HOW MANY ANIMALS OF EACH KIND DID MOSES TAKE ON THE ARK? WHAT IS THE NAME OF THE MEAN CHARACTER FROM THE FAMOUS DISNEY FILM CALLED THE 100 DALMATIANS? IN WHICH DUTCH VILLAGE CAN ONE FIND S FAMOUS BECAUSE JESUS EAT DURING S ELEVEN APOSTLES E WILLEM-ALEXANDER CELEBRATE HIS BIRTHDAY? WHAT IS THE NAME OF THE PORTUGUESE FOOTBALL CLUB THAT CRISTIANO RONALDO IS CURRENTLY PLAYING FOR? WHAT IS THE NAME OF THE FAIRY TALE IN WHICH ONE OF THE PIGLETS HIDES HIMSELF IN A CLOCK? IN HOW MANY DAYS DOES THE SUN CIRCLE AROUND THE EARTH? WHAT IS THE NAME OF THE MEXICAN SAUCE MADE OF MASHED ARTICHO AND WHICH IS OFTEN EATEN WITH NACHOS? CAN MOSQUE IN THE TURKISH WHAT HAS BEEN THE GREAT SINGER JUSTIN BIEBER, THROUGH YOUTUBE? WHAT KIND OF MUSIC DID THE

The Effect of Semantic Illusions on L1 and L2 Sentence Processing: Did Moses Speak Two Languages on the Ark?

A Study in L1 Dutch and L2 English

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Abstract

The aim of the present study was to research the effect of semantic illusions on sentence processing in L1 Dutch and L2 English. A rating study and a sentential judgement task were conducted in order to examine this particular phenomenon. A total of 75 participants (both studies combined) participated in the experiments. The rating study contained a questionnaire in which participants had to judge a question on its semantics. The sentential judgement task included an RSVP (Rapid Serial Visual Presentation) task in which questions were presented word by word. The results showed that participants show a tendency towards a slower processing of semantic illusions in their second language English than in their first language Dutch. Strikingly, the RT did not differ between correct sentences in either language. The current study considers mental model building to be a possible explanation for the findings, as it may be that detailed lexical information pertaining to the mental model is less familiar in the second language (hence creating a longer RT). In conclusion, the present study has opened a new subdomain in the wider field of semantic illusions, namely the effects of a second language on such illusions.

Keywords: semantic illusions, RSVP, L1 Dutch, L2 English, mental model building

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‘It always seems impossible until it’s done.’ – Nelson Mandela

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1. Introduction

When asking interlocutors the question "What did Jesus eat during the Last Supper with his eleven apostles?", the majority of (Dutch) speakers would answer "bread" while failing to notice that the sentence stated *eleven* apostles, rather than the correct number of *twelve*. This example sentence is one of many striking sentences that seem to be semantically correct at first to the speaker but when discussed in more detail, turn out to appear as a semantic anomaly.

The idea of this so-called semantic illusion, that is, when the interlocutor fails to notice the semantic error in a given sentence, has first been researched by Erickson and Mattson (1981). The experiments conducted in their study all evolved around these semantic illusions. The 'prototype' of the semantic illusion, which has been thoroughly researched and discussed in many other papers, might be the following sentence: "How many animals of each kind did Moses take on the Ark?". Most people would answer "two" and would fail to notice that it was of course *Noah* who took the animals on the Ark (and not Moses). Erickson and Mattson's study, then, was the first to examine this phenomenon in more detail. Why is it that interlocutors fail to notice such a semantic error? What are the underlying mechanisms that are used while processing such sentences? And perhaps more strikingly, why does the so-called illusion not work when the word *Moses* is replaced by a different biblical figure, such as *Jesus*?

Through the years, many researchers have attempted to answer these questions by using Erickson and Mattson's study (1981) as a kind of baseline. By using the Moses illusion as a starting point, researchers have tried to closely examine this phenomenon in relation to various topics, such as task demands (e.g. van Jaarsveld et al., 1997) or information structure (e.g. Wang et al., 2009). Although various theories have been developed on the basis of the findings regarding semantic illusions, it seems that there is still one area of research

unexamined: the focus of the previous research has always been on one language. Many studies have examined the effect of semantic illusions in various languages, such as English (Erickson & Mattson, 1981; Reder & Kusbit, 1991), Dutch (van Jaarsveld et al., 1997) and even Mandarin Chinese (Wang et al., 2009). Not one study, however, has examined the effect of semantic illusions *between languages*. This is why the present study aims to research the effect of semantic illusions in the L1 Dutch and the L2 English. The aim of the current paper is to provide new insights in the processing of semantic illusions as well as examining the differences and similarities between a participant's first and second language. The results of the present study, then, might open a new (sub)field in the wider domain of semantic illusions and provide some new answers to the field of first and second language sentence processing.

Before explicitly stating the research questions as well as the hypotheses, it is important to first give a detailed literature overview of some important studies done on the effects of semantic illusions. On the basis of the findings of previous studies, the most significant research gaps can be detected which ultimately lead to new questions about semantic illusions in relation to sentence processing. The next section is divided into various theories that exist about semantic illusions, as well as closely examining the various kinds of methods that were used in the experiments.

2. Previous studies

Before the concept of semantic illusions opened a new research area in the field of linguistics, researchers were convinced that interlocutors attempted to process the sentences they heard by means of analysing every single word that caught their attention (see, for instance, Just & Carpenter, 1980). Of course, this is not always the case. It might sometimes happen that the interlocutor does not process every word they hear, due to, for instance, extraneous factors such as noisy surroundings. This might then consequently lead to a misunderstanding of the utterance. Furthermore, if speakers do not take into account the previous knowledge of their interlocutor (i.e. their common ground), misunderstandings are likely to happen (Traxler, 2012). These are just some examples of many that exemplify that interlocutors are not always able to perfectly analyse and process what they hear or see. In this sense, the concept of a semantic illusion, i.e. when an interlocutor fails to notice a semantic error in a sentence, does not seem to be an exception.

As Erickson and Mattson (1981) state, however, a semantic illusion does seem to be an exception when examining the field of sentence processing. Admittedly, errors and misunderstandings are likely to occur when the interlocutor does not comprehend what is being said. Nevertheless, the idea of a semantic illusion seems to be quite the opposite of such misunderstandings: interlocutors do understand every single word that is being said to them, but somehow, they do not fully process the sentence in the correct way. To exemplify this finding, it might be useful to look at the "Moses-example" again. When a speaker asks "How many animals of each kind did Moses take on the Ark?", the majority of interlocutors will fail to notice the semantic error of Moses and will, without consciously thinking about it, give the answer of "two". The fact that the interlocutor is able to provide an answer to the question already implies that he or she understands every word that is being said. In other words, giving an incorrect answer is not due to some mismatch in the shared knowledge or an

incidental misunderstanding, but seems to be due to some kind of incomplete sentence processing on a semantic level. This is why a semantic illusion is the perfect example of showing that sentence processing might be more difficult to comprehend on an underlying level.

2.1. Behavioural studies in relation to semantic illusions

As aforementioned, Erickson and Mattson (1981) were the first researchers to conduct a series of experiments in order to examine what happens during processing when interlocutors are faced with these so-called semantic illusions.

The first experiment aimed to investigate what would happen when participants had to read the illusion out loud. The underlying idea was that they would be more aware of a semantic anomaly in the question once they read it out themselves. Along with the Moses-question, a number of other questions were constructed, all containing a semantic anomaly. Participants were first presented with all the stimuli questions without actively doing something. After this, they were shown all the sentences again and were asked whether they had already seen the sentence or not. The answers had to be written down. The underlying idea was that participants failed to notice the semantic error by stating that they had already seen the same question (and not the right one, containing no semantic anomalies). The experiment ended with a questionnaire about the participants' knowledge of the questions being asked (e.g. "Who was it that took the animals on the Ark?") (Erickson & Mattson, 1981: 542). The most important finding of the first experiment was that the semantic illusion occurred despite the fact that the participant read the sentence out loud, and therefore making sure "that the inconsistent name is encoded" (Erickson & Mattson, 1981: 543). This finding led to the possible explanation that a Moses-illusion would only occur in the form of a question, as the focus would then not be on the inconsistent name (i.e. the semantic anomaly).

For this reason, a second experiment was conducted. Rather than testing questions, the stimuli as used in experiment 1 were turned into statements that needed to be judged (i.e. true/false). An example of such an statement would be the following: "Moses took two animals of each kind on the Ark" (Erickson & Mattson, 1981: 543). If participants would still fail to notice the semantic error in the sentence, this would lead to the assumption that the illusion is not merely due to the type of phrasing. Rather, something else would be causing these illusions. Participants were asked to read a booklet at their own pace which contained several statements (among them the semantic illusions). They had to judge the statements by encircling "true" or "false". If they did not know the answer to the statements, participants had the possibility to opt for "I don't know". The results led to three rather striking findings. First of all, as participants still failed to notice the semantic anomaly, it could be concluded that the so-called Moses-illusion was not only due to the type of phrasing (i.e. questions). Furthermore, by transforming the questions used in the first experiment into statements, the focus of the semantic anomaly would consistently be on the first thing that appeared in a sentence. Because of the failure to notice this, this leads to the idea that a semantic illusion does not have to be preceded by a "biasing context", i.e. by first creating an image before asking an inconsistent name (Erickson & Mattson, 1981: 544). Another important finding was that, despite the self-paced reading, participants still failed to notice the error, suggesting that time constraints do, to a certain extent, not affect the rate of noticing a semantic anomaly in a sentence. In short, the second experiment provided some evidence that the illusion also occurs in a different form of a sentence as well as during the absence of time constraints.

The third experiment aimed to answer an important question in the processing of semantic illusions: What would happen if the inconsistent name would be changed? As already mentioned in the introduction, it is more likely for participants to notice the error in a sentence such as "How many animals of each kind did *Jesus* take on the Ark?", although

Jesus is also a biblical figure, just as Moses. Erickson and Mattson therefore argue that there are two possible hypotheses for these inconsistent names: phonological similarity or semantic similarity. The former implies that the inconsistent names used in the illusion might be phonologically similar to one another, therefore leading to the assumption that participants fail to notice the discrepancy between the name. As an example, *Moses* and *Noah* both consist of two syllables in which the stress pattern is the same (i.e. the first syllable is stressed in both words). Furthermore, both words have an 'o' sound in the beginning of the word. It might be possible that participants are therefore in some way side-tracked and hence fail to notice the error. The latter hypothesis, on the other hand, implies that there is some kind of relationship between the inconsistent name and the correct one in a semantic illusion. For that matter, both Moses and Noah are biblical figures and can be associated with the sea. It might be possible that, because of this, participants do not notice the inconsistent name but process the semantic anomaly as if it were the right word. In order to test these two hypotheses, Erickson and Mattson (1981) created materials that would adhere to one of the two possible explanations. The procedure of the third experiment was similar to that of the second one, in which participants had to read a booklet. For this experiment, questions were used rather than statements. The findings showed support for the semantic similarity hypothesis but not for the phonological similarity hypothesis. This suggests that the semantic difference between the correct name and the inconsistent name should not be too far. In case both target words have some semantic resemblance, however, a semantic illusion is more likely to occur. Erickson and Mattson (1981) conclude that it seems that the Moses illusion occurs when bundles of semantic features are connected to the content of the sentence. That is, if a participant reads something about an Ark, an entire semantic network will be activated, including biblical figures such as Moses. This might be a reason why the inconsistent name is not noticed, as the connection between several semantic features and the sentence itself lead to other possible

target words as well. The findings in favour of the semantic similarity hypothesis, then,, support this idea. It is also important to note that it seems that semantic illusions are not dependent on time constraints or the form of the sentence. More research is needed, however, in order to say something more about this phenomenon.

As an expansion of the research done by Erickson and Mattson (1981), Bredart and Modolo (1988) examined the role of focalisation in relation to semantic illusions. It is a bit unclear how the stimuli were presented, but it seems that participants received a card for each item, after which they had to write down the answer. The focalisation of sentences could be manipulated in two ways: a) *It was Moses who took two animals of each kind on the Ark*, or b) *It was two animals of each kind that Moses took on the Ark*. The hypothesis was that, once the focus of the sentence was on something else than the semantic anomaly (as in sentence b), there would be fewer occurrences of semantic illusions. The findings indeed showed that focalisation might affect the occurrences of semantic illusions: when the focus of the sentence is on something else than the inconsistent name, more participants fail to notice the anomaly. When comparing this research to Erickson and Mattson's study (1981), it might seem that, by asking a question such as *How many animals of each kind did Moses take on the Ark*, the inconsistent name *Moses* does not appear in a focus position, hence leading to more occurrences of semantic illusions. It is striking to see that, although the research by Bredart and Modolo (1988) might be a possible explanation for the high rate of semantic illusions, not much research has been done as a follow-up to their study.

Similarly to Erickson and Mattson's approach (1981) of semantic similarity, van Oostendorp and Kok (1990) proposed the conceptual relatedness hypothesis. The most important key terms that are related to this concept are the following: first of all, the connection between the concepts is important, i.e. the number of features that two or more concepts have in common in the semantic memory. Secondly, the strength of the relations

between the concepts in the semantic memory are important. This is quite similar to the conclusion by Erickson and Mattson (1981), as they described that connection of semantic features to the rest of the sentence might cause the failure to notice a semantic anomaly. Furthermore, it is important to have some world knowledge in order for a semantic illusion to occur. This related back to the beginning of this section: misunderstandings might occur when the speaker does not take into account the knowledge of the interlocutor. If an interlocutor has no idea about the story of the Ark, they would never fall for the semantic anomaly (as the whole semantic concept is not clear to them).

Van Oostendorp and Kok (1990) aimed to test this hypothesis as well as examining whether previous learning of the relations between an inconsistent name and the concepts that are used in the sentence will also lead to more frequent occurrences of the semantic illusions. In order to do so, twenty sentences were constructed which consisted of a highly related name and a less related inconsistent name (e.g. using *Adam* instead of *Moses*, as the former has nothing to do with the sea and is more well-known than the other concept). Just as Erickson and Mattson's study (1981), van Oostendorp and Kok (1990) used a booklet to test whether participants would fall for the illusion. It is unclear whether time constraints were controlled for.

The findings of the experiment suggest that, as expected, "the greater the similarity of facts people know about proper names, the less likely they are to notice errors in sentences" (van Oostendorp and Kok, 1990: 111). In other words, because of the overlap in semantic features between two concepts, participants are more likely to fall for the semantic illusion. Again, the findings support the idea of semantic similarity (or conceptual relatedness in this case).

A study by Reder and Kusbit (1991) aims to further investigate the concepts of semantic similarity as well as examining other possible explanations for the occurrence of

semantic illusions. The first experiment was conducted in order to see whether the semantic illusion was merely due to the so-called Conversational Postulate (Grice, 1975). This phenomenon implies that people do in fact notice the semantic error, but are too polite to comment on this, as they do not want to point out the flaws in the researcher's experiment.

Reder and Kusbit (1991) constructed two different conditions in order to test this: the literal condition and the gist condition. The former implies that participants had to take each question literally and to not provide an answer if they noticed a semantic anomaly in the sentence. The latter, on the other hand, indicates that participants had to ignore inconsistent or inappropriate words in the question and provide an answer to the question as if it were completely correct. The hypothesis for the first experiment was that, in case participants adhered to the principle of Conversational Postulate, they should find it less difficult to detect inconsistent names (i.e. the literal condition) as opposed to ignoring the semantic anomalies (i.e. the gist condition). The materials, consisting of sentences which were either distorted or correct, were judged by three independent raters.

During the first experiment, participants saw the question on a screen and had to orally provide an answer as quickly and as accurately as possible. The time between the end of the question and the answering of the participants was measured. Participants received implicit feedback after answering each question by the experimenter. The findings show that participants found it easier to ignore the semantic anomalies in a sentence than to detect the anomalies (Reder & Kusbit, 1991). This suggests that the failure to notice a semantic illusion is not due to politeness, but has to be due to a different reason.

A second experiment was conducted in order to test whether falling for a semantic illusion was "due to an impoverished memory" (Reder & Kusbit, 1991). That is, it might be possible that, once the memory trace would be strengthened, this would affect the tendency to fall for the illusion. In order to test this hypothesis, participants were instructed to examine a

series of facts before answering questions. It is important to note that the sentences that were studied always included the correct name (e.g. using the target word *Noah* and not the inconsistent name *Moses*). The findings of the experiment suggested that it might be possible that a strengthening of the memory leads to an enhanced ability to notice the semantic illusions. As the findings were not robust, however, a third experiment was conducted in order to see whether an impoverished memory might be a possible explanation for the failure to notice a semantic anomaly in a sentence (Reder & Kusbit, 1991). In order to do so, participants had to actively memorise the facts that were used in the second experiment, rather than merely studying them. The results of the third experiment indicated that an impoverished memory did not appear to be a reason for the occurrences of semantic illusions. Even when participants had actively memorised the facts, the rate of semantic illusions did not significantly differ from when they had not studied the statements.

Reder and Kusbit (1991) concluded that the Moses illusion occurs as a consequence of an imperfect memory match. It might seem that participants do not carefully read every term that is being presented. These findings, however, are in contrast with the findings by Erickson and Mattson (1981) and van Oostendorp and Kok (1990), as these studies found that, even when participants read the sentence out loud, they still failed to notice the semantic anomaly. This would suggest that people do carefully read every term that is presented to them. Rather, the underlying semantic similarities between the correct name and the inconsistent name might cause participants to fall for the illusion. This is why the conclusion by Reder and Kusbit (1991) does not seem to be very convincing. More research is therefore needed in order to find a possible explanation for the underlying mechanisms of semantic illusions.

The study conducted by van Jaarsveld et al. (1997) aimed to investigate the notion of semantic illusions in order to provide new insights in the various theories that currently exist about this concept. Unlike previous studies, van Jaarsveld et al. (1997) attempted to see

whether task demands might affect the processing of semantic illusions. The first experiment was conducted in order to see what would happen if participants were put under time pressure when reading sentences containing a semantic anomaly. It is striking to notice that the findings suggest that the detection rate of semantic illusions was significantly higher when the instructions emphasised the accuracy of performance as opposed to emphasising both speed and accuracy. This supports the findings by Erickson & Mattson (1981) that it is difficult to notice semantic illusions even without time constraints.

The second experiment was conducted in order to find support for the semantic similarity hypothesis (or the so-called conceptual relatedness hypothesis as proposed by van Oostendorp and Kok (1990)). Two versions of sentences were constructed: one included an inconsistent or distorted term that was similar to the correct term (e.g. *Moses* instead of *Noah*), while the other version included terms that were rather dissimilar from the correct target word (e.g. *Nixon* instead of *Noah*). Two different tasks were carried out: a question-answering task, in which participants had to answer the question being asked, and a detection task, in which participants were asked to detect a possible semantic distortion in the sentence. It appeared that longer reaction times were found in the question-answering task when the term was dissimilar to the correct term. This might indicate that "the output of semantic interpretative processing is monitored continuously for efficient responding in different tasks" (van Jaarsveld, Dijkstra, Hermans, 1997: 228). Because all information in the question needs to be processed in order to provide an answer, dissimilar distorted terms might lead to additional time, as the interpretation of the sentence is in fact interrupted. They conclude that their findings are somewhat in line with the findings by Reder and Kusbit (1991), i.e. that semantic illusions are a result of imperfect encoding and incomplete retrieval. In short, it is interesting to see that the various tasks conducted as well as using task demands as a variable leads to different results in relation to processing semantic illusions.

So far, various theories have been discussed in relation to the processing of the Moses illusion. Both Erickson & Mattson (1981) and van Oostendorp and Kok (1990) found evidence for the so-called semantic similarity hypothesis. Reder and Kusbit (1991) as well as van Jaarsveld et al. (1997) found evidence for imperfect encoding processes regarding semantic illusions, as well as finding that task demands might also influence the detection of semantic anomalies in sentences. It is important to note that this imperfect encoding might be a result of the semantic relatedness of the target words: by activating a specific semantic area, the interlocutor might not feel the need any more to process every word that they hear in detail. Besides these theories, the paper by Shafto and MacKay (2000) introduces a new concept to the various explanations that exist in relation to the notion of semantic illusions. The interactive activation model known as the node structure theory (NST) states that units that are interconnected can be considered nodes, which are organised in a semantic system and a phonological system (Shafto & MacKay, 2000). Figure 1 aims to visually explain this phenomenon.

