Effects of prepositional 'er' on reading speed in link to long-distance dependencies

Bachelor's Project Thesis

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Abstract: The Dutch word 'er' literally translates to 'there' but can have four different meanings depending on the context. The distinction between these can often be ambiguous. In the case of *er* being used with prepositions, it is hypothesised that *er* sets up a long-distance dependency between itself and the preposition. Previous research suggests the processing of this dependency would cause a measurable slow down in reading speed. A Self-Paced Reading experiment is set up to confirm this, but no statistically relevant findings are found. While this could point to *er* setting up a different kind of dependency, interference through confounds and method errors is suspected.

1 Introduction

The Dutch word 'er' translates literally to 'there' and is a shortened version of the word 'daar'.

Er possesses unique linguistic complexity as it can function in four different ways within a Dutch sentence and simultaneously perform multiple of these functions. The naming conventions for the different functions of *er* vary depending on the source. In this study, we will refer to them as (1) *locative er*, (2) *quantitative er*, (3) *existential er* and (4) *prepositional er*.

While this study focuses only on the prepositional function of *er*, it is helpful to view it in contrast to the other forms to understand it fully. Therefore, the four forms of *er* will be outlined first. Additionally, the concept of long-distance dependencies, which is vital to understanding this study, but may be unfamiliar to some readers, will also be explained. Lastly covered will be the relevant previous research leading to the explanation of the aim of the study. The description of the grammar in the following sections is in part based on that found in Bruce Donaldson's "Dutch: A Comprehensive Grammar" (Donaldson, 2008).

1.1 Forms of *er*

Before continuing, it is worth mentioning that while what follows is the grammatically correct syntax, native Dutch speakers may not be aware of these rules or may disregard them frequently when speaking in an informal context. Donaldson claims that the described grammar is the preferred one or at least the on most commonly used, however, during the process of this study native speakers often mentioned that they would consider other versions of sentences more natural. This is important to acknowledge as we continue, but it is assumed that the results of the study are unaffected by it, as it should not cause differences in reading speed.

1.1.1 Locative *er*

Perhaps the most intuitive form, speakers may use locative *er* as a replacement of 'daar' to indicate a non-stressed sense of place. It is translated into English directly as 'there'. For illustrative purposes, Example (1) shows a simple Dutch sentence followed by a translation of each word on its own and then the sentence translated as a whole.

(1) Ik ben er nooit geweest.
I am there never been
'I have never been there.'

1.1.2 Quantitative *er*

The second form, quantitative *er*, is used with numerals or adverbs expressing quantity. Speakers can

translate this form into English as 'of them/it', but it is possible to leave it out entirely without impacting the sentence's meaning, see Example (2).

(2) Ik heb er drie.
    I have there three
    'I have three (of them).'

1.1.3 Existential *er*

Thirdly, the existential form of *er* is used to introduce verbs within sentences which contain an indefinite subject. While it is possible to use 'there' this way in English, it is more common not to translate it, as shown in Example (3).

(3) Er bracht een juffrouw koffie rond.
    There brought a young-woman coffee round
    'A young woman brought coffee around.'

To briefly (and for the sake of illustration very broadly) sum up, these first three forms of *er* are used to point to a location in a literal or more figurative sense or to a thing which is being counted. These forms are translated either as 'there' or usually omitted in English.

1.1.4 Prepositional *er*

Prepositional *er* acts as a replacement for the pronoun 'het' when written together with prepositions referring to things that are of neutral gender (i.e. referred to as 'it' or 'they'). 'Het' literally translates to 'it' and might be expected to work as shown in Example (4), where it takes the position and function of the object.

(4)   a. Ik kijk naar het nieuws
        I look towards the news
        'I am watching the news.'
  *b. Ik kijk naar het
        I look towards it
        'I am watching it.'

However, it is not usual in Dutch grammar to have combinations such as 'naar het' and so the compound word 'ernaar' is used instead. *Er* takes over the role of the pronoun and is also translated as 'it'. A simple case of the use of prepositional *er* is shown in Example (5).

(5) Ik kijk ernaar
    I look it-towards
    'I am watching it.'

1.1.5 Splitting of *er* and *naar*

As Dutch sentences follow a specific syntactic structure, the placement of the preposition (*naar* in the examples used) relative to *er* can change as speakers add more words to the sentence. Prepositional *er* tends to occur after the first verb of the sentence but before any adverbial phrases used to express the place, time or manner of action. The preposition itself always occurs after the adverbs in the sentence. This syntactic property leads to sentences where *ernaar* is split into two parts, as in Example (6), where it is split apart by 'altijd'.

