TEMPORAL PATTERNS OF ERROR REPAIRS AND APPROPRIATENESS REPAIRS IN HUNGARIAN

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Abstract

Natural conversational speech often exhibits interruptions and modifications of the speech stream when the speaker "repairs" what has been said. We examine two types of repairs, those involving real errors and those involving appropriateness considerations, in an eleven-hour corpus produced by 26 Hungarian speakers. Since both the reasons and the supposed processes of the speech planning are different in the two types of repairs, we hypothesize that these differences will be reflected by the temporal patterns of the editing phases, reparanda and repairs. Based on the analysis of the occurrences and temporal properties of the repairs in our corpus, we demonstrate that there are, in fact, distinct patterns in the two types of repairs involving the articulation rate of the speech preceding the editing phase and in that following the editing phases (i.e., in both the reparanda and the repair strings).

Keywords: error repair, appropriateness repair, editing phase, temporal properties.

1 Introduction

Spontaneous utterances reflect both a speaker's thoughts and grammatical competence, and thus a great deal of planning and action must take place in order to produce a message as a grammatical spoken structure (Levelt, 1989). Among other things, the speaker must make many linguistic decisions regarding the morphological, syntactic, phonological and semantic structure of the message, and these, in turn, will lead to the execution of a series of behaviors that ultimately result in the articulation of the intended output. Given the complexity of speech planning and articulation, it is not surprising that we observe a variety of error phenomena, often resulting in disfluencies in spontaneous speech, as well as repairs of about half of these errors (Postma, 2000). The fact that speakers often immediately provide corrections of their errors or inappropriate elements, referred to as self-initiated self-repairs in the conversation-analytic and psycholinguistic literature (e.g., Schegloff et al., 1977; Levelt, 1983; 1989; Swerts, 1998; Nooteboom, 2005; Hartsuiker, 2006; Fox et al., 2010; Pouplier et al., 2014), can be taken as evidence of active monitoring of speech production for grammaticality at all linguistic levels, as well as for utterance

appropriateness (e.g., Levelt, 1983, 1989; Wheeldon & Levelt, 1995; Postma, 2000; Hartsuiker & Kolk, 2001)[1].

Although there is discussion in previous research about different sources for the two types of error phenomena (e.g., Levelt, 1983; Postma, 2000; Hartsuiker & Kolk, 2001), relatively little attention has been paid to their temporal patterns. Plug (2011), however, provides a study of the phonetic relationship between errors and their repairs in a corpus of 83 instances from Dutch conversations. The present study investigates both the distribution and temporal patterns of error repairs and appropriateness repairs in a large corpus of natural Hungarian speech in order to determine similarities and differences between these two types of behaviors. Specifically, we examine recordings of over 11 hours of spontaneous speech produced by 26 young Hungarian speakers and demonstrate that the different types of repairs exhibit different temporal patterns in both the errors themselves and their corrections.

2 Error and Appropriateness Repairs

Before presenting the Hungarian data, we first briefly introduce the assumptions and terminology we adopt in our analysis. We also provide illustrations drawn from our corpus since some of the phenomena observed in Hungarian are not found in more familiar languages, such as English[2].

2.1 The nature of repair types

We use the terms "reparandum" and "error" here to refer to any portion of an utterance that is unintended by the speaker, as evidenced by a disfluency or interruption in the speech stream. More specifically, we distinguish between "speech repairs" in the case of either ungrammatical or in the actual context semantically incorrect productions and "appropriateness repairs" in the case of productions that are felt by the speaker to be undesirable in some other way. The error may be of any size, type of speech, location, reason for their occurrence, or even whether they are followed by a repair or not (e.g., Dell, 1986; Levelt, 1989; Frisch & Wright, 2002; Postma, 2000). When the speaker repairs what s/he said, we refer to it with the type of repair that occurred (i.e., error repair or appropriateness repair).

Actual speech errors may occur at any linguistic level. For example, at the lexical level, such an error would involve the use of an incorrect lexical item. At the morpho-

[1] For discussion of different aspects and modeling of the self-monitoring process, see among others, Levelt (1983, 1989), Blackmer and Mitton (1991), Bear et al. (1992), Bear et al. (1992), Shattuck-Hufnagel and Cutler (1999), Postma (2000), Hartsuiker and Kolk (2001), Nooteboom (2005), Hartsuiker et al. (2005), Hartsuiker (2006).

[2] Given the substantial body of research on different aspects of speech errors and repairs, the goal here is not to provide a review of the literature, but to refer to key works that pertain directly to our investigation. The reader may consult many of the items cited throughout this paper for more detailed review of previous research.

syntactic level, we might observe an inflection error, and at the phonological level, a mispronounced segment or syllable. Appropriateness repairs typically arise when an utterance is grammatical, but the speaker feels that there is something s/he would prefer to express differently for some reason. For example, a particular word or expression may be ambiguous, or it may not reflect the appropriate level of terminology (e.g., either too technical or not technical enough), or its use may not be consistent with previous usage in the conversation (Levelt, 1983; Kormos, 1999). Appropriateness might also involve a preference for using different stylistic choices in a particular context (e.g., more colloquial, formal, technical).

