Prosodic Features at "Sentence Boundaries" in Oral Presentations*

Atsuko Furuta UMESAKI (Tezukayama University)

<Contents>

<Abstact>

Prosodic Features at "Sentence Boundaries" in Oral Presentations

Atsuko Furuta UMESAKI

It is generally said that falling intonation is used at the end of a declarative sentence. However, this is not the case with all stretches of spontaneous speech which are marked in transcription as sentences. The present paper examines intonation patterns appearing at the end of declarative sentences in oral presentations, and discusses instances where falling intonation does not appear. The texts used for analysis are eight oral presentations collected at international conferences in the field of physics. Quantitative and qualitative analyses are carried out. Three major factors related to discourse structure have been found for non-occurrence of falling intonation at sentence boundaries.

1. Intoduction

It is difficult to give a full account of the relationship between the role of intonation in speech and that of punctuation in written texts. Punctuation can indicate syntactic chunks in writing just as intonation can in speech. It is commonly accepted

* This paper was presented at SICOPS 2000.

that a falling tone is associated with statements whereas a rising tone occurs with questions, as 'He is coming today.' and 'He is coming today? / Is he coming today?' With regard to significance of tone patterns. Quirk *et al.* (1985. p.1599) suggest that the falling tone communicates an impression of completeness whereas the rising tone suggests incompleteness. However, Knowles (1987. pp.186-187), considering an informal conversational style, points out that some of the units which would be marked off with full stops end with a rise apparently marking a 'non-final' item, while the apparently 'final' fall comes in the middle.[1] Quirk *et al.* (ibid. p.1611) show that punctuation practice is linked to prosodic features but that the link is neither simple nor systematic. Thus although both punctuation and intonation can play the same role, they do not necessarily correspond exactly.

In order to give a clearer account of the relationship between tone patterns and punctuation, the present paper examines pitch movement at the end of stretches of spontaneous speech which are marked in transcription as sentences. Quantitative analysis is applied to eight oral presentations recorded at international conferences in the field of physics and transcribed by the present author with proofreading by two of the speakers. Instances where falling intonation does not appear are extracted from the eight oral presentations to find factors affecting the appearance of other patterns than falling tone.

2. Analysis

2.1 Texts

Spoken texts used for this analysis are eight oral presentations at international conferences on glass materials by four British (including one female) and four American physicists, referred to here as British 1, American 1 and so on according to the numbering in my previous studies. They were transcribed by the present author

1) An example given in his book is as follows:
WHEN i was |↑FIRST called up, we were VEry ↓COLD. it was in ↓FEbruary. i think i went to ↓MARgate at ↑FIRST. VEry ↓COLD there, marching up and down the ↑PROM. and i had TErrible ↓neuRALgia, because it was so ↑COLD. so i HAD to have ↓TABlets for |↑THAT.
(an intelligent and articulate woman talking in an informal conversational style/ after removing the pause fillers and false starts)

with the help of native speakers of English in the field of material science. The transcripts were later checked by either British 1 or British 3, who were asked to pay special attention to the position of periods.

<Table 1> Texts for Analysis

(Umesaki, 2000)