(6) Ik kijk er altijd naar
    I look it always towards
    'I am always watching it.'

Further, if a sentence includes more than one verb, the preposition occurs after the adverbial phrases but before the second verb, as in Example (7).

(7) Ik wil er altijd naar kijken.
    I want it always towards look
    'I want to always watch it.'

This covers the relevant linguistic background for the word *er* and its different functions.

1.2 Long-Distance Dependencies

In linguistics, the term *long-distance dependency* refers to cases where "the meaning of a phrase in one position is dependent on information contained in a portion of the sentence which is indefinitely far removed from it" (Stowe, 1986, p. 227).

(8) What is Mary hitting that woman with—?

If we look at the sentence shown in Example (8), we can see it contains a long-distance dependency between the word 'what' and the gap left by the missing object after the preposition 'with' (as marked by the dash). What this means in practice is, that the syntactic meaning of the thing which is referred to by 'what' is identical to the preposition's missing object (Stowe, 1986).

In English, these syntactical long-distance dependencies occur for instance in questions or relative clauses, while in Dutch there is the additional case of prepositional *er* (outlined in Examples (4)

through (7)). Here, similarly to the example using questions, the gap of what is referred to by the preposition links to *er* which is acting as a pronoun. A rewritten version of the sentence used in Example (7) using a dash to indicate the gap is shown in Example (9).

(9) Ik wil er altijd naar—kijken

English does not have an equivalent feature of language, so the sentence is translated as just "I want to always watch it".

1.3 Previous Research

1.3.1 Previous research on long-distance dependencies

(10) a. What did Harry say—?

  b. What did Harry say that Tom thought—?

  c. What did Harry say that Tom thought that Marry was hitting—?

  d. What did Harry say that Tom thought that Marry was hitting the woman with—?

A study on long-distance dependencies within WH-questions (i.e. questions of 'who', 'why', and 'where' among others) found that in a sentence such as in Example (10), there are multiple points at which the long-distance dependency set up by the word 'what' could be resolved. As the reader moves through the sentence, they may assume initially that the sentence finishes already after the word 'say', as in Example (10 a), and that the link is between 'What' and the gap left after 'say'. The reader will similarly assume to have found the end of the sentence after 'thought' (see Example (10 b)) and 'hitting' (Example (10 c)). At each of these points it would be possible for the long-distance dependency to resolve, if there was not more context given by the rest of the sentence. The study by Stowe found that there was a measurable slowdown in participants reading speed at each of these points. This includes the final point when the readers reached the end of the sentence, and the long-distance dependency was truly resolved (Example (10 d)). The effect is thought to be caused by the possibility of resolving ambiguity introduced by the word 'what' being reflected in an increase in required computation time (Stowe, 1986).

To summarise: At points at which a syntactical long-distance dependency is (possibly) resolved, a slowing down in reading speed is observed.

1.3.2 Previous research on *er* and measuring reading speed

While few psycholinguistic studies on prepositional *er* exist, a study on the link between existential *er* and reading speed has been done; In the study, participants were shown Dutch sentences ending in unexpected ways. Results showed that reading speed increased when the sentences included *er* in its existential role, compared to sentences which did not. This is thought to be because existential *er* acts as a sort of flag to the reader indicating that some of the information in the sentence will be new or perhaps unexpected (Grondelaers, Speelman, and Geeraerts, 2002).

The method used by the experimenters was *Self-Paced Reading* (SPR). In SPR, participants are shown parts of sentences on a screen and can advance to the next part by pressing a button. The researchers record a time measurement every time participants press the button. Assuming that the pace of advancing through the sentence is consistent and close to natural reading, these time measurements may be used as indications of time taken to read each section(Aaronson and Scarborough, 1976; Mitchell and Green, 1978).

The study by Grondelaers et al. sets a precedent for using SPR to successfully measure changes in reading speed caused by *er* and that this difference in reading time correlates with the associated processing time. It should be mentioned that they later also confirmed their findings using eye-tracking, further giving credibility to the use of SPR (Grondelaers, Speelman, Drieghe, Brysbaert, and Geeraerts, 2009).

Regarding the use of SPR, it is important to mention that SPR is susceptible to two effects which may obscure the results. The first is called the spill-over effect and refers to the fact that an increase in processing time for one word may also affect the reading time of one or multiple words afterwards. SPR is more affected by this effect than other methods such as eye-tracking experiments as readers can not look back on previous parts of the sentence (Vasishth, 2006). The second effect worth mentioning is called the wrap-up effect, which de-

scribes the natural tendency to slow down at the end of sentences as readers process that a sentence has finished. In practice, this means that the target stimuli should always occur before the end of the sentence (Jegerski, 2014).