Different types of speech errors, those involving ungrammatical productions, along with their repairs, are illustrated with Hungarian examples from our corpus in (1) – (3). Here and below, boldface indicates the words involved in the errors and repairs; an asterisk indicates an ungrammatical or wrong (misretrieved) lexical item in the original utterance.

(1) Lexical errors and repairs

a. ***jegyet** vagy mi **bérletet** akarunk venni
ticket.acc or what **monthly pass**.acc want.1pl buy.inf
'We want to buy a **ticket / monthly pass**.'

b. *marketing **előadó** /öö/ hát marketing **gyakornok** leszek
marketing **lecturer** /er/ well marketing **assistant** be.future.1sg
'I will be a marketing **lecturer / assistant**.'

c. földi gyakorlatok voltak ***limitálva** /öö/ **szimulálva**
ground exercises were ***limited** /öö/ **simulated**
'ground exercises were **limited** /öö/ **simulated'**

In these cases, the problem involves lexical retrieval in that the speaker initially retrieved the wrong word from a set of semantically related lexical items. In example (1a), the word *jegy* refers to a ticket that can be used for only one trip, and it is a distinct lexical item from the word used for a pass that may be used freely during a month, *bérlet*.

In (2a), the speaker first uses the wrong case suffix, the inessive *–ban* (which is a grammatical error in Hungarian), and then replaces it with the illative *–ba*. Note that the verb tense in the repair is changed as well. In (2b), the speaker also initially uses an incorrect case and then replaces it with the correct one; however, here it is the base form that changes, as opposed to the suffix. The person-number suffix following the base, which expresses the case, remains the same.

(2) Morpho-syntactic errors and repairs

a.*Kínában is eljut /silent pause/ Kínába is eljutott
China.**iness** also get.3sg /silent pause/ China.**illat** also get.past.3sg
'He got as far as China.**iness** / China.**illat**'[3]

b. ***nek**em vagy **eng**em sem fertőz
dat.1sg or **acc.**1sg nor infect.3sg
'It does not infect **to me** / **me**, either.'

(3) Phonological errors and repairs

a. *érdeklő**dösz** /silent pause/ érdeklő**dsz**
in**[ø]**quire.2sg /silent pause/ inquire.2sg
'You in**[ø]**quire / inquire.'

b. *ez egy pro**bo-** /silent pause/ pro**bléma** az egész osztálynak
this a pro**bo-** /silent pause/ pro**blem** the whole class.dat
'This is a pro**bo-** / pro**blem** for the whole class.'

Both examples contain phonological errors, however, in the first one the full word is uttered since the error appears in the last syllable: a vowel inserted between the last two consonants, [d] and the digraph "sz" which represents [s]. In the second case, the speaker recognizes the erroneous introduction of [o] before the word is finished, and interrupts the production immediately; there is no Hungarian word that begins *probo*).

The examples in (4) – (5) illustrate appropriateness repairs. Note that the symbol $^{+}$ in these cases does not indicate an ungrammatical element; it just signals the use of a less appropriate word. These items are classified into general categories deduced from the nature of the repair, since the original structures do not contain actual errors.

(4) Ambiguity or clarification repairs

a. $^{+}$**tanárnőm** /silent pause/ **földrajztanárnőm** mondta
teacher.gen.1sg /silent pause/ **geography.teacher**.gen.1sg say.past.3sg
egyszer
once
'My **teacher** / **geography teacher** told me once.'

b. mikor bekerültem $^{+}$**középiskolába** **gimnáziumba**
when got.1 singular **high school**.illat **secondary grammar school**.illat
'when I got into **high school / secondary grammar school**'

In (4a), the speaker first uses the generic word for 'teacher', but seems to find it too vague or ambiguous, and thus stops and introduces a more precise compound word, *földrajztanárnő* 'geography teacher,' in its place. In (4b), the speaker uses the word

[3] The abbreviations "iness" and "illat" stand for the inessive and illative cases, respectively. Other case abbreviations used in this paper are the more usual "dat" (= dative), "acc" (= accusative), "gen" (= genitive), "abl" (= ablative).

'high school' which she thinks is too general, and thus clarifies her meaning with the specification *gimnázium*.

In (5a), the appropriateness repair indicates a preference for a more scientific term in this particular situation as the speaker replaces the general word, "cousinhood", with the more technical expression, "genetic similarity." In (5b), the word *ázik* 'soak' accurately portrays the speaker's meaning; however, it is replaced, following the interrupting expression *vagy* 'or' with the more professional term *vizesedik*, as the speaker determines this to be better suited to the context. The example in (5c) shows the speaker replacing the somewhat slang expression that uses the word 'crease' to refer to a difficult situation with a more formal word for 'attack' since this seems more appropriate for the discussion of a historical event.

