



# Phonetic reduction and informational redundancy in self-initiated self-repair in Dutch<sup>☆</sup>

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## ABSTRACT

This paper presents a phonetic analysis of instances of self-initiated self-repair taken from a corpus of Dutch conversation, focusing on their temporal and articulatory characteristics. In particular, the paper investigates whether error repairs and appropriateness repairs, two subtypes of self-repair which differ in the degree of informational redundancy of the repair stretch, are different in terms of the phonetic relationship between reparandum and repair stretch. One might expect error repairs, whose repair stretch is more informative than that of appropriateness repairs, to be associated with local hyperarticulation in the repair stretch, while appropriateness repairs are more likely to be associated with phonetic reduction. Furthermore, the frequent presence of informationally redundant editing terms and repeated lexical items is expected to result in variation within the repair stretch along a hypo–hyper continuum. The paper reports on temporal measurements with controls for the internal structure of the repair, as well as auditory analysis and an attempt at quantifying a ‘reduction quotient’ for the stretches involved. The results show that local hyperarticulation is rare, and increased phonetic reduction in the repair stretch widespread. No significant differences between error and appropriateness repairs are observed. The findings are discussed with reference to the role of information status and pragmatic constraints in governing variation in speech production.

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## 1. Introduction

At least since Lindblom (1990) it has been widely acknowledged that articulatory planning is sensitive to informational redundancy, in that ‘parts of the speech stream that carry little information are realized with less articulatory effort than more informative parts’ (Pluymaekers, Ernestus, & Baayen, 2005a, p. 157). A number of studies (Aylett & Turk, 2006; Bell et al., 2003; Jurafsky, Bell, Gregory, & Raymond, 2001; Pluymaekers et al., 2005a) have assessed the correlation between a measure of informational redundancy and a measure of phonetic reduction—for example the number of absent segments or syllables relative to the word’s canonical realisation—and found it to be significant. These studies have two common features. First, their measures of informational redundancy tend to be based on

frequency measures, such as overall rate of occurrence in a corpus of speech or contextual predictability. Second, they apply their measures to samples from a large corpus of speech, across a range of discourse contexts. While not denying that specific contexts may be associated with specific pragmatically motivated constraints on speech production, the studies are based on the assumption that random sampling should prevent any skewing effect such constraints may have (e.g. Pluymaekers et al., 2005a, p. 149).

This paper takes a different approach to the issue of the relationship between informational redundancy, phonetic reduction and communicative context. First, it explores the influence of informational redundancy on temporal and articulatory reduction in a single, narrowly defined discourse context. Second, it takes a qualitative approach to the measurement of informational redundancy by comparing two sets of utterances in this context which differ in the extent to which they introduce new information into the discourse. On the face of it, it would seem reasonable to assume that with variation in discourse context controlled for, and with informational redundancy defined in functional terms, its influence on phonetic reduction should be clearly observable. This paper addresses this assumption. The context on which it focuses is that of self-initiated self-repair, as defined in the conversation-analytic and psycholinguistic

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literature (see Levelt, 1983; Schegloff, Jefferson, & Sacks, 1977, among others). In self-initiated self-repair, a speaker interrupts the flow of talk to correct or modify something he or she has said before. The stretch of speech to be corrected or modified can be called the 'reparandum'; the correction or modification itself the 'repair'. Two examples are given in (1) and (2), with the sequence of reparandum and repair underlined and the two constituents divided by '//'.

- (1) dat dat dan eh: toch weer minder // toch weer meer is  
 that that then er still less still more is  
*that that then er is still less – still more*
- (2) die gozer kan zo: // die kerel kan zo goed spelen  
 that guy can so that fellow can so well play  
*that guy can – that fellow can play so well*

In (1), the speaker retroactively replaces *minder* 'less' by *meer* 'more'; in (2), the speaker repairs *gozer* 'guy' to *kerel* 'fellow'. Repairs of this type are often accompanied by the repetition of items that precede or follow the reparandum; in these cases *toch weer* 'still' and *die ...kan zo* 'that ...can so' are repeated.

Previous research on the phonetics of self-repair has focused mainly on the various types of disfluency associated with the identification of a reparandum and the 'initiation' of repair, such as the lengthening of pre-repair segments (Fox Tree & Clark, 1997; Shriberg, 2001) or the abrupt, often glottally reinforced 'cut-off' of pre-repair lexical items (Benkenstein & Simpson, 2003; Jasperson, 2002). This study rather focuses on the phonetic characteristics of the repair proper—in particular as compared with those of the reparandum. With regards to informational redundancy and phonetic reduction, the following initial observations can be made. First, self-repair introduces new information, and the introduction of this information is important enough for the speaker to sacrifice fluency. This would suggest that the repair component has a high level of 'informativeness', and is therefore unlikely to be associated with phonetic reduction relative to the reparandum. Second, self-repair often involves the use of 'editing terms' (Levelt, 1983) such as *or* or *I mean*, as well as repetition, as seen in (1) and (2). Given that editing terms and repeated items are informationally highly redundant, we may expect repair stretches that contain editing terms and repeated material to show internal variation between phonetically reduced and phonetically unreduced speech.

