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The Paradox of Comprehensible Input: Hesitation Phenomena in L2 Teacher-Talk

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Hesitation phenomena (HP) have previously been shown to be sources of perceptual error for NNSs. Difficulties of decoding HP, especially filled pauses, are revealed when NNSs are asked to transcribe recorded texts. This procedure was employed in the first of two studies reported in this paper. Results of an analysis of HP-generated errors in the transcripts showed a high proportion of filled pauses (in the region of 20%) to be misperceived. The second study was, therefore, undertaken to investigate the occurrence of filled pauses in segments from 30 lessons given by 10 EFL teachers. A significant reduction in the frequency of filled pauses was observed in the classroom deliveries when compared to NS-NS baseline frequencies. This is presumed to indicate a recognition of the difficulty experienced by NNSs in decoding filled pauses, and a (probably unconscious) monitoring of HP in input by EFL teachers.

HP (hesitation phenomena) は、従来 NNS の知覚を誤らせる原因であるとされてきた。HP、特に"filled pauses"を解読する際の難しさは、NNS に録音したテキストを文字化するように求める時に現れる。この過程は、本稿での 2 つの研究の第一の部分で利用した。文字化をする際に起きる HP 生成エラーを分析した結果、"filled pauses"が高い割合(約20%) で誤って知覚されることが判明した。そこで本稿の第二の研究では、10名の EFL 教師によって与えられた30課の中に現れる"filled pauses"を調べた。その結果、"filled pauses"の頻度が、教室では、NS-NS という基本的な場合と比較して、かなり減少するのが観察された。このことは、NNS が"filled pauses"を解読する際に難しさを感じること、また EFL 教師による HP を (おそらく無意識に) 認識することを示唆している。

1. Background

Despite the difficulties involved in direct investigation of the role of the hearer in communication, a number of L2 input studies (e.g., see Gass & Madden, 1985) have attempted to assess the effect

of the NNS hearer on NS delivery, and more attention is currently being paid to related issues in L1 (e.g., McGregor, 1986). A particularly pertinent question to L2 researchers centres on what exactly the hearer misunderstands. This is, of course, an empirical question, the investigation of which might be expected to result in findings with applied relevance. However, as McGregor (1986, p. 155) points out, the analyst faces considerable difficulty in stating "with even a fair degree of certainty" what a speaker means by some utterance, and how it is interpreted by the hearer.

In this particular study, the question, represented by McGregor (1986, p. 156) as "the asymmetry between utterance production and utterance comprehension," has been investigated within a framework derived from studies of hesitation phenomena (HP). HP, such as filled pauses (normally represented in written form as *uh*, *er*, etc.), repeats, and false starts, can be thought of (linguistically rather than psychologically) as meaningless utterances; certainly they should be interpreted as such by hearers. However an earlier study (Voss, 1979) indicated that HP can be sources of perceptual error to NNSs, who often ascribe semantic significance to them. Spontaneous speech, which is the most common genre in teacher-talk, is replete with HP and as such might cause particular problems for NNSs. It has, in fact, been suggested that the performance dimensions that most distinguish spontaneous speech from prepared speech are the proportion of HP and lack of grammatical pausing (Miller, 1982, p. 156). According to Duez (1982, p. 20), an absence of HP and the grammatical use of pauses (found, for example, in reading or prepared speeches), leads to better decoding by the listener. Likewise, Goldman-Eisler (1968, pp. 24-25) describes this type of controlled delivery in terms of speakers cooperating with listeners and approaching ideal communication.

In prepared speeches and written passages, therefore, the struggle to make the text comprehensible can be seen as already fought, and mostly, if not always, won. As Kowal and O'Connell (1985, p. 94) see it, such delivery can be regarded as pre-planned and formulated. In most spontane-

ous speech (and, therefore, most teacher-talk) no such preparation can occur (by definition)—the battle must be fought in vivo, and it will often result in HP being introduced into the discourse. For the NS this seldom causes problems in comprehension. For example, Deese (1978) writes:

> There is good reason to believe that the speaker's sacrifice of local coherence, at the level of the sentence or the phrase, in the interests of planning discourse as well as possible, given the dynamic nature of planning, is helpful to the listener as well as the speaker. (p. 321)

As with prepared discourse, in spontaneous speech the speaker's chief goal is to ensure that the message is comprehensible. This point is made by Chafe (1980, p. 170), who notes that in formulating the message, the speaker (in NS-NS interaction) is unlikely to consider, or need to consider, the grammaticality of the utterance. Damaging criticism would be that the message was incomprehensible, not that it was ungrammatical. Chafe, in agreement with Deese, also considers that, in spontaneous NS-NS discourse, HP facilitate comprehension rather than hinder it. He suggests that in studying HP it may be found that "they not only enable the speaker to express his ideas more effectively, but also enable the hearer to assimilate them too" (p. 170).