1.4 Research Aim

As established, syntactical long-distance dependencies cause a slowing down in reading speed at points at which the dependency is resolved. Further, there seems to be a syntactical long-distance dependency between prepositional *er* and the preposition of a sentence. It is also known that the effects of *er* on reading speed can be measured using SPR and that the results can be used to make inferences about the role *er* plays in a sentence.

This leads to the following research question: Is there a measurable slowdown in reading speed at the preposition in a sentence containing a prepositional *er* split from its preposition?

Based on the existing linguistic theories regarding *er* and syntactical long-distance dependencies, it is hypothesised that a measurable increase in reading time will be found at the preposition in sentences which include prepositional *er*.

2 Method

An experiment was conducted in which participants were shown sentences which included prepositional *er* and sentences which did not. The experiment aimed to compare reading speed measured at the prepositional phrase. The experiment was coded in Ibex Language* and hosted as a website on the University of Groningen's servers.

2.1 Conditions

The experiment was conducted entirely during lockdown measures in place due to the COVID-19 pandemic, meaning that in-person meetings of multiple people were hard to organise if at all possible. Because of this, the experiment was conducted entirely remotely via an online website that participants could access from their individual computers.

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*The code for the experiment was based on the work of Sherry Yong Chen and can be found at https://github.com/linguistsherry/SPR

The data collected was sent to a server only at the end of a trial, meaning there was no risk of different internet speeds during the experiment affecting the recording of results.

To increase the chance that the experiment was being conducted correctly, an introduction section explaining the experiment and its structure in detail preceded the online experiment.

As part of this, participants were asked simple questions, before they advanced to the experiment, to show that they understood the procedure correctly. Examples of such a question are which button to press to advance stimuli (*the space bar*) or whether previous parts of a stimulus would remain on-screen (*they did not*). Suppose a participant's answer to one of these questions concerning the experiment's procedure was wrong. In that case, it may be decided to exclude their results as it may be assumed they did not complete the experiment correctly.

Additionally, a short practice session took place before the experiment. This session allowed the participants to familiarise themselves with the SPR system to stop initial confusion or other issues with the method from affecting the first few recorded data points.

2.2 Self-Paced Reading

Participants' reading speed was measured via Self-Paced Reading: Participants were shown stimuli on their screen where each stimulus was revealed in parts. Participants advanced the experiment by pressing the space bar. The time intervals between button pressings were recorded. See Figure 2.1 for an illustration of how a stimulus was displayed as the experiment progressed.

The stimuli shown to participants consisted of multiple words grouped into chunks. Having every word separate would haven been further from the natural way of reading, which might have acted as a source of noise in the measurements. Because there would have been no positive gain that would have justified this added confound, sentences were displayed in chunks of up to four words at a time.

While a sentence was displayed on the screen, the whole sentence's length was always indicated by having any currently hidden parts of the sentences replaced by a series of lines. Each line and its length corresponded to the word they represented, giving
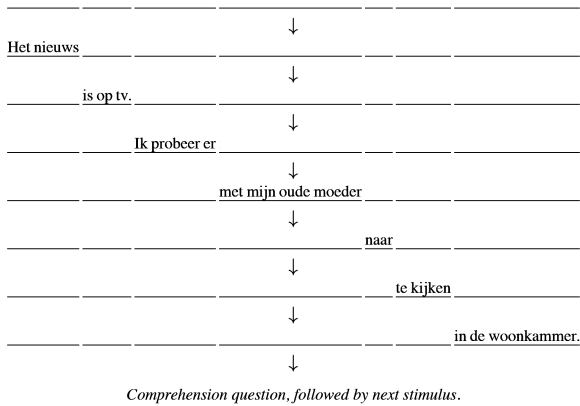
Het nieuws
_____ ↓

is op tv.
_____ ↓

Ik probeer er
_____ ↓

met mijn oude moeder
_____ ↓

naar
_____ ↓

te kijken
_____ ↓

in de woonkammer.
_____ ↓

Comprehension question, followed by next stimulus.

Figure 2.1: Display and progression of an example sentence in the self-paced reading method

the participant a sense of the sentence's length similar to when reading under normal conditions.
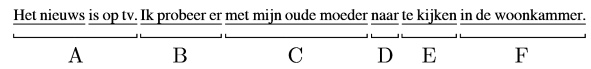
2.3 Stimuli

The experiment used 60 stimuli, of which 20 were the relevant target stimuli. The other 40 were used as filler.