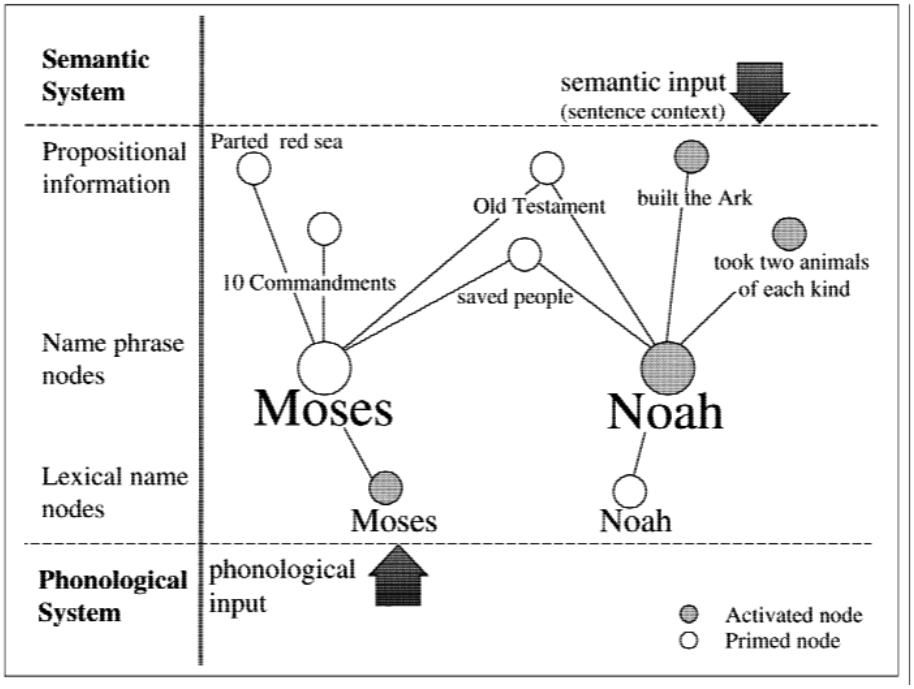

Figure 1: The node structure theory explained in relation to semantic illusions (Shafto & MacKay, 2000: 374).

As Figure 1 shows, the node structure theory states that, due to interconnected units called nodes, the inconsistent name (*Moses* in this case) is processed as if it were the correct target name (i.e. *Noah*). The idea is that the participant hears or sees the inconsistent name *Moses* (i.e. the phonological input). Because of interconnected units, additional sources of information are activated when hearing the illusion. This is why information such as *saved people* and *Old Testament* are also primed subconsciously. The information about the building of the Ark, as well as taking x animals of each kind is activated during the sentence (i.e. the semantic input), which also automatically primes the other propositional information. In short, the phonological input *Moses* and the semantic input *built the Ark* and *took two animals of each kind* causes the participant to interconnect various units that are semantically related, therefore failing to notice the semantic error in the sentence. Shafto and MacKay (2000) propose that not only semantic similarity, but also phonological similarity might cause participants to fall for such illusions. The results of their two conducted experiments suggest that semantic relatedness between the inconsistent name and the correct word might not exclusively be the explanation for the occurrences of semantic illusions. Rather, the phonological similarity of words might also play a role. Shafto and MacKay (2000) found that participants failed to notice the error is the classic *Moses* illusion, but did notice the semantic anomaly once *Moses* had been replaced with *Abraham*. They argue that *Moses* and *Abraham* are both as strongly semantically related to *Noah*, but that *Moses* is more phonologically related to *Noah* than *Abraham* (when looking at the number of syllables as well as the stress pattern). Because participants do notice the semantic anomaly of *Abraham*, Shafto and MacKay (2000) conclude that semantic illusions are also caused by phonological similarity, therefore contradicting previous accounts regarding semantic illusions. It must be noted, however, that it seems that *Abraham* is not as strongly related to *Noah* as *Moses*, although according to the authors this is the case. The name *Abraham* might appear in biblical texts but

it is certainly not as common as *Moses*. More participants might know the role *Moses* played, but the role of *Abraham* is harder to explain. Therefore, the conclusion that *Abraham* is noticed as a semantic anomaly is due to the lack of phonological similarity to *Noah* seems a bit premature. It would be necessary to first test whether the participants' knowledge of the biblical names *Moses* and *Abraham* is quite equal. Only then, one is able to say something about the role of phonological similarity in relation to semantic illusions. This is why one might assume that semantic similarity, as was established by previous studies, but not phonological similarity, definitely play a role in the occurrences of semantic illusions. Admittedly, it might be possible that names that are phonologically related also lead to more semantic illusions. This idea, however, has to be examined in more detail in order to say something more about it.

A study by Büttner (2007) examined the role of statements in relation to the occurrences of semantic illusions. The stimuli were presented to participants via a leaflet that contained either questions or statements. It appeared that statements resulted in a higher rate of semantic illusions when compared to questions. This finding is in line with the findings of the study conducted by Bredart and Modolo (1988): it indeed appears that the position in which the target word appear might have an effect on the occurrences of semantic illusions. It must be noted, however, that Büttner (2007) did not use the same form of sentences as did Bredart and Modolo (1988). Rather, she put the target word in the initial position of the sentence, which is similar to the method used in Erickson and Mattson's paper (1981). Future research might examine whether there still would be a difference in the occurrences of semantic illusions when comparing sentences with the target word in initial position to sentences in which the target word is focalised (i.e. *It was Moses…*). For now, it is important to note that it indeed seems that participants fail to notice semantic illusions more when the form of the sentence is a question (as opposed to a statement).

A recent study by Cantor and Marsh (2017) examined the effects of a semantic illusion in relation to stored knowledge. Through several online experiments, it was tested whether prior knowledge to a certain subject (in this case biology or history) would affect the occurrences of semantic illusions. Participants were asked to detect a semantic error in the questions being asked. After this phase, a knowledge test was presented to the participants. The findings of the study showed that participants still failed to notice semantic anomalies in questions, even if they had some stored knowledge about the topic of the sentence. This finding is in line with the study by Reder and Kusbit (1991) who tested the effects of prior knowledge (see the beginning of this section). The study by Cantor and Marsh (2017), however, was conducted via an online experiment. In this way, one is not able to control for various confounds. First of all, participants were asked whether they used the internet or someone else to look up some of the answers of the questions. Of course, it might be possible that they did not want to admit that they did so. Secondly, participants were able to look at the questions as long as the wanted, as there was no time limit. Admittedly, Cantor and Marsh (2017) still managed to find an effect of semantic illusions, even if the information that was presented was familiar to the participants. Doing an online experiment, however, might lead to the risk of not being able to control everything.

In conclusion, this subsection has focussed on previous studies that developed various theories regarding the concept of semantic illusions. So far, it seems that the most logical explanation for this phenomenon is the idea of semantic similarity or conceptual relatedness. This might then cause imperfect coding, which results in failing to notice the occurrences of semantic illusions. The role of phonological similarity, as thoroughly discussed by Shafto and MacKay (2000), however, seems to be somewhat unconvincing. This might need more further research in the future in order to include or exclude the role of phonological related words in relation to semantic illusions.

Besides the behavioural studies presented in this section, recent studies have also looked at the phenomenon of semantic illusions in relation to ERP evidence. The next subsection will provide an overview regarding this topic.

2.2. EEG studies in relation to semantic illusions

As aforementioned, researchers have recently been investigating the occurrences of semantic illusions in relation to EEG studies (see, inter alia, Sanford et al., 2010). It seems that semantic illusions elicit a certain ERP pattern that appears to be consistent throughout the various studies conducted. As Brouwer et al. (2012) explain in their literature overview, a semantic illusion is a "phenomenon in which a semantically anomalous, syntactically well-formed sentence elicits a P600-effect, but no N400 effect" (Brouwer et al., 2012: 128). This finding contradicts what was previously been found regarding these ERP patterns. In general, it is said that an N400 effect is elicited once a sentence contains a semantic anomaly. In more technical terms, the N400 is a negative component that shows a peak around 400 milliseconds (ms) in ERP studies after the moment that the participant notices a semantically anomalous word or phrase. A P600, on the other hand, is elicited due to a syntactic or grammatical anomaly in the sentence. It is the positive component in ERP studies that shows a peak around 600 ms after the moment that the participant notices a syntactic or grammatical error/anomaly. In relation to semantic illusions, then, one might expect an N400 effect rather than a P600 effect in relation to the occurrences of a semantic illusion due to the semantic anomaly. For some reason, however, recent studies have found the opposite effect. This is explained by Brouwer et al. (2012) by stating that participants are "temporarily under the illusion" that such semantic illusions actually make sense (p. 128). Because they realised afterwards that something has been wrong with their first interpretation, a P600 effect is elicited.

It is crucial to note that participants *need* to notice the semantic illusion during an EEG study. If a participant fails to notice a semantic anomaly in a sentence, therefore believing that the sentence was both semantically and syntactically correct, no effect will be elicited. In this case, one is not able to say something about what happens during the processing of semantic illusions. This might sound a bit counterintuitive: the idea of a semantic illusion is namely that a participants *fails* to notice the anomaly. For an EEG study to work, however, participants have to notice the illusion. This observation will be discussed in more detail in relation to previously conducted EEG studies. Moreover, a previous pilot EEG experiment regarding semantic illusions did not find any P600 effect at all. Rather, the semantic illusions elicited an N400 effect. This might have been due to the lack of participants (i.e. N = 3). It is important to keep in mind, however, that it might not be as self-evident to find a P600 effect, although previous studies have presented this finding as such.

It is striking to see that much research that has been done on the topic of semantically anomalous sentences that elicited a P600 effect are in fact sentences that do not adhere to the notion of semantic illusions. An ERP study by van Herten et al. (2005), for instance, found a P600 effect in semantic anomalies, which, again, might sound counterintuitive as the P600 effect is normally elicited due to syntactic errors (rather than semantic errors). A closer look at the paper, however, showed that the stimuli used were indeed semantic anomalies, but were in no way relatable to the notion of semantic illusions. An example of a sentence used in the study by van Herten et al. (2005) was *The fox that hunted the poacher stalked through the woods*. The idea is of course that a *fox* might not be able to hunt a *poacher*, but the opposite order would be correct (i.e. a poacher is hunting a fox). Such sentences did elicit a P600 effect despite being grammatically correct. Admittedly, this finding is striking as an N400 effect would be expected, but it cannot be compared to the notion of semantic illusions. Semantically anomalous sentences and semantic illusions do have a thing in common: they

both contain a semantic anomaly. The anomaly in a semantic illusion, however, is so subtle that most participants fail to notice the error. Therefore, despite finding a P600 effect in a semantically anomalous sentence, the study by van Herten et al. (2005) cannot be compared to the notion of semantic illusions. Furthermore, it might be worth noticing that a sentence such as *The fox that hunted the poacher stalked through the woods* might be considered grammatically inappropriate, as the agent of the sentence is an animal and the patient is a human being, whereas most sentences would have a human instigator as agent rather than an animal (see, for instance, Mashal et al., 2014). Because of the supposedly conversion of thematic roles, it might be possible that participants did regard this sentence as grammatically inappropriate (rather than spotting an semantic anomaly), because they are not used to such division of thematic roles. All in all, the study by van Herten et al. (2005) cannot be compared to previous studies on semantic illusions, as the sentences do not adhere to the same notion. Furthermore, it might be possible that participants considered the stimuli used as grammatically inappropriate sentences due to the thematic roles, which would ultimately lead to eliciting a P600 effect, rather than an N400 effect.

A quite recent study by Wang et al. (2009), however, did investigate the role of semantic illusions on eliciting a certain P600 effect. This study focused on the role of information structure. An example of the stimuli used was the following:

(1) Who bought the vegetables for cooking today?

Ming bought the eggplant/beef to cook today.

(Wang et al., 2009)

As can be found in example (1), the appropriate word in the sentence would be *eggplant*, as *beef* is not an example of a vegetable. This is in line with the notion of semantic illusion, as

the distorted term *beef* might be regarded as a consistent one, because it shares some semantic features with the consistent name *eggplant* (i.e. both are edible and both can be used for cooking). The role of focus (which would be new information) and non-focus (i.e. given information) was examined. The findings showed that inappropriate focus words (such as *beef* in example 1), elicited an N400 effect, whereas non-focus words elicited a smaller effect of the N400. This finding, then, is in contrast with the description of a semantic illusion as explained by Brouwer et al. (2012). It namely seems that semantic illusions do not elicit a P600 effect, but just the expected N400. This is in line with the findings of the pilot experiment prior to the current study. The results of both Wang et al.'s paper (2009) and the pilot study would suggest that 'genuine' semantic illusions (i.e. sentences that contain a semantic illusion rather than merely a semantic anomaly) do elicit N400 effects. Semantically anomalous sentences such as the ones found in van Herten et al.'s paper (2005), on the other hand, seem to elicit a P600 effect. As aforementioned, this discrepancy might be caused due to the supposedly inappropriate division of thematic roles in the sentences, possibly making them less grammatically acceptable. In conclusion, so far it turns out that the statement by Brouwer et al. (2012) that semantic illusions elicit a P600 effect but do not elicit an N400 effect does not count for 'genuine' semantic illusions. Rather, only semantically anomalous sentences seem to account for the finding of the P600 effect. It must be noted, however, that the study by Wang et al. (2009) used native speakers of Mandarin. It might be possible that, because a language is used from a different language family than Dutch or English, this could influence the results. In-depth research, however, is needed to support this idea.

Although it seems that a clear division of ERP evidence can be found in relation to genuine semantic illusions and semantically anomalous sentences, the study by Sanford et al. (2010) suggests otherwise. The authors distinguished between sentences with a good-fit context and sentences with a poor-fit context. The idea is that the former sentences resemble

phrases such as the Moses-illusion, whereas the latter would be materials that clearly have a semantic anomaly (therefore, they are also known as easy-to-detect anomalies). An example of such an easy-to-detect sentence would, for instance, be the following: *John ate socks for breakfast* (as people normally do not eat socks since it is not edible). The findings of the ERP study clearly show that poor-fit contexts elicited the classic N400 effect, as is expected with semantically anomalous sentences. The good-fit contexts (i.e. the ones containing semantic illusions) did elicit a P600 effect. This finding is in line with the explanation by Brouwer et al. (2012), but it is in contrast with the findings by Wang et al. (2009). Why is it possible that Sanford et al. (2010) did find a P600 effect for semantic illusions, but Wang et al. (2009) did not? Could this be due to the different choice of target language (i.e. English vs. Chinese), or is something else going on?

Although Brouwer et al. (2012) presented the concept of semantic illusions in relation to ERP evidence as robust facts, it seems that the reality is much more complicated. When comparing the study by Sanford et al. (2010) with the other studies regarding semantic illusions, something striking seems to be going on: the authors used contexts in order to create semantic illusions, rather than presenting the participants with just one sentence (as did previous studies). It might therefore be possible that Sanford et al. (2010) did find a P600 effect for semantic illusions because of their different presentation of the stimuli materials. Furthermore, as aforementioned, in order to find an effect of a semantic illusions in EEG studies, participants actually *need* to notice the semantic illusion. Sanford et al. (2010) state that it would be logical to assume that during their experiment, there would be a 50% detection rate of the illusions. It seems, however, that previous studies never found such a high detection rate. Although the findings of Sanford et al.'s paper (2010) seem to support the idea that at least 50% of the semantic illusions was detected, this is in clear contradiction with previous studies. This observation, together with the idea that they used context sentences,

rather than presenting one sentence at a time, might suggest that the P600 effect that was found in relation to semantic illusions was caused by extraneous factors. This would however mean that the description by Brouwer et al. (2012) would be incorrect. In conclusion, the ERP findings concerning semantic illusions still remain somewhat in the dark. Therefore, more thorough research is needed in order to find evidence for the idea that semantic illusions do indeed elicit a genuine P600 effect (as would be in line with Sanford et al., 2010; Brouwer et al., 2012).

3. The present study

So far, it has been shown that a great number of studies have already been investigating the phenomenon that is called a semantic illusion. Not only behavioural studies have looked into this notion, but also various EEG studies attempted to explain the underlying processes that are ongoing during the occurrences of semantic illusions. The main research gap until now, however, is that every study has examined the concept in relation to only one language. In this way, it remains unclear whether the underlying processes that happen during the occurrences of semantic illusions are similar between languages. This is why the current study aims to examine the phenomenon of semantic illusions in relation to one's first and second language. This might also provide new insights in the way sentence processing words in an interlocutor's L2 as opposed to their L1. Previous studies (see, inter alia, Gass et al., 2013; Roberts, 2012) have shown that a second language is acquired differently when compared to the first language. This is why it is expected that, during sentence processing of semantic illusions, discrepancies will be found between the L1 and the L2. It is important to note that the current study defines a second language as a language that is learned after the first language is fully acquired. In this way, the current study differentiates between the concept of a second language and bilingualism, as the latter implies speakers that acquired two (or more) languages at roughly the same time (see, for instance, Montrul, 2015).

The L1 chosen for this study is Dutch. The second language is English. Taking the gap of previous studies of examining only one language as a starting point, the current paper aims to answer the following main research question:

1. To what extent does sentence processing of semantic illusions differ in the L1 Dutch when compared to the L2 English?

Furthermore, the current study aims to use a different method than previous studies in order to investigate the phenomenon of semantic illusions. As aforementioned, most previous studies presented their stimuli (either questions or statements) as one piece. The current study, however, wants to examine the effects of semantic illusions be presenting the materials word by word (by using a Rapid Serial Visual Presentation Task). In this way, participants are unable to look back to the critical parts of a sentence, which enables for controlling for possible extraneous factors. Moreover, the current study aims to investigate semantic illusions by means of visual stimuli, rather than presenting them auditory. In this way, the quality and the content of the materials is kept constant (as the accent or gender of the speaker do not play a role).

Moreover, the present study aims to provide new insights in the idea that a semantic illusion elicits a P600 effect. This would be in line with the findings by Sanford et al. (2010), but, as aforementioned, this would be in contrast with the findings by Wang et al. (2009). The crucial thing to notice here is that Sanford et al. (2010) did not present only one sentence containing a semantic illusion. Rather, they looked at context. In order to control for possible confounds regarding the context of sentences, this study will follow the previous studies by presenting only one sentence (albeit word by word). In short, the current study aims to contribute to the idea that a semantic illusion does or does not elicit an N400 effect or a P600 effect. This will be tested by conducting an EEG experiment after conducting a behavioural experiment, which will consist of a sentential judgement task. The following research questions are put forward in relation to an ERP study on semantic illusions:

2. Do semantic illusions elicit an N400 effect or a P600 effect? Do these effects differ across languages? If so, how can this be explained?

As this would be the first study examining the effects of semantic illusions in relation to an interlocutor's first and second language, it might be interesting to take into account the role of L2 proficiency. It could be possible that there might be a correlation (either positive or negative) between the occurrences of semantic illusions and the level of proficiency of the participant. A reason for this expectation is that highly proficient participants might process the sentence on a more meaning-based level (i.e. taking into account the semantics of the sentences). Less highly proficient participants, on the other hand, might purely take into account the form of the words, rather than considering the actual meaning of the sentence in its entirety. This is purely hypothetical, as the current study is the first in this field to examine this phenomenon. It might be useful, however, to take into account the level of English proficiency of the participants. Therefore, the current study aims to answer the following question as well:

3. What role does the level of proficiency of the L2 play in the processing of semantic illusions?

The following hypotheses are put forward regarding the three research questions:

1. The number of occurrences of semantic illusions is significantly lower in the L1 Dutch than in the L2 English. In other words, it is expected that participants notice the semantic anomalies in sentences significantly more in their first language Dutch than in their second language English.

2. The elicited N400/P600 effect is significantly larger in the L1 Dutch than in the L2 English (note that the "/" is used here to indicate that it is still unclear whether one

will find an N400 effect or a P600 effect). This hypothesis might seem to be a contradiction of the previously stated expectation, but one has to bear in mind that, if participants fail to notice the semantic illusion during an ERP study, no effect (neither an N400 nor a P600 effect) will show, as the participant does not notice the semantic anomaly. If the participant does notice the illusion, on the other hand, this will elicit an N400/P600 effect. This is why it is expected that the effect found will be significantly larger in the L1 Dutch, as participants will significantly more notice the semantic illusion in their first language (as opposed to their L2 English).

3. The level of English proficiency has a negative effect on the occurrences of semantic illusions (i.e. the higher the proficiency level, the fewer occurrences of the semantic illusions). As mentioned earlier, the idea is that a highly proficient participants will take the semantics of a sentence more into account in their L2 than a less proficient participant. As semantic illusions evolve around the idea of a semantic anomaly, it is expected that fewer illusions will occur when the participant has a high level of English proficiency.

The following hypothesis is stated in terms of measuring reaction times, which will be recorded during both the sentential judgement task and the EEG study.

1. Participants have significantly faster reaction times for the occurrences of semantic illusions in Dutch when compared to English. It is expected that participants read faster in their L1 Dutch than in their L2 English. Therefore, faster reaction times are expected, even if the sentence contains a semantic anomaly.

As aforementioned, the present study might provide some new insights in the wider field of semantic illusions and might even open a new subfield in this research, namely the role of a second language in the occurrences of semantic illusions.

Now that the aim of the current study as well as the expectations have been made clear, the remaining of the paper will give a detailed description on the process of the entire experiment. Section 4 will give a thorough overview of the rating study conducted in order to test the hypotheses. Section 5 will provide a detailed description of the behavioural study. Section 6 will give a summary of the EEG study. Section 7 will discuss the overall results as well as comparing the findings of the current study to previous studies. Finally, section 8 will provide a detailed summary of the current study, as well as giving a fitting conclusion and suggesting some further research.

4. Experiment 1: Rating study

The rating study was constructed via the online software programme Qualtrics. The aim of this survey was to test the stimuli as constructed by the researchers as well as examining the phenomenon of semantic illusions in the first language Dutch and in the second language English.

4.1. Participants

A total of 31 participants were recruited (25 female), divided over four different lists of stimuli. The mean age of these participants was 24.53 (*SD* = 9.72; *range* = 49). The majority of them (*N* = 25) were students at the time of testing. All participants reported to be native speakers of Dutch and second language speakers of English (i.e. everyone learnt English through a foreign classroom setting, rather than being immersed in the L2 environment). The self-rated proficiency level of English was measured through a 7 points Likert scale (*M* = 5.70, *SD* = .70 *range* = 3). None of the participants had any knowledge of the aim of the current study prior to the rating study.