Text	Conference	Title	Text Length Total 41,380 words
British 1 male 40s [C1]	4th International Conference on Non-crystalline Materials (held in USA in 1988)	Neutron and X-ray Amorphography	Spoken : 4,277 words (26mins 55secs)
British 2 male 50s [C1]	same as above	The Environment of Ca Ions in Silicate Glasses	Spoken 2,882 words (19mins 41secs)
British 3 male 30s [C3]	7th International Conference on the Physics of Non-crystalline Solids (held in UK in 1991)	Inelastic Neutron Scattering Studies of the Vibrational Modes of Vitreous B_2O_3	Spoken: 1,614 wds (11mins 13secs)
British 4 female 40s [C1]	16th International Congress on Glass (held in Spain in 1992)	Thermal Expansion Control in Metal-cored Glass-ceramic Substrates	Spoken: 1,809 words (13mins 20secs)
American 1 male 50s [C1]	7th International Conference on the Physics of Non-crystalline Solids (held in UK in 1991)	X-ray Induced Electron Spin Resonance and 1.5-3.5 eV Luminescence in Vitreous SiO_2: Effects of Fictive Temperature and Hydroxyl Concentration	Spoken: 3,740 words (28mins 1secs)
American 3 male 50s [C3]	2nd International Conference on Borate Glasses, Crystals & Melts (held in UK in 1996)	Ab initio based studies of borate glasses	Spoken: 6,013 words (39mins 15secs)
American 5 male 30s [C1]	same as above	High Resolution NMR Studies of Borate Glass Structure	Spoken: 5,676 words (38mins 16secs)
American 6 male 70s [C1]	same as above	NMR and NQR Studies of Borates and Borides	Spoken: 8,224 words (58mins 58secs)

[C1] :Transcript checked by British 1. [C3] : Transcript checked by British 3.

As Americans 3, 5 and 6 presented longer texts, the first 3,160, 2,531 and 2,761 words respectively were used for the present analysis.

2.2. Analysis

Quantitative data were collected in the following way. Firstly, sentence finals, that is, syntactic boundaries marked with periods, question marks and exclamation marks, together with possible sentence finals, (i.e. boundaries which can syntactically be regarded as sentence finals but are without sentence-final punctuation marks,) were identified and numbered in order of appearance, as shown in (1). Secondly, types of punctuation marks, tone patterns, relative intensity, relative length of pause and words appearing after the boundary were examined at sentence finals and possible sentence finals, and the frequency of occurrences were calculated. A sample list is given in (2).

(1) Third range is the intermediate range order, which is characterised in terms of the ring statistics.[23] I think Linn Hobbs is going to talk a bit more about his idea of topological clusters, which is basically the cluster of shortest pair rings around any particular unit.[24] And then finally long range order, which of course is absent but there are still fluctuations in density at long range due to things like phase separation.[25] This is mainly in the region of small angle scattering.[26] And I'm not today saying anything about that.[27]

(2) Those are the sort of parameters we are interested in.[28] What we actually get from a diffraction experiment....[29] We don't get that, of course,[30] what we get in the diffraction experiment, is a series of correlation functions.[31]

boundary no.	A punctuation	B tone pattern	C intensity	D pause
23	11	2	1	1
24	11	2	1	1
25	11	2h	1	1
26	11	4	1	1
27	11	1	1	2
28	11	4	0	1
29	29	4	1	1
30	21	4	1	1
31	11	2h	1	2

In the column for punctuation, 11 refers to a period, 12 a question mark, 13 an exclamation mark; 20 no punctuation mark, 21 a comma, 22 a semi-colon, 23 a colon,

24 a parenthesis, 25 other, 29 incomplete sentence marked with four dots (....).

The following exemplifies forms of transcription. The sentence 'He works hard, and enjoys his life.' cannot be divided into two sentences, but if it were, 'He works hard and he enjoys his life.' three forms of transcription are possible: 'He works hard. And he enjoys his life.'; 'He works hard and he enjoys his life.'; and 'He works hard, and he enjoys his life.' If the actual transcript takes the first form, it is marked as 11; if it takes the second form, it is marked as 20; if the third, 21.

For the analysis, four major tone patterns were applied. They are 'falling tone' (indicated as 1), 'level tone' (indicated as 2), 'fall-rise tone' (indicated as 3) and 'rising tone' (indicated as 4), If the 'level tone' appears at high pitch, it is referred to as 2h. Relative intensity was recorded as 0 (with no stress), 1 (with stress), 2 (with greater stress), and 9 (almost indetectible). Relative length of pause was also listed as 0 (no pause), 1 (normal length), 2 (longer than normal), 3 (far longer than normal) and 9 (end of speech). To examine the relationship between the spoken and transcribed versions, analysis was carried out by the use of the frequencies of these five tone patterns.

