Restarts: Symptom or Signal?

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Abstract

Hesitation phenomena are common in spontaneous speech and have been viewed either as a symptom of production difficulties or as a signal to aid listener comprehension. Focusing on simple restarts (i.e. repetitions) and complex restarts (i.e. false starts), this paper examines these in a corpus of naturally occurring conversation for length of restart, association with other hesitation phenomena, position in discourse, content, and complexity (grammatical weight, association with given or new information, and frequency of use of succeeding words). The findings show that restarts are associated with new information and words with low frequencies of use, but rarely occur at the start of T-units and do not differ from non-restarts in grammatical weight. Simple and complex restarts differ in length and in parts of speech either repeated or rephrased. The findings have implications for measuring fluency and for how restarts should be viewed.

Keywords: *hesitation phenomena, restarts, simple restarts, complex restarts, new information*

1. Hesitation phenomena

Hesitation phenomena are very common in spontaneous speech. For instance, in conversation up to a quarter of sentences uttered may be preceded by a filled pause (Ford, 1993). Hesitation phenomena include filled pauses (e.g. *uh* and *um*), silent pauses longer than half a second, repetitions, false starts, syllable lengthening, smallwords (e.g. *Well*), and editing expressions (Johnson & Davis, 1978; Ford, 1993; Shriberg, 1994; Clark & Wasow, 1998; Gilquin, 2008). While traditionally viewed as unimportant incidental aspects of speech, investigations of hesitation phenomena have the potential to shed light on several issues of language processing.

One reason for investigating hesitation phenomena is to try to find out why they are used. As Clark & Wasow (1998) point out, repetitions take extra time and effort to produce, are redundant and may make utterances harder to understand. Given these reasons for not repeating words, why do so many speakers do so? There are two main

theories for the use of hesitation phenomena which have broad implications (de Leeuw, 2007; Nicholson, 2007). The first is that they are symptoms of production difficulties, the Cognitive Burden View of disfluencies. The second is that they provide signals to aid listeners in comprehending the message, a view termed Strategic Modelling.

Viewing hesitation phenomena as symptoms of production difficulties implies that the speaker has not fully planned or formed an utterance before he or she begins to speak, and so hesitation phenomena occur as the speaker searches for what to say next to achieve the intended goal (Bard, Lickley & Aylett, 2001; Clark, Fox Tree & Jean, 2002). Such planning and formation problems are more likely when the intended goal involves new information which cannot be retrieved from the preceding discourse. The need to access the new information from memory imposes a cognitive load on the speaker resulting in less processing space available for the fluent production of speech, hence the term Cognitive Burden View of disfluencies. This view of hesitation phenomena appears to be the default interpretation for their use as evidenced by the widespread use of the term 'disfluencies' for hesitation phenomena. In addition, Clark & Fox Tree (2002) found that listeners judge speakers who use filled pauses as having production difficulties, and the number of false starts and repetitions is often used as a measure of fluency in applied linguistics research (e.g. Skehan & Foster, 1999). Research evidence for the symptom view comes from studies investigating the effects of several different factors on the rate of hesitation phenomena, with some studies finding that planning and production variables had the greatest impact (e.g. Bard et al., 2001). If hesitation phenomena are a symptom of production difficulties, this interpretation can have important real-world applications. Much recent work on hesitation phenomena has been in the field of natural language processing (e.g. Boulis et al., 2005; Georgila, 2009), and for some applications, such as in-vehicle spoken dialogue systems, it can be important to be able to identify the amount of cognitive load on speakers at any given time and disfluencies may provide an indication of this (Lindström et al., 2008).

The second view of hesitation phenomena, that they provide signals for listeners, treats them very differently to the symptom view. From a Strategic Modelling perspective, hesitation phenomena may be purposeful (albeit unconscious) and act as a signal of the information to follow (de Leeuw, 2007). Rather than being errors, they are perceived as instances of successful language use (O'Connell & Kowal, 2005). If this is true, then terms with negative overtones such as 'disfluencies' and 'false starts' are inappropriate. Hesitation phenomena have been found to be related to the length and predictability of succeeding constituents (Shriberg, 1994). For example, phrase-initial filled pauses may indicate discourse boundaries and the duration of a filled pause cues the listener for the complexity of the succeeding phrase (Watanabe et al., 2005). These findings on filled pauses have led to suggestions that *uh* and *um* should be treated as conventional words with different purposes (Clark, Fox Tree & Jean, 2002; Fox Tree, 2001; but cf. O'Connell

