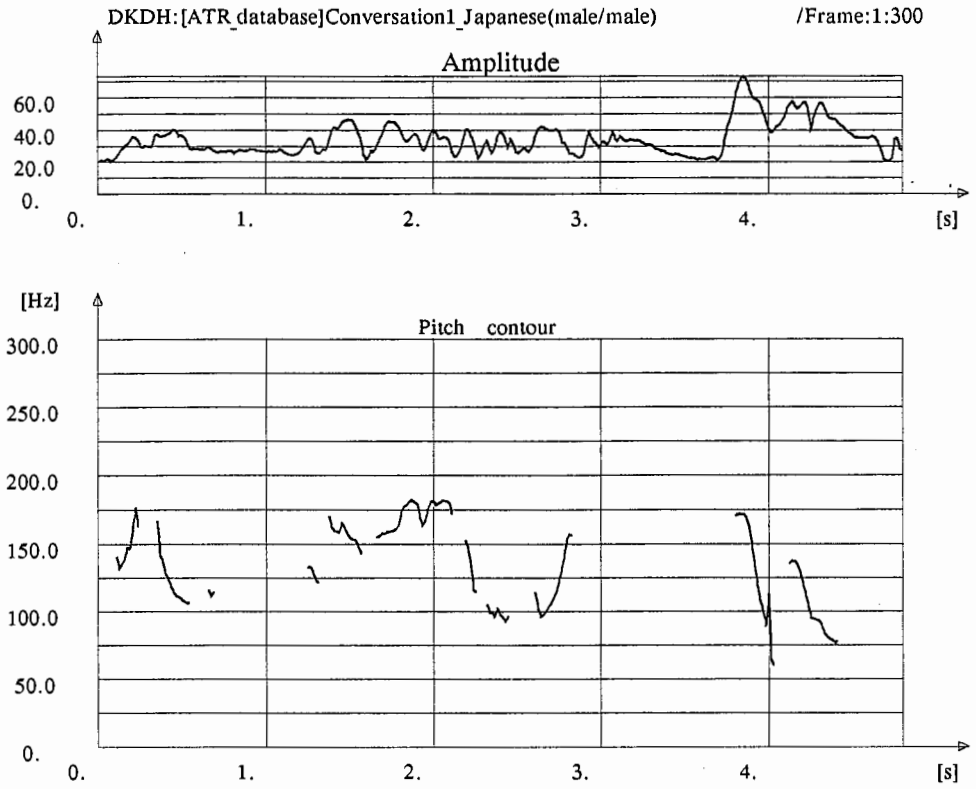

Figure 9 Enlarged pitch contour and amplitude display of the first 300 16-ms frames of conversation 1 (Japanese version), involving the two male speakers **MA** and **HH**.

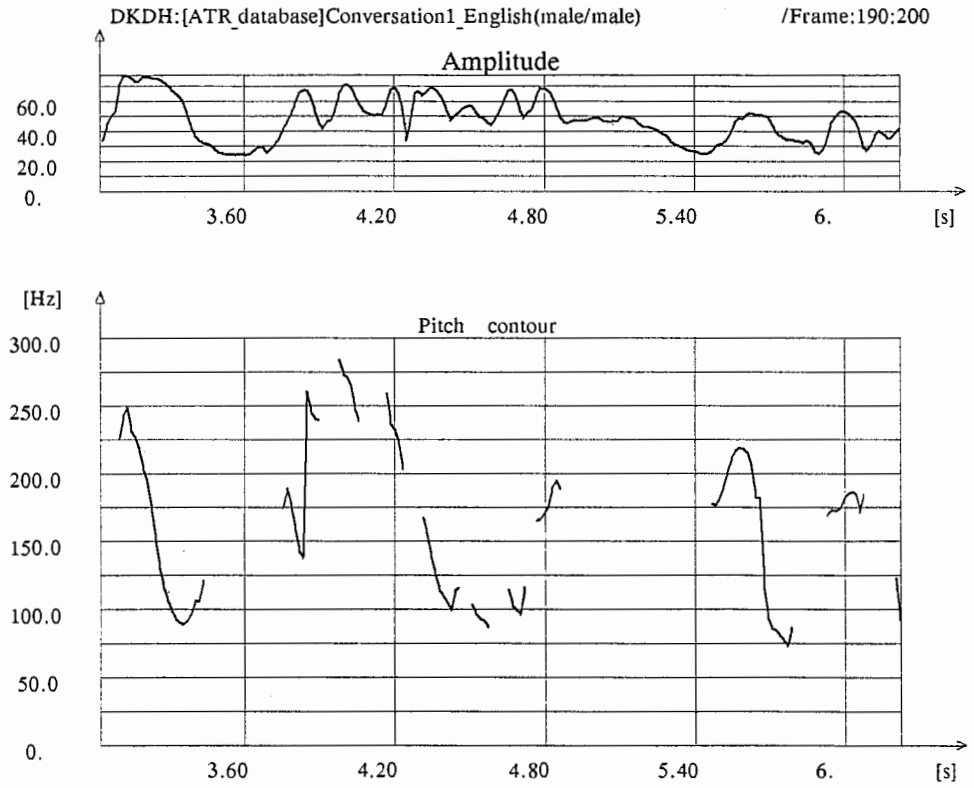

Figure 10 Enlarged pitch contour and amplitude display of the first 200 16-ms frames of conversation_1 (English version), involving the two male speakers **DR** and **EM**.