3. Results

As shown in Table 2 h), 71.5%-85.5% of all syntactically possible positions of sentence boundaries have sentence final marks, i.e. periods, question marks or exclamation marks. This indicates that punctuation marks do not necessarily correspond with syntactic boundaries. Table 3 h) shows that 51.8-93.5% of all sentence finals with periods end with a falling tone. This result indicates that declarative sentences do not necessarily end with a falling tone.

Table 4 j) and u) show that in all eight presentations, falling tones appear more frequently at syntactic boundaries with sentence-final punctuation marks than at possible sentence boundaries without sentence-final punctuation marks. Table 5 h) and r) show that in all eight presentations, pauses, especially longer pauses, appear more often at sentence finals than at possible sentence finals. These results suggest that although falling tones and pauses have some bearing upon sentence-final punctuation marks, there is no one-to-one correspondence with the punctuation marks.

<Table 2> Text Features and Punctuation

	Br1	Br2	Br3	Br4	Am1	Am3	Am5	Am6
a) Total Number of Words	4277	2882	1614	1809	3740	[3160]	[2531]	[2761]
b) Total Minutes spoken	26.9	19.7	11.2	13.3	28.0	20.2	15.9	20.6
c) Words per minute	159	146	144	136	134	156	159	134
d) Words per sentence[a/e]	21.4	26.0	26.0	21.8	22.9	21.2	17.6	17.1
e) Number of sentence finals	200	111	62	83	163	149	143	161
11 period	199	109	62	83	160	140	133	155
12 question mark	1	2	0	0	3	7	10	1
13 exclamation mark	0	0	0	0	0	2	0	5
f) Number of possible-sentence finals	34	27	17	28	44	43	57	45
20 with no punctuation	8	6	6	9	8	2	15	14
21 with comma	16	12	11	18	34	39	39	24
22/23/24/25/29 with other	10	9	0	1	2	2	3	7
g) (e)+(f)	234	138	79	111	207	[192]	[200]	[206]
h) % of sentence finals in (g)	85.5	80.4	78.5	74.8	78.7	78.0	71.5	78.2

<Table 3> Intonation Patterns at Sentence Boundaries with Periods

	Br1	Br2	Br3	Br4	Am1	Am3	Am5	Am6
a) Total periods	199	109	62	83	160	140	133	155
b) Falling tones [1]	103	75	58	56	121	109	101	105
c) Other than falling tones [2+2h+3+4]	96	34	4	27	39	31	32	50
d) level tone [2]	28	10	1	10	15	12	19	11
e) high level tone [2h]	46	2	0	1	4	1	1	1
f) fall-rise tone [3]	5	16	2	6	5	10	9	8
g) rising tone[4]	17	6	1	10	15	8	3	30
h) % of falling tones	51.8	68.8	93.5	67.5	75.6	77.9	75.9	67.7