(5) Terminology / better word choice repairs

a. nagyobb rügyeket növesztettek akik +**rokoni kapcsolatot**
larger sprouts.acc grow. Past.3pl those who **cousinhood**
szóval **genetikai hasonlóságot** mutattak
that is **genetic similarity** showed
'larger sprouts grew (when they) showed "**cousinhood"** that is "**genetic similarity"**

b. +**ázik** vagy **vizesedik** a fal
soak.3sg or **get wet**.3sg the wall
'The wall is getting **soaked** / **water-drenched**.'

c. bírták a +**gyűrődést** bírták a **támadást**
can take.past.3pl the **crease**.acc can take.past.3pl the **attack**.acc
a várvédők
the fortress defender.pl
'The defenders of the fortress were able to withstand the **crease** / withstand **the attack**.'

In addition to the appropriateness repairs just seen, where the issue seems to be a matter of terminology, there are also repairs that appear to be in response to a desire for more discourse cohesion or a certain discourse style, as seen in (6).

(6) Discourse repairs

a. ők voltak a +**legjobb** /silent pause/ **legvitézebb**
they be.past.3pl good.superlative /silent pause/ valiant.superlative
katonák
soldier.pl
'They were the **best** /silent pause/ **most valiant** soldiers.'

b. a faluban azt +**beszélik / mesélik** hogy
the village.iness that speak.pl.3. / tell about that
'In the village they **speak / tell about** that.'

In (6a), the speaker first uses a general word "best," but then selects a different word to emphasize the bravery of the soldiers, more in keeping with the content of the

narrative (i.e., description of a battle). In the sentence in (6b), the speaker replaces the word ‘speak’ with the word ‘tell about’ since the latter is more consistent with the fact that the story she is about to tell is a local tale.

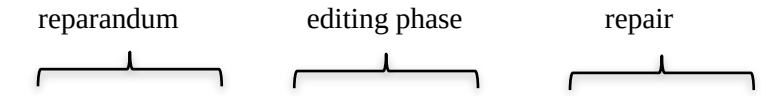
As can be seen from the different types of examples, while it is generally fairly easy to distinguish among the three types of actual errors shown in (1) – (3), it is not always possible to assess the different types of appropriateness errors and repairs shown in (4) – (6) (e.g., Levelt 1983). Thus, our classification is based on the most likely interpretation of the difference between the repair and the reparandum, but it is recognized that in some cases there may be overlap (e.g., a word used for more precision may also be a more technical term preferred in a given context). Given this potential uncertainity, the various types of appropriateness repairs are combined for statistical analysis below.

2.2 Repair process

Levelt (1983) found that appropriateness repairs were often delayed until the end of a word; however, there is generally less information available about the interruption and temporal patterns of appropriateness repairs than repairs of actual speech errors (e.g., Blackmer & Mitton, 1991; Hartsuiker & Kolk, 2001; Plug, 2011). Thus, more systematic data are needed to fully confirm any differences.

Regardless of the type of error, when a repair process arises in speech, we can identify three distinct segments in relation to the interruption point. The reparandum is the string of speech prior to the interruption, specifically the part that contains the error identified by the speaker in the process of self-monitoring. The repair is the continuation of the utterance that contains the correction or modification the speaker wishes to introduce (see among others, Levelt, 1983; 1989; Lickley & Bard, 1996; Roelofs, 2004; Benkenstein & Simpson, 2003; Slevc & Ferreira, 2006; Nooteboom & Quené, 2008). Between the reparandum and the repair, from the interruption point to the onset of the repair, is the cutoff-to-repair interval, or editing term or editing phase (e.g., Levelt, 1989; Hartsuiker & Kolk, 2001). In some cases, the editing phase may also be absent, with the repair immediately following the reparandum (Levelt, 1983). The portions of an error-repair structure are illustrated in (7) with an example from the Hungarian corpus.

(7) Error-Repair Structure



*mi a ***rev-**	öö	**rövidítése**
what is its ibb-	um	abbreviation

‘What is its **ibb-** /um/ **abbreviation**?’

As can be seen, the interruption takes place after the first syllable of the word for ‘abbreviation’, indicated in the translation by the truncated form *ibb-* (i.e., instead of *abb-*). In this case, the speaker detected a phonological error, and interrupted the utterance immediately following the mispronunciation of the vowel in the first

syllable: [ɛ] instead of the intended [ø]. The interruption is followed by a typical filling sound, a relatively long neutral vowel equivalent to English "um", and then the utterance resumes with the correct pronunciation of *rövidítés* 'abbreviation'.

Given the different types of errors and repairs seen above, and the fact that there are three distinct components of an error and repair sequence, questions arise as to whether there are relationships between the error types and the properties of their repair structures. These questions are addressed in the following sections on the basis of the Hungarian corpus.

3 Hungarian Error Repair Investigation

Interruptions may arise either within a word, resulting in truncation, or after a word has been fully uttered. It has been observed that the former is more prevalent with actual speech errors and the latter with appropriateness errors (Levelt, 1989). What is less clear, however, is whether there are also temporal differences in any of the portions of repair structures that distinguish the two error types. We thus first examine the distribution of different error patterns, and then test four specific hypotheses regarding potential differences between speech errors and repairs vs. appropriateness errors and repairs.