9. SEGMENTATION AND LABELING

All dialogues in their entire lengths are being segmented by marking turn boundaries, pauses and inhalation breaks. Individual turns are marked by indicating the speaker label and the sequence number of his or her turn within the respective dialogue (e.g. **HH3** to denote the third turn of speaker **HH**). Pauses are labeled **PPP** and inhalation periods **IH**. False starts, hesitations, repairs, and non-speech sounds (vocalizations) are marked separately.

All labels are written in technical notation in order to facilitate computer handling and storage. Labeling is done manually at 16-ms intervals using the MANPIT program in the SAP signal analysis package. Labels are stored in the signal analysis file (position 58) together with the LPC-coefficients, pitch estimates, etc (compare chapters 7 and 8). Separate listings of the framewise labels for conversation_1 (both Japanese and English version) are exemplified on the following pages. Figures 11 to 14 display the segmentated and labeled pitch contours introduced earlier in chapter 8.

It must be appreciated in this context that MANPIT also supplies the tools for narrow phonetic classification and labeling in the phoneme, allophone and acoustic event domains as well as facilities for automatic conversion between various levels of linguistic analysis (cf. Hedelin & Huber 1990c).

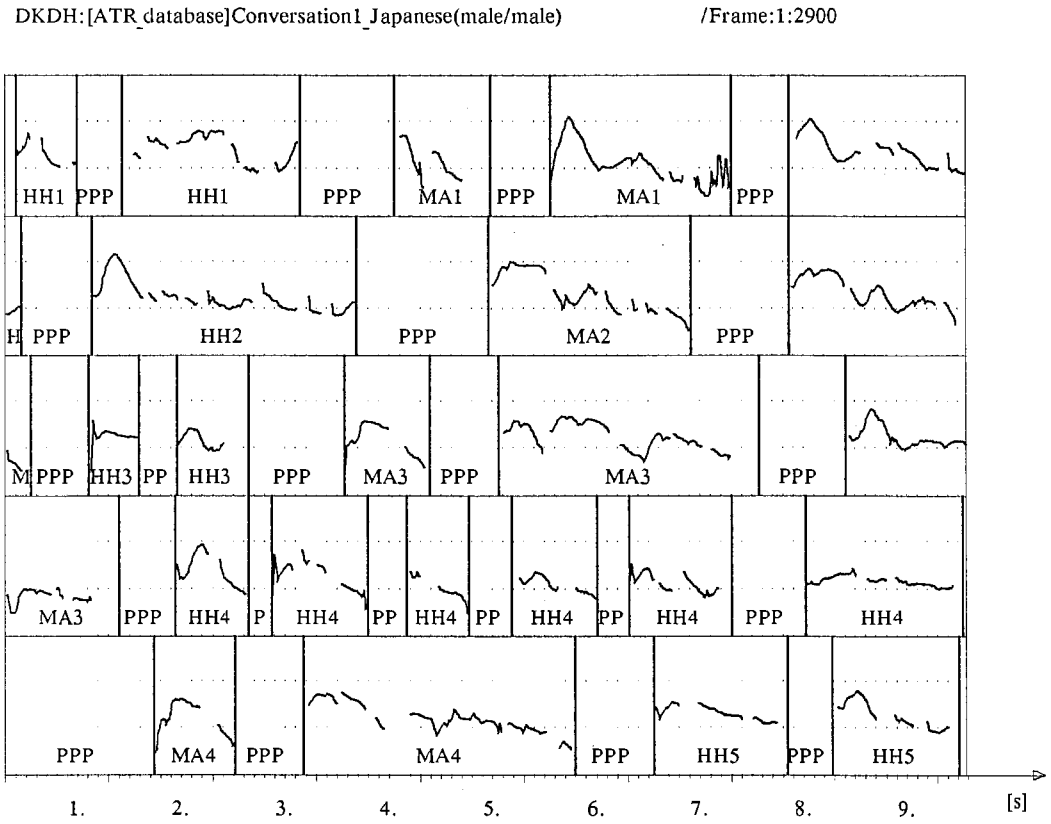

Figure 11 Segmented and labeled pitch contour of conversation_1 (Japanese version), involving the two male speakers **MA** and **HH**.