4.2. Materials

The rating study consisted of a total of 720 sentences. Four different conditions were tested during the experiment: semantic illusions in Dutch (condition 1), correct sentences in Dutch (condition 2), semantic illusions in English (condition 3) and correct sentences in English (condition 4). The correct sentences were the counterparts of the semantic illusion sentences but contained the correct target word rather than the inconsistent name. An example of all four conditions can be found in (2).

(2) a. Hoeveel dieren van elk soort nam *Mozes* mee op de Ark? (condition 1)

b. Hoeveel dieren van elk soort nam *Noach* mee op de Ark? (condition 2)

c. How many animals of each kind did *Moses* take on the Ark? (condition 3)

d. How many animals of each kind did *Noah* take on the Ark? (condition 4)

Furthermore, filler items were created on the basis of the (grammatical) structure of the semantic illusions. In other words, filler sentences in Dutch resembled the structure of the semantic illusions in Dutch and filler sentences in English resembled the structure of the semantic illusions in English. Every condition, including both sets of filler items, consisted of 120 sentences (120 x 6 = 720 sentences in total). During the construction of the sentences, it was taken into account that the target word (i.e. the illusion) appeared at different positions across sentences. That is, the illusion did not always appear at the beginning/middle/end of the sentence. Rather, this position was varied. Every sentence in either language had the form of a question.

The semantic illusions as well as the correct target sentences in Dutch were translated into English. That is, the English semantic illusions are similar to the Dutch illusions. It was strictly taken into account that the sentences were translated as literal and grammatical as possible. A subset of the stimuli had been copied from various papers (i.e. Erickson & Mattson, 1981; Reder & Kusbit, 1991; Büttner, 2007; Sanford et al., 2010) but most of the stimuli was constructed by the researchers of the current study.

4.3. Design of study

The rating study consisted of four different lists, so that every participant would receive 180 different sentences. The division of these sentences can be found in Figure 2.

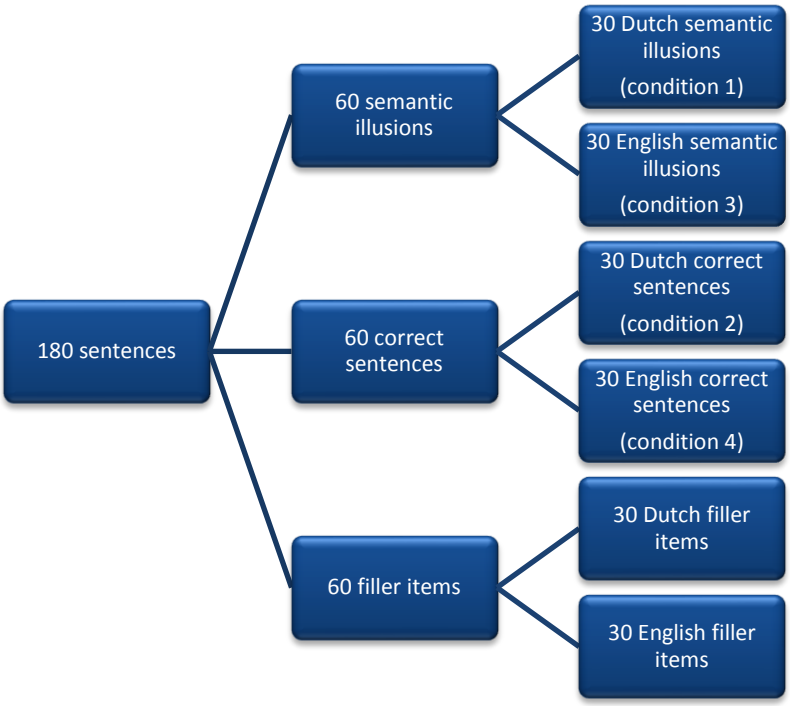

Figure 2: Division of the stimuli sentences for the rating study per participant.

It is important to note that there was no overlap between the sentences that had to be rated. The participant had to rate a particular semantic illusion, but this sentence would only occur again in the form of a related filler items. That is, each sentence, regardless of the language, was new and unfamiliar to the participant. For this reason, it was needed to construct four different versions for the rating study. It is important to note that during the main experiment, the order in which a language appeared (i.e. whether a participant starts with Dutch or English) was randomised across participants. For the sake of the rating study, however, every participant started with the Dutch variant of all sentences.

4.4. Procedure

Participants were asked to rate the questions that the survey showed. The instructions explained that participants had to choose the option **question is correct** when they thought that the question had correctly been asked. Participants had to opt for **question is incorrect**,

on the other hand, when they thought that the question was wrong. It was emphasised that grammatical errors did *not* count as an incorrect question. Rather, participants had to judge the sentences on the basis of the content. Once participants had chosen one of the options, they had to either give the answer to the question (in case of choosing **question is correct**), or explain why they thought that the question was incorrect (in case of choosing **question is incorrect**). When they were not sure about the answer to the question, it was possible to opt for the **I don't know** option. Instructions stated that participants had to be as fast and as accurate as possible. To illustrate the procedure of the rating study, an example question can be found below:

1) How many animals of each kind did Moses take on the Ark?
    a. Question is correct
        i. _____
    b. Question is incorrect
        i. _____
    c. I don't know

The idea was that participants, in case of choosing a), gave the supposedly right answer 'two' (rather than noticing that it was not Moses who took animals on the Ark). In case of choosing b). it was expected that participants answered that 'it was Noah who took animals on the Ark'. On the basis of the answers, the sentences were evaluated so that the most useful materials could be used during the main experiment.

At first, the average duration time was roughly 4 hours per survey. It appeared, however, that some participants saved their responses to continue the questionnaire at a different time. Because of this, some participants had a duration time of over 6 to 7 hours.

Once these outliers were accounted for, the average duration time of the experiment was roughly 1 hour and 10 minutes. This information could be considered relevant for the behavioural study, as it is crucial information for participants to know how long the experiment will last. On the basis of the information of the rating study, then, a decent indication can be made of the duration of the experiment.

4.5. Data analysis

Before performing statistical analyses in order to examine whether the rating study already provides some interesting insights in the hypotheses and the aim of the current study, it is first important to closely examine the results and frequencies of the answers given during the rating study. In this way, the least appropriate materials can be excluded from the stimuli, so that the behavioural study as well as the EEG study only contain the most suitable sentences. As the current study examines the notion of semantic illusions, only these conditions have been taken into account during the analysis of the rating study. The behavioural experiment and the EEG study will take into account the other sentences as well. The rating study, however, will only focus on the sentences of condition 1 (semantic illusions in Dutch) and condition 2 (semantic illusions in English).

In order to select materials for the main experiments, every semantic illusions was listed with its answer frequencies. These frequencies were categorised on the basis of all three answer options (i.e. *question is correct*, *question is incorrect*, and *I don't know*). It is important to bear in mind that, if a participant opted for *question is correct*, this would mean that he or she failed to notice the semantic illusion. The results of the sentences were each marked according to the outcome. In this way, sentences of which the majority of participants (i.e. more than half of the participants per version). did not notice the semantic illusions were classified Furthermore, answer frequencies that indicated that more or the same number of

participants opted for *question is correct* than for *question is incorrect* were categorised. It is important to note that the answer option of *I don't know* was not taken into account during this particular distribution. Finally, sentences of which the majority of participants noticed the illusion were also marked.

After this, the answer frequencies were counted and replaced by percentages in a separate file. That is, the proportion *question is correct* answers in English were turned into percentages. The same was done for the *question is correct* answers in Dutch (i.e. failure to notice the semantic illusion). Furthermore, the proportions of *I don't know* answers were taken into account as well. Sentences that contained an extremely high proportion of such answers (i.e. higher than 50%) were marked. Every sentence was analysed on the basis of the percentage of occurrences of semantic illusions as well as on the basis of the proportion of *I don't know* answers. On the basis of these data, a selection of possibly inappropriate sentences was constructed. An example of an inappropriate sentence is, for instance, *what was being sung during the well-known kids' series when the beggar Swiebertje arrived?*. This particular sentence received received 88% and 56% of *I don't know* answers in English and Dutch respectively. Therefore, it was considered to be a sentence that might be excluded from the list of stimuli.

All answer frequencies per version were put into SPSS (IBM Corp., 2016). The mean was calculated per version in order to examine the proportion of *I don't know* answers per semantic illusion. An example of this analysis can be found in Table 1.

Table 1: An example of the analysis of the answer proportions of version 1 of the rating study.

Descriptive Statistics – Version 1						
	N	Range	Min.	Max.	Mean	Std. Deviation
Q_1_NL	7	2	1	3	**2,14**	,690
Q_2_NL	7	1	2	3	**2,43**	,535
Q_3_NL	7	0	2	2	2,00	,000
Q_4_NL	7	1	1	2	1,71	,488
Q_5_NL	7	1	2	3	**2,14**	,378
Q_6_NL	7	1	2	3	**2,71**	,488

It is important to explain that the three answer possibilities during the rating study were coded for in SPSS. That is, *question is correct* had a value of 1, *question is incorrect* had a value of 2, and *I don't know* had a value of 3. In this way, the mean per question (as can be seen in Table 1) corresponds to these three values. For example, Q_3_NL (i.e. question 3 of the Dutch semantic illusion in version 1) has a mean of 2.00 (*SD* = .00). This means that every participant opted for *question is incorrect* (value 2).

In order to select the best stimuli for the behavioural study and the EEG study, every mean that had a number that was higher than 2.00 was marked in bold. The reason for this cut-off point is that a mean higher than 2.00 indicates that the majority of participants opted for *I don't know*. It does not completely matter if many participants noticed the semantic illusion, as this is crucial for the EEG study. It does matter, however, if the majority of participants opted for *I don't know*, as this might indicate that the question was either unclear or too difficult.

Every sentence was analysed in this way. The entire analysis per sentence per version can be found in Appendix A.

4.6. Selecting stimuli

On the basis of the calculations and the marked sentences in the previous subsection, the materials for the behavioural study and the EEG experiment were selected. Criteria for this selection were, inter alia, the proportion of *I don't know* answers. If, the answer frequency of this option was too high (i.e. a mean of more than 2.00; see the previous subsection for an elaborate explanation of this cut-off point), the formulation of the question would be changed. Furthermore, the comments that participants made in relation to the questions being asked were also taken into account when adapting the sentences.

It is important to note that the *I don't know* answer can mean two different things. this can be made clear by considering the following example sentence:

Has the value of the Chinese *yen* increased or decreased?

If participants did not know the answer, this would still mean that they did not notice the semantic illusion. that is, one does not have to know the right answer in order to notice that the *yen* is in fact Japanese (and not Chinese). Even if a participant was not aware of the increasing or decreasing of the foreign currency, this error would have been noticeable. Such sentences, then, were constructed in such a way that it was easier for participants to come up with the correct answer. All sentences with a high proportion of *I don't know* were analysed in a similar fashion. In this way, a total number of 8 sentences were excluded from the list of 120 semantic illusions. These sentences appeared to be too difficult or too vague for the participant to fall for the semantic illusion and were therefore considered useless for the behavioural study and the EEG experiment. Other sentences that had a high mean (i.e. higher than 2.00) were adapted in such a way that they would be appropriate enough to use them again during the behavioural experiment and the EEG study.

4.7. Results

This section will present the findings of the rating study. The actual SPSS output of the findings that are presented here can be found in Appendix B.

One participant was excluded for not completing the questionnaire, leading to a total of 30 participants that participated in the rating study. Table 2 presents the mean score per answer option (i.e. *question is correct, question is incorrect,* and *I don't know*) and the standard deviations on the L1 Dutch and the L2 English questions from the rating study.

A paired t-test was conducted on the proportions of the answer possibilities in order to examine whether there would be a significant difference between: *question is correct* answers in Dutch and English, *question is incorrect* answers in Dutch and English, and *I don't know* answers in Dutch and English.

Table 2: Mean scores of the proportions per answer option per language (i.e. L1 Dutch and L2 English).

	Mean scores and standard deviations of the proportions per answer option (rating study)	
	L1 Dutch	L2 English
Total *question is correct* answers	4.83 (3.99)	6.17 (3.92)
Total *question is incorrect* answers	17.43 (7.05)	14.23 (6.32)
Total *I don't know* answers	7.70 (5.28)	9.57 (5.44)

The difference between the number of *question is correct* answers in Dutch and English shows a tendency towards significance (t = -1.82, p = .078). Recall that participants fail to notice the semantic illusion if they opted for this particular answer. The difference between the total number of *question is incorrect* answers in Dutch and English is significant (t = 3.12, p = .004) This indicates the number of answers given by participants that do notice the

semantic illusion. In other words, on average, the number of *question is incorrect* answers in Dutch (i.e. noticing the semantic illusion) (M = 17.43, SE = 7.05) is higher than the number of *question is incorrect* answers in English (M = 14.23, SE = 6.32). This difference, 3.20, BCa 95% CI [1.09, 5.31], is significant $t(29) = 3.11$, $p = .004$. The difference between *I don't know* answers in Dutch and English is not significant (t = -1.67, p = .11).

As there were four different lists which all contained different semantic illusions, it might be possible that some lists contained stronger illusions than other versions. A one-way ANOVA was conducted in order to exclude such extraneous factors. The factors included in the ANOVA analysis were the factorial predictor List (these are randomised lists than each contain a different set of stimuli. There are 4 levels for each of the 4 lists) and the continuous predictor Total Number of Answers given by the participants. The analysis shows no significant differences between groups (i.e. between the four lists) in both the occurrences of semantic illusions in Dutch (M = 4.83, SD = 3.99) and the occurrences of semantic illusions in English (M = 6.17, SD = 13.92), although the latter showed a tendency towards significance ($F(3, 26) = 0.80$, $p = 0.50$; $F(3, 26) = 2.66$, $p = .07$ respectively). The p-value of the total *question is incorrect* answers in Dutch (M = 17.43, SD = 7.05) is also not significant: $F(3, 26) = 2.09$, $p = .13$. A significant discrepancy, however, is found between the various versions with regard to *question is incorrect* answers in English. Therefore, it can be said that there was a significant effect of *question is incorrect* answers in English across the four different versions, $F(3, 26) = 3.64$, $p = .03$.

The last analysis that was conducted was a bivariate correlation test in order to examine whether the occurrences of semantic illusions (i.e. the total number of *question is correct* answers) were positively or negatively affected by the level of English proficiency of the participant. The results showed no correlation between the two variables. The correlation coefficient (.114) between the level of English proficiency and the total number of *question is*

correct answers in Dutch was not significant (p = .27). The same can be said of the correlation coefficient (-.039) between the level of English proficiency and the total number of *question is correct* answers in English, which also showed no significant effect (p = .42). This indicates that the level of English proficiency does not influence the occurrences of semantic illusions in either language.

4.8. Discussion

The first results of the paired t-test indicate that the number of occurrences of semantic illusions does not significantly differ across languages. The p-value of .078, however, indicates that there is a trend towards significance. This suggests that there is some discrepancy between the number of *question is correct* answers in Dutch and in English. The difference between the *question is incorrect* answers in Dutch and English, on the other hand, is significant (p = .004), which implies that a high number of participants did notice the semantic illusion: because of the significant difference between Dutch and English, this means that participants noticed the illusion significantly more *in Dutch* when compared to English. In other words, participants seem to spot the semantic anomalies more in their first language. It might also be possible that, due to a lack of English proficiency, participants opted for the *I don't know* answer more in English. The findings of the rating study, however, contradict this assumption: no significant difference can be found between the number of *I don't know* answers in Dutch and English (p = .11), providing support for the hypothesis that interlocutors notice a semantic illusion more in their first language when compared to their second language.

The one-way ANOVA was conducted in order to examine whether there would be some discrepancies between the different versions of the rating study. The results suggested that there might be some discrepancy across the four versions with regard to *question is*

incorrect answers in English (p = .03) However, a one-way ANOVA does not indicate *which* of the four different versions behaves differently. A planned comparisons analysis, however, found a discrepancy between the number of *question is incorrect* answers in list 1 and 2, indicating that participants chose this particular answer significantly more in one of the two lists. If this discrepancy will also show in the main experiment (i.e. the behavioural study and the EEG experiment), an item analysis might be needed in order to explain the significant difference between these two lists. As the results of the rating study caused some items to be excluded from the list of stimuli, it might be possible that the outliers are already excluded and that the analyses of the behavioural study will indicate no discrepancies between versions.

It seems that the level of English proficiency does not play a role in relation to the occurrences of semantic illusion, as the self-rated level of English proficiency does not show any correlation with the results. Therefore, something else must be going on which differs in the L1 Dutch and the L2 English, as can be concluded from the significant difference between the *question is correct* answers in either language. It must be noted, however, that the lack of correlation between the level of English proficiency and the occurrences of semantic illusions might be due to the fact that participants had to rate their own English proficiency on a Likert scale from 1 to 7. In other words, no sophisticated test was used in order to examine the English proficiency level of the participants. This is why the behavioural study will contain both a Dutch LexTALE and an English LexTALE. As proficiency will then be measured in a more objective way, it might be possible that the behavioural study will provide a different outcome with regard to the correlation between the level of English proficiency and the occurrences of semantic illusions in Dutch and English.

In sum, the definite finding of the rating study is the significant difference between the noticing of semantic illusions in the L1 Dutch and the L2 English. This might suggest that participants notice the anomaly more in their first language than in their second language. The

behavioural study will look into this first assumption by comparing its results to the findings of the rating study.

5. Experiment 2: Sentential judgement task

A sentential judgement task was constructed via the software programme PsychoPy (Peirce, 2007). The aim of the experiment was to examine the effect of a first and second language (Dutch and English respectively) on the processing of semantic illusions, as well as examining the influence of the level of English proficiency on the occurrences of such illusions.

The procedure of the RSVP task will be explained in more detail in the upcoming subsections. First of all, the number of participants as well as their background will be discussed. In the subsequent section, the used materials for the behavioural experiment will be described, something which will be elaborated on in the design of study. The procedure subsection will explain the process of testing and the final subsection, the data analysis, will give a short overview of how to analyse the data gathered from the behavioural experiment.

5.1. Participants

A total number of 35 participants (25 female) were recruited for the sentential judgement task. Most of them were selected through an online database called RU Sona. In this way, it was guaranteed that the bulk of the participants (N = 29) were students and were therefore more likely to be around the age of 18-30. Participants that had already participated in the rating study were excluded from further involvement in the current experiment. The mean age of the participants was 24.74 (SD = 8.92, *range* = 42)

All participants reported to be native speakers of Dutch. This statement was supported by the average score of a LexTALE task in Dutch (M = 893.21 , SD = 66.10). Most participants reported that their second language was English, although some of them reported other languages instead (such as German and French). Either way, every participant had knowledge of English and was therefore able to do the experiment in both languages. The

average score of a LexTALE task in English was 756.43 (*SD* = 118.52). Participants also had to rate their own level of English proficiency as well as their general knowledge (when compared to fellow students) on a Likert scale from 1 to 7 (the upcoming subsections will elaborate on this). The average score for the self-rated English proficiency was 5.09 (*SD* = 1.25), and the average score of the self-rated general knowledge was 4.34 (*SD* = .99). Interestingly, a bivariate correlation analysis showed a high correlation coefficient (.77) between the self-rated level of English proficiency and the actual English LexTALE score (p = .00), indicating that participants correctly rated their own English proficiency.

None of the participants had any knowledge about the aim of the experiment before the sentential judgement task.

5.2. Materials

The behavioural study consisted of a total of 112 sentences per condition. This set of stimuli contained all sentences from the rating study but the 8 that were excluded due to failing to meet the criteria of being a genuine semantic illusion. Just as the rating study, the behavioural study also tested four different conditions: condition 1 (semantic illusions in Dutch), condition 2 (correct sentences in Dutch), condition 3 (semantic illusions in English) and condition 4 (correct sentences in English), as well as containing a 112 filler sentences per language (i.e. 112 sentences in Dutch and 112 sentences in English). The total number of sentences was 672, as opposed to the 720 sentences used in the rating study. Either way, the behavioural study still contained 28 sentences per condition, a division which is visualised in the Figure 3. The behavioural study contained four different lists. These lists contained a majority of the same sentences as in the rating study (except for the excluded sentences). Unlike the rating study, the behavioural study contained 10 practise trials before the main experiment. The practise trials were the same across participants but differed in Dutch and English. They

consisted of the excluded sentences of the rating study. The division of the stimuli can be found in Figure 3. This is excluding the 10 practise trials in both Dutch and English, as they were the same for all participants. The complete list of the stimuli used during the sentential judgement task can be found in Appendix C to F.