2.3.1 Target Stimuli

The target stimuli consisted of ten stimuli sets with two variations each. All sentences in these stimuli used the preposition 'naar' (meaning "to" or "towards"). Only certain Dutch verbs may use *naar* as a preposition. The verbs used in the study are: 'kijken' ("to watch"), 'luisteren' ("to listen"), 'zoeken' ("to search"), 'brengen' ("to bring") and 'staren' ("to stare").

Each stimulus set had two variations, which we will call ER+ and ER– respectively. In ER+, *er* was used in a pronoun position, and therefore the object of the sentence was omitted. In ER– the word 'nu' ('now') was used at the position taken by *er* in the other variation. Also, in the ER– condition, the object of the sentence was written after the preposition. For a full list of the target stimuli, see Appendix A.

Each target stimuli was constructed in a set structure to minimise the effect of variations in sentence structure on the data. The structure was as follows and illustrated in Figure 2.2.

Het nieuws is op tv. Ik probeer er met mijn oude moeder naar te kijken in de woonkammer.

A B C D E F

(A) sentence for context
(B) chunk containing *er* or *nu*
(C) adverbial phrases
(D) preposition
(E) catch for over-spill effects
(F) catch for wrap-up effects

Figure 2.2: Structure of stimulus

First, the sentence containing the preposition was preceded by another sentence (A) that gave context to the reader and included the object referred to by the pronoun.

Following this was the sentence containing the target word. This sentence always began with a chunk (B) which includes the sentence's subject and verb. For instance, the pronoun 'Ik' may have acted as the subject and 'probeer' as the verb. (translating to "I try to"). Depending on the condition represented by the stimuli the chunk also included either the word *nu* or *er*. For ER+ the chunk read "Ik probeer er" (literally "I try to [...] it"), while for ER– it would be "Ik probeer nu" ("I now try to [...]"). The verb that was used here was not the verb that required the preposition. This was the case because the prepositional verb had to occur later in the sentence than *er*. This way, it was not already clear to the reader which preposition to expect in the sentence, which might have diminished the effect of the long-distance dependency.

Next in the sentence was chunk (C) containing one or more adverbial phrases. As explained in the introduction, these force the prepositional structure to be split across the sentence. The minimum length of this chunk was two words.

Following this was the target chunk (D) consisting only of the word *naar*. If the stimulus was part of the ER– condition, this chunk was followed by another chunk containing the sentence's object. In the example used in Figure 2.2 this would have been 'het nieuws'.

Lastly, followed two chunks to catch the possible confounds mentioned in the introduction. First, chunk (E) to catch spill-over effects, and finally, the stimulus ended with one or more chunks (F) acting as a buffer against possible wrap-up effects.

While the fixed structure of the stimuli was useful to counteract confounds, it did create a slightly unnatural syntax. This fact, in itself, posed another possible confound. Therefore, all target sentences were shown to multiple native Dutch speakers to ensure they were correct and not too unusual to be used.

2.3.2 Filler Stimuli

The 40 filler stimuli used in the experiment were taken from various sources such as news articles and children's books. These sources were chosen as their style and complexity are similar to those of the target stimuli. The division into chunks for the filler sentences was done in step with natural breaks in sentence structure and checked with native speakers to ensure a natural feeling when reading.

Overall, the language and content of all stimuli sentences were kept simple to prevent participants from being surprised or confused by them, which might cause them to stop reading momentarily.

2.4 Experimental Procedure

Regarding the running order of the experiment, the order of stimuli was generated randomly for each trial. However, the two sentences belonging to one set of target stimuli variations were kept apart from another. This was done to hide the differences between the sentences in each condition.

A simple comprehension question to do with the content of each sentence also followed each stimulus. The question was always answerable with either yes or no, which participants input by pressing the '1' or '2' key respectively. The purpose of this was to provide an incentive for participants to properly read each stimulus and to prevent them from just clicking through the experiment without paying attention. The trials were also occasionally broken up by ten-second breaks. This stopped the experiment from becoming a monotonous task.

There are two possible confounds in the experiment design: All participants used different hardware, and all were under different conditions when completing the experiment. Because of the large differences between participant conditions, the experiment was approached as a within-subject study as it may be impossible to compare data between participants. Because of this, all participants were

shown all stimuli, and then the effect was to be searched for within each participant. If the statistical analysis were to find no significant differences between participants' data, a comparison between all participants may be considered.

