CHAPTER 8

SUMMARY AND CONCLUSION

8.1 Overview

As outlined in Chapter 1, the general aim of the study was to examine the patterns of disfluencies and time intervals of self-repairs (see 1.5) in spontaneous speech to better understand the psycholinguistic process of self-monitoring and self-repair in spontaneous speech. This was motivated by the premise that "disfluencies provide a window onto underlying processes affecting human speech and language production" (Shriberg, 2001, p. 153). This is because, as shown in Chapters 2 and 3, speakers monitor both their inner and audible speech in the process of producing speech. The detection of a problem can result in speech being interrupted and a hesitation produced. At the same time a repair to the problem could also be effectuated and produced. In relation to this, this study sought to examine patterns of disfluencies and time intervals of self-repairs found in spontaneous speech to obtain a better understanding of the process of speech-monitoring and self-repair, particularly as to when error-detection, the decision to interrupt speech and repair-planning commences. This chapter summarizes the main findings of this study and the conclusions that can be drawn from the results.

8.2 Research Question 1: What patterns of disfluencies can be found in the data?

The first research question sought to discover the patterns of disfluencies in the data from two perspectives: the types of hesitation devices speakers produced and the type of

self-repairs speakers made. Accordingly, it was found that speakers generally used one or a combination of three forms of hesitation:

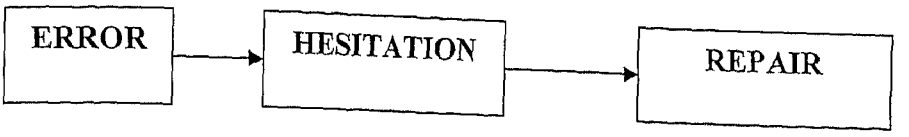
- silent pauses (with durations ranging from 56 to 1257msec)
- filled pauses (*ah*, *er* and *ahm*)
- prolongations

The four categories of self-repairs in this study in order of frequency of occurrence were:

- Repeats
- Deletions
- Substitutions
- Insertions.

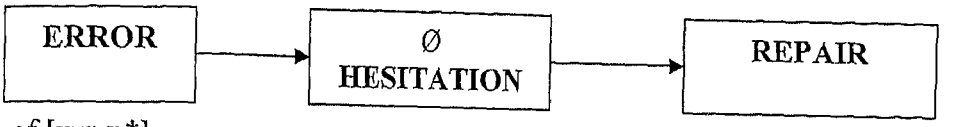
However, the data clearly shows that hesitation and self-repairs do not necessarily occur together, where approximately half of the self-repairs did not have any form of hesitation, while 138 instances of hesitations occurred without any form of self-repair. Thus, three different audible permutations were found as illustrated in Figure 8.1.

Permutation 1



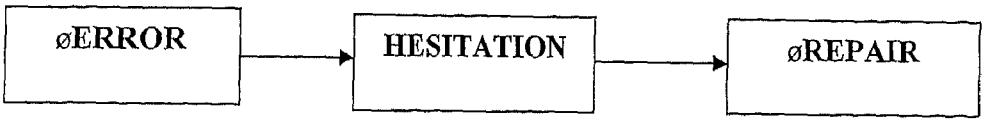
whatever **[they]** **ah** **whatever you**(SUB) do she will have

Permutation 2



...of **[my p*]** **of our prime minister**(SUB)

Permutation 3

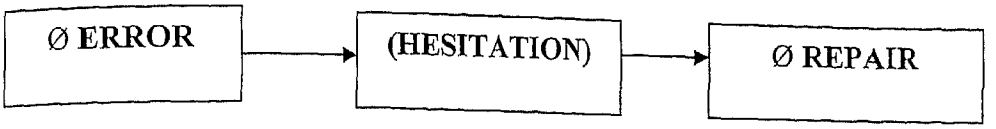


...you cannot make it **ah** other than *cenderamata* ((souvenir))

Figure 8.1

Audible Permutations of Hesitations and Repairs

As explained in earlier chapters, the last permutation only contains a hesitation without any audible error or corresponding repair. Hence, the term *possible-repair* is used to refer to them rather than referring to them as *covert repairs*, while the term *self-repairs* was used to refer to the other two permutations. This leads to a problem with repeats, which correspond to this permutation, to the extent that there are no overt errors and repairs discernable in repeats as can be seen in the following example in Figure 8.2:



...we **we** should have English.

n.b. parenthesis indicates that hesitation is optional

Figure 8.2

Permutation for Repeats

Figure 8.2 clearly shows that the structure of repeats is unlike that of the other permutations suggested in Figure 8.1. Unlike Permutation 1 and Permutation 2 in Figure 8.1, there is no overt error actually present. There also need not be a silent or filled pause present between the tokens as in Permutation 3 in Figure 8.1. However, because repeats are seen as a form of hesitation and a manifestation of ongoing self-monitoring and self-repair in speech production, the tokens preceding and following the interruption point are regarded as the 'error' and repair' in some studies, although they are obviously not the error and repair.

In terms of the structure of all three repairs, it was found that hesitation could occur before and/or after the interruption point (IP) as shown in Figure 8.3. The only form of hesitation that occurs before the IP is a prolonged one. In self-repairs, the prolongation could also constitute or be a part of the error as illustrated in the first structure in Figure 8.3.

Self-Repair

ERROR + PROLONGATION or PROLONGED ERROR	IP	(SILENT/FILLED PAUSE)
[the:]		ah mostly the(INS)

Possible-Repair

(PROLONGATION)	IP	SILENT/FILLED PAUSE	
		ah	own

OR

	IP		
PROLONGATION		(SILENT/FILLED PAUSE)	
to be:		:542	Awie

n.b. '( )' denotes that the hesitation is optional

Figure 8.3

Structure of Repairs

8.2.1 Hesitations

Among the trends that were observed about the types of hesitations used was that most of the self-repairs in the study were not interrupted by silent and/ or filled pauses,

meaning that speakers were able to repair their errors soon after making them. This implies that error-detection and repair-planning must have taken place pre-articulatorily. Prolongations occurred mainly in repeats, where the first token of the repeat was longer than the second token, and this corresponds to their function as hesitation devices. Both silent and filled pauses occurred more frequently in non-fragment self-repairs. In such repairs, the error may have already been detected and corrected, and thus, speakers did not need to use filled pauses to buy repair-planning time.

In relation to this, the duration of silent pauses after non-fragments also tended to be longer than those after fragments, suggesting pre-articulatory error detection and correction in the latter, as corroborated by the fact that the speaker stopped mid-segment. All of the durations of the hesitation pauses found in both possible and self-repairs were under 2 seconds, although the ones in possible-repairs were significantly longer, suggesting that planning may have been going on at this stage, even if there was no overt evidence of an error and repair in such repairs. Although less than a third of the silent pauses were under 200msec, it still shows that non-phonetic pauses can be shorter than 200msec, and therefore, cannot be arbitrarily excluded in a study on hesitation pauses.

In terms of frequency of occurrence, all three types of hesitation occurred more frequently before lexical words in possible-repairs, further suggesting that the presence of cognitive activity at this stage. The same type of unlexicalized filled pauses, *ah* and *er* and *erm*, were used by all the speakers in this study, suggesting that such hesitation devices are an inherent part of the language being spoken. Similar types of lexicalized filled pauses, *you know* and *I mean*, *what*, *what you call this* and *what is this*, were used.

Prolongations appear to function very much like filled pauses, that is, as a vocalized form of hesitation, and hence, tended not to be used together with filled pauses. Prolongations, however, are a unique type of hesitation as they convey lexical meaning and can be part of the erroneous segment of the utterance in self-repairs. Because of this, they were perceived in this study to occur before the interruption point, unlike silent and filled pauses (see Figure 8.3).

8.2.2 Self-repairs

Nearly half of the self-repairs were repeats, followed, in order of frequency, by deletions, substitutions and insertions. All the self-repairs had fragment repairs, strongly suggesting that the problem to be repaired had been detected prearticulatorily. Repeats, however, did not fit in neatly into the structure of self-repairs as speakers reproduced item/s before the interruption point before proceeding with the same item/s. If there was an 'error' or problem, it must have been detected and repaired prior to articulation as it is not overtly produced. This is unlike insertions, which also involve the repetition of item/s with the addition of word/s after before or within the repeated segments. Therefore, since there is no audible error in repetitions, they must be classified as a separate disfluency from the other self-repairs since we are only assuming that there are instances of prearticulatory error-detection.