& Kowal, 2005). Similar patterns have been found for other hesitation phenomena. The use of restarts correlates with the complexity of the succeeding constituent as measured by grammatical weight (Clark & Wasow, 1998), and lexical hesitations precede less predictable words (Shriberg & Stolcke, 1996). This last point can be generalized so that fluent speech biases listeners to pay attention to objects mentioned previously or given information, while speech with frequent hesitation phenomena biases listeners to objects not mentioned or new information (Arnold, Fagano & Tanenhaus, 2003; Arnold, Tanenhaus, Altmann & Fagano, 2004). In this way, hesitation phenomena are not viewed pejoratively as disfluencies, but rather are seen as signals to aid listeners.

Although most of the research cited above favors one or other of the two views of hesitation phenomena, they are not necessarily mutually exclusive. Some research has shown that different phenomena are associated with different views. For instance, Nicholson, Eberhard & Scheutz (2010) found that filled pauses act as signals but restarts act as symptoms, and Fox Tree (1995) found that false starts in the middle of sentences increase the listeners' processing load while repetitions do not.

2. Investigating restarts

This paper focuses on repetitions and false starts, together termed restarts, since these are perhaps the least researched of the hesitation phenomena. While there has been research focusing exclusively on false starts (e.g. O'Shaughnessy, 1992) or on repetitions (e.g. Clark and Wasow, 1998), other research has compared these two phenomena (e.g. Fox Tree, 1995). Although Fox Tree's study suggested that repetitions and false starts are processed differently, other studies have argued that false starts and repetitions are variants on a theme, renaming the phenomena complex and simple restarts respectively (O'Shaughnessy, 1994).

A simple restart or repetition is when one (or a substantial part of one) or more words are repeated in a way that does not fit with expected language use (thus a repetition of *very* before an adjective would not be counted as a restart). An example is given in (1) with the restart in italics.

(1) she didn't do anything *to this to this* new car

A complex restart, traditionally called a false start, is similar to a simple restart but involves the replacement of at least one of the words as in (2).

(2) Sundays in London *if you're if we're* all working or cooking

The previous research on hesitation phenomena, and restarts in particular, highlights several contradictory viewpoints. While all previous studies argue that hesitation phenomena are relatively frequent in spontaneous spoken discourse and that they tend to precede complex constituents, it is unclear whether this complexity is best measured

by the length of the succeeding constituent or by the nature of the information (given or new) that it contains. It is also unclear whether hesitation phenomena should be viewed as symptoms of production difficulties or as signals of succeeding information, whether all hesitation phenomena should be viewed as having similar functions or whether the different categories should be viewed as distinct (and for restarts, whether simple and complex restarts are variants on a theme or distinct phenomena), and whether hesitation phenomena tend to be placed at specific points in discourse. For restarts in particular, two issues have been largely overlooked in previous research, namely, the length of restarts and their content, in other words, what words are repeated or replaced in restarts. This paper takes a corpus approach to addressing these issues by examining the frequency of occurrence of a range of aspects in simple and complex restarts, including incorporation of other hesitation phenomena in restarts, placement of restarts, length of restarts, length of constituents following restarts, prevalence of given and new information in and after restarts, and types of words used in restarts.

3. Methodology

3.1 The corpus

The previous studies of hesitation phenomena are fairly evenly split between experimental studies and corpus analyses. The data in the corpus studies comes from a variety of sources: soap operas (Johnson & Davis, 1978), television interviews (O'Connell & Kowal, 2005), monologues (Swerts, 1998), map tasks (Bard et al., 2001) and the Switchboard corpus (Bell et al. 2003). The only study that clearly uses a corpus of face-to-face everyday conversation is Clark, Fox Tree & Jean (2002). Given the primacy of conversation in descriptions of language (Levelt, 1989), this is surprising. In this study, therefore, the data consists of the detailed transcriptions of naturalistic conversations in Crystal & Davy (1975). Although dated, this remains one of the most readily available highly detailed sets of transcriptions of naturally occurring conversation. It is also still widely used with over 50 citations in the last four years. The transcriptions of 15 conversations on a variety of topics in a variety of contexts include detailed pause marking, intonation organisation (such as tone-unit boundaries), and pitch movement. The total length of the transcriptions is around 10,500 words.