Third, since Levelt (1983) it has been customary to distinguish between 'error repairs', in which a speaker corrects an erroneous formulation, and 'appropriateness repairs', in which a speaker refines, elaborates or clarifies a prior formulation. Of the examples given above, (1) is an error repair, while (2) is an appropriateness repair: *kerel* and *gozer* have the same denotation, but the speaker may consider *kerel* pragmatically more appropriate than *gozer*. The distinction would seem to be highly relevant for the relationship between informational redundancy and phonetic reduction. Error repairs introduce information that is crucial to the listener's correct interpretation of the utterance, while in appropriateness repairs, the new information refines or elaborates rather than corrects. In other words, error repairs are more highly informative than appropriateness repairs; therefore, we can hypothesise that they are less likely to be associated with phonetic reduction in the repair stretch. In fact, Levelt and Cutler (1983) observe in a corpus of Dutch self-repairs that while a majority of error repairs is 'prosodically marked'—that is, marked by a pitch accent on the repair stretch—a majority of appropriateness repairs is unmarked. At first sight, this is consistent with the present hypothesis: in Lindblom's (1990) terms, error repairs are more likely than appropriateness repairs to be associated with local 'hyperspeech'.

## 2. Data and method

### 2.1. Data

Instances of self-initiated self-repair were selected from approximately 15 h of unscripted speech by 10 pairs of male speakers of Standard Dutch, recorded by Mirjam Ernestus in 1995 and 1996 (Ernestus, 2000). The material comprises informal

interviews which Ernestus undertook with each pair, one-to-one conversations between the members of each pair on a range of topics, and unscripted negotiations undertaken by each pair following a set of instructions. During the informal interviews, Ernestus asked a small number of questions with a view to generating talk by the two participants, and minimised her own verbal participation in the ensuing interactions. Most pairs spent little time on the negotiation task, so that across the corpus, a total of over 12 hours involves free conversation by the participants. The participants were friends or colleagues who knew each other well before participating in the recordings. In most cases they had similar ages, with an overall range of 21–55, and similar social and educational backgrounds. Gross measures of syllable and segmental deletions across the corpus suggest that it is similar to other spontaneous speech corpora, including that of Johnson (2004), as far as the prevalence of phonetic reduction is concerned (Schüppler, Ernestus, Scharenborg, & Boves, 2008).

The material contains 83 instances of self-initiated self-repair of the type described above. All instances involve the overt correction or reformulation of immediately prior speech. Instances of 'covert repair' such as hesitations, repetitions and restarts (Fox Tree & Clark, 1997; Levelt, 1983; Nooteboom, 2005; Postma & Kolk, 1993) were not included. It should be noted that the material used for this study is rather different from that used in some of the earlier studies of self-repair referred to above—in particular Levelt (1983) and Levelt and Cutler (1983). Their findings are mostly based on analysis of task-oriented speech, in which much of the interaction involves the participants giving each other instructions. It may well be that different types of interaction are associated with different strategies for dealing with error and repair; therefore, it cannot simply be taken for granted that findings on the phonetics of self-repair generalise across studies. We will return to this issue below.

### 2.2. Classification of repairs

All instances were classified as error or appropriateness repair using the criteria set out by Levelt (1983) and, more recently, Kormos (1999). Kormos' illustrated taxonomy of repairs, reproduced with minor terminological changes in Table 1, provided a useful point of reference in the present study. Following Levelt and Cutler (1983), so-called 'different repairs', which involve the abrupt abandonment of a well-formed utterance followed by an equally well-formed repair, were treated as appropriateness repairs rather than as a third category.

The classification was done by two independent raters: the author and an additional rater familiar with the relevant literature. Unlike the author, the additional rater was not a native speaker of Dutch. Therefore, the author prepared glosses and

**Table 1**

Taxonomy of repairs (adapted from Kormos, 1999: 318, Table 1).

<b>Different repairs</b>	<i>We gaan rechtdoor offe ...We komen binnen via rood, gaan dan rechtdoor naar groen</i> 'We go straight on or ...We come in via red, go then straight to green.' (Levelt, 1983, p. 51)
<b>Appropriateness repairs</b>	
Ambiguity	<i>We beginnen in het midden met ...in het midden van het papier met een blauw rondje</i> 'We start in the middle with ...in the middle of the paper with a blue disc' (Levelt, 1983, p. 52)
Appropriate level	<i>met een blauw vlakje, een blauw rondje aan de bovenkant</i> 'with a blue spot, a blue disc at the upper end' (Levelt, 1983, p. 52)
Coherence	<i>Ga je een naar boven, is uh ...kom je bij geel</i> 'Go you one up, is uh ...come you to yellow' (Levelt, 1983, p. 53)
Good language	<i>C'est qu'un con, un idiot pardon</i> 'He's nothing but a damn fool, an idiot sorry.' (Brédart, 1991, p. 127)
<b>Error repairs</b>	
Lexical	<i>Rechtdoor rood, of sorry, rechtdoor zwart</i> 'Straight on red, or sorry, straight on black' (Levelt, 1983, p. 53)
Morphosyntactic	<i>En zwart ...van zwart naar rechts naar rood</i> 'And black ...from black to right to red' (Levelt, 1983, p. 54)
Phonological	<i>Een eenheid, eenheid vanuit de gele stip</i> 'A unit, unit from the yellow dot.' (Levelt, 1983, p. 54)

translations for all instances, with additional contextual information where this was crucial to the understanding of the repair. All glosses, translations and clarifications were checked and corrected by an independent specialist in Dutch–English translation who was unaware of the classification scheme, to ensure accuracy and avoid the author's own interpretation of the repairs biasing the provided information where other interpretations were possible.