However, not all researchers agree on this issue. Clemmer et al. (1979), for example, in their review of the literature on silent pauses and HP, conclude "silent pauses within constituent boundaries and vocal hesitations . . . are thought to distract the listener and disrupt coding and understanding" (p. 397).

Pauses accompanied by hesitation are, it seems, seldom consciously registered by the NS (Duez, 1985, p. 388) and HP are generally idealized out of the message (Deese, 1978, p. 321; Laver, 1970, p. 73). These idealization processes are so common in L1 that Voss (1979, p. 130) has described them as similar to that of reducing speech to writing; he proposes (controversially) that, as NSs, we hear as we would expect to read.

Idealization, however, is a process which can only occur effectively when the hearer is competent in a language. The little L2 evidence there is on this issue suggests that the language learner, particularly at lower proficiency levels, is unlikely to be fully capable of it. However, the NS untrained and inexperienced in NS-NNS interaction, will probably be unaware of this, and the modifications made in attempting to make the message comprehensible will often include those engaged in natural NS-NS interaction.

Consequently, in attempting to make sure that the message is understood, the untrained NS may introduce elements (such as HP) into the input which render it less, rather than more, comprehensible to the NNS; this can be thought of as the paradox of comprehensible input.

The research reported in this paper was undertaken to discover how far the paradox might apply in NS-NNS classroom interaction. Because the scale of the problem which HP might cause can only be seen in relation to their rate of occurrence, the phenomena were investigated on two levels:

1. The extent to which HP in two segments of an NS-NNS content leture resulted in perceptual error for NNSs of different levels of proficiency (referred to from here on as the Error Study).

2. The frequency of occurrence of filled pauses in segments of teacher-talk from 30 English language lessons deliver to NNSs of differing proficiency levels (referred to from here on as the Occurrence Study).

Findings from both investigations are, however, preceded by a description of what appears to be the only previous L2 study in the first of the above areas. Unfortunately, there appear to be no specific studies of the frequency of occurrence of HP in L2 teacher-talk.

2. A Previous Study of HP as Sources of Perceptual Error for NNSs: Voss (1979)

The idea of HP being sources of perceptual error for NNSs has

been investigated by Voss (1979), who observed at that time that there seemed little or no interest in the question of whether NSs and NNSs use similar perception strategies or not. He also noted that most previous studies of HP had been concerned with encoding, and the few decoding studies which had been undertaken had been investigations with NNSs. His study is, therefore, the first to reveal the difficulties that HP can pose for the NNS. Using the model of speech perception described by Fry (1970, pp. 48-49) in which the perception of speech is seen as a process of matching the listener's (re)construction with the incoming acoustic information, Voss supposes that this is

> a task which although usually no problem for the native speaker is typically more difficult for the non-native speaker. If the perception of speech is determined by the three variables of content information, linguistic information and acoustic information . . . then the non-native speaker because of his imperfect command of the language (i.e., deficient generative system [= linguistic information]) is less likely to make accurate linguistic predictions in his reconstruction attempts. He will therefore have to depend more heavily on the acoustic information. This, however, is problematic in that some hesitation phenomena such as filled pauses or repetitions are acoustically identical with, or at least similar to, unstressed forms or parts of words. The non-native speaker will find it difficult to know in each case whether a given stretch of acoustic information is part of the speaker's performance that can be disregarded, or whether, if the reconstruction is to be correct, it needs to be accounted for. (p. 130)

In order to investigate the influence of HP in normal spontaneous speech on the perception process of NNSs, 22 Ss (of high intermediate proficiency) were asked to transcribe a stretch of recorded speech. The transcript was done in a language laboratory, where the Ss were free to manipulate the tapes at will, and listen to the passage as many times as they wished. Having postulated that a study of errors would permit insights into the perception process or strategy of the individual and the group (without suggesting, however, that such errors reflect global comprehension), Voss analysed the transcripts in terms of: (a) repeats (covering all

semantically non-significant repetitions); (b) false starts (covering incomplete or self-interrupted utterances which can either be corrected or not); (c) filled pauses; (d) silent pauses of "unusual length" and "non-phonemic lengthening of phonemes" (p. 132).