3.2 Identifying restarts

Simple restarts involve the repetition of a word or words in a non-standard form. Where this is a single word repeated as in (3), such cases may seem straightforward to identify.

(3) I mean as far as they're concerned *they they*'re doing a text you know I mean *they're they may* be reading something by Shakespeare

In this case, *they they* is a simple restart. Checking against the Corpus of Contemporary American English to see if it is non-standard, *they they* as an immediate co-occurrence has a Mutual Information score of -7.58, suggesting that this is a non-standard use. In (3), *they're they may* is counted as a complex restart, since the two reiterations are not identical. Also in (3), in *they're concerned they they're doing*, the first and second *they* is not a reiteration, since with an ellipted *that*, this phrase follows standard syntactic rules (with the exception of the immediate repetition of *they*).

Simple restarts can include multiple repetitions as in (4) where *there was there was there was* is counted as one restart and *some some* as another, can include partial repetitions as in (5), and can be interrupted by filled pauses or smallwords as in (6). However, repetitions separated by a lengthy pause are not counted as restarts, since the reason for the pause is unknown.

(4) yeah *there was there was there was some some* trouble as well
(5) where we're living in a way *not not* like that *en entirely* but
(6) and that .. erm *I wouldn't* well *I wouldn't* live there for the world

Complex restarts are more problematic. Where they include a mixture of repetitions and rephrasings in non-standard form as in (3), the case for the majority of the complex restarts in the corpus, identification is often similar to identifying simple restarts. Other cases such as (7) are less straightforward.

(7) they all *went go* straight *out of out of the gr completely away from the place*

In (7), *out of out of* could be counted as a simple restart. However, *completely away from the place* appears to be a replacement for *out of the gr*, and so *out of out of the gr completely away from the place* is counted as a single complex restart. Also in (7), *went go* is a complex restart, these morphological variants being the only case of a single word rephrasing in the corpus.

3.3 Analysing restarts

First, to see whether the various hesitation phenomena serve similar functions, the number of restarts containing other hesitation phenomena, namely, filled pauses and smallwords, were counted. If they serve similar functions, we should expect that they would be combined at a rate greater than chance so the frequency of filled pauses and smallwords in the restarts was compared to their frequency in the overall corpus. In addition, in Clark and Wasow's (1998) model of simple restarts consisting of four stages (initial commitment, suspension of speech, hiatus, restart of constituent), the hiatus may often be marked by a filled pause or sometimes by a smallword (such as the hiatus in (6) filled with *well*). Following this, again we should expect a relatively high frequency of filled pauses within restarts. The frequency of filled pauses and smallwords in the T-units containing restarts was compared to their frequency in the whole corpus.

Second, the length of both simple and complex restarts was calculated to see if the amount of material to be reiterated affected whether it was repeated or replaced. From a Strategic Modelling perspective, simply replacing a single word (for example, if the restart in (2) was *if you we're*) may be confusing rather than aid comprehension, so we might expect complex restarts to include some context around the replaced word and thus be longer than simple restarts. For this, the number of words in the initial phrasing before it was repeated or rephrased was counted. So the restart in (1) has a length of 2, and that in (2) has a length of 3.

Third, the position of the restarts was identified. The discourse was divided into T-units, analogous to spoken sentences (see Fries, 1994). If restarts precede complex constituents, we should expect them to be more frequent at the beginning of T-units. If hesitation phenomena are more frequent at discourse boundaries (Swerts, 1998), we should also expect restarts to be more frequent immediately after discourse markers. The placement of restarts were therefore categorized into T-unit-initial, post-discourse marker, and other (i.e. middle of T-unit).

Fourth, the content of the restarts was examined by looking at the parts of speech of the words which were repeated or replaced. This allows us to see whether certain types of content favour simple or complex restarts.

Fifth, the complexity of succeeding constituents was examined in several ways. The grammatical weight of the constituent including the restart was measured for each restart by counting the number of words in the constituent following the restart (see Wasow, 1997). Whether both the restart and the succeeding parts of the constituent contained new or given information was identified. Given information was taken as being signaled by pronouns, definite noun phrases, unstressed units, shell nouns and previously mentioned material (see Chafe, 1976, 1980). Some succeeding parts of the constituent contained features associated with given information but contextually appeared to present new information; these were identified as containing probable new information. The ease of accessing vocabulary items was measured by looking at the frequencies of use of the words in the node of the restart (*to* in example (1)) and the nucleus of the succeeding parts of the constituent (*car* in example (1)) and categorising these into 1,000-word bands based on the British National Corpus using the RANGE program (Nation, 2012).