```
*** Task LSTPIT ***                                    4-FEB-91
=,DKDH:[DIETER.TEXT]D4.COF;1 /Frame:1:2900
    1 -     -     -     -     -     -     HH1   HH1   HH1   HH1    10
   11 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1    20
   21 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1    30
   31 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1    40
   41 HH1   HH1   HH1   PPP   PPP   PPP   PPP   PPP   PPP   PPP    50
   51 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP    60
   61 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP    70
   71 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1    80
   81 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1    90
   91 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   100
  101 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   110
  111 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   120
  121 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   130
  131 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   140
  141 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   150
  151 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   160
  161 HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   HH1   170
  171 HH1   HH1   HH1   HH1   HH1   HH1   HH1   PPP   PPP   PPP   180
  181 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   190
  191 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   200
  201 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   210
  211 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   220
  221 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   230
  231 PPP   PPP   PPP   PPP   MA1   MA1   MA1   MA1   MA1   MA1   240
  241 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   250
  251 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   260
  261 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   270
  271 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   280
  281 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   290
  291 MA1   MA1   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   300
  301 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   310
  311 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   320
  321 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   MA1   MA1   330
  331 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   340
  341 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   350
  351 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   360
  361 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   370
  371 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   380
  381 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   390
  391 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   400
  401 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   410
  411 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   420
  421 MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   MA1   430
  431 MA1   MA1   MA1   MA1   MA1   MA1   MA1   PPP   PPP   PPP   440
  441 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   450
  451 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   460
  461 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   470
  471 PPP   PPP   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   480
  481 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   490
  491 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   500
  501 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   510
  511 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   520
  521 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   530
  531 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   540
  541 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   550
  551 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   560
  561 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   570
  571 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   580
  581 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   PPP   590
  591 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   600
  601 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   610
  611 PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   PPP   620
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  631 PPP   PPP   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   640
  641 HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   HH2   650
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651	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	660
661	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	670
671	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	680
681	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	690
691	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	700
701	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	710
711	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	720
721	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	730
731	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	740
741	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	750
751	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	760
761	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	770
771	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	780
781	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	HH2	790
791	HH2	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	800
801	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	810
811	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	820
821	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	830
831	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	840
841	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	850
851	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	860
861	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	870
871	PPP	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	880
881	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	890
891	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	900
901	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	910
911	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	920
921	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	930
931	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	940
941	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	950
951	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	960
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971	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	980
981	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	990
991	MA2	MA2	MA2	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1000
1001	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1010
1011	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1020
1021	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1030
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1041	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1050
1051	PPP	PPP	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1060
1061	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1070
1071	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1080
1081	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1090