Before the remote study was conducted, a pilot study was done. This was done to observe whether participants can correctly follow the experiment instructions and if relevant data was able to be obtained. It should be noted that during the pilot study, the participants were observed and a pilot run for a remote version of the study was not done. The pilot study gave a difference in means between the two conditions of $43\ ms$ and a pooled standard deviation of $53\ ms$, giving an effect size of $d = 0.81$. This meant that for a within-study the minimum number of participants required to find an effect (with $\alpha = 0.05$ for a power of 80%) would have been at least 15 participants.

The study participants were recruited online (due to social distancing measures) and were paid 5 euros for participating in the experiment.

When all results were recorded, the differences in reading time between each of the variations of sentences was computed. The values taken were the combination of reading time for the target chunk and the subsequent target+1 chunk. The reading time for the ER– condition was expected to be lower and was subtracted from that of the matching chunk in the ER+ condition.

The data was to be analysed for outliers and individual differences between sets and participants, using an analysis of variance. The difference in means grouped for each participant was to be analysed with a paired t-test.

3 Results

The discussion of results is split for clarity into three parts: A general description of the obtained data, the analysis of variance found in the groups of data, and the statistical analysis of the data itself.

3.1 Obtained Data

The final number of participants used was 13. This was because the lockdown measures in place due to COVID-19 while the experiment was conducted left limited recruitment methods. The distribution

of gender was eight female participants and five male participants. Almost all of the participants indicated they currently live in the Dutch city of Groningen. There was variation regarding their birthplace (though all were from dutch speaking countries, with Dutch as a native language). One participant gave one wrong answer during the quiz on the correct experiment procedure. However, this did not seem to affect their performance, so their data was not removed.

Unfortunately, there was a mistake in one of the stimulus sets, which was only caught after some participants had already completed the experiment. The affected data was removed from the data set. The statistical analysis for outliers did not find any data points to be extreme outliers, and no further data points were removed.

3.2 Analysis of Variance

An analysis of variance showed the item differences between the stimuli sets to be insignificant $F(8, 108) = 1.31$, $p = .248$. The ANOVA table is displayed in Table 3.1.

Table 3.1: ANOVA table for stimuli sets

	Df	Sum Sq	Mean Sq	F value	Pr(F)
Set	8	576126	72016	1.307	0.248
Residuals	108	5951262	55104		

The analysis of variance for item differences between participants was also shown to be insignificant $F(12, 104) = 0.64$, $p = .801$. The ANOVA table is displayed in Table 3.2.

Table 3.2: ANOVA table for participant differences

	Df	Sum Sq	Mean Sq	F value	Pr(F)
Participant	12	450787	37566	0.643	0.801
Residuals	104	6076601	58429		

3.3 Data analysis

As the analysis of variance showed no significant differences between the participants or stimuli sets, the data may be compared amongst all participants. A one-tailed paired t-test comparison of the data indicates a small differences in means for ER–

$(M = 833, SD = 233)$ over ER+ $(M = 792, SD = 203)$, $t(116) = 2.16, p = .98$. The found difference in means is in the opposite direction as expected and thus has a high p-value. Additionally, the statistical power of this t-test is at only 0.4. The data for this test is shown in Figure 3.1.
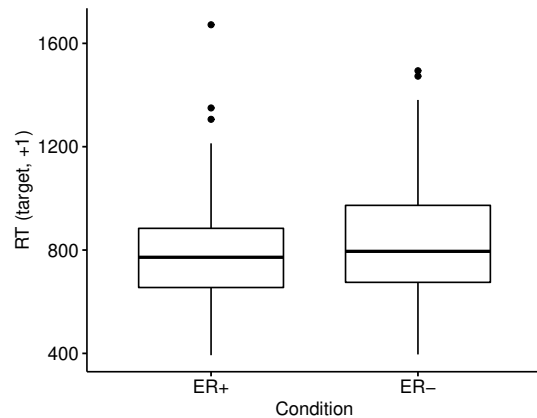

Figure 3.1: Distribution of reading time of target chunk and following chunk (in ms) between conditions ER+/−
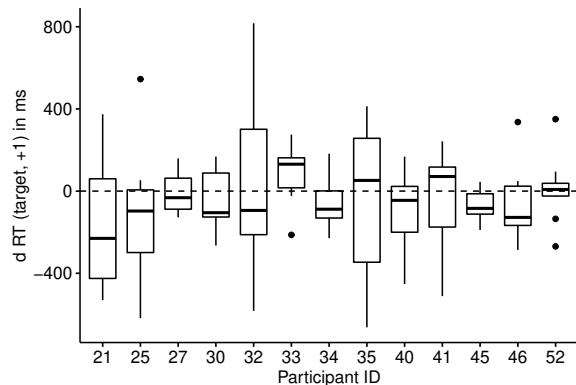

Figure 3.2: Distribution of differences in reading time of target chunk and following chunk (in ms) between conditions ER+/−, divided by participants. Positive values indicate a relative increase of reading time in the ER+ condition.