To see if simple and complex restarts have different characteristics, the frequencies with which certain characteristics are associated with the two types of restart were compared using chi-square (with Cramer's V used for effect size). The characteristics investigated were placement of the restart, length of the restart, type of information (given or new) in the restart, and groupings of parts of speech in the restarts (pronouns, function words and content words). Chi-square cannot be used for all comparisons (see

below), but when possible, where the raw data violates assumptions of chi-square, categories were combined to avoid such violation. For instance, rather than calculating chi-square for all parts of speech, these were grouped to ensure that all expected frequencies were greater than five.

To check that the features associated with restarts are specific to restarts and not general features of spoken discourse in the corpus, 20 T-units not containing restarts but with similar characteristics to the T-units with restarts were identified (for instance, one of the non-restart T-units parallels (4): *and there's no story*).. Points in these T-units where it appears that a restart could have occurred were identified, and these 20 T-units were analysed for grammatical weight, given and new information, and word frequency of nucleus of succeeding constituents and for word frequency of node at the point where a restart could have occurred.

4. Findings

4.1 Types and lengths of restarts

In total in the corpus, there are 128 restarts, of which 94 are simple restarts and 34 are complex restarts. Table 1 shows the lengths of these restarts in terms of the number of words in the initial phrasings. Most simple restarts consist of a single word repeated, while most complex restarts consist of at least three words rephrased. These differences in length between simple and complex restarts are significant with a large effect size ($\chi^2 = 50.76$; df = 2; $p < 0.001$, $\varphi = 0.63$).

Table 1 Lengths of restarts

Length	All restarts (128)		Simple restarts (94)		Complex restarts (34)	
	N	%	N	%	N	%
One word	59	46.09	58	61.70	1	2.94
Two words	32	25.00	24	25.53	8	23.53
Three or more words	37	28.91	12	12.77	25	73.53

4.2 Inclusion of hesitation phenomena in restarts

Nineteen of the 128 restarts include or immediately co-occur with other hesitation phenomena (filled pauses or smallwords). Of these 19 restarts associated with other hesitation phenomena, 11 are simple restarts and 8 are complex restarts. 13 of the associated hesitation phenomena are filled pauses, and 7 are smallwords (one restart includes both). In the whole corpus, there are 78 instances of *er*, 64 of *erm*, and 140 uses of smallwords (e.g. *well*, *you know*), giving a total of 382 of these hesitation phenomena. Comparing their frequency in the whole corpus with their frequency in the 1,485 words of the

T-units containing restarts (the 19 instances plus another 40 outside the restarts) gives a log-likelihood value of 0.39, indicating that these hesitation phenomena occur neither more nor less frequently in the restarts than elsewhere and suggesting that they are not particularly likely to be associated together.

4.3 Positioning of restarts

Examining the points in the discourse where the restarts occur (start of T-unit, after discourse marker, middle of T-unit) gives the frequencies shown in Table 2. It can be seen that restarts occur most frequently in the middle of T-units or immediately after discourse markers with few at the start of T-units. There is little difference in positioning between simple and complex restarts ($\chi^2 = 1.55$, df = 2, not significant, $\varphi = 0.11$).

Table 2 Positioning of restarts

Position	All restarts (128)		Simple restarts (94)		Complex restarts (34)	
	N	%	N	%	N	%
Start of T-unit	18	14.06	15	15.96	3	8.82
After discourse marker	44	34.38	30	31.91	14	41.18
Middle of T-unit	66	51.56	49	52.13	17	50.00

4.4 Types of words in restarts

The parts of speech of the words in the initial phrasing of the restart were identified and counted for frequency with the results given in Table 3. To deal with the large number of low frequencies, the parts of speech were grouped together into content words, pronouns, and function words. The frequencies of these were compared between simple and complex restarts giving $\chi^2 = 9.57$ (df = 2, $p = 0.0083$, $\varphi = 0.27$) suggesting that the two types of restarts differ in the types of words they include with a medium effect size, simple restarts having a greater proportion of function words and complex restarts a greater proportion of content words.