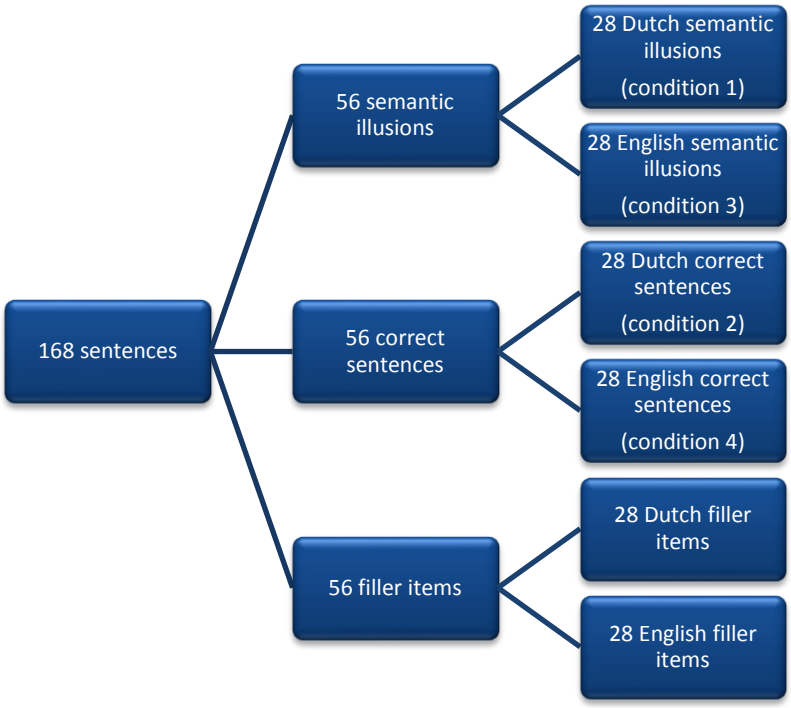

Figure 3: Division of the stimuli sentences of the behavioural experiment per participant.

5.3. Design of study

First of all, it must be noted that this study carried out a Rapid Serial Visual Presentation (RSVP) task, meaning that the stimuli were presented word by word to the participant. It is important to note that previous research on semantic illusions has never tested the stimuli by using an RSVP. The current study, however, chose this type of task for several reasons. First of all, as already mentioned in the introduction, the RSVP is much better controlled for than presenting auditory stimuli, as the accent and/or gender of the speaker do not play a role and the quality and content of the stimuli is kept constant as intonation and stress patterns are not apparent in visual stimuli. Secondly, by using an RSVP task, no choices had to be made about

how long to present a sentence before the participant is allowed to continue with the next one. Related to this argument is a self-paced reading task: participants would be given infinite time to read the sentences. In this way, they might either be too slow or too fast which could influence their reading comprehension of the sentence. This might then influence the results when examining the occurrences of semantic illusions. Furthermore, by using an RSVP, the participant is allowed to focus on every single word equally as long. In this way, no particular word gets too much or too little attention. Another practical reason for using the RSVP task is that participants are not able to accidentally click further and miss (part of) the sentence. Participants have to wait until the last word of the sentence has appeared before providing an answer to the question. Moreover, participants are not able to look back in an RSVP task, again controlling for the fact that the focus is on every word of the sentence and not one part of the sentence only. All in all, the RSVP task is much better controlled for than other (auditory) tasks or a self-paced reading task. Finally, the RSVP has another practical reason as it serves as a baseline for the EEG study. By using a word-by-word task, it is much easier to put markers on the important words (i.e. the inconsistent names in the semantic illusions), which makes it easier to analyse the data afterwards. It is interesting, however, to see what happens during an RSVP task with regard to semantic illusions as it is a new approach in the field of examining semantic illusions. In other words, by using this task, new insights can be given in the best or most appropriate ways to test semantic illusions.

The behavioural experiment was constructed via the software programme PsychoPy (Peirce, 2007). There were two main versions, along with the four different lists that were constructed. The first main versions first presented the Dutch part of the experiment (i.e. a Dutch LexTALE and the Dutch stimuli sentences), followed by the English counterpart of the experiment. The second version presented the stimuli vice versa of the first version: first the English part (i.e. an English LexTALE and English stimuli sentences), then the Dutch part. In

this way, the order of languages was counterbalanced across participants. As aforementioned, four major lists were constructed to present the stimuli to the participants. These lists were similar to the four versions constructed for the rating study.

Participants received three informed consent documents that had been made available by the DCC Institute to protect their privacy. Moreover, participants received a questionnaire at the end of the experiment that contained questions about their gender, age, L1 and L2 and their level of English proficiency and general knowledge. The latter questions were asked in the form of a Likert scale from 1 to 7, with 1 meaning extremely bad and 7 meaning extremely good. The question about the English proficiency was later compared to the score of the English LexTALE in order to get the most convenient indication of the level of the participants' L2. The question about the general knowledge was added so that the overall results of the participant might be explainable through this self-rated score. If, for instance, a participant rated their general world knowledge with a 3, and they had a vast majority of *I don't know* answers in the experiment, this might then be easily explained by their lack of world knowledge. The question asked whether participants could rate their own world knowledge in comparison to fellow students. Finally, the questionnaire asked about the aim of the experiment and possible comments about the experiment (e.g. the length or the difficulty). If a participant knew exactly what the experiment was about, this might have an influence on the outcome of the experiment. This is why such questions were asked. The complete questionnaire can be found in Appendix G.

The behavioural experiment consisted of two LexTALE tasks in both Dutch and English, as well as the main experiment. 10 practise trials were added in both Dutch and English at the beginning of the main experiment (of course, the Dutch practise trials occurred before the Dutch stimuli set and the same went for the English practise trials).

The experiment was mostly done in Dutch, just as the instructions, so that no possible misunderstandings could lead to misleading results. The English main part of the experiment (i.e. testing the semantic illusions) did, however, include English instructions, so that the second language of the participant was already activated. The instructions to both LexTALEs, however, were Dutch to make sure that the participant understood everything as perfectly as possible.

Although the procedure section will go in more detail about the process of the experiment, it can already be mentioned that every task that was presented to the participant via the programme PsychoPy appeared with a black background and white letters. These letters were adjusted to the resolution and the height of the monitor. Participants were instructed to use the keyboard rather than a button box, as they had to type in the answers to the questions after deciding whether the question was correct or not. The most important buttons to use during the LexTALE were the 's' and the 'l', that corresponded to *is not a word* and *is a word*. Red and green stickers were respectively used so that participants knew which buttons to use during the LexTALE. During the main experiment, the most important buttons were 's', 'g', and 'l', which respectively meant *question is incorrect, I don't know* and *question is correct* (note that *question is correct* corresponds to the *is a word* in the LexTALE, so that the more 'positive' answer would always be on the same key. The same goes for the 's' key). The 's' and 'l' remained red and green respectively but the 'g' key received a blue colour, so that it would again be clear to participants which button they had to use. In order to make everything even more obvious, the answer possibilities would appear on the screen after a sentence was presented, so that participants could never confuse the buttons with the answer options. The same procedure was adjusted for the LexTALE.

Just as during the rating study, participants had to provide an answer to the question once they opted for *question is correct* and had to explain why they thought the question was

wrong once they opted for *question is incorrect* (nothing had to be answered when opted for *I don't know*). Participants were not able to push any 'odd' keys, such as ';' or ')', as they all needed to be coded separately. However, participants were able to use the space bar, as well as commas and question marks. More details about this process of answering questions will be explained in the procedure section. The reaction time (RT) was measured from the moment that the last word of the sentence disappeared to the answer that the participant provided (i.e. 's', 'g' or 'l'). The reaction times regarding typing the answer were not taken into account, as there exists great variation in the speed and accuracy of typing across participants.

The experiment contained optional breaks for the participants after the 28th and the 56th trial of each part (i.e. both in the Dutch and in the English version).

PsychoPy saved the data automatically which would then be transported into Excel. The data analysis can be found in section 5.5.

5.4. Procedure

As the experiment contained various parts, the aim of this section is to describe the process of the experiment in more detail from the moment that the participant entered the lab. Once the participant was welcomed, he or she was instructed about the experiment and had to fill in three informed consents as made available by the DCC Institute. The participant was also instructed about which keys to use during the experiment and that the keyboard, rather than a button box, would be the medium to do the experiment. It was also made clear that there was no possibility of asking questions during the main experiment. After this short introduction and the paperwork, the experiment was started in PsychoPy (Peirce, 2007).

The first part of the experiment thanked the participant for his or her participation. They had to push the spacebar to continue. After the short introduction, the Dutch instructions for the LexTALE task (in either English or Dutch; depending on the version) started. The participants were instructed to press the green button ('l') when they thought the word

presented was a word and to press the red button (‘s’) when they thought the word was not an actual word. Both answer possibilities remained on the screen throughout the first part, with only the stimuli changing after the participant pushed either key. In this way, participants were not able to confuse the answer options and therefore the outcome of the experiment was controlled for as much as possible. The LexTALE consisted of 63 trials.

After the LexTALE finished, participants received instructions for the main experiment. They were told to use three different keys throughout the experiment: ‘s’, ‘g’, and ‘l’ which corresponded to the answer possibilities of *question is incorrect, I don’t know* and *question is correct* respectively. The participants were told that a sentence would appear on the screen word by word, after which they had to decide whether the question being asked was correct on the basis of its content. If they thought the question was correct, they also had to provide the answer to the question after the trial. If they thought the question was incorrect, they had to explain why they thought the question was wrong. If they did not know the answer, nothing had to be answered and the participant could continue with the next trial by pressing the enter button. The participant was also told that he or she was still able to ask questions to the experimenter as these were only practise trials. It was also made clear that no questions could be asked after the practise trials anymore.

The stimuli were presented in an RSVP, meaning that the sentence was presented word by word, on a pace of 18 frames per word (this number differs depending on the power and resolution of the monitor the experiment was tested on). Before each trial, a fixation cross would appear for 90 frames. After the fixation cross, the word-by-word question would appear, followed by the three answer possibilities (i.e. *question is incorrect, I don’t know* and *question is correct*). The reaction time was measured from the moment the last word disappeared to the moment the participant pressed either of the three buttons. After they made a choice, they had to a) provide an answer to the question or b) explain why the question was

wrong. This procedure was the same for the practise trials and the real trials. Once the 10 practise sentences had been judged, it was again stated that the participant might ask questions, as the real experiment would start afterwards. During the main experiment, no questions could be asked anymore.

The procedure of the main experiment was exactly the same as the practise trials. As aforementioned, the language of the instructions depended on the order in which the languages appeared (i.e. the Dutch part of the experiment presented Dutch instructions and the same went for the English part).

After the experiment was over, participants were instructed to warn the experimenter. Then they received another questionnaire about their age, gender, L1 and L2 as well as their self-rated English proficiency and their self-rated general knowledge. The questionnaire ended with questions about the aim of the experiment and some space to add comments in relation to the experiments. Participants also got the possibility to write down their e-mail addresses in order to have a chance at winning 10 euros. All participants received 1 point for their participation.

5.5. Data analysis

PsychoPy (Peirce, 2007) automatically stored the data of the participants in an Excel file. The reaction times of the answers as well as the reaction times of the LexTALES were also recorded. As aforementioned, the reaction times were measured from the moment the last word of the sentence disappeared to the moment that the participant choses his or her answer (i.e. ‘s’, ‘g’, ‘l’, respectively *question is incorrect, I don’t know* and *question is correct*). The reaction times for the LexTALE tasks were measured from the moment the target word appeared to the moment the participant choses his or her answer. All the data was re-organised in a separate data file and the RTs were measured per condition. Every single

sentence per participant was analysed and interpreted on the basis of various factors. First of all, the sentences were categorised on the basis of their condition (i.e. semantic illusions in Dutch, correct sentences in Dutch, semantic illusions in English, correct sentences in English, filler items in Dutch, filler items in English, practise trials in Dutch, and practise trials in English). For each sentence, it was determined whether the participant provided the correct answer (in the analysis, the number 0 corresponds to incorrect answers; the number 1 corresponds to the correct answers). In other words, the correct answers were compared to the actual responses of the participants. The numbers correspond to the various answer options: the numbers 1 to 3 correspond to *question is correct, question is incorrect,* and *I don't know* respectively.

It is also important to bear in mind that, when participants opted for *question is correct* ('l') when the question was, in fact, incorrect, this would be a sign of a failure to notice the semantic illusions. Furthermore, the trial numbers were added, in order to see whether extraneous factors such as fatigue might have played a role during the experiment. Besides this, the reaction times per sentence were added, as well as the participants' LexTALE scores (and reaction times) and their self-rated English proficiency and general knowledge scores. These data were entered in Excel per participant and then put in IBM SPSS Statistics 24 (IBM Corp., 2016). In this way, all the data was ordered before it was put into SPSS. The final analyses have been carried out in RStudio (RStudio, 2016).

4.6. Results

Two participants were discarded from further analysis due to incomplete data, leaving 33 participants for this analysis.

When doing an in-depth item analysis, the average score per sentence was considered. It is important to note that sentences were coded with a 0 (= incorrect answer) and a 1

(= correct answer). There were 9 sentences that showed an average accuracy of 0, meaning that no participants provided the 'correct answer'. However, it is important to note that all these sentences contained a semantic illusion. That is, every participant failed to notice the illusion in the questions, hence leading to the assumption that these questions were actually incredibly valuable. 106 sentences (out of the total number of 693) had an average accuracy score of 1, indicating that every participant provided the correct answer. Only 4.7% of these sentences contained a question with a semantic illusion. This might indicate that these illusions were too easy. As it is important to compare the occurrences of semantic illusions with the actual noticing of semantic illusions, however, these couple of sentences were not excluded from the analysis. It is important to note, however, that it might be possible that they will be discarded for the EEG study for being too easy. For now, all 106 sentences with a average accuracy score of 1 were taken into account.

After the exclusion of two participants, the dataset contained 6204 data points. The data of the practise trials as well as the data of the filler items were discarded for this particular analysis. This left a total of 3697 trials. Furthermore, data that contained reaction times of 2.5 standard deviations below or above the mean average were excluded (i.e. 2.95%). Data that contained reaction times faster than 300 ms were also discarded, leading to the exclusion of another .45% of the data. In summary, the final analysis excluded the filler sentences and the practise trials. Moreover, 3.40% of the data was discarded due to outliers.

The accuracy and the RT data were analysed with (logistic) linear mixed effect models that contained subject and sentence as cross-random effects. In both the accuracy and the RT analysis, the following factorial predictors were taken into account: *Language* (2 levels: Dutch or English), *Accuracy* (2 levels: incorrect or correct answer), *Sentence Type* (4 levels: 1 = semantic illusions in Dutch, 2 = correct sentences in Dutch, 3 = semantic illusions in English, 4 = correct sentences in English), *Self-rated general knowledge* (7 levels: measured

on a Likert scale from 1 to 7), and *Order* (i.e. the order in which the stimuli per language were presented to the participants: NL-EN or EN-NL). The following continuous predictors were considered: *English LexTALE score* (English proficiency of the participants), *Previous RT* (the response latency at the previous trial), and *Trial* (the chronological progress of the experiment).

In order to obtain the best fitting model, a stepwise variable selection procedure was performed in which one of the above mentioned predictors was added at a time. For every significant predictor or interaction, it was thoroughly examined and evaluated whether inclusion of this particular predictor or interaction resulted in a better fitting model. That is, whether the model would show a lower AIC compared to the previous model, in which the predictor was not part of the model).

4.6.1. Accuracy

The average accuracy score of all the sentences was .65 (*SD* = .26). The average accuracy per sentence type can be found in Figure 4. Table 3 shows the coefficients, estimate and t-value of the predictors of the final model. As can be seen in Table 3, no significant difference can be found between the accuracy of correct sentences between Dutch and English. The difference between sentence type 1 (semantic illusions in Dutch) and sentence type 2 (correct sentences in Dutch) is, however, significant, indicating that semantic illusions in Dutch are responded to less accurately than correct sentences in Dutch. Moreover, the difference between sentence type 2 (correct sentences in Dutch) and sentence type 3 (semantic illusions in English) is also significant, showing that participants responded more accurately to correct sentences in Dutch than to semantic illusions in English. Interestingly, the predictor of English proficiency (as measured by the English LexTALE) also shows great significance. This means that, in general, participants performed better during the experiment when their English level of proficiency was high. It turned out, however, that there was no significant interaction between

language and the English level of proficiency, indicating that a better level of proficiency led to overall better results and not only in one of the two languages.

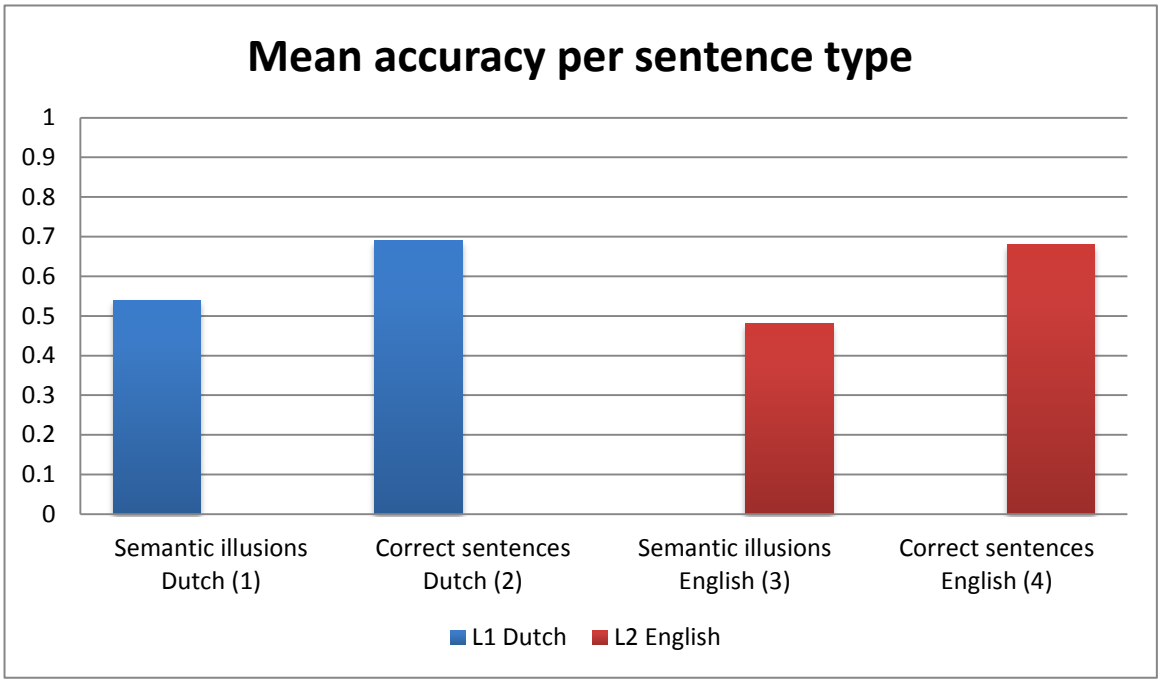

Figure 4: Mean accuracy of the proportion per sentence type and per language

Table 3: Summary of the final model predicting accuracy. On the reference level of the intercept are L1 Dutch (language) and correct sentences in Dutch (sentence type 2).

	β	std.err	*z(p)*
Intercept	-1.95	0.61	-3.21**
Sentence type 1 (semantic illusions Dutch)	-0.88	0.19	-4.58***
Sentence type 3 (semantic illusions English)	-1.18	0.19	-6.11***
Sentence type 4 (correct sentences English)	-0.06	0.20	-0.32
English LexTALE score	0.00	0.00	4.32***
Self-rated general knowledge	0.14	0.08	1.66
Random effects	var	sd	
Subject (intercept)	0.29	0.54	
Sentence (intercept)	1.45	1.21	

Note: *** $p < 0.001$; ** $p < 0.01$.

It is important to note that the correct sentences in Dutch and the language Dutch were taken as the reference level on the intercept as both were the most neutral variables. In this way, however, the accuracy of the sentences that contained a semantic illusion in Dutch could not be compared to the same type of sentences in English (as the reference level was correct sentences in Dutch, and not semantic illusions in Dutch). For this reason, the same model analysis has been conducted in which the reference level on the intercept was changed into semantic illusions in Dutch. The reference level of language remained Dutch. The results of this analysis can be found in Table 4, which shows the coefficients, estimate and t-value of the predictors of the final model with a difference reference level on the intercept. As can be seen in Table 4, the difference between semantic illusions in Dutch (sentence type 1; reference level) and semantic illusions in English (sentence type 3) is not significant, indicating that participants did not respond more or less accurately in either language. The difference between semantic illusions in Dutch and correct sentences in English, however, is significant, showing that participants responded more accurately to the latter condition. This is in line with previous findings, as these results shows a significant difference between correct sentences in Dutch and semantic illusions in English.

The reference level of the intercept was also changed another time into sentence type 3 (semantic illusions in English) in order to see whether there would be a significant difference within the language itself. The results showed a significant difference (β = 1.12, *SE* = 0.19, *z(p)* = 5.81***) between semantic illusions in English (sentence type 3) and correct sentences in English (sentence type 4), which shows that participants responded more accurately to correct sentences in English than to semantic illusions in the same language. This is also in line with the results within Dutch, which showed a similar pattern.

Table 4: Summary of the final model predicting accuracy. On the reference level of the intercept are L1 Dutch (language) and semantic illusions in Dutch (sentence type 1).

	β	std.err	*z(p)*
Intercept	-2.84	0.61	-4.64***
Sentence type 2 (correct sentences Dutch)	0.88	0.19	-4.58***
Sentence type 3 (semantic illusions English)	-0.30	0.19	-1.60
Sentence type 4 (correct sentences English)	0.82	0.19	4.26***
English LexTALE score	0.00	0.00	4.32***
Self-rated general knowledge	0.14	0.08	1.66
Random effects	var	sd	
Subject (intercept)	0.17	0.42	
Sentence (intercept)	1.32	1.15	

Note: *** $p < 0.001$; ** $p < 0.01$.