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1101	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1110
1111	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1120
1121	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1130
1131	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1140
1141	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1150
1151	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1160
1161	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	MA2	1170
1171	MA2	MA2	MA2	MA2	MA2	PPP	PPP	PPP	PPP	PPP	1180
1181	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1190
1191	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1200
1201	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1210
1211	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	1220
1221	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	1230
1231	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	1240
1241	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1250
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1261	PPP	PPP	PPP	HH3	HH3	HH3	HH3	HH3	HH3	HH3	1270
1271	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	1280
1281	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	1290
1291	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	HH3	1300
1301	HH3	HH3	HH3	HH3	HH3	HH3	PPP	PPP	PPP	PPP	1310
1311	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1320

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1981 PPP HH4 HH4 HH4 HH4 HH4 HH4 HH4 HH4 HH4 1990

1991	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2000
2001	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2010
2011	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	PPP	2020
2021	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2030
2031	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2040
2041	PPP	PPP	PPP	PPP	PPP	HH4	HH4	HH4	HH4	HH4	2050
2051	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2060
2061	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2070
2071	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2080
2081	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2090
2091	HH4	HH4	HH4	HH4	HH4	HH4	PPP	PPP	PPP	PPP	2100
2101	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2110
2111	PPP	PPP	PPP	PPP	PPP	HH4	HH4	HH4	HH4	HH4	2120
2121	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2130
2131	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2140
2141	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2150
2151	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2160
2161	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2170
2171	HH4	HH4	HH4	HH4	HH4	HH4	HH4	PPP	PPP	PPP	2180
2181	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2190
2191	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2200
2201	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2210
2211	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2220
2221	PPP	PPP	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2230
2231	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2240
2241	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2250
2251	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2260
2261	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2270
2271	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2280
2281	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2290
2291	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2300
2301	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	HH4	2310
2311	HH4	HH4	HH4	HH4	HH4	HH4	HH4	PPP	PPP	PPP	2320
2321	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2330
2331	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2340
2341	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2350
2351	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2360
2361	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2370
2371	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2380
2381	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2390
2391	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2400
2401	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	MA4	2410
2411	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2420
2421	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2430
2431	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2440
2441	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2450
2451	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	PPP	PPP	2460
2461	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2470
2471	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2480
2481	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2490
2491	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	MA4	2500
2501	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2510
2511	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2520
2521	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2530
2531	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2540
2541	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2550
2551	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2560
2561	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2570
2571	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2580
2581	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2590
2591	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2600
2601	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2610
2611	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2620
2621	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2630
2631	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2640
2641	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2650
2651	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	MA4	2660

2661	MA4	MA4	MA4	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2670
2671	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2680
2681	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2690
2691	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2700
2701	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2710
2711	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2720
2721	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2730
2731	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2740
2741	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2750
2751	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2760
2761	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2770
2771	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2780
2781	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2790
2791	HH5	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2800
2801	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	2810
2811	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	HH5	HH5	2820
2821	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2830
2831	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2840
2841	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2850
2851	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2860
2861	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2870
2871	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2880
2881	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	HH5	2890
2891	HH5	HH5	HH5	HH5	HH5	–	–	–	–	–	2900

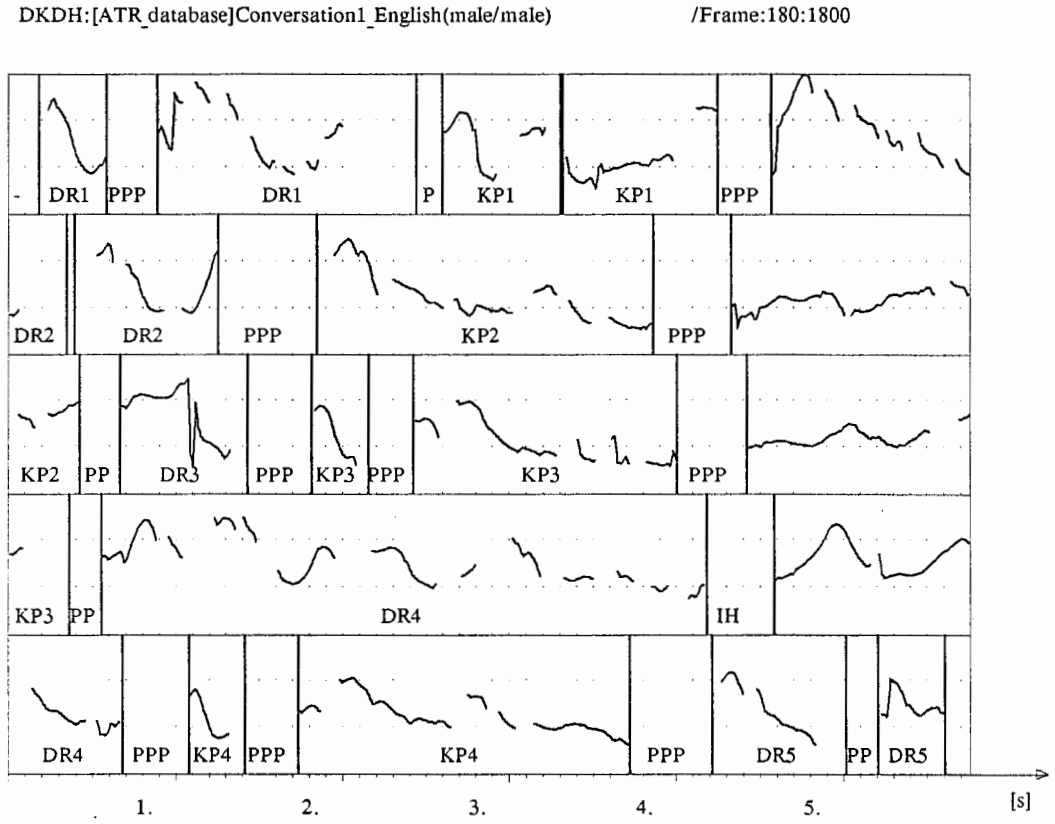

Figure 12 Segmented and labeled pitch contour of conversation 1 (English version), involving the two male speakers **DR** and **EM**.