Table 3 Types of words in restarts

Part of speech	All restarts (128)		Simple restarts (94)		Complex restarts (34)	
	N	%	N	%	N	%
Subject pronoun	61	26.41	40	28.17	21	23.86
Other pronoun	17	7.36	12	8.45	5	5.68
All pronouns	78	33.77	52	36.62	26	29.54
Determiner	33	14.29	21	14.79	12	13.64
Preposition	20	8.66	15	10.56	5	5.68
Negation	7	3.03	4	2.82	3	3.41
Conjunction	2	0.87	2	1.41	0	0.00
Copula/auxiliary verb	38	16.45	25	17.61	13	14.77
Model verb	2	0.87	2	1.41	0	0.00
Other function word	13	5.63	6	4.23	6	6.82
Function words	115	49.8	75	52.83	39	44.32
Content word	38	16.45	15	10.56	23	26.14

4.5 Complexity succeeding restarts

Complexity was investigated in three ways: the grammatical weight of the succeeding constituents in the T-unit measured as number of words, given or new information in the restarts and the succeeding constituents, and word frequencies of the words in the node of the restarts and the nucleus of the succeeding constituents. For the first and third of these, the findings were compared against twenty non-restarts.

The average grammatical weight of the constituents including the restarts was 9.89 (9.71 for simple restarts; 10.38 for complex restarts). The average grammatical weight for the non-restarts was 12.95, suggesting that the length of the expected constituents does not prompt the speaker to form a restart.

For given or new information, the restarts were categorized into whether the restart itself contained given or new information, and whether it was followed by new information, probable new information or given information. The findings are given in Table 4 and suggest that restarts, especially complex restarts, are associated with new information. Comparing the frequencies for simple and complex restarts for information in the restart itself, we find $\chi^2 = 13.60$ (df = 1, $p = 0.0002$, $\varphi = 0.32$), suggesting that new information is more closely associated with complex restarts than with simple restarts. The chi square comparison for information following the restart could not be calculated (since the data violates an assumption of the statistic), but the percentages suggest that restarts, especially complex restarts, tend to precede new information. Since the general pattern in English is for given information to precede new information, we should

expect the restart to be more likely to contain given information with new information following this. However, comparing patterns for restarts with the given-new patterns in non-restarts suggests that restarts, especially complex restarts, precede new information at a rate greater than is usual in conversation.

Table 4 Given and new information associated with restarts

Nature of information	All restarts (128)		Simple restarts (94)		Complex restarts (34)		Non-restarts (20)	
	N	%	N	%	N	%	N	%
Information in restart								
Given information	108	84.37	86	91.49	22	64.71	19	95.00
New information	20	15.63	8	8.51	12	35.29	1	5.00
Information following restart								
Given information	15	11.72	14	14.89	1	2.94	4	20.00
Probable new information	20	15.63	16	17.02	4	11.76	7	35.00
New information	93	72.66	64	68.09	29	85.29	9	45.00

To investigate the lexis in restarts, the frequencies of use in the British National Corpus of the words at the node of the restart and the word at the nucleus of the succeeding parts of the constituent were categorized into 1,000-word frequency bands with Base 1 being the 1,000 most frequent words in English, Base 2 being the words ranked 1,001 to 2,000, Base 3 the words ranked 2,001 to 3,000, and Other being words outside these bands. The same procedure was also followed for the non-restarts (with a potential point where a restart could have occurred identified in the T-unit). In general, words with a higher frequency of use should be more accessible, so a greater proportion of words in high bands (Other) suggests a greater processing load. From Table 5, the words at the nucleus are generally less frequent and therefore less accessible than the words at the node, and there is some evidence that the words in restarts are generally less frequent and less easily accessible than the words in non-restarts.

Table 5 Frequency of lexis in node and nucleus of restarts and non-restarts

Word list	Restarts: Nodes				Restarts: Nucleus			
	Tokens		Types		Tokens		Types	
	N	%	N	%	N	%	N	%
Base 1	466	92.1	92	76.7	76	59.4	62	57.4
Base 2	11	2.2	8	6.7	20	15.6	16	14.8
Base 3	2	0.4	2	1.7	10	7.8	10	9.3
Other	27	5.3	18	15.0	22	17.2	20	18.5

Word list	Non-restarts: Nodes				Non-restarts: Nucleus			
	Tokens		Types		Tokens		Types	
	N	%	N	%	N	%	N	%
Base 1	25	96.2	13	92.9	13	65.0	12	63.2
Base 2	0	0.0	0	0.0	4	20.0	4	21.0
Base 3	0	0.0	0	0.0	1	5.0	1	5.3
Other	1	3.8	1	7.1	2	10.0	2	10.5