From a detailed analysis of the data, Voss reported empirical support for "some kind of matching process between the listener's projection and the incoming acoustic information" (p. 138), and he discovered that the perceptual errors of the NNSs followed patterns similar to those observed with NSs. Specifically, he found that nearly one third of the errors were connected with HP, with misunderstandings being due to their being misinterpreted as parts of words, or to parts of words being misinterpreted as HP not to be transcribed. He concluded that the high number of perceptual errors connected with HP suggested that they "present a major perceptual difficulty for the non-native speaker confronted with spontaneous speech" (p. 138).

The present study sought to provide more evidence on this issue, but, as neither Voss's text nor his method of analysis are employed, and as the Ss involved are of different levels of proficiency, it is not a strict replication. However, an identical procedure is adopted, and the notion that errors in the transcriptions indicate perceptual difficulties is also assumed. This is, in fact, one of the few occasions when the analyst can be relatively certain about what a speaker means by an utterance and how it is interpreted by the hearer (cf. McGregor, 1986, p. 157).

3. Error Study: Methodology

Two short excerpts (208 and 152 syllables in length) from the video recording of a science lecture delivered to low-proficiency NNS first-year Omani university students by an English chemistry professor, were recorded onto audio cassettes. The lecture itself was a representative sample of classroom input to such groups (the students were, therefore, familiar with the content of the lecture), and the passages were selected as they included a number of features found to

cause perceptual difficulties for both NSs and NNSs in the study by Voss.

The passages, which were recorded with only a 3 second break between them, are reproduced in the Appendix. From this it can be seen that Passage 1 includes 3 filled pauses (at positions 1, 64, and 129), 4 false starts (at positions 28, 62, 98, and 122) and 2 repetitions at positions 40 and 93, as defined by Voss above. Passage 2 includes 4 false starts (at positions 6, 12, 66 and 105), 8 filled pauses (at positions 7, 13, 46, 67, 78, 86, 106, and 114), and 1 repetition (at position 8). Passage 1 was 74 seconds long and Passage 2 was 57 seconds long; they were, therefore, delivered at speech rates of 2.82 syllables per second (sps) and 2.66 sps respectively. (As the task in this investigation was to transcribe the passages, the rates are only relevant insofar as they indicate a slow original delivery; during transcription, of course, long pauses are placed in that delivery.)

Ss were told that there were 2 short excerpts from a science lecture on the tape, and instructed to "write down, as accurately as possible, everything the lecturer says." Following Voss (1979, p. 132), they were given no specific instructions on how to deal with HP, punctuation, contractions, and so forth.

Subjects

Three groups of Ss were asked to transcribe the recording:

1. The first group consisted of 19 NNS first-year university science students of elementary language proficiency. They performed the task in a language laboratory where they could manipulate the tape at will and listen to the recording as many times as theychose. (Mean transcription time = 45 minutes)

2. A second group of 10 intermediate proficiency NNS Ss were given the recordings and asked to transcribe the tapes in the

same way but on an individual basis, where and when they pleased, with the specification that it should be done in quiet and be uninterrupted. It was not possible for this group to do the transcriptions in the language laboratory but this was not considered significant as performance on the task is not observed to be influenced by location. (Mean reported transcription time = 20 minutes)

3. The third group consisted of 10 NS EFL university teachers who also transcribed the tapes individually. Data collected from this group provides NS validation. Although this group cannot be thought of as linguistically naive, there is little reason to suppose thatother educated NSs would produce significantly different transcripts. (Mean reported transcription time = 12.5 minutes)

4. Error Study: Analysis and Results

As the error classification used by Voss was inadequate to cope with the degree of error observed in the low-proficiency group scripts, Voss's method of analysis could not be strictly followed. However, as the focus of the investigation was on HP- generated error, it was decided that analysis of all 39 scripts would take the form of identifying the frequency of errors in the transcripts at points where HP occurred (with one possible error being possible for each HP). The non-transcription of HP was not regarded as error (specific attention would not, after all, be given to HP), nor, therefore, was the misinterpretation of words as HP. The latter, although investigated by Voss, did not appear susceptible to reliable identification. This was also the case with unusual lengthening of silent pauses, which, consequently, was not investigated. Errors other than those arising from HP were not calculated, as this study was concerned only to show the incidence of specifically identifiable misperception. Other errors, however interesting they may have been, were not amenable to such accurate classification. The number of errors observed at each HP location is shown in Table 1.