On the basis of the resulting material, the author and additional rater independently classified 72 out of 83 instances identically (Cohen's Kappa 0.78,  $p < 0.001$ ). The 11 instances where initial judgements were different were then reconsidered independently by both raters, with a closer consideration of the context in which the repair occurred. Following this reconsideration, the raters reached agreement on 8. The remaining three instances were excluded from the analyses presented below. The resulting data set of 80 repairs contains 41 error repairs (51%) and 39 appropriateness repairs (49%). Further examples are given in (3)–(5). (3) and (4) were classified as error repairs; (5) as an appropriateness repair.

- (3) wat er met deze opnames gaan gebeuren ma- // gaat gebeuren  
 what there with these recordings go happen but goes happen  
*what will[sc] happen with these recordings bu – what will[pl] happen*
- (4) het dons ligt nu hoog opgeschaveld // gestapeld in de magazijnen  
 the down lies now high NON-WORD stacked in the warehouses  
*the down is now stapped up – stacked up high in the warehouses*
- (5) dat weet je // althans ik weet dat ook inderdaad  
 that know you at-least I know that too indeed  
*you know that – at least I know that too, that's right*

Finally, instances classified as error repair were further classified as lexical, morphosyntactic or phonological according to the nature of the error addressed by the repair. This was done by the author only. (1) Above is an example of a lexical error repair. (3) Is a morphosyntactic error repair: it addresses the erroneous number marking on the auxiliary verb *gaan*. (4) Is a phonological error repair, addressing the initial mispronunciation

of *opgestapeld* 'stacked up'. Of the 41 error repairs, 31 (76%) are lexical error repairs, 7 (17%) are morphosyntactic repairs, and 3 (7%) are phonological repairs. This means that a meaningful comparison between subtypes of error repair is not feasible.<sup>1</sup> It also means that the majority of error repairs are similar to the appropriateness repairs in the data set in that they involve the correction of the selection of one or more lexical items.

### 2.3. Temporal analysis

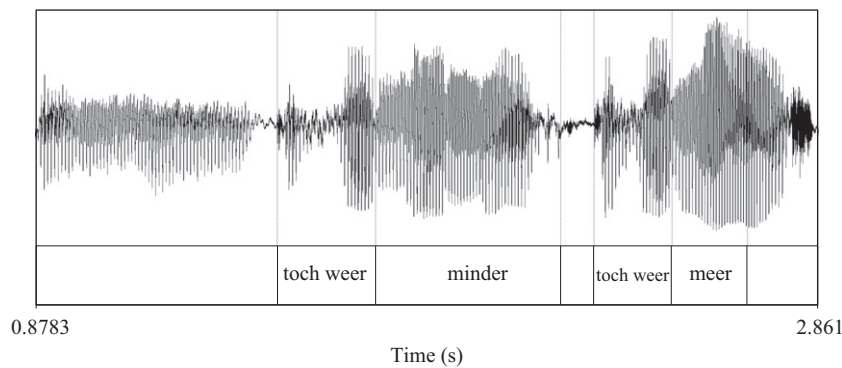
Duration measurements were taken for the reparandum and the repair stretch as a whole as well as for various components that make up the repair stretch, which are specified further below. Segment boundaries were placed at waveform zero-crossings nearest to visual discontinuities that corresponded to the audible start or end of the component involved, following the general method described by Rietveld and van Heuven (1997). In cases where placement was difficult, care was taken to apply a single method to both reparandum and repair. For example, in cases where both reparandum and repair started with a voiceless plosive and the onset of the plosive hold phase was difficult to identify in either component, boundaries were placed at the plosive release for both. This is illustrated in Fig. 1, which shows a segmented waveform for the repair in (1) above.

To ensure comparability across stretches with different numbers of syllables, duration measurements were converted into speech rate values. The conversion was done by dividing the canonical number of syllables of a given stretch by its duration. To facilitate comparison of the speech rate of a repair stretch, or one of its components, to that of the corresponding reparandum, the former was expressed as a proportion of the latter. For example, in the case of (1) the speech rate across the repair stretch *toch weer meer* is 7.1 sylls/s, as compared with 5.3 sylls/s across the reparandum *toch weer minder*. The resulting proportional value is 1.34.

In what follows, proportional values will be presented in three ranges. Research on the perception of tempo variation has repeatedly found a just noticeable difference for tempo variation of approximately 5% (Eefting & Rietveld, 1989; Quené, 2007). In terms of the proportional values, this would mean that a value between 0.95 and 1.05 can be taken to characterise a repair whose repair stretch is not noticeably faster or slower than the reparandum, while values below 0.95 and above 1.05 characterise repairs in which the repair stretch is temporally 'marked'. In order not to overestimate the proportion of such marked repairs, this study adopts the wider 'equivalence range' of 0.90–1.10—that is, a range of tempo variation of up to 10%. Instances with values in this range will be presented as not *clearly* having a temporally expanded or reduced repair stretch. Values below 0.90 represent

expansion of the repair relative to the reparandum; values above 1.10 reduction.

<sup>1</sup> Cutler (1983) and Shattuck-Hufnagel and Cutler (1999) report a phonetic difference between phonological repairs on the one hand and lexical repairs on the other, in that the former are less frequently prosodically marked.



**Fig. 1.** Segmented waveform for the repair sequence in (1); boundaries mark the beginning and end of the reparandum and repair, as well as the beginning and end of repeated lexical items that accompany the repair.