It must be said that the accuracy as measured in this particular analysis is not, in fact, the accuracy that might explain differences in the occurrences of semantic illusions between Dutch and English. Rather, this analysis was based on the number of correct and incorrect answers. Recall that, when a participant gives a supposedly incorrect answer, this might also be an example of the occurrence of a semantic illusion (as the 'correct' answer is *question is incorrect*, but the participant does not notice the illusion and answers *question is correct* instead). For this reason, another variable was being considered, namely the occurrences of semantic illusions, in which accuracy was calculated on the basis of the occurrences of semantic illusions. That is, sentences that contained an illusion and were read as correct sentences received a 1 (= occurrence of a semantic illusion), whereas all other sentences received a 0 (= no occurrence of a semantic illusion). Furthermore, it is important to include only the semantic illusion sentences in this particular analysis, in order to see how many times a participant did not notice the illusion, rather than considering all the sentences again. For this reason, the same analysis as above has been conducted, only with a different factor, namely the occurrences of semantic illusions (i.e. when a participant does not notice the

semantic anomaly) in sentences that contained a semantic illusion in both L1 Dutch and L2 English.

Another (logistic) linear mixed effect model analysis was conducted, this time only including sentences that contained a semantic illusion (which would be 1795 out of the total number of 3572 trials). The mean accuracy of sentences that contained a semantic illusion was .32 (*SD* = .16). The accuracy was calculated as 0 (meaning no occurrence of an illusion) and 1 (meaning an occurrence of an illusion). In this case, this would mean that, on average, participants did not notice a semantic anomaly in the question in 32% of all sentences. The mean accuracy per language can be found in Figure 5. Table 5 shows the coefficients, estimates and t-values of the final model that was conducted which focused only on sentences that contained a semantic illusion. The same predictors that were considered for the previous analysis have been taken into account during this analysis.

As can be seen in Table 5, no significant difference can be found between semantic illusions in Dutch (sentence type 1; reference level) and semantic illusions in English (sentence type 3), indicating that there was no difference in the occurrences of semantic illusions in either language. The difference between semantic illusions in Dutch and correct sentences in Dutch is also not significant, showing that semantic illusions did not occur more in either condition. This result shows a discrepancy with the outcome of the previous analysis, as the latter did show a significant difference between semantic illusions and correct sentences in Dutch.

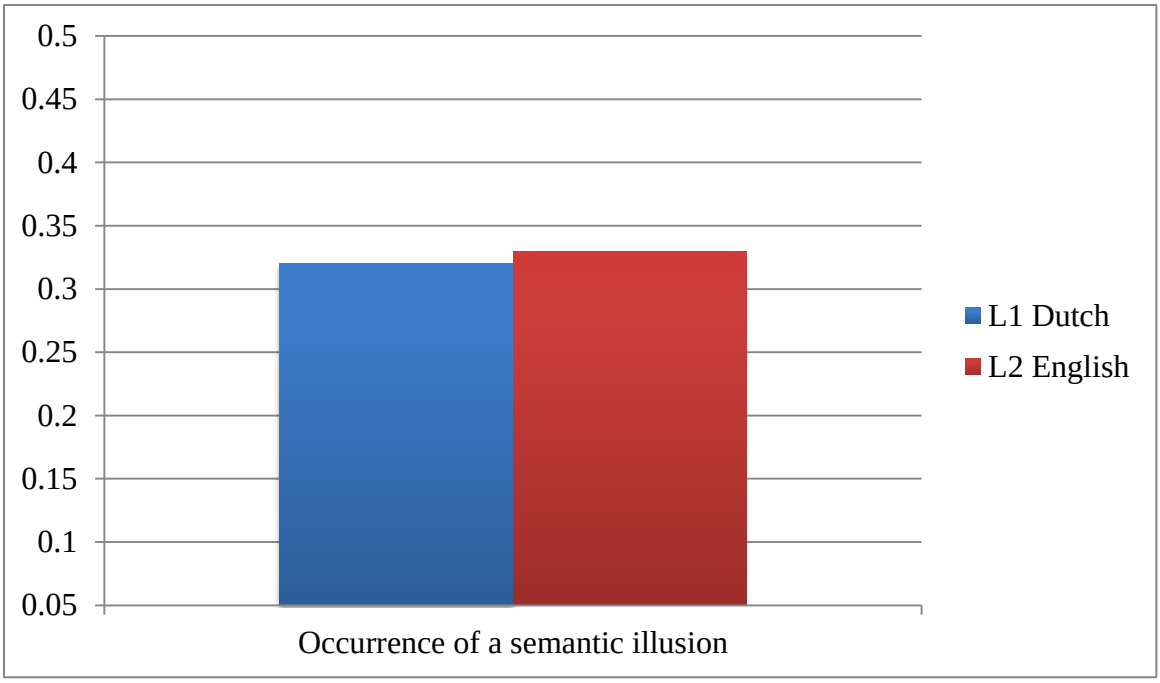

Figure 5: Mean accuracy per language of the occurrences of semantic illusions.

Table 5: Summary of the final model predicting accuracy in sentences containing a semantic illusion. On the reference level of the intercept are L1 Dutch and semantic illusions in Dutch (sentence type 1).

	β	std.err	*z(p)*
Intercept	-0.95	0.19	-4.97***
Sentence type 2 (correct sentences Dutch)	-14.35	104.51	-0.14
Sentence type 3 (semantic illusions English)	-0.01	0.17	-0.06
Random effects	var	sd	
Subject (intercept)	0.68	0.83	
Sentence (intercept)	0.94	0.97	

Note: *** $p < 0.001$; ** $p < 0.01$.

4.6.2. RT

For the analysis of the RT, only the trials that were responded to accurately were taken into account (i.e. trials that received a 1, indicating a correct answer). Table 6 summarises the final model predicting RTs by showing the coefficients, the estimates and the t-values of the predictors that were taken into account in the final analysis. As can be seen in the Table, only Trial is significant, indicating that participants became faster in the course of the experiment.

It can also be seen that the difference between the RT of correct sentences in Dutch (sentence type 2; reference level) and correct sentences in English (sentence type 4) is marginally significant, showing that participants were slower when answering such sentences in English than in Dutch. Furthermore, the random effect of sentence type plays a role within participants, indicating that some participants are more sensitive to this particular manipulation than others.

Table 6: Summary of the model predicting RT. On the reference level of the intercept are L1 Dutch (language) and correct sentences in Dutch (sentence type 2).

	β	std.err	*t*
Intercept	7.98	0.07	118.42
Sentence type 1 (semantic illusions Dutch)	-0.12	0.07	-1.71
Sentence type 3 (semantic illusions English)	0.01	0.08	0.10
Sentence type 4 (correct sentences English)	0.12	0.06	1.90
Trial	-0.00	0.00	-8.00
Random effects	var	sd	
Subject (intercept)	0.06	0.25	
Sentence (intercept)	0.10	0.32	
Sentence type 1	0.04	0.19	
Sentence type 3	0.08	0.28	
Sentence type 4	0.03	0.18	

Note: t > 1.96 or < -1.96 is significant.

Just as aforementioned, the reference level on in the intercept was chosen in order to compare the other variables with the most neutral one, in this case correct sentences in Dutch. As the current study is interested in the difference between semantic illusions in L1 Dutch and L2 English, however, the reference level was changed into semantic illusions in Dutch in order to compare these RTs with the RTs of semantic illusions in English. The results can be found in Table 7. It turns out that the difference between semantic illusions in Dutch (sentence type 1) and correct sentences in English (sentence type 4) is significant, indicating that participants were faster when responding to semantic illusions in Dutch. Furthermore, the difference

between semantic illusions in Dutch and the same sort of sentences in English is marginally significant, showing that participants were faster when answering questions that contained an illusion in their L1 Dutch than in their L2 English. Finally, the random effect of sentence type within participants again plays a role in predicting RT in the final model, suggesting that some participants are more sensitive to this manipulation than others.

Table 7: Summary of the model predicting RT. On the reference level of the intercept are L1 Dutch (language) and semantic illusions in Dutch (sentence type 1).

	β	std.err	*t*
Intercept	7.87	0.07	118.70
Sentence type 2 (correct sentences Dutch)	0.12	0.07	1.70
Sentence type 3 (semantic illusions English)	0.12	0.07	1.90
Sentence type 4 (correct sentences English)	0.24	0.07	3.40
Trial	-0.00	0.00	-8.00
Random effects	var	sd	
Subject (intercept)	0.05	0.23	
Sentence (intercept)	0.10	0.32	
Sentence type 2	0.04	0.19	
Sentence type 3	0.02	0.14	
Sentence type 4	0.04	2.12	

Note: t > 1.96 or < -1.96 is significant.

As stated in the beginning of this section, the analyses carried out so far had only taken into account the questions that were responded to accurately. However, an accurate answer does not mean that there was an occurrence of a semantic illusion. For this reason, the same process as was done with the accuracy analysis has been conducted for the RTs as well: only the sentences that contained a semantic illusion were taken into account for this analysis. The coefficients, the estimates and the t-values can be found in Table 8. As can be seen in this Table, only Trial is significant, indicating that participants became faster in the course of the experiment. The difference in RT between semantic illusions in Dutch and English is not

significant, indicating that sentences in which participants did not notice the semantic illusion were responded to faster in Dutch or English. This is a different finding from the previous analysis, in which a significant difference was found between these two variables.

Table 7: Summary of the model predicting RT. On the reference level of the intercept are L1 Dutch (language) and semantic illusions in Dutch (sentence type 1).

	β	std.err	*t*
Intercept	8.03	0.08	99.00
Sentence type 3 (semantic illusions English)	0.06	0.06	0.90
Trial	-0.00	0.00	-5.00
Random effects	var	sd	
Subject (intercept)	0.04	0.20	
Sentence (intercept)	0.03	0.16	

Note: t > 1.96 or < -1.96 is significant.

4.7. Discussion

The results of the sentential judgement task provide important insights in the behaviour of participants regarding semantic illusions in both L1 Dutch and L2 English. First of all, it is interesting to see that within a language (i.e. within Dutch and within English) the two conditions of semantic illusions and correct sentences show significant differences in accuracy, indicating that participants are more accurate in the latter condition than in the former. At first, this might not seem crucial information, but it is important to note that accuracy was measured on the basis of correct answers, rather than looking at the occurrences of semantic illusions. That is, if participants did not notice the illusion, this was initially marked as an incorrect answer. In this way, the results found on the basis of accuracy make perfect sense: sentences that contain a semantic illusion were responded to less accurately, as participants did not notice the semantic anomaly and therefore thought the question was correct (whereas is was, in fact, incorrect). These results are, then, in line with previous studies, as they indicate the occurrences of semantic illusions. If there would have been no

significant difference between semantic illusions and correct sentences, every participant would have noticed the illusion in the sentences, which would then contradict previous results. In summary, the first results support the outcome of the experiments conducted by previous researchers. The only difference is that the current study conducted an RSVP task in which questions were presented word by word. It is important to note that, even with this innovative way of measuring semantic illusions, similar results have been found. In this way, it can be said that the RSVP is a useful way of measuring semantic illusions, as it might be considered much more controlled than presenting the question in its entirety (for more detail on this topic, see the method section of the sentential judgement task).

The results of the sentential judgement task also show that the level of English proficiency had an overall effect on the accuracy of the experiment. Participants that had a high level of English proficiency performed overall better on the experiment. It is striking that this English proficiency showed no interaction with either language. Rather, the experiment in its entirety was done more accurate. It might therefore be possible that a high level of proficiency in English also shows beneficial results in the first language Dutch, rather than interference with the first language.

Another analysis was carried out which focussed only on accuracy of the sentences that contained a semantic illusion. In this analysis, the accuracy would mean the occurrence of a semantic illusion. the results of the linear mixed effect model analysis showed no significant differences between the various sentence types. In other words, the number of occurrences of semantic illusions did not significantly differ in Dutch and English.

The outcome of the model predicting RT showed a marginally significant difference between semantic illusions in Dutch and English. This suggests that participants responded faster when reading a sentence containing a semantic illusion in their first language Dutch as opposed to their second language English. This marginally significant result also indicates

that the way in which sentences are processed is not entirely the same in either language: it appears that participants need a longer time in order to fully process the semantic illusion sentences that occur in English. A possible explanation for the finding of this result and the absence of finding this in the accuracy analysis might be that participants want to perform as accurate as possible during the experiment. Only the RT reveals that they seemed to have more difficulty in processing the semantic illusions in their second language.

The model predicting RT also showed a random effect of sentence type, indicating that certain participants were more sensitive to this particular manipulation than others. A possible explanation for this phenomenon might be that some participants became aware of the semantic anomalies in particular sentences. In this way, they might perform differently in these conditions than participants who did not have the slightest idea of the aim of the experiment. The questionnaire that was given after the experiment also revealed that some participants indeed guessed the right aim of the experiment. It might be possible that these participants were also more sensitive to the manipulation of sentence type.

As with the accuracy analysis, the RT analysis was also carried out based on sentences that contained a semantic illusion. Only the variable of Trial showed a significant result, which is easy to explain: during the course of the experiment, participants become faster as they want to end the study as fast as possible. Their concentration might be higher during the first couple of trials of the experiment, but this slowly decreased throughout the experiment. In this way, they might also make faster decisions with regard to the sentences. Fortunately, all sentence types were randomised, so that the final data was as clean as possible.

In conclusion, although it might seem that there is no significant difference between the occurrences of semantic illusions in Dutch and English, the RT analysis shows a marginally significant difference between the two conditions. This suggests that participants are slightly faster in their first language with regard to semantic illusions than in their second

language. On the basis of accuracy, significant differences were found between semantic illusions and correct sentences within a language, supporting previous research that participants do not always notice the semantic anomalies when reading sentences.

6. Experiment 3: EEG study

Due to various extraneous factors, the current paper has not been able to include an EEG study. Several things, however, can already be said about the upcoming study. First of all, as the results of the sentential judgement task supported the results found by previous researchers, it can be concluded that the RSVP task is an appropriate task to test semantic illusions. Moreover, an RSVP task seems to be more controlled than presenting the stimuli in their entirety, as an RSVP task presents the sentence word by word, so that participants are both not able to look back and have a consistent amount of time for each word individually to process. By presenting sentences word by word, it is far easier to decide where to put the marker for the EEG study. It is therefore expected that an RSVP task will be an appropriate task for the EEG study.

Furthermore, the results of the sentential judgement task as well as the results of the rating study indicate that participants show a slightly easier processing when reading semantic illusions in their own language. This does not mean that these illusions occur more in the second language, but it shows that semantic illusions might be processed in a different way depending on the language of the participant. The upcoming EEG study will therefore look into this phenomenon in more detail in order to find more concrete answers. It is expected that the elicited effects during such a study will support if not strengthen the evidence that has already been found during the current experiments. The next subsection will more concretely state what is to be expected during the EEG study.

6.1. Expectations

As participants seem to have more difficulty with processing semantic illusions in their second language, it might be a logical expectation that the elicited N400/P600 effect will be significantly larger in the L2 English than in the L1 Dutch. The ERP of a participant will

namely show a certain effect from the moment that a participant shows difficulty in processing a particular sentence.: the RTs of semantic illusions in English differed from semantic illusions in Dutch. Therefore, one might assume that the processing of the former sentences is more difficult/costs more effort than the processing of illusions in the native language. For this reason, then, it is expected that a clearer N400/P600 effect will be elicited for processing in the second language. This contradicts the hypothesis as stated in the beginning of this study, but this is because no significant difference in the *occurrence* of an illusion was found. Rather, the RTs were longer.

In conclusion, it is expected that the EEG study will support the findings of the rating study and the sentential judgement task by showing a significantly larger elicited N400/P600 effect for the second language. It might also be possible that the EEG study will find a significant difference between the occurrences of semantic illusions in Dutch and English as it is a far more fine-grained measure than behavioural studies.

7. Overall discussion

The aim of the current study was to examine whether the proportions of semantic illusions during sentence processing differ between languages, in this case L1 Dutch and L2 English. The main research question was to see whether sentence processing of semantic illusions differs in L1 Dutch when compared to L2 English. The idea that this processing might differ between one's first and second language comes from findings of previous studies that showed a different process of acquiring a language in one's second language when compared to the L1. This is why it was expected that participants would notice the illusion significantly more in their L1 as they would process sentences in their native language in more depth than those in their second language. The present study was the first one in the field of semantic illusions to examine this phenomenon, as previous studies had only focused on one language, rather than looking at two different languages.

To prepare for an on-line study on semantic illusions in Dutch and English, sentences containing illusions were initially made and tested by means of a rating study. The aim of this study was to test the materials constructed and to already examine possible differences between Dutch and English regarding the processing of semantic illusions. A total of 30 participants participated in the experiment, divided over four different lists, all containing the same number of semantic illusions. Four different conditions were tested: semantic illusions in Dutch, correct sentences in Dutch, semantic illusions in English and correct sentences in English (correct sentences were the same sentences as the illusions, only with the correct target word rather than an inconsistent name). The rating study consisted first of a Dutch part and then of an English part. The stimuli were presented sentence by sentence and participants had to judge the sentence on the basis of its semantics and provided an answer to the question.

The results of the rating study showed a marginally significant difference (p = .078) between the occurrences of semantic illusions between Dutch and English, indicating that

participants did notice the illusion more in their first language as opposed to their second language. This finding was in line with the hypothesis that the number of occurrences of semantic illusions (i.e. the state of not noticing an illusion) would be significantly lower in the L1 Dutch than in the L2 English. That is, it was expected that participants would notice the illusion more in their first language, a hypothesis which was borne out on the basis of the outcome of the rating study. Furthermore, the results of the rating study showed a significant difference between the number of *question is incorrect* answers in Dutch and English, which shows that participants noticed the illusion significantly more often in their first language than in their second language ($p = .004$). At first it was thought that this discrepancy was due to the fact that participants chose the *I don't know* answer more in English because of the lack of English proficiency, which would ultimately lead to a greater number of *question is incorrect* answers in Dutch. A paired t-test, however, showed no significant difference ($p = .11$) between the number of *I don't know* answers in Dutch and English, supporting the hypothesis that interlocutors do indeed notice a semantic illusion more in their first language when compared to their second language. Finally, a bivariate correlation analysis between the level of English proficiency and the occurrences of semantic illusions showed no significant correlation effect, suggesting that the level of English proficiency did not influence the overall results during the experiment. This finding, however, might be caused due to a rather subjective way of testing English proficiency (i.e. by means of a self-rated questionnaire). This is why the follow-up experiment contained an English LexTALE task, in order to examine this correlation more objectively.

The results of the rating study also showed which questions of the stimuli were not reliable. On the basis of the proportions of *I don't know* answers and on the basis of the comments participants gave on the questions, a total of 8 semantic illusions were discarded

from the experiment. In this way, the most useful and most reliable stimuli was used during the behavioural study.

After the rating study, a behavioural study was conducted in order to examine whether the processing of semantic illusions would differ between L1 Dutch and L2 English and whether the results would support the outcome of the rating study. Again, the expectation was that the number of occurrences of semantic illusions would be significantly lower in the L1 Dutch than in the L2 English. In other words, it was again expected that participants would notice the illusion significantly more in their first language when compared to their second language. Furthermore, it was expected that the RTs for the occurrences of semantic illusions would be significantly faster in the L1 Dutch than in the L2 English as it was expected that participants would read faster in their native language than in their second language. Therefore, faster RTs were expected, even if the sentence contained a semantic anomaly.

A sentential judgement task was conducted in order to test the research interests. A total of 35 participants participated in the experiment. The experiment consisted of two different parts: a Dutch one and an English one, just as the rating study. Unlike the rating study, the order in which the languages appeared was randomised across participants. Regardless of which language came first, participants started with a LexTALE task in that particular language, followed by the main experiment. This entailed that stimuli were presented word by word (RSVP task) rather than presenting questions in its entirety, something which can be seen as an innovative way of testing semantic illusions as it has never been done before by previous studies.

The results of the sentential judgement task reveal a significant difference between the accuracy of semantic illusions and correct sentences within either language. That is, semantic illusions were responded to less accurately by participants than the correct target sentences within both Dutch and English. This supports the findings of previous researchers (see, inter

alia, Erickson & Mattson, 1981) that already showed that participants indeed do not always notice the semantic anomaly in sentences. The main research question of this study, however, focussed on the difference *between* languages rather than discrepancies within languages. The results show a marginally significant difference between the RTs of sentences that contained a semantic illusion in Dutch and English, indicating that participants were slower when reading semantic illusion sentences in their second language than in their first language.

The results of the accuracy analysis, however, did not support this finding, therefore contradicting the significant difference between occurrences of semantic illusions in Dutch and English that was found in the rating study. A possible explanation for this discrepancy might be due to a different method: the rating study presented sentences in their entirety, whereas the behavioural study presented sentences word by word. Participants might be more concentrated when reading questions word by word, as they cannot read the sentences at their own pace (something which was possible during the rating study). Therefore, participants might have been more concentrated and more motivated during the sentential judgement task, leading to fewer occurrences of semantic illusions. As aforementioned, however, the findings of the sentential judgement task did suggest that processing was longer when reading semantic illusions in English than in Dutch.