Before examining the details of our error and repair data, we first assess the previous observation about the earlier interruption point in actual speech errors as opposed to appropriateness errors in the Hungarian corpus. We then examine the speech rate of these two portions of the utterances, anticipating that the repair will exhibit a faster speech rate than the reparandum, on the assumption that the material in the repair is already somewhat primed by the reparandum. Finally, on the assumption that more consideration is involved in selecting a different, more desirable, word than repairing a grammatical error in a word being used in a sentence, we examine the temporal patterns of the two error types. Specifically, we anticipate that appropriateness repairs will be more substantial than error repairs, both in terms of the timing of the editing phase and its content.

The following hypotheses are thus formulated:

i. Speech errors will be interrupted before a word is fully uttered more frequently than appropriateness errors.
ii. Repairs will be produced by a faster tempo than the reparanda irrespective of repair type.
iii. The duration of editing phases associated with appropriateness errors will be longer than the editing phases associated with speech errors.
iv. The editing phases associated with appropriateness errors will contain more material (e.g., filler sounds, words) than the editing associated with speech errors.

These hypotheses are tested with the speech corpus described below.

4 Methodology

4.1 Corpus

The recordings analyzed for this investigation are part of a large database of spontaneous Hungarian speech, the BEA corpus (Gósy, 2012). Specifically, we examine the speech of a randomly selected group of 26 speakers (13 F, 13 M) between the ages of 22 and 32 years). All of the speakers are from Budapest and speak standard Hungarian, typical of moderate to high education levels. The recordings were made using a variety of topics in a sound-proof room at the Hungarian Academy of Sciences in Budapest. The interviewer was the same in all cases. In total, the corpus comprises 11.5 hours (F: 5.9 hours; M: 5.6), approximately 26 minutes per speaker.

The first and third authors, both native speakers of Hungarian, identified all of the repairs separately from each other; unrepaired errors were not included in this study. Each repair was then classified as an error repair or appropriateness repair, and in the case of errors, the category of the error was specified (i.e., morpho-syntactic, phonological or lexical). Items that were classified differently by the two native speakers were excluded from consideration (N = 3). Subsequently, the selected items were assessed by 12 PhD students specializing in phonetics or in psycholinguistics. The students listened to the context of each repair and the repair itself, and also saw a written version. For each, they indicated whether it was a speech error or an appropriateness error, and again, in the case of speech errors, they specified the type of error. The students worked at their own pace, and could listen to the items multiple times. Only 2% of the items showed discrepancies with respect to the first coding, and they were discarded, leaving a total of 343 items for analysis.

4.2 Annotation and acoustic analysis

The speech samples used for analysis were annotated manually in Praat (Boersma & Weenink, 2015) with indications for the reparanda or errors, the editing phases if present, and the repairs. All segmentations and annotations were carried out individually by the first and third authors, and found to exhibit inter-rater agreement greater than 98%.

The word boundaries were identified in the waveform signal and spectrographic display in conjunction with auditory assessment. Markers for word boundaries and editing phrases were inserted between acoustically distinct regions in the signal, specifically, at the closure and release of stops, at the onset and offset of other obstruents, and at the onset and offset of voicing, as well as between the first and last glottal pulse in the case of vowels, nasals and approximants following standard acoustic-phonetic criteria (see Turk & Shattuck-Hufnagel, 2000).

For each speech error, the type of error was labeled (morpho-syntactic, phonological or lexical). In addition, extensions of 2-3 words (8-9 syllables) preceding and following the error / repair strings were identified for use in assessing speech rate. For the editing phases, the time interval between the last speech sound of the reparandum and the first speech sound of the repair, further specifications were provided as to whether they contained verbal material, and if so, what it was.

The durations of the three components of the repair structures (i.e., the error, editing phase and repair) were calculated using a Praat script. In addition, the articulation rates of the syllables preceding the reparandum and following the repair were determined as the ratio of speech sounds per second (Laver, 1994). A sample annotation is shown in Figure 1.

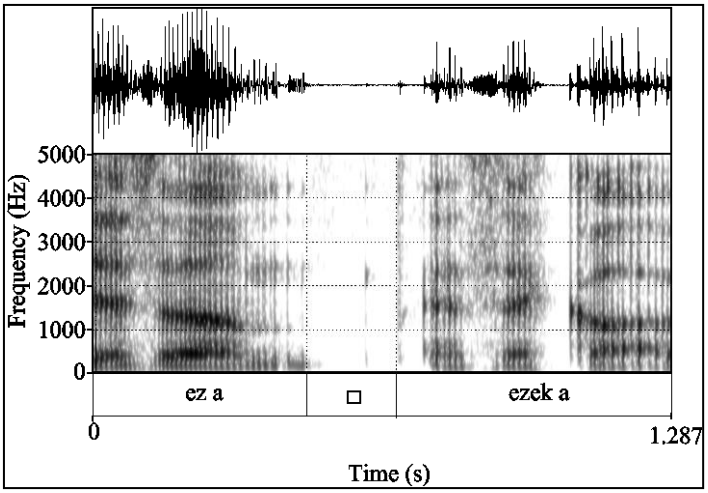


Figure 1. Annotated speech sample: *ez a* /silent pause/ *ezek a* (= 'this' /silent pause/ 'these').