**Table 2**  
Segmental transcription of the repair in (1).

	Reparandum	Repair
Canonical form	<i>toch weer minder</i> tɔx vɛr mindər	<i>toch weer meer</i> tɔx vɛr mɛr
Attested form	tɔx ʋi mindər	tɔ ʋi mɪr

#### 2.4. Segmental analysis

In addition to the temporal analysis, all instances of self-repair were transcribed phonetically by the author as well as an additional transcriber with no particular knowledge of the phonetics and phonology of Dutch and no particular intuitions regarding the phonetics of self-repair. The latter transcriber was provided with a canonical transcription of each utterance for reference, taken from Heemskerk and Zonneveld (2000). Transcription was conducted independently, on the basis of auditory analysis and concurrent inspection of spectrograms and waveforms, and followed the conventions of the International Phonetic Association (IPA, 1999) for narrow segmental transcription. Example transcriptions for the repair in (1), prepared by the author,<sup>2</sup> are given in Table 2.

Degree of segmental reduction was quantified in terms of the absence of segments relative to a canonical realisation (Binnenpoorte, Cucchiari, Boves, & Strik, 2005; Johnson, 2004). Of course this measure does not cover all types of articulatory reduction and cannot be seen as anything more than a crude approximation of a 'reduction quotient' (Kohler, 1991, 2000). Nevertheless, the measure was deemed useful as a complement to the temporal measures described above. Counting reparanda and repairs as separate utterances, the transcribers provided transcriptions that matched in terms of the number of absent or non-segmentally realised canonical segments for 114 out of 160 utterances (71%). Most cases of divergence reflect the fact that segmental reduction is a gradient phenomenon, and the line between a weakly articulated segment and the absence of a segmental realisation is a fine one (see Ball, 2001; Cucchiari, 1996). Rather than discarding all non-matching transcriptions, the author reconsidered the relevant audio files, paying particular attention to the spectral properties of the utterance. If a spectral discontinuity or the absence thereof favoured one of the two transcriptions, that transcription was taken as representative.

For example, in the case of the repair in (2) above, the transcribers disagreed on whether the initial /d/ in the repair component *die kerel kan zo* is realised segmentally. The spectrogram in Fig. 2 shows a spectral discontinuity that suggests it is, although there is no evidence of a canonical plosive release.<sup>3</sup> It was possible to make such an informed decision in 38 out of 46 cases. For the remaining eight instances, for which the inspection of spectral records did not motivate a choice between transcriptions, the transcription produced by the non-native transcriber was taken as representative, given that it is less likely to have been biased by expectations as to the segmental make-up of the utterance.

The agreed counts were then used for a comparison between reparandum and repair stretch along the lines of the temporal analysis outlined above. To ensure comparability across stretches of different lengths, numbers of observed segments were expressed as a percentage of the corresponding number of canonical segments. An outcome of 100% means no segmental deletions were observed, and the higher the proportion of canonical segments deemed absent, the lower the resulting value. To compare the percentages across reparandum and repair, the latter was subtracted from the former. A positive result means the repair has more segmental deletion than the reparandum, while a negative result means the reverse and zero means equivalence in terms of relative segment counts. In the case of (1), the reparandum as a whole has a proportion of realised segments of 92%, while the repair has 77%; the resulting value of 15 is consistent with reduction of the repair relative to the reparandum.

#### 2.5. Editing terms and repetition

As suggested above, repairs of the type considered here are recurrently accompanied by editing terms and the repetition of lexical material. We have already seen several examples of lexical repetition. For an example of a repair with an editing term, see (5) above, in which the repair is prefaced by *althans* 'at least'. Across the data set, 27 instances (24%) contain editing terms, and 55 instances (69%) involve lexical repetition.

In addition to calculating the temporal and segmental values specified above over the entire reparandum and repair stretch, values were calculated excluding any editing terms and repeated items, as well as for the repeated items alone.<sup>4</sup> Previous research

<sup>3</sup> On the other hand, the sequence [ɹ] is difficult to segment, but both transcribers agreed that rhoticity can be observed.

<sup>4</sup> The data set contains four 'expansion repairs', which involve the retroactive addition of a lexical item or items to a reparandum phrase, which is repeated in the repair. In these cases, excluding repeated material leaves no reparandum to compare the repair to. Therefore the number of instances for the analyses excluding editing terms and repeated material is 76 rather than 80.

<sup>2</sup> While the two transcribers did not produce identical transcriptions in this instance, their transcriptions matched in terms of the number of observed segmental deletions; see below.



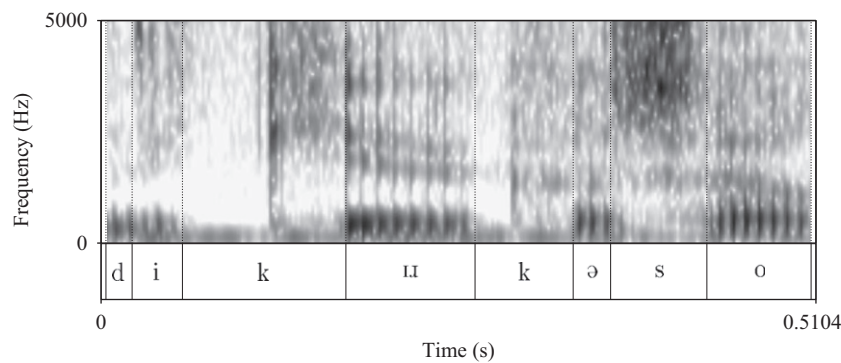


Fig. 2. Segmented spectrogram for the repair *die kerel kan zo* /di kerəl kan zo/ in (2), in which /əl/ and /n/ were deemed absent.

on the Dutch editing term *eigenlijk* ‘actually’ (Plug, 2005) suggests that it is recurrently highly reduced, while most previous research on the phonetics of repetition has observed phonetic reduction rather than expansion, too, across a range of contexts (e.g. Bard et al., 2000; Fowler, 1988). While the function of these repair components is different (see Levelt, 1983), neither adds new propositional information, and it is only in the component of the repair that does add new information that any difference between error and appropriateness repairs due to a difference in informational redundancy might be observed.