The statistical power of the t-test is low because the standard deviation for the data overall is very high. To see why, it is worth looking at the data displayed as changes in the time taken to read sentences in the ER+ condition compared to the ER–

condition when divided by participants, as shown in Figure 3.2. Values displayed in the graph above the zero line represent cases in which ER+ was read quicker than the corresponding ER– stimuli, and vice versa for negative values. It can be observed that the range of data is not consistent and at times, quite large. In many cases such as participant 21, 25, 32 and 35, the time taken to read sentences varies largely within one participant.

Table 3.3: Mean and Standard Deviation of delta RT in ms, by participants

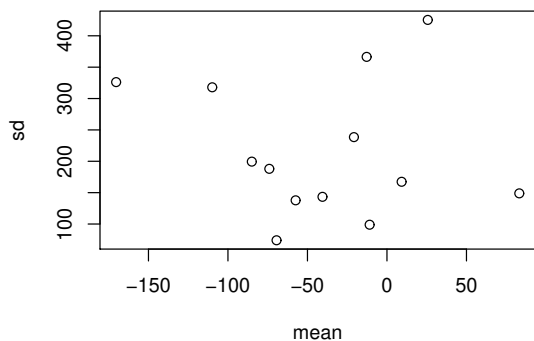| Participant ID	mean	sd
21	-170.34	326.20
25	-109.89	317.92
27	-10.89	98.89
30	-40.56	143.34
32	25.67	425.32
33	83.22	148.86
34	-57.44	137.77
35	-12.78	366.40
40	-85.00	199.46
41	-20.78	238.50
45	-69.44	74.11
46	-74.00	187.96
52	9.22	167.34

Figure 3.3: Scatter plot for mean and standard deviation values of delta RT in ms, by participants

Table 3.3 displays the values of standard deviation (sd) for each participant. Here as well, it can

be seen that five of the participants have standard deviation values larger than at least 200, which is four times as much as the standard deviation value observed during the pilot study. It can be noted that the variance of data gathered within one participant increases when the study is conducted remotely, compared to when it was done with participants and experimenter in the same room. In Figure 3.3 it can be seen that there is no correlation between means and standard deviation values.

The equivalent graph for sentence pairs differences is shown in Figure 3.4. It can be seen that similar to when divided by participants the means are slightly below 0 and that the standard deviation is large, as can be seen in Table 3.4. While the standard deviation values are overall less extreme for the division by sentence pairs than when divided by participants, six of the sets have a standard deviation larger than 200. This further indicates that the variance increased overall in the remote study, as opposed to a specific participant or set being its cause. This also aligns with the lack of outliers or item differences found by the analysis of variance. In Figure 3.5 it can be seen that there is again no correlation between means and standard deviation values.

4 Discussion

Before heading into the discussion, a quick summation of the study: Prepositional *er* in Dutch was suspected to behave in a similar way to WH-question words in English, in that both set up syntactical long-distance dependencies. It was hypothesised that if this similarity exists, then it should be possible to find a slowdown in reading speed at the preposition of a sentence which includes prepositional *er*. A Self-Paced Reading experiment was set up to confirm this, but the data found did not show an effect in the expected direction and was very high in its standard deviation values. As part of the discussion, first will be outlined what may be concluded from the data followed by what research could be continued in the future.

4.1 Conclusion

Based on the experiment results, the hypothesis that a measurable increase in reading time for the
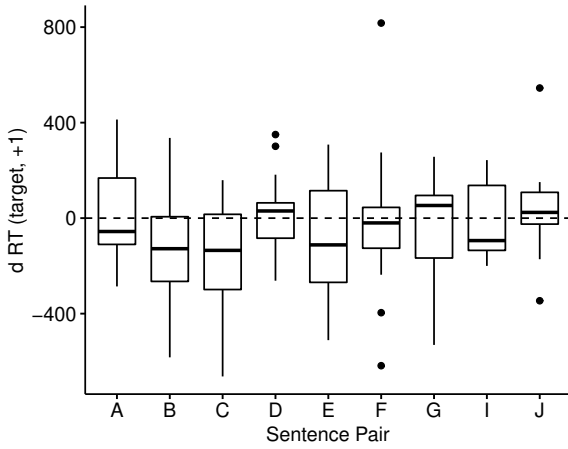
Figure 3.4: Distribution of differences in reading time of target chunk and following chunk (in *ms*) between conditions ER+/−, divided by sentence pairs. Positive values indicate a relative increase of reading time in the ER+ condition.