Thus, it is suggested that the taxonomy of disfluencies be revised to take into account the structure and function of different forms of hesitation and self-repairs as presented in Figure 8.4. As shown in Figure 8.4, the term *speech disfluencies* can be used as an

umbrella term, comprising all forms of speech errors (see Table 2.1 and 2.8.3), hesitation phenomena and repairs. Hesitations encompass silent and filled pauses and prolongations. Repairs, on the other hand, can be divided into self-repairs and possible repairs. In hindsight, since repeats function both as a possible reflection of an ongoing repair and a form of retrospective or prospective hesitation, they are put under the categories of both hesitation and possible-repairs.

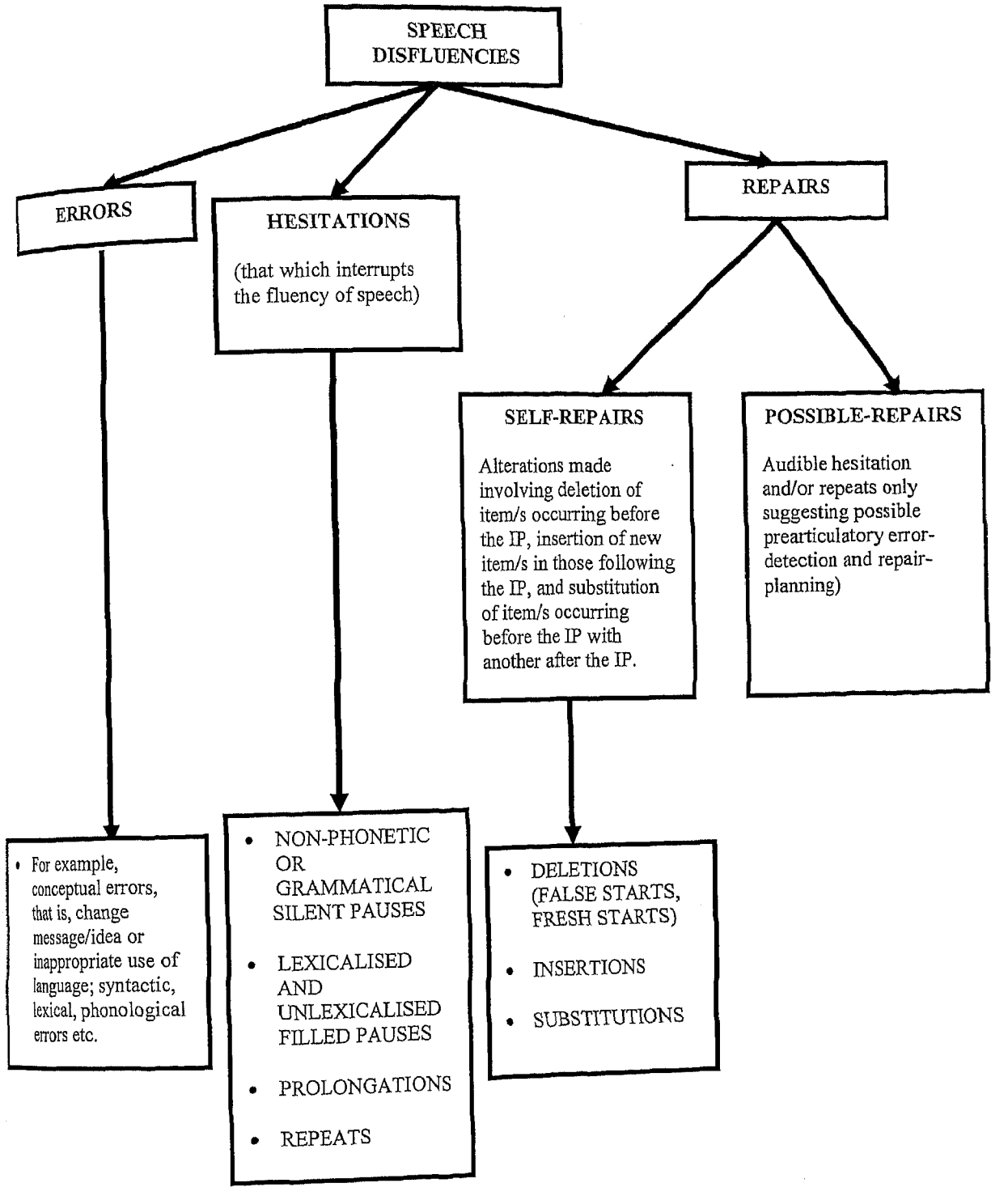


Figure 8.4

Taxonomy of Disfluencies

8.2.2.1 Repeats

Repeats can comprise fragments, single words or more than one word, although there appears to be a tendency to repeat single words more frequently. Fragments and words can be repeated once (*simple repeats*) or more than once (*multiple repeats*). However, there was a tendency to repeat words once rather than produce multiple repeats. In this study, approximately a quarter of the first tokens were fragments, indicating that speakers were ready to resume their utterance soon after or at the second token (in cases where there was no editing phase).

The function of repeats as a form of hesitation device can be evidenced by the fact that in many repeats, the first token was found to be significantly longer than the second token. Such repeats can be regarded as retrospective repeats, where the longer R1 indicates that a problem had been detected and the repair planned, while the shorter R2 signals that the speaker was resuming his utterance. Similarly, even with repeats with a longer R2, especially where R1 was a fragment, the error may already have been detected prior to this causing the speaker to stop abruptly, while the longer R2 may indicate that the speaker was buying planning-time at this point.