Table 1.
Number of Transcription Errors Due to Misperceptions of Hesitation Phenomena

	Elem. NNS (n = 19)	Inter. NNS (n = 10)	NS (n = 10)
		Passage 1	
FP1	1	3	0
FS1	1	0	0
R1	0	0	0
FS2	0	0	0
FP2	4	1	0
R2	0	0	0
FS3	0	0	0
FS4	3	1	0
FP3	7	7	0
		Passage 2	
FS1	0	0	0
FP1	1	1	0
FS2	0	1	0
R1	0	0	0
FP2	1	1	0
FP3	4	3	1
FS3	0	0	0
FP4	1	0	1
FPS	3	0	0
FP6	11	6	0
FS4	0	0	0
FP7	0	0	0
FP8	2	0	0

(FP = Filled Pause; FS = False Start; R = Repeat)

As can be seen from Table 1, the vast majority of HP-generated errors were induced by filled pauses (59/65 = 91%), with all other HP accounting for only a very small proportion of such errors. The following errors were observed: filled pauses were written as "a," "is," "am," "that," "at," "and," "the," "are," "I'm," and "now," and words or morphemes were added to the conclusion of false starts. No errors resulted from repeats. Actual frequency of errors, possible frequency of errors (Error sources [22] x n), and percentages of the former in terms of the latter, are given in Table 2.

Table 2.
Total Number of Errors Generated by All HP Calculated in Relation to the Possible Number of Errors

	Poss Errors	Actual Errors	Act/Poss Error Ratio
Elem NNSs	418	39	10.72
Inter NNSs	220	24	9.16
NSs	220	2	0.009

(Poss = Possible; Act = Actual; Elem = Elementary-level; Inter = Intermediate-level)

While the actual/possible error ratios for the NNS groups may not, from these figures, appear too alarming (although they differ considerably from the NS group), the picture is radically altered if only filled pause-generated error is considered. Figures for this are shown in Table 3.

Table 3.
Total Number of Errors Generated by Filled Pauses Calculated in Relation to the Possible Number of Such Errors

	Poss Errors	Actual Errors	Act/Poss Error Ratio
Elem NNSs	190	35	18.42
Inter NNSs	100	22	22.00
NSs	100	2	2.00

(Poss = Possible; Act = Actual; Elem = Elementary-level; Inter = Intermediate-level)

These figures indicate that a substantial proportion of filled pauses are misinterpreted by the NNS groups. This being the case, the high frequency of such perceptual errors might be expected to result in their being less frequently emitted in EFL teacher-talk than in NS-NS interaction. This hypothesis was consequently investigated by looking at their occurrence in segments from teacher-talk in 30 English language lessons and comparing the resulting figures to those obtained in NS-NS baseline sessions. The findings from this investigation are reported in the following section.

5. Occurrence Study: Subjects and Data Sources

Data for this study were derived from thirty audio-taped English language lessons delivered to elementary- to intermediate-

proficiency students at Sultan Qaboos University, Oman. Each teacher recorded one lesson (delivered to a particular group) during the first, fifth, and tenth week of a semester. Very occasional delays in recordings where lessons were postponed, for example, due to health reasons, were not considered of significance. In order to sample language to NNS students of different proficiency levels, recordings were made in first, second and third year classes.

Four male teachers, three American and one English, each recorded three language lessons with first year science students in their first semester at university. Testing of this group on CELT indicated them to be largely of elementary proficiency, although a minority of students were at intermediate levels. Three British teachers, two female and one male, each recorded three language lessons delivered to second-year agriculture students whose general proficiency level is best described as upper elementary. Three other teachers, two female and one male, and two English and one Irish, recorded language lessons delivered to third-year students of intermediate proficiency in the Faculty of Medicine.

NS-NS baselines were obtained as the teachers presented a body of information in a short lecture to groups of NSs in a formal setting (classroom or office). Despite duplicating the formality of the setting and despite the language of the lessons and short lectures being cognitively comparable, it has to be acknowledged that genre may not be exactly identical. However, no more satisfactory comparison can be drawn—total equivalence is clearly impossible.