The string shown in Figure 1 contains a morpho-syntactic error. The reparandum *ez a* 'this' is a singular form; however, the speaker intended to produce the plural form seen in the repair, *ezek a* 'these'. Once the error was recognized, the speaker introduced a silent pause, indicated in the annotation with the small box "□", and then resumed the utterance with the correct form.

All temporal data were normalized (using *z*-scores) in order to control for differences in the speakers' articulation rates, and analyzed statistically using a Generalized Linear Mixed Model (with repeated measures analysis within the model), unless otherwise specified. In the case of the editing phase analysis, the gamma log was added to the GLMM in order to model the (probability) distribution. In all cases, significance was at the 95% confidence level, based on calculations using SPSS 19.0.

5 Results

We present the results pertaining to both the occurrences and temporal patterns of the error and appropriateness repairs. With regard to the temporal patterns, we examine the timing of the editing phases in relation to the nature of the reparanda, as well as the speech rates in both the reparanda and repairs. We consider, moreover, whether the patterns are the same in the two types of repairs, or whether they might exhibit noteworthy interactions and / or trade-offs.

5.1 Distribution of repair types

Of the 343 disfluencies in our corpus, 54.5% (N = 187) were classified as involving speech errors and repairs, and 45.5% (N = 156) were classified appropriateness errors; however, a chi-square test determined that the difference was not significant. As to their frequency, error repairs occurred every 3.6 minutes, while appropriateness repairs occurred every 4.3 minutes.

Examination of the type of errors involved in error repairs revealed 49 phonological errors (26.2%), 63 morpho-syntactic (33.7%) and 75 lexical errors (40.1%), a distribution very similar to that found by Levelt (1983). With regard to the location of the interruption within a word or after its completion, the following distribution was observed. While only 33% of the interruptions with appropriateness repairs occurred before the word had been fully uttered, 59% of the error repairs took place before the word was finished. This pattern suggests that speakers typically react more quickly to actual speech errors in their own speech than they do to cases that only involve a preference among well-formed alternatives.

5.2. Duration of editing phases

Overall, there was a significant difference in the mean duration of the editing phases associated with error repairs (720 ms) and appropriateness repairs (850 ms), ($F(1, 342) = 11.301$, $p = 0.001$), see Figure 2.

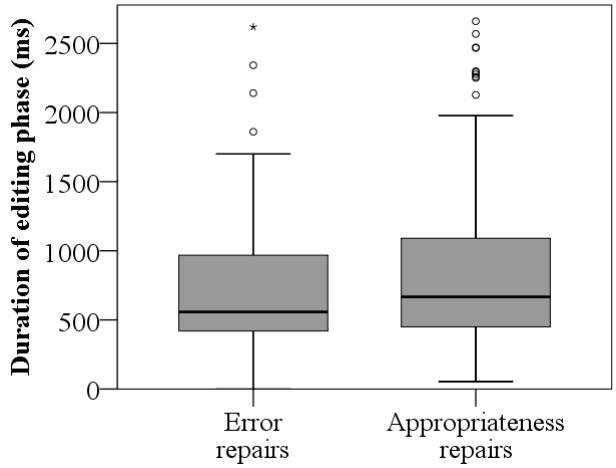


Figure 2. Duration of editing phases of error repairs and appropriateness repairs (medians and ranges)

We also found temporal differences when we considered the location of the interruption. As expected, longer editing phases occurred following full words (874 ms in error repairs and 915 ms in appropriateness repairs) as opposed to interrupted words (617 ms in error repair and 736 ms in appropriateness repairs) in both types of repairs. These differences were significant (error repairs: $F(1, 186) = 16.599$, $p = 0.001$;

appropriateness repairs: $F(1, 155) = 9.594$, $p = 0.004$), and a check for gender differences revealed no significant effect.

Not all cases of appropriateness repairs involved long editing phases, however. In fact, in some cases, there were particularly short editing phases, or even a lack of an editing phase, resulting in an immediate repair, as illustrated in (9).

(9) vannak **+pozitív** és **+negatív** [0 ms] **jó** és **rossz**
there are **positive** and **negative** [0 ms] **good** and **bad**
következmények
consequences
'there are **positive** and **negative** [0 ms] **good** and **bad** consequences'

In this case, the speaker first uttered the borrowed (or foreign) words *pozitív* and *negatív*, but immediately decided that it was preferable or more appropriate to use the Hungarian words *jó* 'good' and *rossz* 'bad;' these were thus inserted without any editing phase.