=,DKDH:[DIETER.TEXT]D1.COF;1 /Frame:180:1800

180	-	-	-	-	-	-	-	-	-	-	189
190	-	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	199
200	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	209
210	DR1	DR1	DR1	DR1	DR1	DR1	PPP	PPP	PPP	PPP	219
220	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	229
230	PPP	PPP	PPP	PPP	PPP	DR1	DR1	DR1	DR1	DR1	239
240	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	249
250	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	259
260	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	269
270	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	279
280	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	289
290	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	299
300	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	309
310	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	319
320	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	DR1	329
330	DR1	DR1	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	339
340	PPP	PPP	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	349
350	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	359
360	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	369
370	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	379
380	KP1	KP1	KP1	KP1	KP1	KP1	KEL1	KP1	KP1	KP1	389
390	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	399
400	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	409
410	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	419
420	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	429
430	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	KP1	439
440	KP1	KP1	KP1	KP1	KP1	PPP	PPP	PPP	PPP	PPP	449
450	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	459
460	PPP	PPP	PPP	PPP	PPP	DR2	DR2	DR2	DR2	DR2	469
470	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	479
480	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	489
490	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	499
500	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	509
510	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	519
520	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	529
530	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	539
540	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	549
550	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	559
560	DR2	PPP	PPP	PPP	DR2	DR2	DR2	DR2	DR2	DR2	569
570	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	579
580	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	589
590	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	599
600	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	609
610	DR2	DR2	DR2	DR2	DR2	DR2	DR2	DR2	PPP	PPP	619
620	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	629
630	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	639
640	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	649
650	PPP	PPP	PPP	PPP	PPP	KP2	KP2	KP2	KP2	KP2	659
660	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	669
670	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	679
680	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	689
690	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	699
700	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	709
710	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	719
720	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	729
730	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	739
740	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	749
750	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	759
760	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	769
770	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	779
780	KP2	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	789

790	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	799
800	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	809
810	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	819
820	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	829
830	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	839
840	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	849
850	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	859
860	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	869
870	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	879
880	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	889
890	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	899
900	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	909
910	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	KP2	919
920	KP2	KP2	KP2	KP2	KP2	KP2	PPP	PPP	PPP	PPP	929
930	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	939
940	PPP	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	949
950	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	959
960	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	969
970	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	979
980	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	DR3	PPP	989
990	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	999
1000	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1009
1010	PPP	PPP	PPP	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1019
1020	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1029
1030	KP3	KP3	KP3	KP3	PPP	PPP	PPP	PPP	PPP	PPP	1039
1040	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1049
1050	PPP	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1059
1060	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1069
1070	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1079
1080	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1089
1090	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1099
1100	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1109
1110	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1119