<Table 4> Tone Patterns at Sentence Boundaries

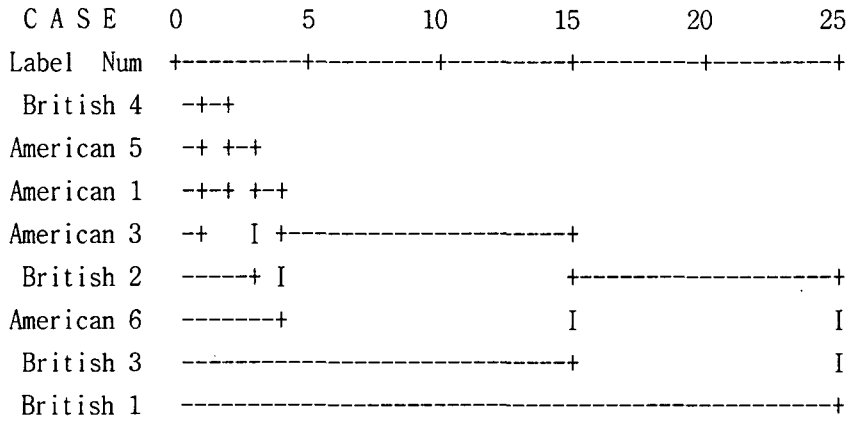
	Br1	Br2	Br3	Br4	Am1	Am3	Am5	Am6
a) sentence finals + non-sentence final	234	138	79	111	207	[192]	[200]	[206]
b) sentence finals	200	111	62	83	163	149	143	161
c) falling tones at sentence final [1]	103	76	58	56	123	117	103	108
d) total tones other than falling [2+2h+3+4]	97	35	4	27	40	32	40	53
e) level tone [2]	29	10	1	10	15	13	19	11
f) high level tone [2h]	46	2	0	1	4	1	1	1
g) fall-rise tone [3]	5	16	2	6	5	10	9	9
h) rising tone[4]	17	7	1	10	16	8	11	32
j) % of total falling tone at sentence final	51.5	68.5	93.5	67.5	75.5	78.5	72.0	67.1
k) possible sentence final	34	27	17	28	44	43	57	45
m)falling tone at possible sentence final [1]	6	8	12	8	11	10	29	17
n) total tones other than falling [2+2h+3+4]	28	19	5	20	33	33	28	28
p) level tone[2]	12	5	1	9	11	19	16	6
q) high level tone [2h]	6	2	0	0	1	0	2	0
r) fall-rise tone [3]	6	5	1	6	10	8	8	11
s) rising tone[4]	4	7	3	5	11	6	2	11
u) % of falling tones at possible s. final	17.6	29.6	70.6	28.6	25.0	23.3	50.9	37.8

<Table 5> Pauses at Sentence Boundaries

	Br1	Br2	Br3	Br4	Am1	Am3	Am5	Am6
a) sentence finals + non-sentence final	234	138	79	111	207	[192]	[200]	[206]
b) sentence finals	200	111	62	83	163	149	143	161
c) no pauses [0]	28	11	0	3	13	9	11	5
d) with pauses [1+2+3]	172	100	62	80	150	140	132	156
e) length 1	129	73	47	67	125	71	122	150
f) length 2	25	19	1	6	16	57	5	4
g) length 3	18	8	14	7	9	12	5	2
h) % of pauses in total sentence finals	86.0	90.1	100	96.4	92.0	94.0	92.3	96.9
j) possible sentence finals	34	27	17	28	44	43	57	45
k) no pauses [0]	10	8	0	1	6	3	3	1
m) with pauses [1+2+3]	24	19	17	27	38	40	54	44
n) length 1	23	19	17	27	38	34	51	44
p) length 2	0	0	0	1	0	6	1	0
q) length 3	1	0	0	0	0	0	2	0
r) % of 'with pauses' in total non-s. finals	70.6	70.4	100	96.4	86.4	93.0	94.7	97.8

Figure 1 shows that British 4 and American 5, and Americans 1 and 3 are closest in the characteristics they show in terms of tone patterns at sentence finals. Each of

the two pairs belongs to a larger group with similar characteristics to British 2 and American 6. British 1 shows the greatest individual variance, British 3 coming next.[2] This indicates that there may be some individual differences in terms of tone patterns at sentence finals.



<Fig. 1> Dendrogram using Average Linkage (Five Tone Patterns)

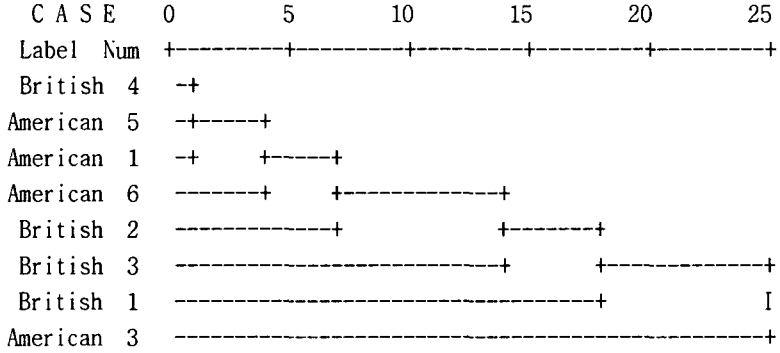
4. Qualitative Results

The above quantitative results show that 6.5%-48.2% of all sentence finals indicated by periods do not end with falling tones. By examining the examples where this is the case, the reasons for the phenomenon will be considered.