## 2.6. Reparandum type and lexical frequency

It has been observed that disfluencies are regularly anticipated by ‘a lengthening of rhymes or syllables preceding the interruption point’ (Shriberg, 2001, p. 161). We have already seen that this ‘pre-repair lengthening’ occurs in the data set; in example (2), a noticeably long duration of the pre-repair segment is marked by a colon. The occurrence of pre-repair lengthening in the data raises the possibility that a measurement result indicative of relative reduction in the repair stretch for a given instance may be due more to the temporal expansion of isolated segments or syllables in the reparandum than to reduction across the repair stretch due to a change in degree of informational redundancy. Therefore, reparandum type was treated as a possible explanatory factor in the analyses reported below. Three types were distinguished: lengthened, cut-off and neutral. A reparandum was classified as lengthened if one or both of the independent phonetic transcribers involved in this research transcribed a long reparandum-final segment. This method was chosen so as not to underestimate the size of this subset. A reparandum was classified as cut-off if it involved a premature cessation of the production of a lexical item, as in (3) above. Only clearly incomplete productions were considered. All remaining instances were classified as neutral in terms of reparandum type.

Finally, a preliminary attempt was made to assess the influence of lexical frequency on degree of reduction in the repair. Given that more frequent words are more likely to undergo phonetic reduction (Bybee, 2001; Pluymaekers, Ernestus, & Baayen, 2005b), a repair which corrects a less frequent word or phrase in favour of a more frequent one is arguably less likely to be associated with local hyperarticulation than a repair which replaces a frequent word or phrase with a less frequent one. In the present study, all instances involving the repair of a single lexical item or short phrase without additional reformulation ( $N=45$ ) were subjected to frequency analysis. For each word or phrase a frequency count was taken from the Corpus Spoken Dutch, a 10 million-word corpus of Dutch speech (Oostdijk & Broeder, 2003; Schuurman, Schouppe, Hoekstra, & van der Wouden, 2003).

Table 3

Speech rate of the repair stretch as a proportion of that of the reparandum.

	All ( $N=80$ )	Error ( $N=41$ )	Appropriateness ( $N=39$ )
Range	0.69–3.17	0.70–3.17	0.69–3.04
Mean (SD)	1.39 (0.56)	1.37 (0.58)	1.42 (0.54)
Reduction (> 1.10)	54 (68%)	28 (68%)	26 (67%)
Equivalence (0.90–1.10)	18 (23%)	8 (20%)	10 (26%)
Expansion (< 0.90)	8 (10%)	5 (12%)	3 (8%)

Descriptive statistics and numbers of values in three ranges.

For example, in the case of (2) counts were taken for *gozer* and *kerel*, and for (3) counts were taken for *gaan gebeuren* and *gaat gebeuren*. In each case the count for the repair was expressed as a proportion of the count for the reparandum. To reduce the effects of extreme values, all values were logarithmically transformed before their correlation with the measures of phonetic reduction specified above was evaluated.

## 3. Results

### 3.1. Overall comparison

Table 3 presents the results of a comparison in speech rate between the repair stretch and the reparandum for all instances in the data set. A clear majority of proportional values (68%) is above 1.10; that is, there appears to be an overall tendency towards temporal reduction of the repair stretch. A relatively small number of instances has a value in the ‘equivalence’ or ‘expansion’ ranges (23% and 10%, respectively). As for the two subtypes of repair, distinguishing error repairs from appropriateness repairs does little to explain the variation in values. Both subtypes have similar ranges of values, and there is no significant difference in mean (unpaired  $t$ -test:  $t(78) = -0.38$ ,  $p=0.70$ ) or in the distribution of instances across the three ranges of values (Fisher’s exact probability test,  $p > 0.05$ ).

Table 4 presents the effect of reparandum type on proportional values for the two subtypes of repair. It can be seen that within both error and appropriateness repairs, instances with pre-repair lengthening have the highest mean proportional value, and instances with a cut-off reparandum the lowest. Error and appropriateness have similar proportions of instances with the three types of reparandum, and a factorial analysis of variance confirms that while the effect of reparandum type is statistically significant ( $F(2)=7.78$ ,  $p=0.001$ ), due to a significant difference between repairs with pre-repair lengthening on the one hand and

**Table 4**  
Influence of reparandum type on proportional values in temporal analysis.

	Mean (SD)	N
Error		
Neutral	1.36 (0.59)	23
Cut-off	1.18 (0.30)	13
Lengthened	1.90 (0.84)	5
Appropriateness		
Neutral	1.37 (0.49)	20
Cut-off	1.20 (0.30)	12
Lengthened	1.93 (0.71)	7

Descriptive statistics across repair types.

**Table 5**  
Proportion of realised canonical segments for the repair stretch subtracted from the proportion for the reparandum.