The mean duration of editing phases arising with appropriateness repairs was quite long, 850 ms. However, examination of the distribution of these durations revealed an interesting pattern, as seen in Figure 3, where the durations of the editing phases are grouped in 200 ms categories.

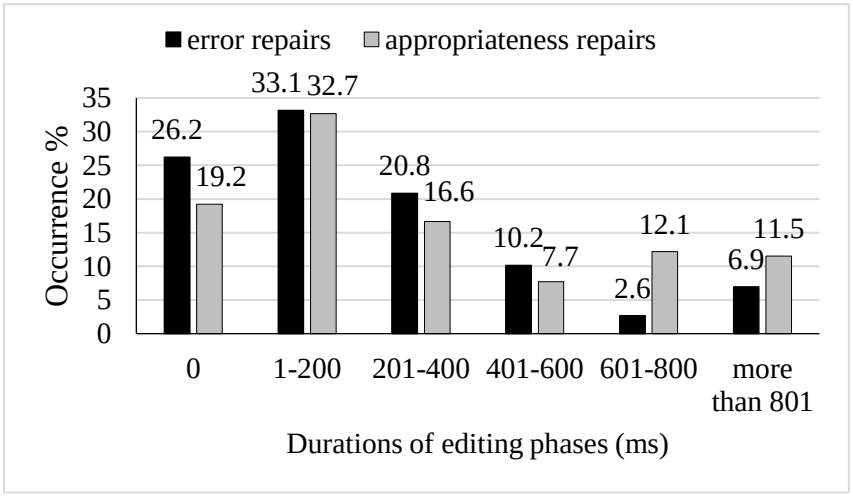


Figure 3. Editing phase durations: Comparison of original durations of error repairs and appropriateness repairs

As can be seen, there are more cases of immediate repairs (0 ms) with actual errors than with appropriateness errors. Of the measurable editing phases (i.e., more than 0 ms), the shortest ones, up to 200 ms, are the most common, and they are equally present with both repair types. There are also minimal differences between the repair types in the ranges up to 600 ms, with the longer editing phases becoming less common. Where a difference arises is with the particularly long editing phases, above

600 ms. In this range, although there are relatively fewer instances, it can be seen that almost all occurred with appropriateness repairs. Thus at the extremes, we see most 0 ms editing phases with error repairs, and the longest editing phases with appropriateness repairs.

When we consider the durational differences in the editing phases associated with the three categories of actual errors, several patterns can be observed, as shown in Table 1.

Table 1. Durations and standard deviations of editing phases with different error type repairs

Error repair type	**Duration of editing phases (ms)**	
	mean value	**std. dev.**
phonological error repairs	548	278
morpho-syntactic error repairs	743	453
lexical error repairs	814	441

First, it can be seen that the shortest mean durations of the editing phases arise with phonological errors (548 ms). The durations associated with lexical and morpho-syntactic errors are very similar (743 ms and 814 ms); there is no significant difference between them, but both are significantly longer than the mean editing phase duration associated with phonological errors (548 ms) ($F(2) = 6.940$, $p = 0.001$). When compared with appropriateness repairs, it can be seen, furthermore, that even the longest editing phases occurring with lexical error repairs are on average shorter than those occurring with appropriateness repairs (814 ms vs. 850 ms), although the difference is not significant. What these findings suggest is that the higher an error occurs in the speech process, the longer it takes to repair it. This confirms earlier findings by Blackmer and Mitton (1991) and van Hest (1996) that conceptual errors are repaired significantly more slowly than lexical or phonological errors.

As far as the content of editing phases is concerned, we observe a good deal of variation. We have thus divided the results into five categories: (i) phase absent (i.e., immediate repairs discussed above: 0 ms duration), (ii) silent pause, (iii) filled pause (e.g., the equivalent of English "er", "um"), (iv) cue phrase present (e.g., equivalent to English "well", "I mean", "that is", etc.), and (v) combination (e.g., filled pause + cue phrase).[4] As can be seen in Figure 4, the various options for editing phases are not distributed in the same way for error and appropriateness repairs; this difference is significant ($\chi^2(4) = 25.494$, $p = 0.001$).

While all options are observed in both error and appropriateness repairs, when actual errors occur, the tendency is to insert minimal content in the editing phase (mostly 0 ms or silence), and when appropriateness repairs occur, the tendency is to insert more

[4] For discussion of different types and content of editing phases, see among others Jefferson (1974), Fraser (1999), Schourup (1999), Fox Tree and Schrock (2002), Schegloff (2007).

substance. It turns out that there are relatively few filled pauses with no other content (i.e., (iii)) for both types of repairs, the only case of similarity between them.