Three major functions have been found for sentence finals in tones other than falling. They are deviation, continuation and interaction.

---

2) Another cluster analysis by the use of five tone patterns and four lengths of pause gave the following cluster. In this analysis, American 3 is the most distinct, followed by British 1 and 3.



4.1 Deviation

A large number of instances with non-falling tones at sentence finals have been found where the speech concerns information given by visual aids such as OHPs. Deviation refers to the function where the content is shifting from the main stream to other information such as that given by visual aids. Examples are cited below. (↓ refers to a falling tone, ↑ a rising tone, → a level tone, and | ↑ a fall-rise tone.) In (3), a rising tone appears just before the author moves to the information presented by OHP. As a syntactic signal of information shift, an exophoric reference, *this*, is used at the beginning of the OHP material. In (4), a rising tone appears just before the OHP information with a syntactic signal, *these*. Until this stream of information ends, rising and level tones appear at sentence boundaries. During this stream, another exophoric reference, *this*, appears preceded by a rising intonation. In (5)-(7), the speech flow moves to the information given on the OHPs after level or fall-rise tones. Thus, non-falling tones tend to be used in the case where the information given is at a tangent to the main stream.

(3) Now let me just tell you a very little bit about inelastic neutron scattering. ↑ This is a schematic of a typical instrument. | ↑ A monochromatic beam of neutrons of energy E nought are incident on the sample. ↓ (British 3, 10-11)

(4) So what we did is we took two glass compositions. ↑ These are the components. → We we mixed the two together in different ratios, fired them, analysed them, and showed, not surprisingly, that this a straight line relationship within the error of the analysis technique used. ↑ We had to be very careful to get the right particle size for these materials. ↑ This is c... this is a cordierite glass-ceramic(↑) and, as people I'm sure are well know well know, it does not nucleate easily.→ You get surface crystallisation. ↑ We have modifiers in there, viscosity modifiers, nucleation modifiers,(→) but basically, if you have a difference in the particle size you get a shift in the XXX crystallisation temperature.→ So you have to match your particle sizes, if you're going to mix these materials together.→ (British 4, 88-97)

(5) For example, the E prime line in the wet sample was roughly linear with dose.→ Here it's significantly non-linear with dose. ↓ (American1, 55-56)

(6) We want to form a match to silicon. | ↑ Here we've got the thermal expansions of the crystal phases present in this system. ↑ (British 4, 37-38)

(7) Let me show you what I mean.| ↑ Go back to this picture.| ↑ Heres the single quantum transition Im talking about. ↓ (American 5, 117-119)

4.2 Continuation

Another case where non-falling tones tend to appear is that where detailed, additional or listed information is given. In other words, information is incomplete and is in the process of being provided. Examples are shown below. In (8) and (9), information is structured as detailed exposition of the double-underlined phrases in the subsequent sentences. In (10), information is added to the previous sentence to clarify its meaning. In (11), a sequence of events is presented in sentences ending with level tones. In (12)-(14), the first and the subsequent sentence can be regarded as a package of information. As can be seen in these examples, non-falling tones tend to appear where connected information is continuing.