5. Discussion

The main findings from this study are:

- Restarts are relatively common in the corpus.
- Simple restarts are more frequent than complex restarts.
- There is a difference in length between simple and complex restarts with most simple restarts consisting of a single word and most complex restarts consisting of three or more words.
- Other hesitation phenomena are neither particularly associated nor particularly dissociated with restarts.
- Restarts occur more frequently in the middle of T-units or after discourse markers than at the start of T-units.
- The types of words found in restarts differ between simple restarts (higher proportion of function words) and complex restarts (higher proportion of content words).
- Restarts are not associated with the length of the expected succeeding parts of the constituents.
- Restarts, especially complex restarts, are associated with new information.
- The nucleus of the constituents following restarts generally consists of words with a lower overall frequency of use than in the node of the restart.
- The words in and following restarts are generally of a lower overall frequency of use than those in and following non-restarts.

These findings suggest that, in addition to whether words are repeated or rephrased, simple and complex restarts differ in their typical forms (length and word types). On this basis, they might best be considered separate phenomena. However, the two types of restart appear similar in how they function (placement and complexity) with perhaps complex restarts being preferred where these aspects are emphasized. On this basis, they are probably better considered variants of the same phenomenon. How to treat simple and complex restarts, then, depends on the focus of analysis.

The key aspect influencing the use of restarts in this study is complexity. In contrast to Clark and Wasow's (1998) complexity hypothesis which states that the greater the

grammatical weight of a constituent, the more likely a restart, in this study the grammatical weight of the constituent was not related to the likelihood of a restart occurring (since the same analysis was used in the two studies, the difference in findings is not methodological, and so is difficult to explain). However, the complexity of the constituent when defined in different terms did affect the likelihood of a restart. Restarts are associated with the production of new (as opposed to given) information and with the production of words with a low general frequency of use. New information is generally less accessible than given information, and lower frequency words are generally less accessible than high frequency words. The aspect likely to prompt a restart, therefore is not syntactic complexity, but accessibility of information and lexis. The less accessible these are, the greater the processing time and load and thus the greater the need for a delay or for a reformulation. Thus, restarts can be viewed as a symptom of production difficulties.

From the perspective of restarts as a symptom of production difficulties, perhaps the most important application is in measuring fluency of speech. Such measurements are most commonly made with language learners, but taking native speakers as a model (admittedly a controversial stance with the growth of World Englishes and English as a Lingua Franca), the findings from the current study could provide benchmarks against which L2 speakers' fluency can be compared. Most previous attempts to assess fluency use multiple measures, one of which often concerns restarts. For instance, Wood (2010) reports on five previous studies of fluency, four of which include restart frequency as a measure. While it is common to include restart frequency as a component of measures of fluency, it is not clear whether this practice is justified. For example, Kormos & Dénes (2004) investigated the validity of ten typical components of fluency measurements, one of which was number of "repetitions, restarts and repairs" (p. 152) per minute, by comparing the measurements between two levels of learners and by comparing measurements against teachers' ratings of fluency. In both comparisons, other components of fluency (e.g. mean length of runs) provided a much better measure of fluency than restart frequency, which showed no relationship with either learner level or teacher ratings. If restarts are prompted by accessibility, only certain types of accessibility problems are relevant to measuring learners' fluency. Accessibility of new information is not relevant, since whether information is new or given affects all speakers alike and thus is not an appropriate basis for evaluating fluency. Whether lexis is easily accessible, however, may be of more relevance. With larger, easily accessible vocabularies, higher-level speakers should find searching for an uncommon word less of a production difficulty than it is for lower-level learners. This concerns access fluidity where searching for a word is an automated process (Segalowitz, 2007). However, while a given word may be more easily accessible to a higher-level speaker, such speakers also have more words in their vocabularies which are not easily accessible. If word accessibility is generally

associated with frequency of use, there should be a band-level difference in ease of accessibility between higher- and lower-level speakers. For example, native speakers may find that generally words less frequent than the 8,000-word band are difficult to access, whereas a learner may find words less frequent than the 3,000-word band difficult. However, the proportion of the words in their vocabularies that are easy-to-access and difficult-to-access may be similar, and thus their frequency of use of restarts prompted by difficulty of accessing lexis may be similar. Although it is possible to make judgments about whether a restart is prompted by new information or difficulty of lexical access and about the level of lexis that is difficult to access, this is a complex process that is impractical for most uses of fluency measurements. It is therefore better to conclude that, although restarts are a symptom of production difficulty, they should not be used in measurements of fluency.