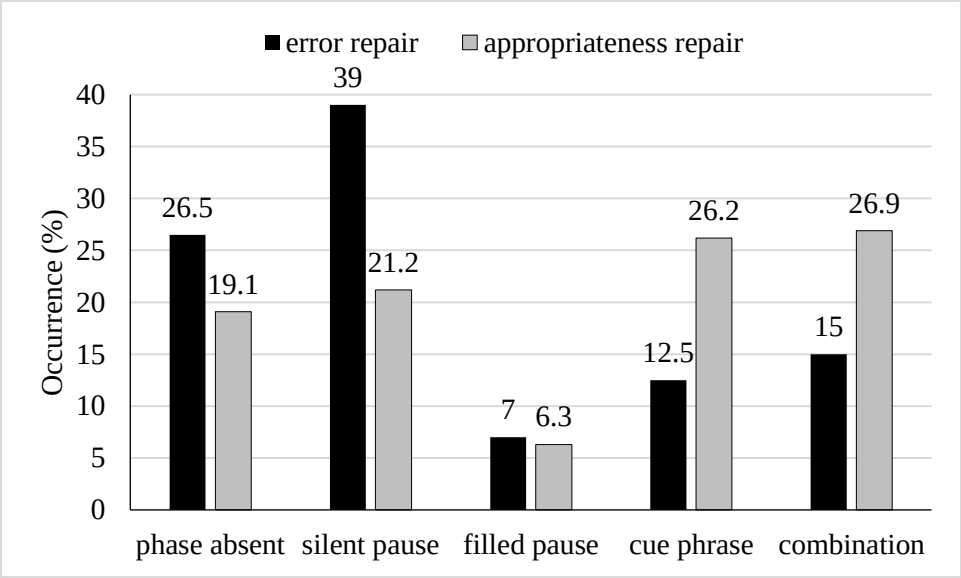


Figure 4. Percentage of different types of content in editing phases for the two types of self-repair

5.3 Rate of speech of reparanda and repairs

The rate of speech provides another view of the temporal patterns of the two types of repairs under investigation. Figure 5 presents the speech rates for error and appropriateness repairs calculated in terms of the number of segments (i.e., vowels and consonants) per second.

As can be seen, the speech rates were the same for the reparanda, regardless of error type: 12.1 and 12.3 segments per second for error and appropriateness repairs, respectively. The articulation rates of the repair portions, however, were statistically different ($F(1, 342) = 12.172$, $p = 0.001$), with error repairs being slower than appropriateness repairs (16.8 and 18.7 segments per second for error and appropriateness repairs, respectively). In addition, there was a significant difference in speech rate between the reparanda and repairs for both repair types (i.e., appropriateness repairs: $F(1, 185) = 9.400$, $p = 0.002$; error repairs: $F(1, 155) = 8.973$, $p = 0.001$). Thus, although we have not determined the speech rate for all of the utterances, what is clear in our results is that speakers consistently had a faster speech rate following any type of error. This would be consistent with the observation that the disfluencies are, in fact, anticipated by the speaker, resulting in "a lengthening of rhymes or syllables preceding the interruption point" (Shriberg, 2001; Plug, 2011).

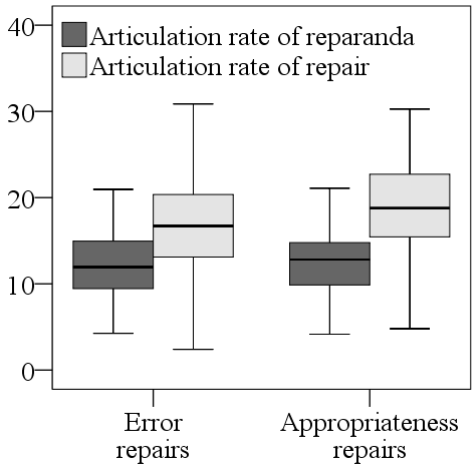


Figure 5. Speech rates (segments per second) of reparanda and repairs in error and appropriateness repairs (median and range)

6 Discussion and conclusion

We have presented different types of information from Hungarian regarding a common phenomenon observed in the course of daily conversations – speakers interrupting their own utterances. This takes place when speakers feel the need to modify their spoken utterances either because they have made an actual error or because they would simply prefer to express themselves somewhat differently (e.g., Levelt, 1983, 1989; Shattuck-Hufnagel & Cutler, 1999; Postma, 2000; Benkenstein & Simpson, 2003; Plug, 2011). Specifically, we have investigated to what extent the properties of the interruptions for error and for appropriateness repairs are similar or different. The findings about appropriateness repairs are particularly important since this type of interruption has been less studied in the literature than repairs following actual errors. This is most likely due to the fact that appropriateness repairs are somewhat more difficult to characterize since no actual speech mistake has been made, and they are thus more open to interpretation.

First, it was noted that error repairs and appropriateness repairs were not evenly distributed in the analyzed material the latter occurred less frequently, as also reported elsewhere in the literature (Levelt, 1983; Plug, 2011). Several possible explanations seem to be available for these differences. First, there were some speakers who introduced overt error repairs, but who did not seem to be particularly concerned about repairing words or expressions for clarity or coherence or for stylistic purposes (“error repairers”, in our case 13 speakers). By contrast, there were other speakers who paid more attention to the appropriateness of their messages, and somewhat less attention to real errors (“appropriateness repairers”, in our case 10 speakers). In this case, it seemed that the speakers assumed that the listener could correct the errors s/he heard based on their mutual language knowledge, however, they were concerned that their thoughts were properly expressed. No preference was found with 3 speakers in our material.