(8) As you all know there are two crystal structures for, for B_2O_3. ↑ One a relatively low pressure structure which is trigonal, fifteen atoms in the unit cell, ribbons, no rings. ↑ And the oth-, high pressure one is basically tetrahedral in form, with edge sharing and twenty atoms in the unit cell. ↓ (American 3 90-92)

(9) The other two lines are hole-like centers. ↑ One is the the spin at a non-bridging oxygen hole center,(↑) and the other is on the oxygen of a peroxy radical. ↓ (American 1, 17-19)

(10) Now, another experiment, this is still not trivial.| ↑ I mean you cant do this with an ordinary NMR setup, because you have to to hop the sample spinner between two axes. ↓ (American 5, 107-108)

(11) So you spin, let the magetisation evolve.→ It acquires some anisotropy.→ You hop to the new angle.→ That takes about twenty milliseconds.→ You acquire more anisotropy,(→) but it has a different sign because youve changed the orientation(↓) and that focuses it all away, into a spin echo that has no

broadening what so ever. ↓ (American 5, 100-106)

(12) When Soules did this he found essentially no boroxol rings.→ In a thousand atoms done this way we find one. ↓ But if the typical bonding angle's a hundred and fifty four degress, you canít close the rings,(→) so you don't expect to find any. ↓ That was the simple argument against the Soules structure(→) and it's still good today. ↓ (American 3)

(13) The- the questions are: how can er an odd-membered ring like the boroxol ring support a coupled rotation, because if you think about it only an even-membered ring can support a coupled
rotation.→ And this suggests to me there may be a link we can make between low energy modes and intermediate range order in glasses. ↓ .... And in summary I would conclude.... (British 3, 72-72)

(14) There are many many other very fine scientists doing or have done excellent work in magnetic resonance studies in glasses. ↑ I apologize for just not being able to incorporate all of their work here,(| ↑) so the manuscript that goes with this talk that will appear in the proceedings does involve and quote some of that work. ↓ (American 6, 18-20)

British 1 uses non-falling tones far more frequently than the other speakers. Example (15) is one whole paragraph of the presentation of British 1 in which all sentences end with non-falling tones. This may be because he, more than other speakers, considers information as continuing.

(15) Those are the sort of parameters we are interested in. ↑ What we actually get from a diffraction experiment....(↑) We don't get that, of course,(↑) what we get in the diffraction experiment, is a series of correlation functions. ↑ Er the ones I'm using here are those linear in r.→ The reason for that is that, in these functions, the experimental broadening is symmetric and independent of r.→ Er the ones I'm using are defined here.→ For a sample containing n elements or atom types, we may wish to distinguish between occasionally different versions of the same element,(→) then the number of independent correlation functions is n into n plus one over two. ↓ (British 1, 28-36)

4.3 Interaction

Non-falling tones tend to be used in cases where some interaction is expected between a speaker and the audience. In such cases, rising-tones were found. In (16)-(19), it is assumed that the speakers are implicitly asking for the audience's consent. In other words, these rising tones imply 'Don't you think so?' Example (20) shows an address to a chairperson. Such interaction may be associated with a speaker's expression of politeness to the audience.

(16) This possible interpretation of the first peak o- of in the vibrational density of states as er some sort of rotational mode is quite encouraging. ↑ er In the case of silica there's this famous paper by Buchenau et al where they studied er the low energy modes of silica and they they found that they can explain the low energy modes in the region of five or six milli volts by a coupled rotation of the tetrahedra. ↓ (British 3, 67)

(17) Um and I'd like to congratulate Phil on this marvellous occasion. ↑ We have mixed feelings at Corning about Phil because er when we developed, shortly after sharp glass, our pyrex and other borosilicate glasses, we did so in total ignorance, relying totally on empiricism. ↓ (American 3, 2-3)

(18) I'm sure you're all familiar with this. ↑ If you have materials with different thermal expansion at temperature.... (British 4, 72)

(19) Let me show you what I mean. ↑ (American 5, 117)

(20) Thank you, Steve. ↑ (American 6, 2)

5. Discussion

Three discourse factors, i.e. deviation, continuation and interaction, have been found for the occurrences of non-falling tones at sentence boundaries. The occurrences of non-falling tones can be accounted for by reference to discourse strategies (Umesaki, 2000). A user of language adopts different strategies for forming a text to achieve communication in different registers. These strategies can be called discourse strategies. The discourse strategies consist of 'the textual strategy', 'the interpersonal strategy' and 'the ideational strategy'. The terms 'textual', 'interpersonal' and 'ideational' are taken

from Halliday's scheme of three kinds of meaning embodied in human language as a whole (Halliday, 1985c). A speaker's oral presentation at an international conference will adopt an interpersonal strategy of interacting with the audience, and one realisation of this strategy is in rising tones at sentence finals. The speaker will also adopt a textual strategy of constructing texts which are cohesive and coherent, and attempt to show continuation and deviation by using non-falling tones.