The finding of a significant difference in RT between semantic illusions in Dutch and English could be due to the level of English proficiency of participants: if participants were not that proficient, reading in English might cost more effort than reading in the native language. However, in the sentential judgement task, participants did not show a more accurate performance in their native language than in their second language when they were reading correct sentences. Moreover, the average English LexTALE score of the participants was 756.43 (*SD* = 118.52), indicating that on average, they were highly proficient in their second language. As the LexTALE score also correlates with the self-rated English

proficiency, it can be concluded that participants were well-aware of their (high) level of English proficiency. Because of these reasons, then, it is not likely that reading in English would cost more effort. Therefore, there must be a different reason for the observed longer RTs when semantic illusions are read in English.

Before closely examining this reason, another result was found during the sentential judgement task: a high English level of proficiency led to overall better performance throughout the sentential judgement task. Interestingly, an interaction analysis between language and the English LexTALE score showed no significant results. Therefore, it can be said that a higher English level of proficiency does not lead to better results in the English part of the experiment, but to overall better results. In this way, it might seem that one's second language is in some way connected with one's first language in a beneficial way rather than causing interference.

7.1. Semantic illusions and mental models

When considering the theories that have previously been developed in order to explain the phenomenon of semantic illusions, it seems that semantic similarity (or conceptual relatedness) are completely reasonable explanations for the phenomenon of semantic illusions (e.g. van Oostendorp & Kok, 1990). Occurrences of semantic illusions might indeed result from semantic similarities between the target word and the inconsistent name. If this would be the case, however, then one would not expect a difference between the detection of a semantic illusion in the two languages, as semantic similarities can be called a universal pattern (as various studies of various languages found this phenomenon: Erickson & Mattson (1981) English, and van Jaarsveld et al. (1997) examined this phenomenon in Dutch). Therefore, a similar pattern would be expected across languages.

As discussed above, all participants were proficient enough in their second language to perfectly read and understand the stimuli that were presented. Therefore, it seems rather odd that processing costs more effort and took more time in the second language than in the native language. Semantic similarities between the target and the illusion term may not completely solve the problem, as the same semantic similarities exist in the Dutch and the English sentences due to translations that were as literal as possible. For this reason, a different theory is needed to provide a suitable if not satisfying explanation for the processing of semantic illusions in L1 Dutch and L2 English.

For another explanation of the failure of noticing semantic illusions, we may refer to another theoretical notion: 'mental model'. As explained by Warren (2013), mental models refer to "the conceptual notions that speakers or writers want to convey, or to the abstract representation of what a reader or listener understands" (Warren, 2013: 200). In other words, interlocutors appear to store information they have heard or read rather than remembering this information as separate pieces. That is, they integrate information they receive as the entire picture, rather than just pieces of a puzzle. The mental model can be seen as a multidimensional mental structure with slots for particular sorts of information, e.g. who did what, where, and when. Possibly, in addition to such conceptual information, language-specific lexical information may be stored as part of the mental model.

This theory may explain the phenomenon of semantic illusions in two languages. First of all, consider the classic Moses-illusion again: *How many animals of each kind did Moses take on the Ark*? When a participant reads this particular sentence, certain features of the words in the sentence are activated in the lexicon and together evoke the mental model of the Biblical story of the Ark: words like *animals* and *Ark* as well as the biblical figure of Moses. The information in this mental structure about the person who actually made the Ark (i.e. some biblical figure) is not immediately important. Rather, participants seem to have a mental

model of the Ark, in which at least two information slots are present: for animals and for a biblical figure (either Moses or Noah). In this case, all that the question requires is to retrieve the number information associated with the slot of the animals (which is *two*). According to the mental model approach, participants already had the relevant information stored *before* the sentence was being presented to them. Note that a participant who has never before heard of the Ark is not able to provide an answer to the question, as no mental model has yet been built regarding this topic. Another example of mental model building might be the following: when a friend talks about the bar she has been visiting for the past few months, it is likely that the interlocutor 'builds' a mental model of this bar. The next time this friend talks about a bar again, the interlocutor has available the entire picture of the bar, albeit a different bar from the last conversation. This is just one of many examples that interlocutors store information in terms of structured wholes and connect information they hear or read to the things that have already been stored in particular slots of the structure.

The notion of mental model building can be applied to the results of the current study. It is proposed that the processing of semantic illusions differs in the L1 and the L2. Although every participant seems to be a highly proficient English speaker, more mental effort is required in processing illusions formulated in the second language. Most likely, more mental models have over the years been stored on the basis of Dutch language encounters, as this is the native language of all participants. As a consequence, it may be that detailed lexical information pertaining to the mental model is less familiar in the second language.

This difference in stored information might make a crucial difference when reading sentences that contain a semantic anomaly. Consider the following sentence: *What did Jesus eat during the Last Supper with his eleven apostles?* Dutch participants are probably perfectly able to understand the sentence in English, however, it is also likely that they have not stored the lexical information of *Last Supper* together with the mental model (but rather the Dutch

words *Laatste Avondmaal*). So, although participants are able to comprehend the sentence in its entirety, their mental model does not refer to these particular English words. Possibly, they first have to relate the English words *Last Supper* to their Dutch meaning, in order to retrieve the mental model, after which they can then decide whether there were eleven or twelve apostles. Given enough processing time, they can be as accurate on English sentences as on Dutch sentences, but retrieving the mental core model is more difficult when the language in which it is presented is not as familiar as the first language. Processing correct sentences, however, does not lead to any additional processing effort. Therefore, it may well be the case that participants are subconsciously aware of the anomaly in the sentence, as they already have the entire image in their head in the Dutch language. If they have to first connect the Dutch mental model to the English sentence and afterwards decide whether the entire sentence is correct, however, the RTs are longer for the semantic illusions in English.

Admittedly, the idea of mental models still leaves many questions unanswered. For instance, what would happen if participants read the same sentence in both languages? In this case, they would already have built a mental model in one language. Would the RT then become faster or even slower between languages? Furthermore, is it really possible to state that mental model building is based on one language? What if the stored information is conceptual in nature and not connected to one specific language? What if, in fact, participants immediately connect the *Last Supper* to their Dutch mental model of *Het Laatste Avondmaal*?

As this study was the first one to examine the processing of semantic illusions across languages, many questions are still unanswered. This discussion, then, does not lead to black-and-white evidence of what happens when participants process semantic illusions in their second language. On the contrary, it leads to more questions that need answers. Such research generativity can be considered as a good thing. Furthermore, it is important to note, that this study has found evidence for different sentence processing in L1 Dutch and L2 English and

that its findings might be supported by the theory of mental model building. Further fine-grained investigation is needed to investigate this complex issue in more detail.

8. Conclusion

Preparations are currently made to extend this behavioural study to an EEG study. The same research technique, namely an RSVP reading task, will be used to examine the effects of semantic illusions on L1 and L2 sentence processing in the brain. Moreover, the upcoming EEG study will test the findings of the current study and may provide more new insights in this new domain.

Furthermore, the current research can be seen as a starting point for doing more investigations concerning mental model building and the concept of mental models in relation to one's first and second language. The usefulness of linking mental models to the occurrences of semantic illusions can thus be tested.

A logical present step to take is to investigate semantic illusions for other language combinations in a follow-up study. Dutch and English share many similar features as they are from the same language family. It would be interesting to examine participants with a different second language background, such as Spanish or Turkish, that are not as closely related as Dutch and English. Another interesting option would be to conduct the present research with low proficient speakers of English. If L2 proficiency plays a role in the overall performance of the experiment, as the present data suggest, the performance of low proficient speakers of English might lead to different results.

As a final suggestion for future research, one might conducted the same second language study (with RSVP) again but now present the stimulus sentences as questions. As previous research (see, inter alia, Bredart & Modolo, 1988) has shown, fewer semantic illusions occur when presenting stimuli as statements rather than as questions due to a different focalisation effect. Possibly, statements might lead to different results regarding processing of semantic illusions in Dutch and English, and more or fewer illusions might occur because of the form of the sentences.

In conclusion, the current study has been the first one to investigate the occurrences of semantic illusions in L1 Dutch and L2 English. Its results might suggest that Moses did indeed speak two languages on the Ark.

References

Bredart, S., & Modolo, K. (1988). Moses strikes again: Focalization effect on a semantic illusion. *Acta Psychologica 67*, 135-144.

Brouwer, H., Fitz, H., & Hoeks, J. (2012). Getting real about semantic illusions: Rethinking the functional role of P600 in language comprehension. *Brain research, 1446,* 127-143.

Büttner, A. C. (2007). Questions versus statements: Challenging an assumption about semantic illusions. *The Quarterly Journal of Experimental Psychology, 60*(6), 779-789.

Cantor, A. D., & Marsh, E. J. (2017). Expertise effects in the Moses illusion: Detecting contradictions with stored knowledge. *Memory, 25*(2), 220-230.

Erickson T. D., & Mattson, M E. (1981). From words to meaning: A semantic illusion. *Journal of Verbal Learning and Verbal Behavior, 20*, 540-551.

Gass, S. M., Behney, J. & L. Plonsky. (2013). *Second Language Acquisition: An Introductory Course* (4th ed.). Oxford: Routledge.

Grice, P. (1975). Logic and conversation. *Syntax and Semantics, 3,* 41-85.

Herten, van, M., Kolk, H. H. J., & Chwilla, D. J. (2005). An ERP study of P600 effects elicited by semantic anomalies. *Cognitive Brain Research, 22*, 241-255.

IBM Corp. (2016). *IBM SPSS Statistics for Windows*. Version 24.0. Armonk, NY: IBM Corp.

Jaarsveld van, H. J., Dijkstra, T., & Hermans, D. (1997). The detection of semantic illusions: Task-specific effects for similarity and position of distorted terms.

Just, M. A., & Carpenter, P. A. (1980). A theory of reading: From eye fixations to comprehension. *Psychological Review, 87*(4), 329-354).

Mashal, N., Shen, Y., Jospe, K., & Gil, D. (2014). Language effects on the conceptualization

of hybrids. *Language and Cognition, 6,* 217-241.

Montrul, S. (2015). Dominance and proficiency in early and late bilingualism. In C. Silva-Corvalán and J. Treffers-Daller (Eds.). *Language dominance in bilinguals: Issues of measurement and operationalization* (pp. 15-35). Cambridge: Cambridge University Press.

Oostendorp van, H., & Kok, I. (1990). Failing to notice errors in sentences. *Language and Cognitive Processes, 5*(2), 105-113.

Peirce, J. W. (2007) *PsychoPy - Psychophysics software in Python.* J Neuroscience Methods, *162*(1-2), 8-13.

Reder, L. M. & Kusbit, G. W. (1991). Locus of the Moses illusion: Imperfect encoding, retrieval or match? *Journal of Memory and Language, 30*, 385-406.

RStudio (2016). Version 1.0.143. RStudio, Inc.

Roberts, L. (2011). Individual differences in second language processing. *Language Learning, 62*, 172-188.

Sanford, A. J., Leuthold, H., Bohan, J., & Sanford, J. S. (2010). Anomalies at the borderline of awareness: An ERP study. *Journal of Cognitive Neuroscience, 23*(3), 514-523).

Shafto, M., & MacKay, D. G. (2000). The Moses, Mega-Moses, and Amstrong illusion: Integrating language comprehension and semantic memory. *Psychological Science, 11*(5), 372-378.

Traxler, M. T. (2012). *Introduction to psycholinguistics: Understanding language science*. Oxford: Blackwell Publishing.

Wang, L., Hagoort, P., & Yang, Y. (2009). Semantic illusion depends on information structure: ERP evidence. *Brain Research, 1282,* 50-56.

Warren, P. (2013). *Introducing Psycholinguistics.* Cambridge: Cambridge University Press.

Appendix A: Answer frequencies of the rating study (per version)

N.B.: The numbers in bold correspond to a relatively high proportion of* I don't know *answers. These were all reconsidered before excluding several sentences before the behavioural study.

Descriptive Statistics – Version 1						
	N	Range	Min.	Max.	Mean	Std. Deviation
Q_1_NL	7	2	1	3	**2,14**	,690
Q_2_NL	7	1	2	3	**2,43**	,535
Q_3_NL	7	0	2	2	2,00	,000
Q_4_NL	7	1	1	2	1,71	,488
Q_5_NL	7	1	2	3	**2,14**	,378
Q_6_NL	7	1	2	3	**2,71**	,488
Q_7_NL	7	0	3	3	**3,00**	,000
Q_8_NL	7	1	1	2	1,43	,535
Q_9_NL	7	1	1	2	1,14	,378
Q_10_NL	7	2	1	3	2,00	,577
Q_11_NL	7	0	2	2	2,00	,000
Q_12_NL	7	1	1	2	1,71	,488
Q_13_NL	7	1	1	2	1,71	,488
Q_14_NL	7	2	1	3	1,86	,900
Q_15_NL	7	2	1	3	**2,14**	,690
Q_16_NL	7	1	2	3	**2,14**	,378
Q_17_NL	7	1	1	2	1,86	,378
Q_18_NL	7	0	2	2	2,00	,000
Q_19_NL	7	1	1	2	1,71	,488
Q_20_NL	7	2	1	3	2,00	,577
Q_21_NL	7	1	2	3	**2,14**	,378
Q_22_NL	7	1	2	3	**2,29**	,488
Q_23_NL	7	0	2	2	2,00	,000
Q_24_NL	7	2	1	3	2,00	,816
Q_25_NL	7	2	1	3	**2,29**	,756
Q_26_NL	7	2	1	3	1,86	,690
Q_27_NL	7	1	1	2	1,86	,378
Q_28_NL	7	1	1	2	1,71	,488
Q_29_NL	7	1	2	3	**2,86**	,378
Q_30_NL	7	2	1	3	1,57	,976
Q_1_EN	7	1	2	3	**2,86**	,378
Q_2_EN	7	1	2	3	**2,71**	,488
Q_3_EN	7	1	2	3	**2,14**	,378
Q_4_EN	7	2	1	3	**2,71**	,756

Q_5_EN	7	2	1	3	1,57	,787
Q_6_EN	7	1	2	3	**2,71**	,488
Q_7_EN	7	2	1	3	**2,43**	,976
Q_8_EN	7	2	1	3	**2,43**	,976
Q_9_EN	7	1	2	3	**2,86**	,378
Q_10_EN	7	2	1	3	2,00	,577
Q_11_EN	7	1	2	3	**2,86**	,378
Q_12_EN	7	1	2	3	**2,86**	,378
Q_13_EN	7	2	1	3	**2,14**	,900
Q_14_EN	7	2	1	3	**2,14**	,900
Q_15_EN	7	2	1	3	**2,71**	,756
Q_16_EN	7	0	3	3	**3,00**	,000
Q_17_EN	7	1	2	3	**2,86**	,378
Q_18_EN	7	2	1	3	**2,29**	,951
Q_19_EN	7	1	2	3	**2,29**	,488
Q_20_EN	7	2	1	3	**2,14**	1,069
Q_21_EN	7	2	1	3	2,00	,577
Q_22_EN	7	2	1	3	**2,29**	,951
Q_23_EN	7	1	1	2	1,57	,535
Q_24_EN	7	1	2	3	**2,29**	,488
Q_25_EN	7	0	2	2	2,00	,000
Q_26_EN	7	2	1	3	1,71	,756
Q_27_EN	7	2	1	3	**2,43**	,787
Q_28_EN	7	2	1	3	**2,43**	,976
Q_29_EN	7	2	1	3	**2,14**	,690
Q_30_EN	7	1	2	3	**2,29**	,488
Valid N (listwise)	7					

Descriptive Statistics – Version 2						
	N	Range	Min.	Max.	Mean	Std. Deviation
Q_1_NL	7	0	2	2	2,00	,000
Q_2_NL	7	0	2	2	2,00	,000
Q_3_NL	7	1	1	2	1,86	,378
Q_4_NL	7	2	1	3	1,86	,900
Q_5_NL	7	2	1	3	**2,43**	,787
Q_6_NL	7	1	2	3	**2,43**	,535
Q_7_NL	7	1	2	3	**2,43**	,535
Q_8_NL	7	1	1	2	1,29	,488
Q_9_NL	7	1	2	3	**2,43**	,535
Q_10_NL	7	1	2	3	**2,86**	,378
Q_11_NL	7	1	1	2	1,71	,488
Q_12_NL	7	2	1	3	**2,14**	,690
Q_13_NL	7	1	2	3	**2,71**	,488
Q_14_NL	7	1	2	3	**2,14**	,378
Q_15_NL	7	1	2	3	**2,43**	,535
Q_16_NL	7	2	1	3	2,00	,577
Q_17_NL	7	2	1	3	2,00	,577
Q_18_NL	7	1	2	3	**2,29**	,488
Q_19_NL	7	1	2	3	**2,71**	,488
Q_20_NL	7	1	2	3	**2,14**	,378
Q_21_NL	7	2	1	3	**2,57**	,787
Q_22_NL	7	1	2	3	**2,14**	,378
Q_23_NL	7	0	2	2	2,00	,000
Q_24_NL	7	2	1	3	1,86	,690
Q_25_NL	7	2	1	3	**2,14**	,690
Q_26_NL	7	1	2	3	**2,43**	,535
Q_27_NL	7	1	2	3	**2,57**	,535
Q_28_NL	7	1	2	3	**2,29**	,488
Q_29_NL	7	1	2	3	**2,57**	,535
Q_30_NL	7	2	1	3	2,00	,577
Q_1_EN	7	2	1	3	1,86	,900
Q_2_EN	7	2	1	3	2,00	,577
Q_3_EN	7	2	1	3	2,00	,577
Q_4_EN	7	1	1	2	1,86	,378
Q_5_EN	7	0	2	2	2,00	,000
Q_6_EN	7	2	1	3	**2,43**	,787
Q_7_EN	7	1	1	2	1,71	,488
Q_8_EN	7	1	1	2	1,57	,535
Q_9_EN	7	1	1	2	1,86	,378

Q_10_EN	7	2	1	3	2,00	,577
Q_11_EN	7	1	2	3	**2,29**	,488
Q_12_EN	7	2	1	3	**2,43**	,787
Q_13_EN	7	0	2	2	2,00	,000
Q_14_EN	7	1	2	3	**2,14**	,378
Q_15_EN	7	2	1	3	2,00	,577
Q_16_EN	7	1	2	3	**2,43**	,535
Q_17_EN	7	0	2	2	2,00	,000
Q_18_EN	7	1	2	3	**2,29**	,488
Q_19_EN	7	1	2	3	**2,29**	,488
Q_20_EN	7	1	1	2	1,43	,535
Q_21_EN	7	1	2	3	**2,29**	,488
Q_22_EN	7	0	2	2	2,00	,000
Q_23_EN	7	1	2	3	**2,57**	,535
Q_24_EN	7	1	1	2	1,71	,488
Q_25_EN	7	2	1	3	**2,29**	,951
Q_26_EN	7	1	1	2	1,86	,378
Q_27_EN	7	2	1	3	**2,57**	,787
Q_28_EN	7	2	1	3	2,00	,577
Q_29_EN	7	1	2	3	**2,57**	,535
Q_30_EN	7	2	1	3	1,71	,756
Valid N (listwise)	7					

Descriptive Statistics – Version 3						
	N	Range	Min.	Max.	Mean	Std. Deviation
Q_1_NL	9	2	1	3	**2,56**	,726
Q_2_NL	9	1	2	3	**2,33**	,500
Q_3_NL	9	1	2	3	**2,33**	,500
Q_4_NL	9	2	1	3	**2,33**	,866
Q_5_NL	9	1	1	2	1,44	,527
Q_6_NL	9	2	1	3	**2,33**	,866
Q_7_NL	9	2	1	3	**2,22**	,667
Q_8_NL	9	2	1	3	**2,44**	,726
Q_9_NL	9	2	1	3	**2,11**	,928
Q_10_NL	9	2	1	3	1,78	,667
Q_11_NL	9	2	1	3	**2,33**	,707
Q_12_NL	9	2	1	3	**2,11**	,928
Q_13_NL	9	2	1	3	**2,22**	,833
Q_14_NL	9	2	1	3	1,67	,707
Q_15_NL	9	2	1	3	1,89	,928
Q_16_NL	9	1	2	3	**2,56**	,527
Q_17_NL	9	2	1	3	**2,33**	,866
Q_18_NL	9	2	1	3	**2,22**	,667
Q_19_NL	9	1	2	3	**2,44**	,527
Q_20_NL	9	2	1	3	**2,11**	,601
Q_21_NL	9	2	1	3	2,00	,500
Q_22_NL	9	1	2	3	**2,67**	,500
Q_23_NL	9	2	1	3	1,44	,726
Q_24_NL	9	1	2	3	**2,11**	,333
Q_25_NL	9	1	2	3	**2,22**	,441
Q_26_NL	9	2	1	3	**2,33**	,707
Q_27_NL	9	2	1	3	**2,22**	,833
Q_28_NL	9	2	1	3	1,89	,601
Q_29_NL	9	2	1	3	**2,11**	,601
Q_30_NL	9	2	1	3	1,89	,782
Q_1_EN	9	2	1	3	1,44	,726
Q_2_EN	9	1	2	3	**2,44**	,527
Q_3_EN	9	1	1	2	1,78	,441
Q_4_EN	9	1	1	2	1,22	,441
Q_5_EN	9	1	2	3	**2,33**	,500
Q_6_EN	9	2	1	3	**2,56**	,726
Q_7_EN	9	2	1	3	2,00	,707
Q_8_EN	9	1	1	2	1,22	,441
Q_9_EN	9	2	1	3	1,56	,882