6. Occurrence Study: Analysis and Results

As a detailed analysis of temporal variables was to be undertaken from the data, the first two distinct 30-second segments of teacher-talk (in which the teacher spoke continuously without interruption of any kind, and in which no pause was equal to or less than 3 secs; see Griffiths, 1990, March, p. 8, for rationale for this procedure) were transcribed, and the rates were summed to allow comparison with baseline data derived from the first 60 seconds of the NS-NS presentations. Table 4 indicates the number of filled pauses identified in these segments.

Table 4.
Frequency of Filled Pauses in 30 2x30-second Segments in 30 EFL Lessons and 10 60-second Segments of Short NS-NS Lectures Obtained to Give Baseline Data

Student Level	Teacher	Time 1	Time 2	Time 3	NS-NS
Elementary-proficiency	A	3	2	1	16
" "	B	2	3	2	6
" "	C	2	0	6	13
" "	D	1	2	0	7
Upper-elementary proficiency	E	2	0	1	6
	F	0	2	0	11
	G	0	0	1	3
Intermediate-proficiency	H	7	5	7	11
	I	2	3	1	5
" "	J	1	2	0	5

As is clear from an initial consideration of the figures in Table 4, there is a radical difference in the frequency of filled pauses between the two situations. In NS-NS interaction, filled pauses are used with extreme frequency (on average 8.3 times a minute), while in English language lessons their use is relatively rare (on average 1.93 times a minute). There is absolute consistency of this pattern over all time periods and at all levels; not one of the ten teachers comes close to equalling her or his NS-NS filled pause totals while addressing the NNSs. For almost all teachers the fall in frequency is truly remarkable and represents a control of delivery on a scale which might not have been expected.

Impressions suggested by the raw data were confirmed by the findings of a one-tailed Matched Pairs t-Test conducted on the means for the NS-NNS data and the NS-NS data. This showed the difference to be significant at the .005 level ($t[9] = 5.446$, $p < .005$). Reasons for this and the Error Study findings are suggested in the next section.

7. Discussion and Conclusion

The finding that HP are "overheard" and, therefore, become sources of perceptual error for NNSs was predicted from previous investigation. However, the scale of the difficulty

which filled pauses give rise to is unexpected. HP are, almost axiomatically, meaningless utterances, but many of them were not regarded as irrelevant by the NNSs in this study. The seriousness of the resulting errors cannot be judged from these data; from a NS viewpoint they do not seem too serious but that may not be the situation for the NNS. The frequency of the errors must, in any case, give rise to concern, for, as Deese points out (1980, p. 80), even for NSs, unusually dense disfluency frequencies are likely to interfere with processing by the hearer.

The second of the two studies reported here indicates that this concern over HP frequency is perceived by EFL teachers (although perhaps not on a conscious level). All of the teachers involved in this study will have been aware of the need to speak clearly to language learners, but it is highly unlikely that they will ever have thought specifically about the incidence of filled pauses in their speech. The scale on which they adapt their deliveries to NNSs, and the consistency of the pattern in which this is done, is, therefore, unexpected.

There are, in fact, few previous studies of the occurrence of NS performance modifications in teacher-talk in which the results have been so unequivocal and, in a sense, so positive. In a word, filled pauses give rise to misperception so their employment is severely curtailed. This finding is particularly surprising as no significant modification was observed on another temporal variable investigated in this research programme—that of speech rate (Griffiths, 1990, March). Language teachers are, however, clearly mindful of HP and self-monitor its use; they compensate for NNSs not possessing the skills necessary to idealize HP out of the message.

In agreement with Good and Butterworth (1980, p. 152), findings from the Occurrence Study therefore demonstrate that an individual's hesitancy is determined by interactional goals as well as cognitive processing demands. The fundamental reason for hesitating may, as Chafe (1980, p. 170) states, be due to speech production being "an act of creation." However, control over disfluency seems to result from this creativity not occurring in a vacuum,

but rather in response to audience comprehension-capacity.

In general, this finding is in agreement with much of the input-studies literature (e.g., see Gass & Madden, 1985) which demonstrates the high degree of modification made by NSs, notably language teachers, in addressing NNSs. It does, however, lend no support to the notion that "authenticity" is the natural strategy when faced with NNS incomprehension. On the contrary, it reflects an acknowledgement that production modification is an appropriate comprehension facilitating strategy at least where hearers are of elementary levels of proficiency.