1120	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1129
1130	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1139
1140	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1149
1150	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1159
1160	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1169
1170	PPP	PPP	PPP	PPP	PPP	PPP	KP3	KP3	KP3	KP3	1179
1180	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1189
1190	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1199
1200	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1209
1210	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1219
1220	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1229
1230	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1239
1240	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1249
1250	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1259
1260	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1269
1270	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	KP3	1279
1280	KP3	KP3	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1289
1290	PPP	PPP	PPP	PPP	DR4	DR4	DR4	DR4	DR4	DR4	1299
1300	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1309
1310	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1319
1320	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1329
1330	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1339
1340	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1349
1350	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1359
1360	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1369
1370	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1379
1380	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1389
1390	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1399
1400	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1409
1410	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1419

1420	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1429
1430	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1439
1440	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1449
1450	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1459
1460	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1469
1470	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1479
1480	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1489
1490	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1499
1500	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1509
1510	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1519
1520	DR4	IH	IH	IH	IH	IH	IH	IH	IH	IH	1529
1530	IH	IH	IH	IH	IH	IH	IH	IH	IH	IH	1539
1540	IH	IH	IH	IH	IH	IH	DR4	DR4	DR4	DR4	1549
1550	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1559
1560	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1569
1570	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1579
1580	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1589
1590	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1599
1600	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1609
1610	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1619
1620	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1629
1630	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1639
1640	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1649
1650	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	DR4	1659
1660	DR4	DR4	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1669
1670	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1679
1680	PPP	PPP	PPP	PPP	PPP	PPP	PPP	KP4	KP4	KP4	1689
1690	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1699
1700	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	PPP	PPP	1709
1710	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1719
1720	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	KP4	KP4	1729
1730	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1739
1740	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1749
1750	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1759
1760	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1769
1770	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1779
1780	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1789
1790	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1799
1800	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1809
1810	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1819
1820	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1829
1830	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1839
1840	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	KP4	1849
1850	KP4	KP4	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1859
1860	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1869
1870	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1879
1880	PPP	PPP	PPP	DR5	DR5	DR5	DR5	DR5	DR5	DR5	1889
1890	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	1899
1900	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	1909
1910	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	1919
1920	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	1929
1930	DR5	DR5	DR5	PPP	PPP	PPP	PPP	PPP	PPP	PPP	1939
1940	PPP	PPP	PPP	PPP	PPP	DR5	DR5	DR5	DR5	DR5	1949
1950	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	1959
1960	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	DR5	1969
1970	–	–	–	–	–	–	–	–	–	–	1979

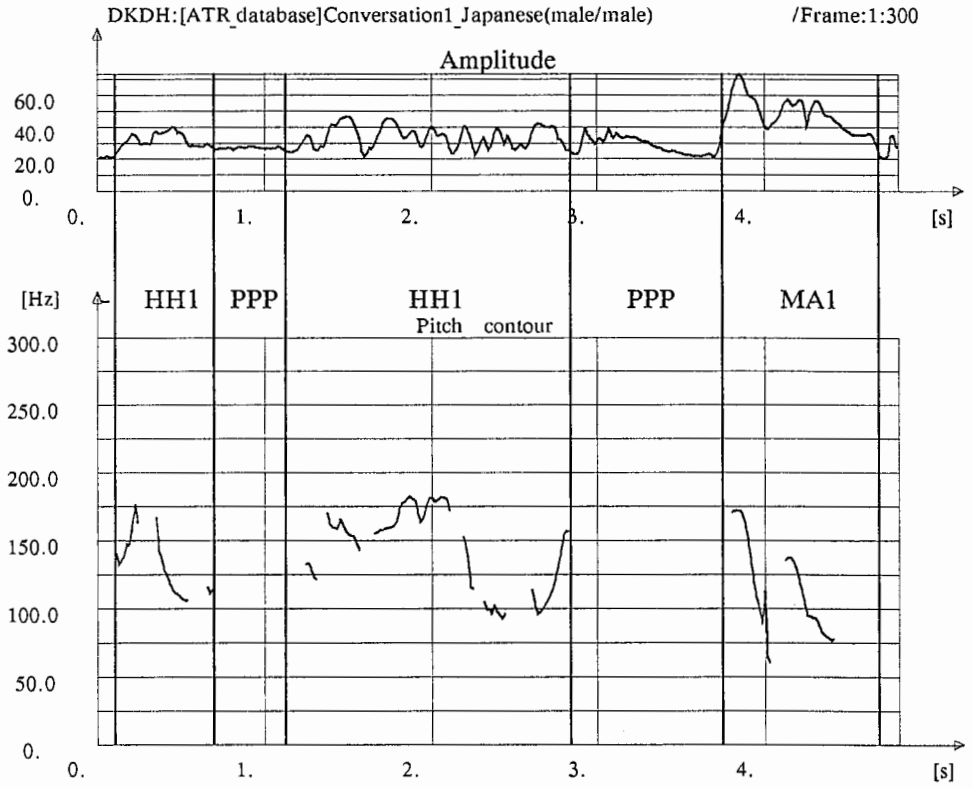

Figure 13 Segmented and labeled pitch contour and amplitude display of the first 300 16-ms frames of conversation 1 (Japanese version), involving the two male speakers **MA** and **HH**.

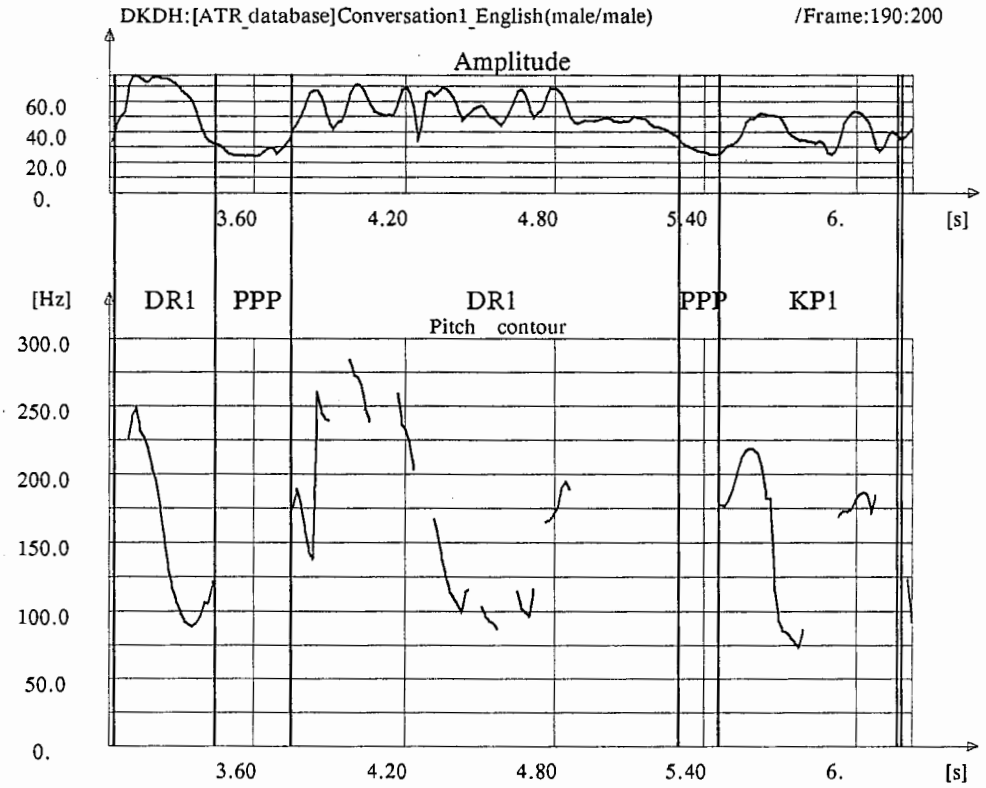

Figure 14 Segmented and labeled pitch contour and amplitude display of the first 200 16-ms frames of conversation_1 (English version), involving the two male speakers **DR** and **EM**.