As explained earlier in this chapter, what distinguishes repeats from the other three self-repairs is that, unlike the others but similar to possible-repairs, there is no direct evidence of an error and its subsequent repair as the error-detection may have occurred prearticulatorily, causing the speakers to hesitate and resume their speech via repeats. The repeats in themselves are not the problem at this point, which is probably why most of the repeats were found to be function rather than lexical words. Thus, there is a need

to re-categorize repeats as a type of hesitation, similar to prolongations, rather than an actual self-repair. The difference in R1 and R2 duration may be more indicative of the error-detection and repair-planning process going on rather than an indication of a different category of self-repair (See Figure 8.4)

8.2.2.2 Deletions

If repeats are discounted as self-repairs then almost a half of the self-repairs were words and phrases that were deleted. Nearly a half of the deletions were interrupted as fragments, indicating that speakers had detected a problem. Since they had decided to expunge the problem tokens, they had to re-plan their 'new' utterance. Hence, in many cases, speakers subsequently bought time through silent and /or filled pauses in this type of self-repair. Because deletions often involve speakers restarting the utterance following the deletion, they can be considered as a type of false start if they occur at the beginning of the utterance, while the part following the interruption or editing phase, if there is one, or the 'repair' can be considered as a fresh start. The way in which deletions fit into the structure of self-repairs is shown in Figure 8.5, where it can be seen that all the elements that are expunged are considered as the 'error'.