6. Conclusion

In eight oral presentations at scientific conferences, not all boundaries which can syntactically be regarded as sentence finals were marked with sentence-final punctuation marks, i.e. periods, question marks and exclamation marks. Not all sentence finals with periods have falling tones. The proportion of falling tones at sentence finals with periods varies from 52 to 93 percent, according to the speakers. The sentence finals ending with non-falling tones tend to appear in cases where what is said moves from the main stream to other information such as that given on OHPs, where the connection of particular chunks of information is stronger than that before or after the information, and where some interaction is involved between the speaker and the audience. These three functions can be referred to as deviation, continuation and interaction. It can be said that these functions are realised in the contrast of tones which represent textual, interpersonal and ideational strategies.

References

Biber, D., S. Johannson, G. Leech, S. Conrad and E. Finegan (1999), *Longman Grammar of Spoken and Written English*, Pearson Education, Harlow.

Cruttenden, A. (1986), *Intonation*, 2nd ed., Cambridge University Press, Cambridge.

Gimson, A. C. (1980), *An Introduction to the Pronunciation of English*, 3rd ed., Edward Arnold, London.

Halliday, M. A. K. (1985a), *Spoken and Written Language*, Oxford University Press, Oxford.

Halliday, M. A. K. (1985b), *Language, context, and text: Aspects of language in a social-semiotic perspective*, Deakin University, Victoria.

Halliday, M. A. K. (1985c), *An Introduction to Functional Grammar*, 1st ed., Edward Arnold, London.

Leech, G., G. Myers and J. Thomas (1995), *Spoken English on Computer: transcription, mark-up, and application*, Longman, Harlow.

Knowles, G. (1987), *Patterns of Spoken English*, Longman, Harlow.

Knowles, G., B. Williams and L. Taylor, eds. (1996a), *A corpus of formal British English Speech*, Longman, Harlow.

Knowles, G., B. Williams and P. Alderson, eds. (1996b), *Working with Speech: Perspectives on research into the Lancaster/IBM Spoken English Corpus*, Longman, Harlow.

O'Connor, J. D. and G. F. Arnold (1973), *Intonation of colloquial English*, 2nd. ed., Longman, Harlow.

Pickering, B. (1996), "Distributional features of TSMs in the SEC," in Knowles *et al.*, eds. (1996), pp. 108-128.

Quirk, R., S. Greenbaum, G. Leech and J. Svartvik (1985), *A Comprehensive Grammar of the English Language,* Longman, Harlow.

Roach, P. (1983), *English Phonetics and Phonology*, Cambridge University Press, Cambridge.

Saito, T., J. Nakamura and I Akano, eds. (1998), *English Corpus Studies* (in Japanese), Kenkyusha-Shuppan, Tokyo.

Taylor, L. (1996), "The correlation between punctuation and tone group boundaries," in Knowles *et al.*, eds. (1996), pp. 129-145.

Umesaki, A. F. (2000), "Syntactic Differences in the Discourse of Oral and Written Papers," *English Corpus Studies*, No.7, pp. 39-59.

Yagi, K. (1994), "Prolegomena to the Study of Spoken English," (in Japanese) *JASEC BULLETIN* 3, pp.1-6.

접수일자: 2001년 4월 27일
게재결정: 2001년 5월 31일

▶ Atsuko Furuta UMESAKI
address: 7-1-1 Tezukayama, Nara City 631-8501, Japan
affiliation: Tezukayama University
e-mail: ufatsuko@hcn.zaq.ne.jp