It is obvious that this view is incompatible with the currently received wisdom on the issue of L2 listening comprehension, whether of teacher-talk or of materials. In regard to the latter, as stated in an earlier paper:

> evidence from temporal variable research leads to the recommendation that authentic materials should be approached gradually rather than be instantly confronted. This does not mean that the ultimate aim embodied in such an approach is anything other than the comprehension of authentic spontaneous speech. This must, of course, be the goal. It is, however, considered that materials must incorporate a programmed move towards authenticity rather than beginning with it. . . . (Griffiths, 1990a, p. 60)

Also in that paper it was recommended that HP should be avoided in beginner-level materials; the results of the Occurrence study show that this recommendation anticipates the natural modification already made by language teachers when addressing NNSs.

A general implication which might be drawn from the findings in these studies (and others on temporal variables in this series of studies, e.g., Griffiths, 1990b) is that the present emphasis on "authenticity" in discussions of listening comprehension might usefully be substituted for, or at least complemented by, one in which "modification" is accorded greater significance. In regard to HP, at least, teachers themselves clearly recognise a learner need and largely satisfy it. Listening comprehension materials might be expected to do no less, but clearly "authenticity" in production

(insofar as that is taken to mean unmodified NS-NS discourse) cannot even be guaranteed to be low in the very HP shown here to be frequently misperceived by language learners.

At a more local level in terms of language learner perception/misperception of teacher-talk, it can be seen that the methodology used here (transcription) proved effective in demonstrating where HP generated error. Over and above this, however, other major sources of error were apparent in the scripts (notably those caused by contractions), and the possibility of further using transcription to identify points of perceptual difficulty clearly recommends itself for language classroom use. Transcripts can, in fact, not only be used to provide feedback on perceptual problems for language teachers (and students), but they can also be employed to bring these difficulties to the awareness of content lecturers teaching NNSs (an application of this being described in Griffiths, 1989, November), or to other NSs unfamiliar with the level of difficulty occasioned to NNS hearers by unmodified NS speech. In this respect, as Humphreys-Jones (1986) notes:

> It is to be hoped that by turning increasingly more attention to what hearers do, and to what they have to do in order to understand correctly, we shall become more aware of the immense difficulties a hearer can face in endeavouring to understand what a speaker is endeavouring to communicate. (p. 124)

Her work on the "states of realization" (1986, p. 110) of discourse participants brings the speaker into the picture and is particularly relevant to language teaching where the question of assessing hearer comprehension must be a constant consideration. The studies reported here demonstrate, on this particular dimension, the acuteness of the state of realization achieved by EFL teachers. The paradox of comprehensible input is, it seems, both recognized and reacted to.

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Appendix

Passage 1

FP1
1 2 3 4 5 6 7 8 9 10 11 12 13 14
uh you think it comes bigger d'you / well the answer is that the

15 16 17 18 19 20 21 22 23 24 25
effects of lone pairs / an' double bonds and triple bonds/ is

FS1
26 27 28 29 30 31 32 33 34 35 36
absolutely nothing / now that / you didn't expect that did you I

R1
37 38 39 40 41 42 43 44 45 46 47 48 49
but there are / there are / some problems/let's see if I can

FS2 FP2
50 51 52 53 54 55 56 57 58 59 60 61 62 63 64
give you an example/so we've looked now at all the com-/at uh

65 66 67 68 69 70 71 72 73 74 75
a group of examples of these elements that form these compounds/

76 77 78 79 80 81 82 83 84 85 86 87 88
and in each case all the electrons that we talk about are bonding

R2
89 90 91 92 93 94 95 96 97
electrons / all right / these / these / electron pairs all refer

FS3
98 99 100 101 102 103 104 105 106 107 108
to/ all mean /that they are bonding pairs / what happens when

109 110 111 112 113 114 115 116 117
we've got some non-bonding or lone pairs/ well
FS4
118 119 120 121 122 123 124 125 126 127
let's take a g-/ an example that we've
FP3
128 129 130 131 132 133 134 135 136
been uh using a lot lately an' that is
137 138 139 140 141 142 143 144 145 146 147 148 149
water / let's take a look at water/now water is formed between
150 152 152 153 154 155 156 157 158 159 160
two atoms of hydrogen and one atom of oxygen / so what
161 162 163 164 165 166 167
group is oxygen in the periodic table /