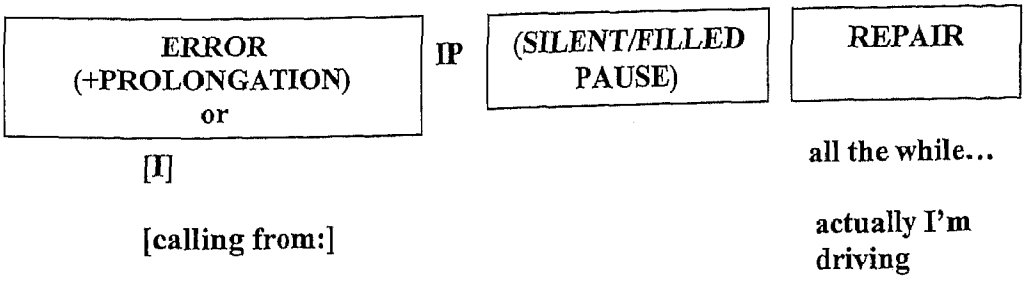
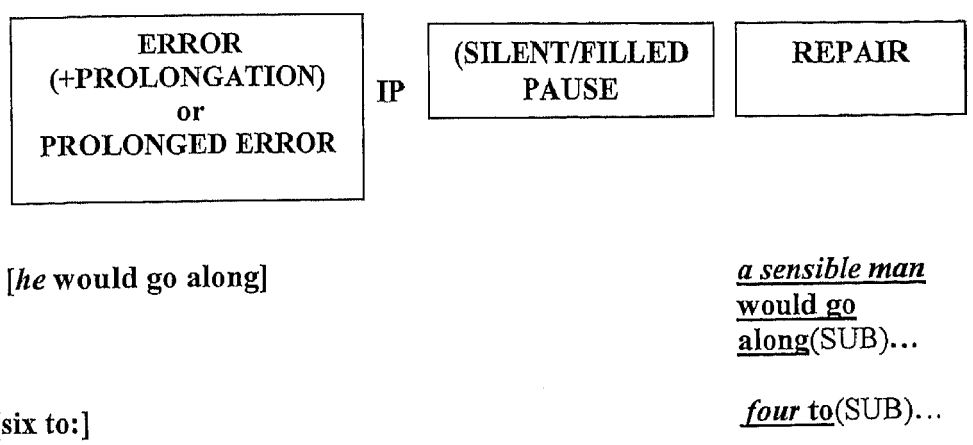


Figure 8.5

Deletions in the Structure of Self-Repairs

8.2.2.3 Substitutions

In contrast to deletions, where more than one word was often deleted, speakers tended to substitute one word rather than a phrase. In this study, the words substituted suggest that speakers were self-correcting their grammar (for example there were many substitutions of articles, pronouns, prepositions). Figure 8.6 shows how substitutions fit into the structure of self-repairs. The 'error' is taken to begin at the element that is substituted in the repair. Thus, any word following the error is also considered as part of the reparandum.



n.b. the substituted words are shown in italics

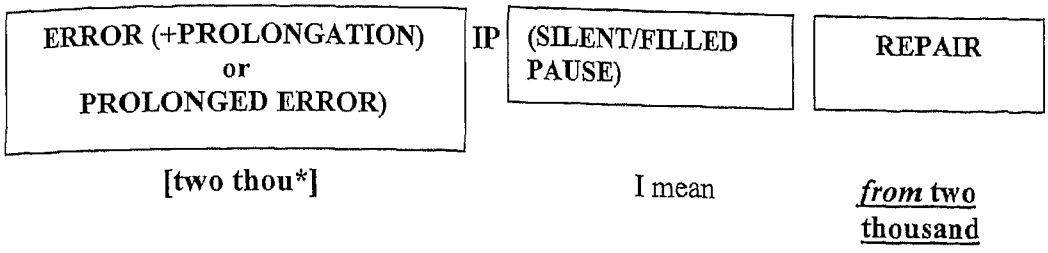
Figure 8.6

Substitutions in the Structure of Self-Repairs

8.2.2.4 Insertions

In this study, words that were inserted appeared to be motivated by a need to make meaning clearer. Speakers would typically repair some part of their utterance, inserting

one or more words in the repair. For insertions, the word following the insertion is considered as the beginning of the 'error' as show in Figure 8.7.