Table 3.4: Mean and Standard Deviation of delta RT in ms, by sentence pairs

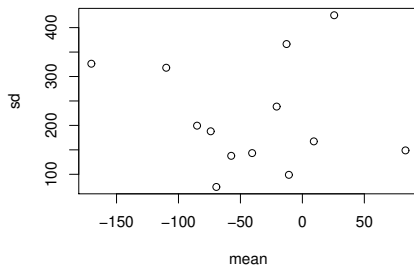| Sentence Pair	mean	sd
A	24.62	23.45
B	-133.23	248.85
C	-172.31	239.32
D	23.23	180.44
E	-92.77	241.80
F	-23.23	339.39
G	-17.15	216.96
I	-13.39	164.31
J	35.23	207.11

Figure 3.5: Scatter plot for mean and standard deviation values of delta RT in ms, by sentence pairs

preposition will be found in sentences that include prepositional *er* versus those that do not, can not be confirmed. Ignoring for now how to reconcile this with the large differences in standard deviation values between the pilot study and remotely conducted experiment, there are three possible conclusions to draw from this:

1. It is possible that prepositional *er* does not set up a long-distance dependency of the same kind set up by WH-questions, and that there is no similar slowdown effect as observed by Stowe.

2. It is possible that the time measurements obtained by Self-Paced Reading are not a good indication of the internal comprehension processes which take place when reading sentences with prepositional *er*.

3. It is possible that the data obtained during this study is not reliable and the method used does not accurately measure what it claims to do.

We can reject the first possibility on the grounds that the results found by this study are low in statistical power. Any possible difference in means is distorted by the large amount of noise within the data, and the findings can not be generalised to normal reading behaviour. Therefore, this study's findings should not be used to confirm or deny any theories about the use and processing of prepositional *er*.

Similarly, possibility two can be dismissed based on the fact that SPR is a method generally accepted to be both high in validity and reliability (Jegerski, 2014) and has been used in the past to find results later replicated by other methods (Grondelaers et al., 2002, 2009). Considering that the conducted pilot study successfully gathered results using SPR, which were in line with what was expected, it is only possible to claim that SPR which is conducted remotely, is not a reliable method[†].

This hypothesis that unsupervised SPR is not reliable is precisely the last possibility left. It is, by process of elimination, most likely the correct explanation of the data found. The lack of clear findings and the more extensive range in reading

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[†]In fact, it is known that other SPR experiment conducted remotely during lockdown did also not yield any useful results (Spenader, personal communication, 2021)

time between sentences support the theory that the method used in this study and the data obtained are low in reliability. It seems that participants did not perform the experiment with enough focus required for SPR to obtain useful results. Whether this is down to lack of experimental conditions or lack of engagement by participants when they are not being watched during the experiment is difficult to say. However, it is clear that the method does not work in a remote setting. For comparison in her description of a typical Self-Paced Reading study, Jegerski giives example standard deviation values ranging between just 26 ms and 109 ms. There also exist precedent cases where participant data is rejected when standard deviation values were outside a believable range of 30 ms to 500 ms (e.g., Kush, Lidz, and Phillips, 2017). This further supports the explanation that the method used in this study is not reliable.

4.2 Future research

For future research, three steps can be suggested:

First, it makes sense to repeat the study in a more controlled environment with participants being observed, if possible, by an experimenter in the same room. It could be possible that due to the already unnatural way of reading via SPR, participants must be continuously prompted to stay engaged. As the time differences between conditions are likely to be small, it is essential to reduce the amount of noise in the data as much as possible. Also worth mentioning is that in future research involving remote testing, which is to do with time measurements or attention, a pilot study that reflects the remote conditions of the eventual study should be done. Doing this in this project would have probably shown a lack of findings earlier.

If conducting an SPR study under better conditions does not yield more useful results still, conducting an eye-tracking study instead might be worthwhile. It could be possible that while there is not a slowdown effect at the preposition itself, there are other changes in reading behaviour between conditions. Eye-tracking gives more detailed data than SPR, meaning researchers can see precisely where participants are looking when reading stimuli, which might give insights into the processing of sentences containing prepositional er that are missed by SPR.