Similarly to Levelt (1983; 1989), we found that speakers halted production of a word before finishing it more frequently with real errors (in our case: 59%) as opposed to appropriateness errors (in our case: 33%). The assumption of an inner monitoring mechanism suggests that errors may sometimes be detected and intercepted before they are articulated (Hartsuiker & Kolk, 2001). It seemed that the case was slightly different with the appropriateness repairs in this respect, since more appropriateness repairs occurred after finishing the production of the whole word.

A goal of this study was to determine whether the basic difference between error and appropriateness repairs was confirmed by measured data and statistical analysis. As expected, the durations of editing phases in appropriateness repairs turned out to be longer in our material than those in error repairs. This is consistent with the view that the sources of the problems in the two cases are different (Levelt, 1983; 1989; Postma, 2000). That is, while actual errors originate at the levels of the speech planning mechanism associated with grammatical or phonological encoding or word retrieval from the mental lexicon, appropriateness repairs appear to involve higher levels associated with the formulation of concepts and the selection of the necessary lexemes from the mental lexicon. In the former case, the speaker accidentally retrieves an erroneous word or segment, while in the latter case, the selected word is correct in the given context but the speaker, upon consideration, deems it inadequate or inappropriate for some reason. Thus, in the latter case, the speaker must make conceptual comparisons among words or phrases in appropriateness repairs, as opposed to just replacing an erroneous sound, word or expression with the correct one. Indeed, our empirical data revealed that appropriateness repairs needed longer editing phases in more instances than error repairs. That is, when the speaker had several (competing) ways to formulate a given thought (semantically and/or syntactically), longer hesitations were produced when repairing the undesirable utterance.

It is noteworthy that there was a relatively large number of absent (0 ms) or extremely short editing phases, although Blackmer and Mitton (1991) reported that in almost 50% of the errors they examined, the duration of the cutoff to-repair interval was less than 100 ms. There seemed to be several possible reasons for this behavior. As noted, with error repairs, it is often only part of a word that needs to be adjusted. In the case of appropriateness repairs, however, the short editing phase (although less common) could indicate that both of the competing concepts and structures may have already been activated, making the replacement immediately available for use in place of the item that had just been uttered. In some cases, the short editing phases might also be due to a relatively small number of options available in the language. When this is the situation, if there are two words or expressions that are equally appropriate for a given concept, both lemmas might be selected and undergo phonological activation, allowing immediate replacement if the one selected first is deemed less desirable (Jescheniak & Schriefers, 1999).

With regard to the actual content of the editing phases, it was found, perhaps unsurprisingly, that appropriateness repairs tended to include more "substance" or content words, specifically cue phrases, than actual error repairs. It is possible that

this is evidence that the speaker wishes to continue communicating with the listener even while searching for a more appropriate word or expression; however, it is also possible that simply reflects the fact that the speaker needs to take more time to do the search, and is just filling the gap. The use of items such as "that is" or "you know", may even serve to draw the listener's attention to the fact that speaker is searching for a "better" word. In this case, the content during the editing phase may serve a pragmatic role in the broader discourse structure – that of relating the earlier and later parts of the utterance, providing a link between the problematic string and its repair (e.g., Fraser, 1999; Schourup, 1999; Schegloff, 2007). By contrast, when a real error is made, since this is equally obvious for the speaker and listener, the speaker may not feel as inclined to send the "additional message" that a replacement is coming.

It was also noted that the repairs were produced at a significantly faster speech rate than the reparanda irrespective of repair type. Interestingly, however, the speech rate in error repairs was significantly slower than in appropriateness repairs. One possible reason for this is that in the case of error repairs, the speaker may unconsciously be attempting to make the correction more intelligible for the listener by using a slower articulation rate. Since appropriateness repairs are not providing new information, only refining information already present, the speaker may feel that the clarity of articulation is secondary to the clarity of the concept. Taken together, our findings revealed a possible pattern of equivalence or compensation, whereby a longer editing phase was combined with a subsequent faster speech rate in appropriateness repairs, and the opposite pattern was found with error repairs. Although the details were somewhat different, this compensatory pattern may be fundamentally similar to that observed by Levelt and Cutler (1983) in Dutch self-repairs. Specifically, while the majority of error repairs exhibited a pitch accent on the repair stretch, the majority of appropriateness repairs lacked a pitch accent. Since the error repairs in Dutch had a faster speech rate, it is possible that they did not need additional time since the pitch accent was clear enough. The unaccented appropriateness repairs, however, were compensated by their slow speech rate. Ultimately, similar types of comparisons of speech rate and other properties of error and appropriateness repairs must be conducted across different types of languages in order to gain further insight into the different aspects of speech repairs.

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