n.b. inserted word shown in italics

Figure 8.7

Insertions in the Structure of Self-Repairs

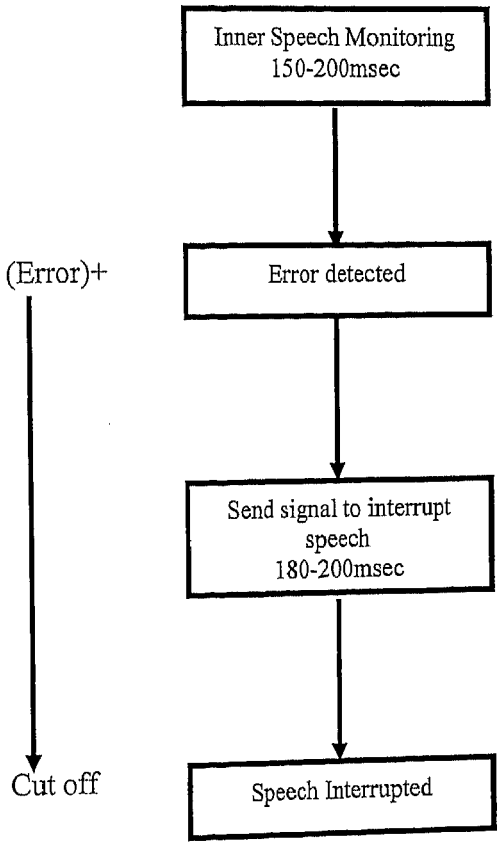
8.3 Research Question 2: What do the time intervals of error-to-cut off, cut off-to-repair and error-to-repair reveal about the process of self-monitoring and self-repair in the spontaneous production of speech?

The second research question sought to discover what error-to-cut off, cut off-to-repair and error-to-repair time intervals could reveal about when errors are detected and repaired, and when speech is interrupted.

8.3.1 Error-to-cut-off Intervals

Error-to-cut off intervals in this study ranged from 15 to 1785msec, but most of them were below 400msec. Thus, in most cases, speech was not cut off immediately upon the production of an error, and this can be said more confidently for deletions, substitutions and insertions since errors are not overt in repeats (see 8.2). However, the short intervals show that the decision to interrupt speech seems to have been made soon after the

detection of an error, consistent with the Main Interruption Rule. This process is summarized in Figure 8.8. This means that even if errors have been detected, they may still be overtly produced if the articulators had already begun to produce the part of the message containing the error before it received the signal to interrupt speech. Thus overt errors, particularly those that are cut off as fragments, may have been detected prearticulatorily rather than postarticulatorily.



+the error will be overtly produced if arrival of the speech interruption signal precedes its articulation

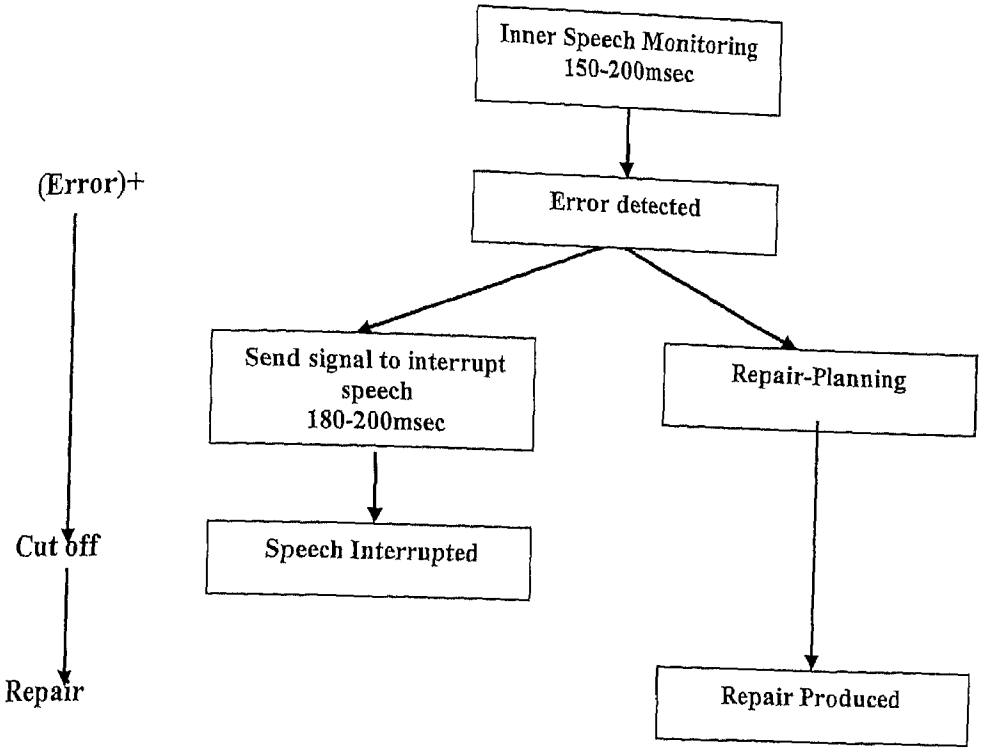
Figure 8.8

The Process of Error-Detection and Speech Interruption

8.3.2 Cut off-to-repair Intervals

In this study, the cut off-to-repair intervals ranged from 0 to 1512msec. In fact, almost half or more of all the self-repairs had 0msec intervals. This means that once speech was interrupted, speakers were able to produce repairs almost immediately, which strongly suggests that the repair-planning must have commenced prior and not upon to interruption.