	All (N=80)	Error (N=41)	Appropriateness (N=39)
Range	–23.00–45.00	–20.00–36.00	–23.00–45.00
Mean (SD)	6.63 (12.88)	6.17 (12.00)	7.10 (13.89)
Reduction (> 0)	47 (59%)	23 (56%)	24 (62%)
Equivalence (0)	10 (13%)	7 (17%)	3 (1%)
Expansion (< 0)	23 (29%)	11 (27%)	12 (31%)

Descriptive statistics and numbers of values in three ranges.

those with a neutral or cut-off reparandum on the other (Tukey HSD,  $p < 0.001$ ), there is no significant interaction between repair type and reparandum type ( $F(2)=0.003$ ,  $p=0.99$ ). In other words, controlling for reparandum type does not result in the emergence of a difference between error and appropriateness repairs; rather, it shows that they are similar in terms of the nature of the disfluency that ‘initiates’ repair as well as the temporal relationship between reparandum and repair.

Finally, Table 5 presents the results of a comparison between repair stretch and reparandum in the proportion of realised canonical segments. It can be seen that this measurement, too, indicates that in a majority of cases (here 59% overall) the repair is reduced relative to the reparandum.<sup>5</sup> Again, there is no significant difference between error and appropriateness repairs in means ( $t(78)=-0.32$ ,  $p=0.75$ ) or in distribution across the three ranges of values (Fisher’s,  $p > 0.05$ ).

### 3.2. Editing terms

As indicated above, 27 instances of repair in the data set contain an initial editing term or combination of editing terms. Many of these show considerable phonetic reduction, both temporally and articulatorily. Speech rate figures range from 4.3 to 26.7 sylls/s, with a median of 10.0 sylls/s.<sup>6</sup> In terms of articulation, 13 out of 27 editing expressions show at least one instance of segmental deletion, with a mean proportion of canonical segments realised of 81%. The transcriptions in Table 6 illustrate that articulatory reduction is commonly observed.<sup>7</sup>

<sup>5</sup> The larger proportion of values in the ‘expansion’ range in comparison with the temporal measurements (29% vs 10%) suggests that it is possible for a repair stretch to be temporally reduced relative to the reparandum, while exhibiting fewer segmental deletions.

<sup>6</sup> 26.7 sylls/s is an outlier, measured for a highly contracted form of *of eigenlijk* ‘or actually’. Excluding this outlier, the mean speech rate across the remaining editing terms is 9.9 sylls/s.

<sup>7</sup> As in the case of Table 1, the transcriptions presented here are the author’s. Both transcribers agreed on the number of realised segments in each instance. The same is the case for Tables 7 and 10, respectively.

**Table 6**  
Transcriptions of the editing terms in the data set.

Editing expression	N	Canonical form	Observed form(s)
<i>of</i> ‘or’	17	ɔf	ɔf, əf, əv, f
<i>althans</i> ‘that is’	2	altans	atəs, aɪtəz
<i>of eigenlijk</i> ‘or actually’	2	ɔf eɪxələk	əvɛɛgʻ
<i>ik bedoel</i> ‘I mean’	1	ɪk bədul	bduɪ
<i>nou</i> ‘well’	1	nau	nɑ
<i>nee</i> ‘no’	2	ne	ne
<i>even kijken</i> ‘let’s see’	1	evə kɛikə	əfke_e
<i>of tenminste</i> ‘or at least’	1	ɔf təminstə	əftəmisə

**Table 7**  
Speech rate of the repair stretch (repeated lexical items only) as a proportion of that of the reparandum.

	All (N=55)	Error (N=28)	Appropriateness (N=27)
Range	0.59–4.14	0.59–4.14	0.65–2.28
Mean (SD)	1.38 (0.65)	1.35 (0.78)	1.41 (0.51)
Reduction (> 1.10)	33 (60%)	19 (68%)	14 (52%)
Equivalence (0.90–1.10)	14 (25%)	5 (18%)	9 (33%)
Expansion (< 0.90)	8 (15%)	4 (14%)	4 (15%)

Descriptive statistics and numbers of values in three ranges.

For example, *of* recurrently lacks a vowel portion, and when it does have a vowel, it is recurrently central rather than back. It can also be seen that *eigenlijk* occurs in its highly reduced, mono-syllabic form, as previously described by Ernestus (2000), Keune, Ernestus, van Hout, and Baayen (2005) and Plug (2005).

With reference to the two subtypes of repair, of the 27 instances with editing terms, 15 are error repairs and 12 are appropriateness repairs. The two subgroups of editing terms are not significantly different in terms of speech rate (11.8 vs 9.0,  $t(25)=1.62$ ,  $p=0.12$ ) or proportion of canonical segments realised (85% vs 76%,  $t(25)=1.68$ ,  $p=0.11$ ). Therefore, excluding editing terms from measurement is likely to affect both subgroups of repair to a similar extent.

### 3.3. Repeated lexical items

Table 7 shows that the temporal proportional values for repeated lexical items are very similar to those reported in Table 3. The repeated items are not invariably temporally reduced relative to the first mention, and the mean proportional value of 1.38 is almost identical to the mean proportional value calculated over the repairs as a whole. Proportional values for repeated lexical material are similar across the subgroups of error and appropriateness repairs; the difference in mean (1.35 vs 1.41) is not statistically significant ( $t(53)=-0.35$ ,  $p=0.73$ ), and neither is the distribution of instances across the three ranges of values (Fisher’s,  $p > 0.05$ ).