Most work on hesitation phenomena conducted by linguists, as in the current study, has focused on the speaker's production, whereas most work in natural language processing has examined the comprehension of the phenomena (Brennan & Schober, 2001). The work in linguistics, then, is biased towards viewing restarts as a symptom of production difficulty. This does not mean, however, that restarts cannot also be viewed as a signal to aid listeners. The findings show that restarts are often prompted by the need to produce new information or low frequency lexis. From a listener's perspective, taking an emergentist view of language processing where frequency of exposure leads to the generation of probabilistic expectations (see Ellis, 2003), if restarts frequently precede new information or low frequency lexis, an expectation will be generated that hearing a restart can be taken as a signal that the succeeding parts of the constituent have a reasonable probability of containing new information or low frequency lexis. This provides an explanation for why speech with frequent hesitation phenomena biases listeners to new information (Arnold et al., 2003, 2004). Research is needed to see if speech with frequent hesitation phenomena, especially restarts, also biases listeners to low frequency lexis. It seems likely, then, that, rather than choosing between viewing restarts as a symptom or as a signal, they act as both. From a speaker's perspective, restarts are a symptom of production difficulties, but, from a listener's perspective, they are a signal to aid processing.

References

Arnold, J. E., Fagano, M., & Tanenhaus, M. K. (2003). Disfluencies signal theee, um, new information. *Journal of Psycholinguistic Research*, *32*(1), 25-36.

Arnold, J. E., Tanenhaus, M. K., Altmann R. J., & Fagano, M. (2004). The old and thee, uh, new. *Psychological Science, 15*(9), 578-581.

Bard, E. G., Lickley, R. J., & Aylett, M. P. (2001). Is disfluency just difficulty? *Proceedings of ISCA Tutorial and Research Workshop (ITRW) on Disfluency in Spontaneous*

Speech (pp. 97-100), Edinburgh.

Bell, A., Jurafsky, D., Fosler-Kussier, E., Girand, C., Gregory, M., & Gildea, D. (2003). Effects of disfluencies, predictability, and utterance position on word form variation in English conversation. *Journal of the Acoustical Society of America*, *113*, 1001–1024.

Boulis, C., Kahn, J. G., & Ostendorf, M. (2005). The role of disfluencies in topic classification of human-human conversations. *Proceedings of the AAAI Workshop on Spoken Language Understanding*, Pittsburgh.

Brennan, S. E., & Schober, M. F. (2001). How listeners compensate for disfluencies in spontaneous speech. *Journal of Memory and Language, 44*, 274-296.

Chafe, W. L. (1976). Givenness, contrastiveness, definiteness, subjects, topics and point of view. In C.N. Li (Ed.), *Subject and topic* (pp. 25-55). New York, NY: Academic Press.

Chafe, W. L. (1980). The deployment of consciousness in the reproduction of a narrative. In W. L. Chafe (Ed.), *The Pear stories: Cognitive, cultural and linguistic aspects of narrative production* (pp. 9-50). Norwood, NJ: Ablex.

Clark, H. H., Fox Tree, J.E., & Jean E. (2002). Using uh and um in spontaneous speaking. *Cognition, 84*, 73-111.

Clark, H. H., & Wasow, T. (1998). Repeating words in spontaneous speech. *Cognitive Psychology, 37*, 201-242.

Crystal, D., & Davy, D. (1975). *Advanced conversational English*. London, England: Longman.

de Leeuw, E. (2007). Hesitation markers in English, German and Dutch. *Journal of Germanic Linguistics, 19*, 85-114.

Ellis, N. (2003). Constructions, chunking, and connectionism: the emergence of second language structure. In C.J. Doughty & M.H. Ling (Eds.), *The handbook of second language acquisition* (pp. 63-103). Malden, MA: Blackwell.

Ford, M. (1993). Characteristics of hesitation phenomena. In G. Blanken, J. Dittman, H. Grimm, J.C. Marshall & C. Wallesch (Eds.), *Linguistic disorders and pathologies: An international handbook* (pp. 46-52). New York, NY: Walter de Gruyter.