Passage 2

FS1 FP1 R1 FS2 FP2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
so let's go on to/ uhm let's go on to uh an' mercuric-chloride
16 17 18 19 20 21 22 23 24 25 26
would be exactly the same / mercury occurs in group two / two
27 28 29 30 31 32 33 34 35
valence electrons forms mercuric-chloride h- g- c- l- two/
FP3
36 37 38 39 40 41 42 43 44 45 46 47 48 49
but I gave you beryllium because I think that is uh an atom that
50 51 52 53 54 55 56 57 58 59 60 61
you already know something about / let's go on to the next
FS3 FP4
62 63 64 65 66 67 68 69 70 71 72 73 74
example and we'll t-/uh there's another example there by the
FP5
75 76 77 78 79 80 81 82 83 84 85
way of silver uh diamine that's called / that's silver-diamine/

FP6

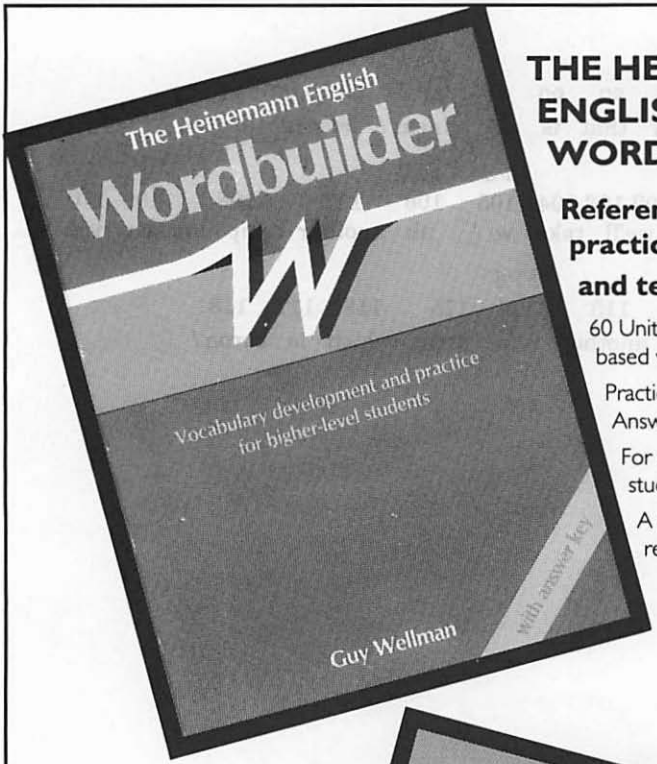
86	87	88	89	90	91	92	94	95	96	97	98
uhm	cation	an'	that	is	also	linear /	let's	go	on	to	

FS4 FP7

99	100	101	102	103	104	105	106	107	108	109	110
the	three	and	we'll	take	w- /	uh	another	compound	that	you	

FP8

111	112	113	114	115	116	117	118
already	know /	another	uhm	atom	which	is	boron /



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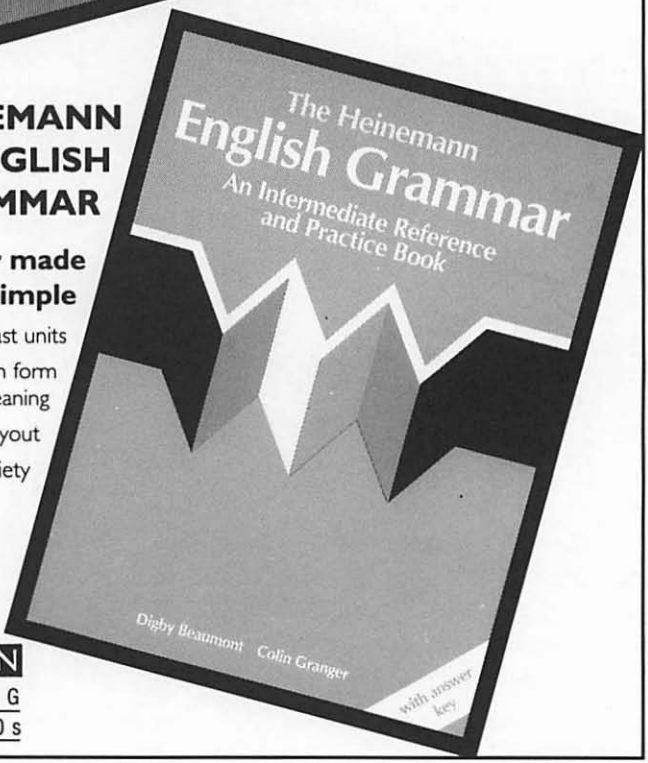
- A unique vocabulary resource



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