10. DATA STORAGE AND TRANSFER

All analysis data are stored in a separate data file running parallel to the sampled speech signal file. This data file is organized in terms of a HEADER followed by an array of RECORDS.

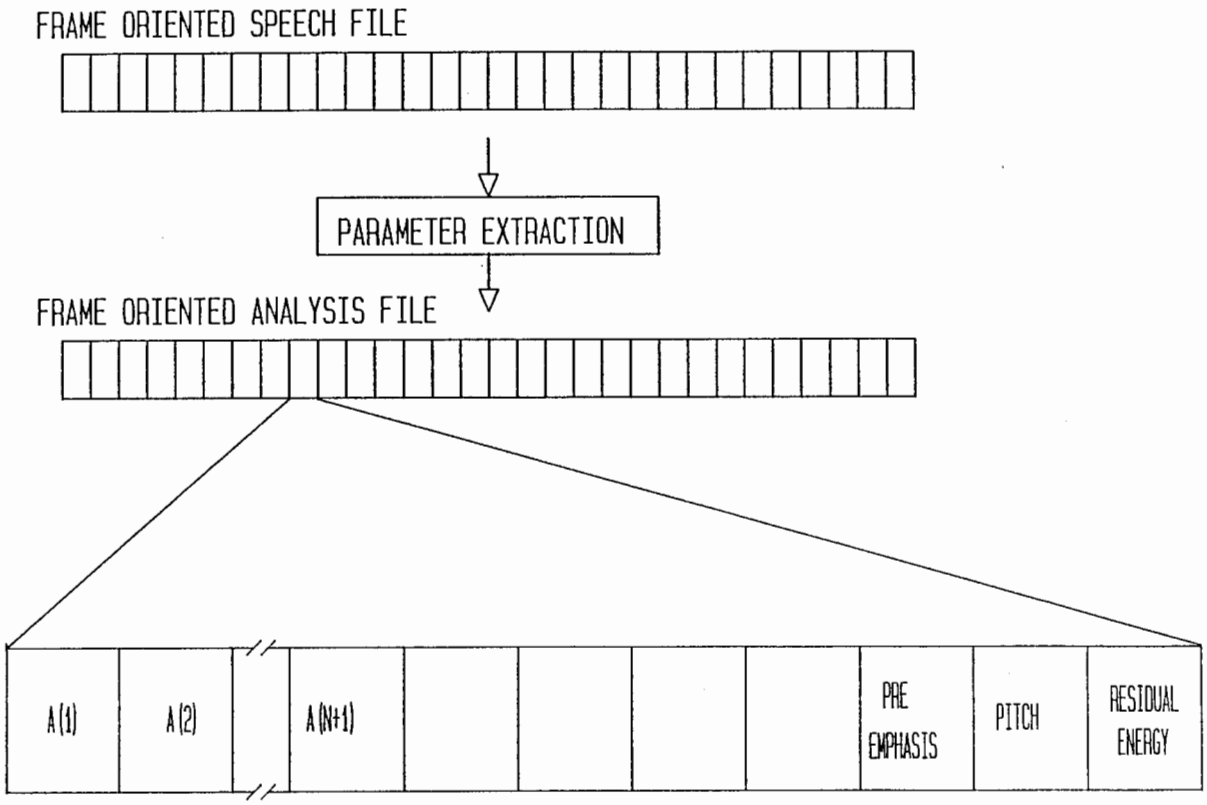

Figure 15 Data storage and file organisation

The HEADER is defined by the first 256 (16-bit) words of the file, which describe

(1) the file address;

(2) the order m of the a-parameters;

(3) the pre-emphasis p (adaptive pre-emphasis is signaled by HEADER(4) = -32768);

(4) the analysis frame size.

Each RECORD corresponds to one frame of signal analysis data and describes essentially a source-filter model of speech representation. Thus, one record of analysis data consists of an array or N variables, which are organized as follows:

(1) the first 17 variables represent the 16 a-parameters of the LPC-analysis (with an initial identification label);

(2) the last variable N states the prediction error (residual energy);

(3) the pitch value F_0 is listed in the second last position of the record N-1, stated in Hertz (Hz);

(4) the adaptive (time-varying) pre-emphasis is listed at position N-2 in the record;

(5) transcription labels are listed in position N-6 in the record;

(6) optionally, a formant area starts at position N-10, with N-10 stating the number of formants listed for the present frame, N-11 the center frequency of the first formant F_1, N-12 the bandwidth of the first formant B_1, position N-13 the center frequency of the second formant F_2, etc.

One complete RECORD of analysis data from the onset of conversation_1 (Japanese version) is listed on the following pages for illustration purposes.