In terms of articulation, 17 out of 55 instances have a lower proportion of realised canonical segments in the repair; 36 have the same proportion across repair and reparandum; and two instances have a higher proportion in the repair. Representative transcriptions are given in Table 8. Error and appropriateness repairs have a very similar mean difference between repair and reparandum (7.46 vs 7.48,  $t(53)=-0.004$ ,  $p=0.99$ ), and show no significant difference in terms of proportions of positive, negative

**Table 8**

Transcriptions of selected repeated lexical items.

Repeated item(s)	Reparandum	Repair stretch
<i>van de</i> 'of the'	fʌndə	fɪnə
<i>ik heb het nu</i> 'I have it now'	ikɛpəny	kəβəny
<i>die</i> 'that'	di	dʲ
<i>tot</i> 'until'	tɔt	tɔt
<i>voor</i> 'for'	fɔr	fɔr
<i>gebeuren</i> 'happen'	χbœrə	χbœrə
<i>daar is</i> 'there is'	dəs	dərəz

**Table 9**

Speech rate of the repair stretch (excluding any editing terms and repeated lexical items) as a proportion of that of the reparandum.

	All (N=76)	Error (N=41)	Appropriateness (N=35)
Range	0.56–2.97	0.56–2.82	0.70–2.97
Mean (SD)	1.37 (0.53)	1.30 (0.50)	1.40 (0.52)
Reduction (> 1.10)	50 (66%)	25 (61%)	25 (71%)
Equivalence (0.90–1.10)	15 (20%)	8 (20%)	7 (20%)
Expansion (< 0.90)	11 (14%)	8 (20%)	3 (9%)

Descriptive statistics and numbers of values in three ranges.

and zero values (Fisher's,  $p > 0.05$ ). In other words, like excluding editing terms, excluding repeated lexical material from measurement is likely to affect both subgroups of repair to a similar extent.

### 3.4. Corrected lexical items only

Table 9 presents the results of a recalculation of proportional values excluding any editing terms and repeated lexical items that may occur in the repair stretch. In terms of the overall distribution of proportional values, a lowering effect of controlling for editing terms and repetition is only weakly observed. The range and mean are marginally lower than in the gross comparison reported above, and the proportion of values below 0.90 has increased by 4% only. The recalculation has little effect on the differentiation of error and appropriateness repairs, too. The expected lowering effect is observed more clearly in the error repairs, but the resulting difference in mean between the two subgroups (1.30 vs 1.40) is not statistically significant ( $t(74) = -0.86$ ,  $p = 0.39$ ). In terms of the distribution of instances across the three ranges of values, it can be seen that the subgroup of appropriateness repairs has a higher proportion of instances in the 'reduction' range and a lower proportion in the 'expansion' range in comparison with the error repairs. While this difference is consistent with the idea that appropriateness repairs are more likely to undergo phonetic reduction than error repairs, it is not robust enough to reach statistical significance in the data under consideration (Fisher's,  $p > 0.05$ ).

The effect of reparandum type on the proportional values is similar to that reported above (see Table 4). Again, while the effect of reparandum type is statistically significant (ANOVA,  $F(2) = 4.08$ ,  $p = 0.02$ ) due to a significant difference between repairs with pre-repair lengthening on the one hand and those with a neutral or cut-off reparandum on the other (Tukey,  $p < 0.01$ ), there is no significant interaction between repair type and reparandum type ( $F(2) = 1.36$ ,  $p = 0.26$ ). In other words,

**Table 10**

Proportion of realised canonical segments for the repair stretch (excluding any editing terms and repeated lexical items) subtracted from the proportion for the reparandum.

	All (N=76)	Error (N=41)	Appropriateness (N=35)
Range	–50.00–67.00	–50.00–50.00	–30.00–67.00
Mean (SD)	6.74 (18.43)	5.80 (19.52)	7.83 (19.29)
Reduction (> 0)	42 (55%)	21 (51%)	21 (60%)
Equivalence (0)	16 (21%)	10 (24%)	6 (17%)
Expansion (< 0)	18 (24%)	10 (24%)	8 (23%)

Descriptive statistics and numbers of values in three ranges.

**Table 11**

Transcriptions of old and new information in instances of repair discussed in this paper.

	Reparandum	Repair
(2)	<i>gozer</i> 'guy'	<i>kerel</i> 'fellow'
Canonical form	xozər	kerəl
Observed form	χɔsə	kɪ
(3)	<i>gaan</i> 'go'	<i>gaat</i> 'goes'
Canonical form	ɣan	ɣat
Observed form	xā	xat
(4)	<i>opgeschaveld</i> 'NONWORD'	<i>gestapeld</i> 'stacked'
Canonical form	ɔpxəsxavəlt	xəstapəlt
Observed form	ɔpxəsxavəlt	xstapət
(5)	<i>weet je</i> 'you know'	<i>ik weet</i> 'I know'
Canonical form	wet jə	ik wet
Observed form	ʋeçə	ikvət

controlling for reparandum type does not result in the emergence of a difference between error and appropriateness repairs. Moreover, the correlation between proportional values and corresponding lexical frequency values is weak and does not reach significance ( $R^2 = 0.08$ ,  $p = 0.06$ ) in the subset of instances involving straightforward lexical repair; that is, it is unlikely that the distribution of proportional values across instances is an effect of differences in lexical frequency between reparandum and repair items.