Q_10_EN	9	1	2	3	**2,89**	,333
Q_11_EN	9	2	1	3	**2,11**	,601
Q_12_EN	9	2	1	3	2,00	,866
Q_13_EN	9	1	1	2	1,78	,441
Q_14_EN	9	2	1	3	**2,56**	,726
Q_15_EN	9	2	1	3	1,22	,667
Q_16_EN	9	1	2	3	**2,22**	,441
Q_17_EN	9	2	1	3	1,44	,726
Q_18_EN	9	1	1	2	1,78	,441
Q_19_EN	9	2	1	3	1,89	,782
Q_20_EN	9	2	1	3	**2,11**	,782
Q_21_EN	9	2	1	3	2,00	,500
Q_22_EN	9	2	1	3	**2,22**	,667
Q_23_EN	9	2	1	3	2,11	,601
Q_24_EN	9	2	1	3	**2,44**	,726
Q_25_EN	9	1	2	3	**2,67**	,500
Q_26_EN	9	2	1	3	1,78	,833
Q_27_EN	9	2	1	3	2,00	,707
Q_28_EN	9	1	1	2	1,56	,527
Q_29_EN	9	2	1	3	**2,33**	,707
Q_30_EN	9	2	1	3	1,78	,972
Valid N (listwise)	9					

Descriptive Statistics – Version 4						
	N	Range	Min.	Max.	Mean	Std. Deviation
Q_1_NL	7	2	1	3	2,00	,816
Q_2_NL	7	1	1	2	1,86	,378
Q_3_NL	7	1	1	2	1,86	,378
Q_4_NL	7	1	1	2	1,71	,488
Q_5_NL	7	1	1	2	1,86	,378
Q_6_NL	7	2	1	3	1,71	,756
Q_7_NL	7	1	1	2	1,86	,378
Q_8_NL	7	1	1	2	1,71	,488
Q_9_NL	7	1	1	2	1,86	,378
Q_10_NL	7	1	1	2	1,86	,378
Q_11_NL	7	1	1	2	1,86	,378
Q_12_NL	7	1	2	3	**2,29**	,488
Q_13_NL	7	1	2	3	**2,14**	,378
Q_14_NL	7	1	1	2	1,71	,488
Q_15_NL	7	1	2	3	**2,14**	,378
Q_16_NL	7	1	2	3	**2,57**	,535
Q_17_NL	7	0	2	2	2,00	,000
Q_18_NL	7	1	2	3	**2,14**	,378
Q_19_NL	7	1	2	3	**2,14**	,378
Q_20_NL	7	1	1	2	1,57	,535
Q_21_NL	7	1	1	2	1,86	,378
Q_22_NL	7	2	1	3	**2,14**	,690
Q_23_NL	7	1	2	3	**2,43**	,535
Q_24_NL	7	1	1	2	1,71	,488
Q_25_NL	7	2	1	3	**2,14**	,690
Q_26_NL	7	2	1	3	2,00	,577
Q_27_NL	7	2	1	3	1,86	,900
Q_28_NL	7	1	2	3	**2,14**	,378
Q_29_NL	7	2	1	3	2,00	,577
Q_30_NL	7	1	1	2	1,57	,535
Q_1_EN	7	2	1	3	2,00	,577
Q_2_EN	7	1	1	2	1,86	,378
Q_3_EN	7	1	2	3	**2,14**	,378
Q_4_EN	7	1	1	2	1,43	,535
Q_5_EN	7	1	1	2	1,86	,378
Q_6_EN	7	1	2	3	**2,29**	,488
Q_7_EN	7	2	1	3	**2,29**	,756
Q_8_EN	7	2	1	3	2,00	1,000
Q_9_EN	7	2	1	3	1,86	,690

Q_10_EN	7	2	1	3	1,71	,951
Q_11_EN	7	2	1	3	**2,14**	,690
Q_12_EN	7	2	1	3	**2,14**	,900
Q_13_EN	7	2	1	3	**2,29**	,756
Q_14_EN	7	1	1	2	1,71	,488
Q_15_EN	7	2	1	3	**2,29**	,756
Q_16_EN	7	1	1	2	1,43	,535
Q_17_EN	7	2	1	3	**2,29**	,951
Q_18_EN	7	2	1	3	**2,43**	,787
Q_19_EN	7	2	1	3	**2,29**	,756
Q_20_EN	7	1	2	3	**2,29**	,488
Q_21_EN	7	2	1	3	**2,43**	,787
Q_22_EN	7	1	1	2	1,86	,378
Q_23_EN	7	0	2	2	**2,00**	,000
Q_24_EN	7	2	1	3	**2,00**	1,000
Q_25_EN	7	2	1	3	1,86	,690
Q_26_EN	7	1	2	3	**2,71**	,488
Q_27_EN	7	2	1	3	**2,29**	,756
Q_28_EN	7	1	2	3	**2,14**	,378
Q_29_EN	7	2	1	3	**2,14**	,900
Q_30_EN	7	2	1	3	2,00	,816
Valid N (listwise)	7					

Appendix B: SPSS output data of the rating study
N.B.: The data inside the red box contain the significant results.

Paired Samples Test – Overall Results

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Q_Total_Correct_NL - Q_Total_Correct_EN	-1,333	4,003	,731	-2,828	,161	-1,824	29	,078
Pair 2	Q_Total_Incorrect_NL - Q_Total_Incorrect_EN	3,200	5,641	1,030	1,094	5,306	3,107	29	,004
Pair 3	Q_Total_I_dont_know_NL - Q_Total_I_dont_know_EN	-1,867	6,124	1,118	-4,153	,420	-1,670	29	,106

One-way ANOVA between the four versions of the rating study

		Sum of Squares	df	Mean Square	F	Sig.
Q_Total_Correct_NL	Between Groups	39,183	3	13,061	,803	,504
	Within Groups	422,984	26	16,269		
	Total	462,167	29			
Q_Total_Incorrect_NL	Between Groups	279,525	3	93,175	2,085	,127
	Within Groups	1161,841	26	44,686		
	Total	1441,367	29			
Q_Total_Correct_EN	Between Groups	104,897	3	34,966	2,664	,069
	Within Groups	341,270	26	13,126		
	Total	446,167	29			
Q_Total_Incorrect_EN	Between Groups	343,081	3	114,360	3,643	,026
	Within Groups	816,286	26	31,396		
	Total	1159,367	29			

Bivariate correlation test between level of English proficiency and semantic illusions

			Level of English proficiency	Q_Total_ Correct_ NL	Q_Total_ Correct_ EN
Spearman's rho	Level of English proficiency	Correlation Coefficient	1,000	-,114	-,039
		Sig. (1-tailed)	.	,274	,418
		N	30	30	30
	Q_Total_Correct_NL	Correlation Coefficient	-,114	1,000	,519**
		Sig. (1-tailed)	,274	.	,002
		N	30	30	30
	Q_Total_Correct_EN	Correlation Coefficient	-,039	,519**	1,000
		Sig. (1-tailed)	,418	,002	.
		N	30	30	30

**. Correlation is significant at the 0.01 level (1-tailed).

Appendix C: Stimuli Behavioural Study (sentential judgement task)

1 = Semantic illusions Dutch
2 = Correct sentence Dutch
3 = Semantic illusions English
4 = Correct sentence English

The words marked in italics are the target words. The '|' sign before particular words is used as an indication where to put the markers during future EEG studies.

1. 1. Hoeveel dieren van elk soort nam *Mozes* mee op de |Ark?
   2. Hoeveel dieren van elk soort nam *Noach* mee op de |Ark?
   3. How many animals of each kind did *Moses* take on the |Ark?
   4. How many animals of each kind did *Noah* take on the |Ark?

2. 1. Hoe heet het sprookje waarin een van de *biggetjes* zich in de |klok verstopte?
   2. Hoe heet het sprookje waarin een van de *geitjes* zich in de |klok verstopte?
   3. What is the name of the fairy tale in which one of the *piglets* hides itself in a |clock?
   4. What is the name of the fairy tale in which one of the *little goats* hides itself in a |clock?

3. 1. Hoe heet het sprookje waarin *Assepoester* |ontwaakte door een kus van de prins?
   2. Hoe heet het sprookje waarin *Doornroosje* |ontwaakte door een kus van de prins?
   3. What is the name of the fairy tale in which *Cinderella* |awakens after the prince kisses her?
   4. What is the name of the fairy tale in which *Sleeping Beauty* |awakens after the prince kisses her?

4. 1. In welk land is *prinses* |Máxima geboren?
   2. In welk land is *koningin* |Máxima geboren?
   3. In which country was *princess* |Máxima born?
   4. In which country was *Queen* |Máxima born?

5. 1. In welke periode kwam Hitler aan de macht waarna de *eerste* |wereldoorlog uitbrak?
   2. In welke periode kwam Hitler aan de macht waarna de *tweede* |wereldoorlog uitbrak?
   3. In which period did Hitler gain power, after which the *first* |world war started?
   4. In which period did Hitler gain power, after which the *second* |world war started?

6. 1. Vanaf welk hotel in *Rotterdam* is |Herman Brood gesprongen?
   2. Vanaf welk hotel in *Amsterdam* is |Herman Brood gesprongen?
   3. From which hotel in *Rotterdam* did |Herman Brood jump?

4. From which hotel in *Amsterdam* did |Herman Brood jump?

7. 1. Wat at Jezus tijdens het laatste avondmaal met zijn |*elf* apostelen?
2. Wat at Jezus tijdens het laatste avondmaal met zijn |*twaalf* apostelen?
3. What did Jesus eat during the Last Supper with his |*eleven* apostles?
4. What did Jesus eat during the Last Supper with his |*twelve* apostles?

8. 1. Welk dier is de beste vriend van het groene monster uit *Disney's* |Shrek in de gelijknamige film?
2. Welk dier is de beste vriend van het groene monster uit *Dreamwork's* |Shrek in de gelijknamige film?
3. Which animal is the best friend of the green creature from *Disney's* |Shrek in the famous film?
4. Which animal is the best friend of the green creature from *Dreamwork's* |Shrek in the famous film?

9. 1. Wat is een vast onderdeel van het NOS-journaal van *zeven* uur op de publieke omroep?
2. Wat is een vast onderdeel van het NOS-journaal van *acht* uur op de publieke omroep?
3. What is a fixed section of the NOS news of *seven* o'clock on the public broadcast station?
4. What is a fixed section of the NOS news of *eight* o'clock on the public broadcast station?

10. 1. Welke blonde voorzitter van de |*VVD* is kenmerkend voor zijn felle uitspraken?
2. Welke blonde voorzitter van de |*PVV* is kenmerkend voor zijn felle uitspraken?
3. What is the name of the blonde chairman of the |*VVD* who is characterised by his intensive statements?
4. What is the name of the blonde chairman of the |*PVV* who is characterised by his intensive statements?

11. 1. Wat is de naam van het gemene personage uit de bekende Disneyfilm de *100* |Dalmatiërs?
2. Wat is de naam van het gemene personage uit de bekende Disneyfilm de *101* |Dalmatiërs?
3. What is the name of the mean character from the famous Disney film called the *100* |Dalmatians?
4. What is the name of the mean character from the famous Disney film called the *101* |Dalmatians?

12. 1. Hoeveel *cijfers* zitten er in het |alfabet dat ook in het Nederlands gebruikt wordt?
2. Hoeveel *letters* zitten er in het |alfabet dat ook in het Nederlands gebruikt wordt?
3. How many *numbers* does the |alphabet contain which is also used in Dutch?

4. How many *letters* does the |alphabet contain which is also used in Dutch?

13. 1. Door welke militaire eenheid wordt de F16 |*helikopter* vaak gebruikt tijdens trainingen?
2. Door welke militaire eenheid wordt het F16 |*vliegtuig* vaak gebruikt tijdens trainingen?
3. What is the name of the military unit that often uses the F16 |*helicopters* during training sessions?
4. What is the name of the military unit that often uses the F16 |*planes* during training sessions?

14. 1. Op welke datum viert *prins* |Willem-Alexander zijn verjaardag?
2. Op welke datum viert *koning* |Willem-Alexander zijn verjaardag?
3. On which date does *prince* |Willem-Alexander celebrate his birthday?
4. On which date does *king* |Willem-Alexander celebrate his birthday?

15. 1. Welke Nederlandse voetbalclub speelt in het Philips Stadion in |*Den Bosch* zijn thuiswedstrijden?
2. Welke Nederlandse voetbalclub speelt in het Philips Stadion in |*Eindhoven* zijn thuiswedstrijden?
3. Which Dutch football club plays its home matches in the Philips Stadium in |*Den Bosch*?
4. Which Dutch football club plays its home matches in the Philips Stadium in |*Eindhoven*?

16. 1. In welk Nederlands dorp ligt het |Rijksmuseum dat bekend is door de Nachtwacht?
2. In welke Nederlandse *stad* ligt het |Rijksmuseum dat bekend is door de Nachtwacht?
3. In which Dutch *village* can one find the |Rijksmuseum which is famous because of the Night Watch?
4. In which Dutch *city* can one find the |Rijksmuseum which is famous because of the Night Watch?

17. 1. Welk fastfood restaurant heeft als logo een grote *witte* |M?
2. Welk fastfood restaurant heeft als logo een grote *gele* |M?
3. Which fast food restaurant has a huge *white* |M as their logo?
4. Which fast food restaurant has a huge *yellow* |M as their logo?

18. 1. In hoeveel dagen draait *de zon om de aarde*?
2. In hoeveel dagen draait *de aarde om de zon*?
3. In how many days does the *sun circle around the earth*?
4. In how many days does the *earth circle around the sun*?

19. 1. Welke Amerikaanse president werd in 1963 |*neergestoken* door een burger?

2. Welke Amerikaanse president werd in 1963 |*neergeschoten* door een burger?
3. Which American president was *stabbed to death* in |1963 by a citizen?
4. Which American president was *shot* in |1963 by a citizen?

20. 1. Welke Nederlandse bank heeft als logo een *rode* |leeuw?
2. Welke Nederlandse bank heeft als logo een *oranje* |leeuw?
3. Which bank in the Netherlands has a *red* |lion as their logo?
4. Which bank in the Netherlands has an *orange* |lion as their logo?

21. 1. Van welk land is Margaret Thatcher |*president* geweest?
2. Van welk land is Margaret Thatcher |*premier* geweest?
3. Which country did Margaret Thatcher serve for as |*president*?
4. Which country did Margaret Thatcher serve for as |*prime-minister*?

22. 1. Door wie werd het glazen muiltje van |*Sneeuwwitje* gevonden?
2. Door wie werd het glazen muiltje van |*Assepoester* gevonden?
3. Who was responsible for finding *Snow White's* |glass slipper?
4. Who was responsible for finding *Cinderella's* |glass slipper?

23. 1. Een vliegtuig stort neer op de grens tussen twee landen. Waar moeten de autoriteiten de *overlevenden* |begraven?
2. Een vliegtuig stort neer op de grens tussen twee landen. Waar moeten de autoriteiten de *overledenen* |begraven?
3. An airplane crashes on the boundary of two countries. Where should the |*survivors* be buried?
4. An airplane crashes on the boundary of two countries. Where should the |*dead* be buried?

24. 1. Hoe heet het Mexicaanse sausje dat gemaakt wordt van geprakte |*artisjok* en vaak met nacho's wordt gegeten?
2. Hoe heet het Mexicaanse sausje dat gemaakt wordt van geprakte |*avocado* en vaak met nacho's wordt gegeten?
3. What is the name of the Mexican sauce made of mashed |*artichoke* and often eaten with nachos?
4. What is the name of the Mexican sauce made of mashed |*avocado* and often eaten with nachos?

25. 1. Wat werd er met Jezus gedaan nadat hij verraden was door |*Jonas* die hij als zijn vriend beschouwde?
2. Wat werd er met Jezus gedaan nadat hij verraden was door |*Judas* die hij als zijn vriend beschouwde?
3. What happened to Jesus after he was betrayed by |*Jonas*, whom he considered to be his friend?

4. What happened to Jesus after he was betrayed by |*Judas*, whom he considered to be his friend?

26. 1. Uit welk land komt J. K. Rowling, de schrijfster van de beroemde |*Lord of the Rings* boeken?
2. Uit welk land komt J. K. Rowling, de schrijfster van de beroemde |*Harry Potter* boeken?
3. From which country does J. K. Rowling originate, the author of the well-known |*Lord of the Rings* books?
4. From which country does J. K. Rowling originate, the author of the well-known |*Harry Potter* books?

27. 1. Met welk feest gaan kinderen verkleed om snoep |*uit te delen* langs de deuren?
2. Met welk feest gaan kinderen verkleed om snoep |*te vragen* langs de deuren?
3. What is the name of the feast during which children dress up and walk from door to door to |*give* candy?
4. What is the name of the feast during which children dress up and walk from door to door to |*collect* candy?

28. 1. Van welke Engelse rockband uit de jaren zestig en zeventig was Ringo Star de |*gitarist*?
2. Van welke Engelse rockband uit de jaren zestig en zeventig was Ringo Starr de |*drummer*?
3. What is the name of the English rock band of the sixties-seventies that had Ringo Starr as their |*guitarist*?
4. What is the name of the English rock band of the sixties-seventies that had Ringo Starr as their |*drummer*?

29. 1. Wie dansen er op de tafel als de |*rat* van huis is?
2. Wie dansen er op de tafel als de |*kat* van huis is?
3. Who are dancing on the table once the |*rat* leaves the house?
4. Who are dancing on the table once the |*cat* leaves the house?

30. 1. Welk personage gaf de appel aan |*Doornroosje* die haar vergiftigde?
2. Welk personage gaf de appel aan |*Sneeuwwitje* die haar vergiftigde?
3. Which character gave the apple to |*Cinderella* that poisoned her?
4. Which character gave the apple to |*Snow White* that poisoned her?

31. 1. Stond het huis van de *negen* |dwergen midden in het bos of bij het dorp?
2. Stond het huis van de *zeven* |dwergen midden in het bos of bij het dorp?
3. Was the house of the *nine* |dwarves located in the centre of the forest or near the village?
4. Was the house of the *seven* |dwarves located in the centre of the forest or near th village?

32. 1. Wat was de grootste hit van de *Amerikaanse* zanger |Justin Bieber die bekend werd door YouTube?
2. Wat was de grootste hit van de *Canadese* zanger |Justin Bieber die bekend werd door YouTube?
3. What has been the greatest hit by the *American* singer |Justin Bieber who became famous through YouTube?
4. What has been the greatest hit by the *Canadian* singer |Justin Bieber who became famous through YouTube?

33. 1. Wanneer werd de *Taiwanese* stad |Hiroshima getroffen door een atoombom?
2. Wanneer werd de *Japanese* stad |Hiroshima getroffen door een atoombom?
3. When was the *Taiwanese* city |Hiroshima hit by an atomic bomb?
4. When was the *Japanese* city |Hiroshima hit by an atomic bomb?

34. 1. Heeft de hoofdstad van Flevoland, |*Almere*, meer of minder dan dertig duizend inwoners?
2. Heeft de hoofdstad van Flevoland, |*Lelystad*, meer of minder dan dertig duizend inwoners?
3. Does the capital city of Flevoland, |*Almere*, have more or fewer than thirty thousand citizens?
4. Does the capital city of Flevoland, |*Lelystad*, have more or fewer than thirty thousand citizens?

35. 1. Welk Grieks eiland ving vluchtelingen op die per *trein* van Bulgarije naar Griekenland kwamen?
2. Welk Grieks eiland ving vluchtelingen op die per *boot* van Bulgarije naar Griekenland kwamen?
3. Which Greek island helped refugees as they came by *train* from Bulgaria to Greece?
4. Which Greek island helped refugees as they came by *boat* from Bulgaria to Greece?

36. 1. Wat is de naam van de vijand van de bekende *clowns* Bassie en Adriaan die regelmatig op tv kwamen?
2. Wat is de naam van de vijand van de bekende *clown* Bassie en de *acrobaat* |Adriaan die regelmatig op tv kwamen?
3. What is the name of the enemy of the well-known *clowns* Bassie and |Adriaan who could often be seen on television?
4. What is the name of the enemy of the well-known *clown* Bassie and the *acrobat* |Adriaan who could often be seen on television?

37. 1. Ligt de hoofdstad van Hongarije, |*Boekarest*, in het midden of in het zuiden van het land?
2. Ligt de hoofdstad van Hongarije, |*Boedapest*, in het midden of in het zuiden van het land?

3. Is the capital city of Hungary, |*Bucharest*, located in the middle or in the south of the country?
4. Is the capital city of Hungary, |*Budapest*, located in the middle or in the south of the country?

38. 1. Is de grootste moskee ter wereld in de Turkse hoofdstad |*Istanbul* te vinden?
2. Is de grootste moskee ter wereld in de Turkse hoofdstad |*Ankara* te vinden?
3. Can one find the biggest mosque in the Turkish capital city |*Istanbul*?
4. Can one find the biggest mosque in the Turkish capital city |*Ankara*?

39. 1. Door wie werd *VVD* politicus |Pim Fortuyn vermoord?
2. Door wie werd *LPF* politicus |Pim Fortuyn vermoord?
3. Who was responsible for murdering *VVD* politician |Pim Fortuyn?
4. Who was responsible for murdering *LPF* politician |Pim Fortuyn?

40. 1. Wat is de naam van de oprichtster van het *zeeleeuwencentrum* in |Pieterburen?
2. Wat is de naam van de oprichtster van het *zeehondencentrum* in |Pieterburen?
3. What is the name of the founder of the *sea lions centre* in |Pieterburen?
4. What is the name of the founder of the *seals centre* in |Pieterburen?