The high number of 0msec intervals in repeats indicates that although it was not the repair that was being produced after the interruption point, but a repeat of previous elements, speakers were ready to resume their speech upon interruption. The 0msec and short intervals were even more salient in the other self-repairs as they show that that it is possible for the repair-planning to have commenced prior to interruption, and thus for the repair to be produced upon interruption. Thus, perhaps as suggested by Hartsuiker and Kolk (2001), the processes of error-detection, speech interruption and repair-planning are not serial, carry forward type of processes but parallel ones, where in the process of monitoring internal speech, error detection may trigger both the instructions to stop speech and to commence repair-planning. This process of error-detection, speech-interruption and repair-planning is shown in Figure 8.9.



+the error will be audible if arrival of the speech interruption signal precedes its articulation

Figure 8.9

The Process of Error-Detection, Speech-Interruption and Repair-Planning

8.3.3 Error-to-Repair Intervals

The error-to-repair intervals in this study ranged from 15 to 1785msec. It was not uncommon to find intervals below 200msec, not just in repeats, but also in the other three self-repairs, further indicating the possibility of prearticulatory error-detection and of re-planning commencing before interruption. If we once again consider the times estimated for error detection (100msec) and the stop signal to be sent to the articulator (180msec), and take away the total of this from the total duration of the intervals in this

study, it would leave approximately 170msec and below for most of the intervals (excluding repeats) for re-planning.

8.4 Significance of the Findings and Future Directions

The findings of this study indicate that firstly, the different categories of disfluencies such as silent and filled pauses, prolongations, repeats and forms of self-repair such as additions, deletions and substitutions, need to be better defined so that they may be studied more consistently. The definitions should include what each disfluency entails and how each can be identified, categorized and measured (if necessary). This is particularly in relation to prolongations and repeats. Thus, a revised taxonomy of disfluencies is suggested as presented in Figure 8.4.

Secondly, this study has shown that not all forms of hesitation occur in the same position in the structure of a repair. Thus, *the structures of repairs have to be made* specific, taking into consideration that prolongations and the first token of repeat come before the interruption point, while silent and filled pauses come after the interruption point as suggested in Figure 8.3.

This also affects the way in which repairs are defined and categorized, as in some cases there is only audible evidence of hesitation but not self-repair (see Figure 8.1). Hence, it is suggested that such cases be referred to as *possible-repairs* rather than covert repairs. This is because we are only assuming that silent pauses, filled pauses, prolongations and repeats or a combination of these hesitation, which occur on their own, are evidence of prearticulatory monitoring.

Thirdly, the time intervals found in this study indicate the presence of both prearticulatory error-detection and repair-planning commencing before the point of interruption. While the former can be explained by production the Perceptual Loop theory and even Laver's Production model and the Node Structure Theory, more cross-linguistic and experimental research, including the use of Functional Magnetic Resonance Imaging (fMRI), is needed to study the mechanisms involved in repair-planning. A combination of data comprising points of brain activation and outward production of disfluencies, such as in Nota and Honda (2003) may be able to provide a better picture of the entire process of speech-monitoring, including error-detection, speech-interruption and repair-planning.

8.5 Conclusion

This study has shown that disfluencies such as silent and filled pauses, prolongations, repeats, substitutions, insertions and deletes occur in spontaneous speech. The results show that that the categorization of these disfluencies needs to be reevaluated to take into account their function and position in the structure of self-repairs. This is especially in relation to prolongations and repeats. The results also indicate not only the possibility of prearticulatory monitoring of inner speech, but also the possibility of repair-planning commencing before speech is interrupted.