Finally, Table 10 presents the results of a comparison between repair stretch and reparandum in the proportion of realised canonical segments, excluding editing terms and repeated items. The main effects of the exclusion are an increase in the overall range of values and an increase in the proportion of instances with a repair and reparandum that are equal in terms of the realisation of canonical segments. In other words, considering just the new information contained in the repairs results in more extreme differentiation of repair stretch and reparandum, but only in a small minority of instances. Crucially, these instances appear to be evenly distributed across error and appropriateness repairs; again, there is no significant difference between error and appropriateness repairs in means ( $t(74) = -0.48$ ,  $p = 0.64$ ) or in distribution across the three ranges of values (Fisher's,  $p > 0.05$ ).<sup>8</sup> Representative transcriptions are given in Table 11.

<sup>8</sup> Analyses of the influence of reparandum type and lexical frequency on segmental values are not reported here; as above, no significant effects were found.

#### 4. Discussion

This paper sets out to explore the influence of informational redundancy on temporal and articulatory reduction in the context of self-initiated self-repair in Dutch. Its starting point was three hypotheses: first, that self-repair is more likely, on the whole, to be associated with phonetic expansion than with phonetic reduction, given that its function is to introduce new information; second, that repair stretches are likely to show internal variation in degree of reduction, given that the new information introduced by a repair is often accompanied by editing terms and repeated lexical items, whose propositional value is minimal; and third, that the distinction between error and appropriateness repairs is relevant since error repairs are, on the face of it, more highly informative than appropriateness repairs.

The results of the study reported here challenge all three hypotheses. First, the majority pattern appears to be relative reduction across the repair stretch, not expansion. Second, while editing terms are certainly recurrently reduced relative to canonical realisations, repeated lexical items are not invariably more reduced in the repair than in the reparandum, and excluding editing terms and repeated lexical items from analysis has little effect on the comparison of temporal and segmental measures between the two repair components. Third, no statistically significant effect of repair type—error vs appropriateness—was attested. Additional findings are that pre-repair lengthening is a significant factor, while a comparison of lexical frequency between repair and reparandum items does little to explain their relative degrees of phonetic reduction.

Starting with the third main finding, the lack of differentiation between error and appropriateness repairs suggests that the two types of repair are treated similarly by interactants in the material under consideration in terms of their informativeness. Recall that the majority of both error and appropriateness repairs in the data set are lexical repairs. Recall also that Levelt and Cutler (1983), who report a significant difference between error and appropriateness repairs in the proportion of prosodically marked instances in the two subgroups, base their observations on a corpus of task-oriented dialogue. The difference between a lexical error and an infelicity is arguably more significant in the context of an instruction than it is in the context of an informing in free conversation; compare the significance of saying *left* instead of *right* in giving a direction with claiming one's brother is 23 rather than 22 in informal talk. Both would lead to an error repair, but the former would be more highly informative than the latter, in the sense that the success of the interactional task at hand depended on it. In the context of informal talk, pragmatic infelicity may in fact be more significant than factual or linguistic accuracy in terms of its contribution to the avoidance of interactional 'trouble'.

In other words, to fully understand the influence of informational redundancy on sound patterns in the context of self-repair, we would need to adopt a more context-sensitive analytic approach than that demonstrated in this paper. This should involve measures of the contextual predictability of reparandum and repair items; as shown in this paper, lexical frequency alone is not an explanatory factor (cf. Pluymaekers et al., 2005a). In fact, Levelt and Cutler report that the likelihood that an error repair is prosodically marked depends on the size of the semantic set from which the reparandum and repair items are selected; the smaller the set, the higher the contrastive value of the repair, and the higher the likelihood of prosodic marking. While the analysis of semantic set sizes is more straightforward in task-oriented dialogue with a highly constrained vocabulary than in free conversation, this approach constitutes a useful starting point for more context-sensitive investigation of self-repair in spontaneous speech.

With respect to the first main finding of this study, more context-sensitive investigation may confirm that contrary to our intuitions, many instances of self-repair in spontaneous conversation are informationally redundant and therefore predictably associated with local phonetic reduction. Still, it is worth considering an alternative account for the preponderance of phonetic reduction in self-initiated self-repair, which refers to a conflict between information-based and pragmatic constraints. A common observation in the conversation-analytic literature on self-repair (Fox & Jaspersen, 1995; Jaspersen, 2002; Rieger, 2003; Schegloff, 1979) is that in spontaneous conversation, speakers tend to do self-repair work without delay, while *other*-repair—in which listeners notice an error and invite the speaker to repair it—is frequently delayed, if not avoided altogether, as shown by Schegloff et al. (1977). Psycholinguistic studies confirm that speakers tend to initiate self-repair as soon as an error is detected (Blackmer & Mitton, 1991; Levelt, 1983; Nooteboom, 2005).

Together, early onset and hypoarticulation throughout the repair stretch are consistent with an attempt by the speaker to enable a soonest possible resumption of post-repair talk (cf. Jaspersen, 2002, p. 278). An interpretation in terms of face-saving seems plausible; in self-repair, the speaker moves the discourse away from the error and its correction as quickly as possible, while in other-repair the listener gives the speaker as much opportunity as possible to do the same, by delaying the initiation of repair. Thus, speakers may be orienting to a pragmatically motivated constraint which promotes hypoarticulation throughout the repair stretch—even if its level of informational redundancy would seem to promote local hyperarticulation. Again, establishing the validity of this account requires highly context-sensitive analysis; not only in terms of the semantics of the repairs, but crucially in terms of their pragmatic and interactional import. If anything, the present study confirms that the interaction between information-based and pragmatically motivated constraints, discussed briefly by Lindblom (1990) and Rischel (1992) but not extensively explored in subsequent work, is a major area for further research—particularly in relation to phonetic reduction.

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