Lastly, if eye-tracking still does not find any results, it can be suggested to research the usage and understanding of prepositional er by native speakers. As mentioned in the introduction section, it is not a given that native Dutch speakers will follow the exact syntax described. It is a possibility worth considering that speakers naturally avoid the split of er and the preposition or that the long-distance dependency set up by the split is not relevant or ambiguous enough to them to cause the same slowdown effect observed with WH-questions. For example, research in the use of prepositional er such as at which point the amount of adverbials phrases is so large that native speakers would see it more natural to restructure the sentence might give insight into how important the link between er and the preposition is. However, while this is a possibility worth considering, it is very unlikely as it does not align with what is previously known about native speakers preferences (Donaldson, 2008). Based on the results of this study and especially the difference between the data obtained by pilot experiment and remote experiment, it is more likely that future studies will obtain results in line with previous research once the added factor of socially distant experimentation is removed.

Lastly, it is worth discussing what may be done if a future repeated study would find results that confirm the initial hypothesis (i.e. prepositional er causing a slow-down in reading speed at the preposition). If this is the case it would give credit to the assumption of prepositional er acting in the way of a syntactical long-distance dependency. From this future experiments would be possible:

First, the confirmation of results using eye-tracking, as done by Grondelaers et al., to further solidify the findings. Second, if a slowdown effect is found at the point where the long-distance dependency is resolved (i.e. at the preposition), the context of the previous research by Stowe would suggest that you would also find a slowdown at previous points in a sentence which falsely appear to resolve the long-distance dependency. Constructing and studying sentences that include such scenarios would further give information about how prepositional er is used. Lastly, it can be said that overall the psycholinguistic properties of all forms of er are still very under-explored and further research into any of them would likely prove insightful.

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A   List of Target Stimuli

1a. Het nieuws / is op tv. / Ik probeer nu / met mijn oude moeder / naar / het nieuws / te kijken / in de woonkammer.

1b. Het nieuws / is op tv. / Ik probeer er / met mijn oude moeder / naar / te kijken / in de woonkammer.

2a. Klassiek is / zijn favoriete muziek. / Hij wil nu / in de auto altijd / naar / klassiek luisteren / op hoog volume.

2b. Klassiek is / zijn favoriete muziek. / Hij wil er / in de auto altijd / naar / luisteren / op hoog volume.

3a. Haar autosleutel / is rood. / Ze moet nu / 's ochtends vaak / naar / haar autosleutel zoeken / als ze weggaat.

3b. Haar autosleutel / is rood. / Ze moet er / 's ochtends vaak / naar / zoeken / als ze weggaat.

4a. Het postkantoor / is open. / U kunt nu / elke dag pakketten / naar / het postkantoor brengen / tot sluitingstijd.

4b. Het postkantoor / is open. / U kunt er / elke dag pakketten / naar / brengen / tot sluitingstijd.

5a. Deze film / lijkt goed. / Hij wil nu / met zijn vrienden / naar / deze film kijken / in de bioscoop.

5b. Deze film / lijkt goed. / Hij wil er / met zijn vrienden / naar / kijken / in de bioscoop.

6a. De kat / is verlegen. / We moeten nu / vaak allemaal / naar / de kat zoeken / nadat mensen / weer zijn vertrokken.

6b. De kat / is verlegen. / We moeten er / vaak allemaal / naar / zoeken nadat mensen / weer zijn vertrokken.

7a. Dit was / zijn favoriete schilderij. / Hij lijkt nu / altijd / met veel bewondering / naar / het schilderij / te staren / als hij / hem bezoekt.

7b. Dit was / zijn favoriete schilderij. / Hij lijkt er / altijd / met veel bewondering / naar / te staren / als hij / hem bezoekt.

8a. Hij woont / aan zee. / Hij luistert nu / vaak vanaf zijn balkon / naar / de zee / om te ontspannen.

8b. Hij woont / aan zee. / Hij luistert er / vaak vanaf zijn balkon / naar / om te ontspannen.

9a. De koning / houdt een toespraak. / Ik probeer nu / met mijn grootmoeder / naar / de toespraak / te luisteren / terwijl ze / aan het koken is.

9b. De koning / houdt een toespraak. / Ik probeer er / met mijn grootmoeder / naar / te luisteren / terwijl ze / aan het koken is.

10a. Ze liet / haar rugzak / achter / naast een boom. / Ze zal nu / later op de dag / naar / de rugzak / moeten zoeken / als ze terugkomt.

10b. Ze liet / haar rugzak / achter / naast een boom. / Ze zal er / later op de dag / naar / moeten zoeken / als ze terugkomt.