As can be seen in these listings, each record includes a considerable number of empty positions (marked as 0.00000 in the listings) which can be used for simultaneous storage of additional parameters derived from extended signal analyses and/or further phonetic-linguistic-prosodic labeling.

DK21:[ATR.DATABASE] CONVERSATION1_JAPANESE(MALE/MALE).COF;1

10	1	1.00000	0.72220
10	2	-0.72220	0.40276
10	3	-0.14197	0.37530
10	4	-0.14721	0.18930
10	5	0.06916	-0.08709
10	6	0.24216	0.07437
10	7	-0.11968	0.30344
10	8	-0.27696	0.13631
10	9	0.05177	0.06360
10	10	0.08329	0.16368
10	11	-0.03807	-0.09311
10	12	0.20481	-0.18113
10	13	0.07027	-0.01808
10	14	-0.10603	-0.06747
10	15	0.04384	-0.06255
10	16	-0.02643	0.00589
10	17	-0.01657	0.00000
10	18	0.00000	0.00000
10	19	0.00000	0.00000
10	20	0.00000	0.00000
10	21	0.00000	0.00000
10	22	0.00000	0.00000
10	23	0.00000	0.00000
10	24	0.00000	0.00000
10	25	0.00000	0.00000
10	26	0.00000	0.00000
10	27	0.00000	0.00000
10	28	0.00000	0.00000
10	29	0.00000	0.00000
10	30	0.00000	0.00000
10	31	0.00000	0.00000
10	32	0.00000	0.00000
10	33	0.00000	0.00000
10	34	0.00000	0.00000
10	35	0.00000	0.00000
10	36	0.00000	0.00000
10	37	0.00000	0.00000
10	38	0.00000	0.00000
10	39	0.00000	0.00000
10	40	0.00000	0.00000
10	41	0.00000	0.00000
10	42	0.00000	0.00000
10	43	0.00000	0.00000
10	44	0.00000	0.00000
10	45	0.00000	0.00000
10	46	0.00000	0.00000
10	47	0.00000	0.00000
10	48	0.00000	0.00000
10	49	0.00000	0.00000
10	50	0.00000	0.00000
10	51	0.00000	0.00000
10	52	0.00000	0.00000
10	53	0.00000	0.00000
10	54	0.00000	0.00000
10	55	1.00000	0.00000
10	56	16.00000	0.00000
10	57	0.00000	0.00000
10	58	51232.19141	0.00000
10	59	0.00000	0.00000
10	60	0.00000	0.00000
10	61	1.00000	0.00000

10	62	0.91460	0.00000
10	63	138.76981	0.00000
10	64	110693.74219	0.00000
11	1	1.00000	1.07926
11	2	-1.07926	0.60904
11	3	-0.02664	0.42152
11	4	0.02627	0.05444
11	5	0.28779	-0.26311
11	6	0.24833	-0.09931
11	7	-0.24499	0.18809
11	8	-0.34321	0.03955
11	9	0.17693	0.01561
11	10	0.12369	0.07454
11	11	0.00166	0.00459
11	12	-0.00957	-0.14577
11	13	0.05148	-0.01168
11	14	-0.12272	-0.06900
11	15	0.09884	0.08233
11	16	-0.16463	-0.00215
11	17	0.12738	0.00000
11	18	0.00000	0.00000
11	19	0.00000	0.00000
11	20	0.00000	0.00000
11	21	0.00000	0.00000
11	22	0.00000	0.00000
11	23	0.00000	0.00000
11	24	0.00000	0.00000
11	25	0.00000	0.00000
11	26	0.00000	0.00000
11	27	0.00000	0.00000
11	28	0.00000	0.00000
11	29	0.00000	0.00000
11	30	0.00000	0.00000
11	31	0.00000	0.00000
11	32	0.00000	0.00000
11	33	0.00000	0.00000
11	34	0.00000	0.00000
11	35	0.00000	0.00000
11	36	0.00000	0.00000
11	37	0.00000	0.00000
11	38	0.00000	0.00000
11	39	0.00000	0.00000
11	40	0.00000	0.00000
11	41	0.00000	0.00000
11	42	0.00000	0.00000
11	43	0.00000	0.00000
11	44	0.00000	0.00000
11	45	0.00000	0.00000
11	46	0.00000	0.00000
11	47	0.00000	0.00000
11	48	0.00000	0.00000
11	49	0.00000	0.00000
11	50	0.00000	0.00000
11	51	0.00000	0.00000
11	52	0.00000	0.00000
11	53	0.00000	0.00000
11	54	0.00000	0.00000
11	55	1.00000	0.00000
11	56	16.00000	0.00000
11	57	0.00000	0.00000
11	58	51232.19141	0.00000
11	59	0.00000	0.00000

11	60	0.00000	0.00000
11	61	1.00000	0.00000
11	62	0.91019	0.00000
11	63	147.81116	0.00000
11	64	146934.48438	0.00000

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