Fox Tree, J. E. (1995). The effects of false starts and repetitions on the processing of subsequent words in spontaneous speech. *Journal of Memory and Language, 34*(6), 709-738.

Fox Tree, J. E. (2001). Listeners' uses of um and uh in speech comprehension. *Memory and Cognition, 29*(2), 320-326.

Fox Tree, J. E. (2002). Interpreting pauses and ums at turn exchanges. *Discourse Processes, 34*(1), 37-55.

Fries, P. H. (1994). On theme, rheme and discourse goals. In: M. Coulthard (Ed.), *Advances in written text analysis* (pp. 229-249). London, England: Routledge.

Georgila, K. (2009). Using Integer Linear Programming for detecting speech disfluencies. *Proceedings of NAACL HLT 2009: Short Papers* (pp. 109-112), Boulder, Colorado.

Gilquin, G. (2008). Hesitation markers among EFL learners: Pragmatic deficiency or difference? In J.Romero-Trillo (Ed.), *Pragmatics and corpus linguistics: A mutualistic entente* (pp. 119-150). Berlin, Germany: Mouton de Gruyter.

Johnson, F. L., & Davis, L. K. (1978). Hesitation phenomena in the language of family conversations across three conversational styles in three formats of television programming in the USA. Paper presented at The World Congress of Sociology, Sweden. ERIC Document: ED158612.

Kormos, J., & Dénes, M. (2004). Exploring measures and perceptions of fluency in the speech of second language learners. *System, 32*(2), 145-164.

Levelt, W. (1989). *Speaking: From intention to articulation*. Cambridge, England: Cambridge University Press.

Lindström, A., Villing, J., Larsson, S., Seward, A., Aberg, N., & Holtelius, C. (2008). The effect of cognitive load on disfluencies during in-vehicle spoken dialogue. *Proceedings of Interspeech 2008,* (pp. 1196-1199), Brisbane, Australia.

Nation, P. (2012). Range [Computer software]. Available at: http://www.victoria.ac.nz/lals/ about/staff/paul-nation.

Nicholson, H. B. M. (2007). *Disfluency in dialogue: Attention, structure and function* (Unpublished doctoral thesis, University of Edinburgh).

Nicholson, H., Eberhard, K., & Scheutz, M. (2010). "Um...I don't see any": The function of filled pauses and repairs. *Proceedings of DiSS-LPSS Joint Workshop,* 2010 (pp. 89-92), Tokyo, Japan.

O'Connell, D. C., & Kowal, S. (2005). Uh and um revisited: Are they interjections for signaling delay? *Journal of Psycholinguistic Research*, *34*(6), 555-576.

O'Shaughnessy, D. (1992). Analysis of false starts in spontaneous speech. *Proceedings of Second International Conference on Spoken Language Processing,* (ICSLP'92) (pp. 931-934), Alberta, Canada.

O'Shaughnessy, D. (1994). Correcting complex false starts in spontaneous speech. *Proceedings of 1994 IEEE International Conference on Acoustics, Speech and Signal Processing,* Volume 1 (pp. 349-352), Adelaide, Australia.

Segalowitz, N. (2007). Access fluidity, attention control, and the acquisition of fluency in a second language. *TESOL Quarterly*, *41*(1), 181-186.

Shriberg, E., & Stolcke, A. (1996). Word predictability after hesitations: a corpus-based study. *Proceedings of the Fourth International Conference on Spoken Language* (ICSLP96), Volume 3 (pp. 1868-1871), Philadelphia.

Shriberg, E. E. (1994). *Preliminaries to a theory of speech disfluencies* (Unpublished doctoral thesis, University of California at Berkeley).

Skehan, P., & Foster, P. (1999). The influence of task structure and processing conditions on narrative retellings. *Language Learning, 49*(1), 93-120.

Swerts, M. (1998). Filled pauses as markers of discourse structure. *Journal of Pragmatics, 30*(4), 485-496.

Wasow, T. (1997). Remarks on grammatical weight. *Language Variation and Change, 9*, 81-105.

Watanabe, M., Hirose, K., Den, Y., & Minematsu, N. (2005). Filled pauses as cues to the complexity of following phrases. *Proceedings of Interspeech,* 2005 (pp. 37-40), Lisbon, Portugal.

Wood, D. (2010). *Formulaic language and second language speech fluency: Background, evidence and classroom applications*. London, England: Continuum International Publishing Group.

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