41. 1. Welke Britse acteur speelde de hoofdrol bij de opening van de Olympische *winterspelen* in |Londen in 2012?
2. Welke Britse acteur speelde de hoofdrol bij de opening van de Olympische *zomerspelen* in |Londen in 2012?
3. Which British actor played the leading role during the opening of the Olympic *winter games* in |London in 2012?
4. Which British actor played the leading role during the opening of the Olympic *summer games* in |London in 2012?

42. 1. Wat is de kleur van de vacht van de beren op de |*Zuidpool*?
2. Wat is de kleur van de vacht van de beren op de |*Noordpool*?
3. What is the colour of the fur of the bears on the |*South Pole*?
4. What is the colour of the fur of the bears on the |*North Pole*?

43. 1. Voor welke televisiezender presenteerde *Jeroen* Krabbé dit jaar weer |The Voice of Holland?
2. Voor welke televisiezender presenteerde *Martijn* Krabbé dit jaar weer |The Voice of Holland?
3. For which broadcasting station did *Martijn* Krabbé present |The Voice of Holland this year?
4. For which broadcasting station did *Jeroen* Krabbé present |The Voice of Holland this year?

44. 1. Wat zijn volgens Geert Wilders het soort |*emigranten* dat telkens weer aan bod komt?
2. Wat zijn volgens Geert Wilders het soort |*immigranten* dat telkens weer aan bod komt?
3. What are according to Geert Wilders the kind of |*emigrants* that are often discussed?
4. What are according to Geert Wilders the kind of |*immigrants* that are often discussed?

45. 1. Waarvan beschuldigde de nieuwe president Trupm de eigen Amerikaanse veiligheidsdienst |*KGB* in een speech?
2. Waarvan beschuldigde de nieuwe president Trump de eigen Amerikaanse veiligheidsdienst |*NSA* in een speech?
3. Of what action did the new president Trump accuse his own American safety service the |*KGB* in a speech?
4. Of what action did the new president Trump accuse his own American safety service the |*NSA* in a speech?

46. 1. Waaraan is a-kwadraat plus b-kwadraat gelijk als we de stelling van |*Archimedes*?
2. Waaraan is a-kwadraat plus b-kwadraat gelijk als we de stelling van |*Pythagoras* volgen?
3. What is equal to a-squared and b-squared if one adheres to |*Archimedes'* theorem?
4. What is equal to a-squared and b-squared if one adheres to |*Pythagoras'* theorem?

47. 1. In welk jaar begon de Russische Revolutie van |*Stalin* door de tsaar af te zetten?
2. In welk jaar begon de Russische Revolutie van |*Lenin* door de tsaar af te zetten?
3. In what year did the Russian Revolution by |*Stalin* start by discharging the tsar?
4. In what year did the Russian Revolution by |*Lenin* start by discharging the tsar?

48. 1. Welk dier staat er op de achterkant van het Franse merk |*Renault* dat elk jaar veel auto's produceert?
2. Welk dier staat er op de achterkant van het Franse merk |*Peugeot* dat elk jaar veel auto's produceert?
3. Which animal can be found on the rear of the French |*Renault* that produces many cars every year?
4. Which animal can be found on the rear of the French |*Peugeot* that produces many cars every year?

49. 1. Door welke *Belgische* popgroep wordt het liedje |Waterloo gezongen?
2. Door welke *Zweedse* popgroep wordt het liedje |Waterloo gezongen?
3. Which *Belgian* pop group performed the famous song |Waterloo?
4. Which *Swedish* pop group performed the famous song |Waterloo?

50. 1. Waardoor verloor de schilder Vincent van Gogh zijn |*oog* tijdens zijn leven?

2. Waardoor verloor de schilder Vincent van Gogh zijn |*oor* tijdens zijn leven?
3. How did painter Vincent van Gogh lose his |*eye* during his life?
4. How did painter Vincent van Gogh lose his |*ear* during his life?

51. 1. Hoe heet het staatje dat tussen Frankrijk en Spanje in de |*Alpen* ligt?
2. Hoe heet het staatje dat tussen Frankrijk en Spanje in de |*Pyreneeën* ligt?
3. What is the name of the country that is located between France and Spain in the |*Alps*?
4. What is the name of the country that is located between France and Spain in the |*Pyrenees*?

52. 1. Hoeveel *graden Celsius* heeft een hoek van een |vierkant?
2. Hoeveel *graden* heeft een hoek van een |vierkant?
3. How many *Celsius degrees* is an angle in a |square?
4. How many *degrees* is an angle in a |square?

53. 1. Bij welke plaats in *Overijssel* komt de |Rijn ons land binnen?
2. Bij welke plaats in *Gelderland* komt de |Rijn ons land binnen?
3. What is the name of the place in *Overijssel* where the |Rhine enters our country?
4. What is the name of the place in *Gelderland* where the |Rhine enters our country?

54. 1. Ligt Rome ten oosten of ten westen van de Italiaanse |*Pyreneeën?*
2. Ligt Rome ten oosten of ten westen van de Italiaanse |*Apennijnen*?
3. Is Rome located in the southern or in the western side of the Italian |*Pyrenees*?
4. Is Rome located in the southern or in the western side of the Italian |*Apennines*?

55. 1. Hoe heet de *Spaanse* |pizza met vier soorten kaas?
2. Hoe heet de *Italiaanse* |pizza met vier soorten kaas?
3. What is the name of the *Spanish* |pizza consisting of four different kinds of cheese?
4. What is the name of the *Italian* |pizza consisting of four different kinds of cheese?

56. 1. Op welke verdieping van het *Spinozagebouw* is |In'to Languages gehuisvest?
2. Op welke verdieping van het *Erasmusgebouw* is |In'to Languages gehuisvest?
3. On which floor of the *Spinoza building* can |In'to Languages be found?
4. On which floor of the *Erasmus building* can |In'to Languages be found?

57. 1. Welk bekend beeldje is in de haven van de Deense hoofdstad |*Stockholm* te vinden?
2. Welk bekend beeldje is in de haven van de Deense hoofdstad |*Kopenhagen* te vinden?
3. Which famous statuette can be found in the harbour of the Danish capital city |*Stockholm*?
4. Which famous statuette can be found in the harbour of the Danish capital city |*Copenhagen*?

58. 1. Welke kleur had de wijnvlek die de Russische president |*Jeltsin* op zijn hoofd had?
2. Welke kleur had de wijnvlek die de Russische president |*Gorbatsjov* op zijn hoofd had?
3. Which colour was the birthmark that the Russian general |*Jeltsin* had on his head?
4. Which colour was the birthmark that the Russian general |*Gorbachev* had on his head?

59. 1. Waardoor is de Mona Lisa van de Italiaanse schilder |*Michelangelo* bekend?
2. Waardoor is de Mona Lisa van de Italiaanse schilder |*Da Vinci* bekend?
3. For what aspect has the Mona Lisa from the Italian painter |*Michelangelo* become famous?
4. For what aspect has the Mona Lisa from the Italian painter |*Da Vinci* become famous?

60. 1. Waaraan is de Nederlandse ruimtevaarder *André Kuypers* in 2014 |overleden?
2. Waaraan is de Nederlandse ruimtevaarder *Wubbo Ockels* in 2014 |overleden?
3. Because of which disease did the Dutch astronaut *André Kuypers* |die in 2014?
4. Because of which disease did the Dutch astronaut *Wubbo Ockels* |die in 2014?

61. 1. Kost de Chinese |*yen* meer of minder dan de Euro?
2. Kost de Chinese |*yuan* meer of minder dan de Euro?
3. Does the Chinese |*yen* cost more or less than the Euro?
4. Does the Chinese |*yuan* cost more or less than the Euro?

62. 1. Hoe heet de tekenaar van het bekende *haasje* |Nijntje die onlangs overleed?
2. Hoe heet de tekenaar van het bekende *konijntje* |Nijntje die onlangs overleed?
3. What is the name of the artist of the well-known *hare* |Nijntje who recently passed away?
4. What is the name of the artist of the well-known *rabbit* |Nijntje who recently passed away?

63. 1. In welk jaar ontdekte Columbus Amerika in de |*veertiende* eeuw?
2. In welk jaar ontdekte Columbus Amerika in de |*vijftiende* eeuw?
3. What is the exact year in which Columbus discovered America in the |*fourteenth* century?
4. What is the exact year in which Columbus discovered America in the |*fifteenth* century?

64. 1. Hoe noemt men de promotie van een pion als deze bij het denkspel |*dammen* de overzijde van het bord bereikt?
2. Hoe noemt men de promotie van een pion als deze bij het denkspel |*schaken* de overzijde van het bord bereikt?
3. What is the name of the promotion of a pawn during |*dams* when it reaches the other side of the play board?

4. What is the name of the promotion of a pawn during |*chess* when it reaches the other side of the play board?

65. 1. Welke stad bij Napels werd in de oudheid door de |*Etna* verwoest?
2. Welke stad bij Napels werd in de oudheid door de |*Vesuvius* verwoest?
3. Which city near Naples has been destroyed by the |*Etna* in ancient times?
4. Which city near Naples has been destroyed by the |*Vesuvius* in ancient times?

66. 1. Als wie vermomde de *vos* zich in het sprookje van |Roodkapje in de hoop om haar op te eten?
2. Als wie vermomde de *wolf* zich in het sprookje van |Roodkapje in de hoop om haar op te eten?
3. As whom did the *fox* dress up in the fairy tale of |Red Riding Hood with the intention to eat her?
4. As whom did the *wolf* dress up in the fairy tale of |Red Riding Hood with the intention to eat her?

67. 1. Hoe heet de Hobbit die in de filmserie The Lord of the |*Kings* uiteindelijk het kwaad verslaat?
2. Hoe heet de Hobbit die in de filmserie The Lord of the |*Rings* uiteindelijk het kwaad verslaat?
3. What is the name of the Hobbit in the filmseries The Lord of the |*Kings* who eventually defeats evil?
4. What is the name of the Hobbit in the filmseries The Lord of the |*Rings* who eventually defeats evil?

68. 1. Hoe noemt men in de *scheikunde* een ontploffende |ster in het heelal?
2. Hoe noemt men in de *natuurkunde* een ontploffende |ster in het heelal?
3. How do researchers in *chemistry* call an exploding |star in the universe?
4. How do researchers in *natural sciences* call an exploding |star in the universe?

69. 1. Door hoeveel *kabouters* werd |Sneeuwwitje geholpen voordat de prins kwam?
2. Door hoeveel *dwergen* werd |Sneeuwwitje geholpen voordat de prins kwam?
3. By how many *imps* was |Snow White helped before the prince came to her?
4. By how many *dwarves* was |Snow White helped before the prince came to her?

70. 1. Wie was er voor Ringo Starr de drummer van *The* |*Rolling Stones*?
2. Wie was er voor Ringo Starr de drummer van *The* |*Beatles*?
3. Who was the drummer of *The Rolling Stones* before |Ringo Starr?
4. Who was the drummer of *The Beatles* before |Ringo Starr?

71. 1. Welke nationaliteit had de uitvinder van de telefoon, |*Thomas Edison*?
2. Welke nationaliteit had de uitvinder van de telefoon, |*Alexander Bell*?
3. Which nationality did *Thomas Edison*, the inventor of the |telephone, have?

4. Which nationality did *Alexander Bell*, the inventor of the |telephone, have?

72. 1. In welk verhaal werd de zee in tweeën gespleten door |*Jehova*?
2. In welk verhaal werd de zee in tweeën gespleten door |*Mozes*?
3. In which story was the sea being split into two by |*Jehova*?
4. In which story was the sea being split into two by |*Moses*?

73. 1. Welk voorwerp wordt gebruikt om een geest op te roepen door |*Ali Baba* in het Arabische sprookje?
2. Welk voorwerp wordt gebruikt om een geest op te roepen door |*Aladdin* in het Arabische sprookje?
3. Which object is used in order to call a genie by |*Ali Baba* in the Arabic fairy tale?
4. Which object is used in order to call a genie by |*Aladdin* in the Arabic fairy tale?

74. 1. Nadat ze zich geprikt had aan het spinnenwiel sliep |*Assepoester* voor hoeveel jaar voordat ze wakker werd gekust?
2. Nadat ze zich geprikt had aan het spinnenwiel sliep |*Doornroosje* voor hoeveel jaar voordat de wakker werd gekust?
3. After the spinning wheel had pricked her, for how many years did |*Cinderella* sleep before she was awakened by the kiss of a prince?
4. After the spinning wheel had pricked her, for how many years did |*Sleeping Beauty* sleep before she was awakened by the kiss of a prince?

75. 1. De bekende formule E=mc2 werd door welke |*Oostenrijkse* wetenschapper geformuleerd?
2. De bekende formule E=mc2 werd door welke |*Duitse* wetenschapper geformuleerd?
3. The famous formula E=mc2 has been formulated by which |*Austrian* researcher?
4. The famous formula E=mc2 has been formulated by which |*German* researcher?

76. 1. Wat is de naam van de gedrukte puntjes op papier die |*dove* mensen gebruiken om te kunnen lezen?
2. Wat is de naam van de gedrukte puntjes op papier die |*blinde* mensen gebruiken om te kunnen lezen?
3. What is the name of the raised lumps on paper which enables |*deaf* people to read?
4. What is the name of the raised lumps on paper which enables |*blind* people to read?

77. 1. Hoeveel kilo *appels* heb je nodig om een pak |jus d'orange te maken?
2. Hoeveel kilo *sinaasappels* heb je nodig om een pak |jus d'orange te maken?
3. How many kilos of *apples* does one need to make a package of |orange juice?
4. How many kilos of *oranges* does one need to make a package of |orange juice?

78. 1. Op welke afstand werd de *Duitse* schaatser |Irene Wüst dit jaar kampioen?
2. Op welke afstand werd de *Nederlandse* schaatser |Irene Wüst dit jaar kampioen?
3. On which distance did the *German* skater |Irene Wüst become champion this year?

4. On which distance did the *Dutch* skater |Irene Wüst become champion this year?

79. 1. In welke plaats in *Zuid*-Holland is het mogelijk om met de veerboot naar |Engeland te gaan?
2. In welke plaats in *Noord*-Holland is het mogelijk om met de veerboot naar |Engeland te gaan?
3. In which place in *South Holland* is one able to use the ferry in order to go to |England?
4. In which place in *North Holland* is one able to use the ferry in order to go to |England?

80. 1. Hoe heet het monument bestaande uit metalen bollen dat in de Belgische stad |*Antwerpen* is gevestigd?
2. Hoe heet het monument bestaande uit metalen bollen dat in de Belgische stad |*Brussel* is gevestigd?
3. What is the name of the monument consisting of metal balls which can be found in the Belgian city of |*Antwerp*?
4. What is the name of the monument consisting of metal balls which can be found in the Belgian city of |*Antwerp*?

81. 1. Welk muziekfestival wordt ieder jaar in het Limburgse |*Geleen* georganiseerd?
2. Welk muziekfestival wordt ieder jaar in het Limburgse |*Landgraaf* georganiseerd?
3. Which music festival is organised in the Limburgian |*Geleen* every year during Whitsun?
4. Which music festival is organised in the Limburgian |*Landgraaf* every year during Whitsun?

82. 1. Wat is na Jupiter de grootste |*ster* in ons zonnestelsel?
2. Wat is na Jupiter de grootste |*planeet* in ons zonnestelsel?
3. What can after Jupiter be considered the largest |*star* in our solar system?
4. What can after Jupiter be considered the largest |*planet* in our solar system?

83. 1. In welk stadion speelt de *Amsterdamse* club |Feyenoord zijn thuiswedstrijden?
2. In welk stadion speelt de *Rotterdamse* club |Feyenoord zijn thuiswedstrijden?
3. In which stadium does the *Amsterdam* football club |Feyenoord play its home games?
4. In which stadium does the *Rotterdam* football club |Feyenoord play its home games?

84. 1. Wat is de naam van de bekende *Nederlandse* reporter die met zijn |hond Bobby allerlei avonturen beleeft in de gelijknamige stripserie?
2. Wat is de naam van de bekende *Belgische* reporter die met zijn |hond Bobby allerlei avonturen beleeft in de gelijknamige stripserie?
3. What is the name of the well-known *Dutch* reporter who experienced many

adventures with his dog |Bobby in the equally named comic books?
4. What is the name of the well-known *Belgian* reporter who experienced many adventures with his dog |Bobby in the equally named comic books?

85. 1. Wat zijn de namen van de drie *zoontjes* van |Donald Duck uit de gelijknamige stripserie?
2. Wat zijn de namen van de drie *neefjes* van |Donald Duck uit de gelijknamige stripserie?
3. What are the names of the three *sons* of |Donald Duck in the equally named comic book series?
4. What are the names of the three *nephews* of |Donald Duck in the equally named comic book series?

86. 1. Wanneer wordt ieder jaar door *3FM* de bekende |Top 2000 uitgezonden?
2. Wanneer wordt ieder jaar door *Radio 2* de bekende |Top 2000 uitgezonden?
3. When does *3FM* broadcast the well-known |Top 2000 every year?
4. When does *Radio 2* broadcast the well-known |Top 2000 every year?

87. 1. Wat is de naam van de overleden King of *Rock* die bekend werd door de |moonwalk en hits als Thriller?
2. Wat is de naam van de overleden King of *Pop* die bekend werd door de |moonwalk en hits als Thriller?
3. What is the name of the late King of *Rock* who became famous because of the |moonwalk and songs like Thriller?
4. What is the name of the late King of *Pop* who became famous because of the |moonwalk and songs like Thriller?

88. 1. De bekende toren van Pisa is in welke |*Franse* stad te vinden?
2. De bekende toren van Pisa is in welke |*Italiaanse* stad te vinden?
3. The famous tower of Pisa can be found in which |*French* city?
4. The famous tower of Pisa can be found in which |*Italian* city?

89. 1. Wat is de naam van het hoofdpersonage in Twilight die later in een |*weerwolf* zal veranderen?
2. Wat is de naam van het hoofdpersonage in Twilight die later in een |*vampier* zal veranderen?
3. What is the name of the main character in Twilight who will later on change into a |*werewolf*?
4. What is the name of the main character in Twilight who will later on change into a |*vampire*?

90. 1. In welke *hoofdstad* bevindt zich de grootste |haven van Nederland?
2. In welke *stad* bevindt zich de grootste |haven van Nederland?
3. In what *capital city* can one find the biggest |harbour in the Netherlands?

4. In what *city* can one find the biggest |harbour in the Netherlands?

91. 1. Van welke politieke partij is *president* |Rutte de partijleider?
2. Van welke politieke partij is *minister-president* |Rutte de partijleider?
3. Of which political party is *president* |Rutte the leader?
4. Of which political party is *minister-president* |Rutte the leader?

92. 1. In welke maand wordt *Koninginnedag* gevierd in Nederland?
2. In welke maand wordt *Koningsdag* gevierd in Nederland?
3. In which month is *Queen's Day* celebrated in the Netherlands?
4. In which month is *King's Day* celebrated in the Netherlands?

93. 1. Welke vrucht viel uit de boom waarna *Einstein* de wetten van de |zwaartekracht ontdekte?
2. Welke vrucht viel uit de boom waarna *Newton* de wetten van de |zwaartekracht ontdekte?
3. What kind of fruit fell out of the tree after which *Einstein* discovered the laws of |gravity?
4. What kind of fruit fell out of the tree after which *Newton* discovered the laws of |gravity?

94. 1. Welke zoon van prinses *Juliana* kwam tijdens een skivakantie om het leven?
2. Welke zoon van prinses *Beatrix* kwam tijdens een skivakantie om het leven?
3. Which son of princess *Juliana* died as a result of a ski vacation?
4. Which son of princess *Beatrix* died as a result of a ski vacation?

95. 1. Welke zin volgt er in het beroemde toneelstuk *Macbeth* na de uitspraak "|To be or not to be"?
2. Welke zin volgt er in het beroemde toneelstuk *Hamlet* na de uitspraak "|To be or not to be"?
3. What is the next line in the play *Macbeth* after the famous statement "|To be or not to be?"
4. What is the next line in the play *Hamlet* after the famous statement "|To be or not to be?"

96. 1. In welke plaats in de provincie *Gelderland* ligt het pretpark de |Efteling dat bekend is van onder andere Holle Bolle Gijs?
2. In welke plaats in de provincie *Noord-Brabant* ligt het pretpark de |Efteling dat bekend is van onder andere Holle Bolle Gijs?
3. In which place in the province of *Gelderland* can one find the attraction park the |Efteling which is famous for among other things Holle Bolle Gijs?
4. In which place in the province of *North Brabant* can one find the attraction park the |Efteling which is famous for among other things Holle Bolle Gijs?

97. 1. Wat voor soort muziek schreef de beroemde *violist* Mozart tijdens zijn leven?
2. Wat voor soort muziek schreef de beroemde *componist* Mozart tijdens zijn leven?
3. What kind of music did the famous *violist* Mozart write during his life?
4. What kind of music did the famous *composer* Mozart write during his life?

98. 1. Welke kleur heeft de *poema* op het logo van |Ferrari dat vaak snelle en dure auto's verkoopt?
2. Welke kleur heeft het *paard* op het logo van |Ferrari dat vaak snelle en dure auto's verkoopt?
3. Which colour does the *puma* have on the logo of |Ferrari which often sells fast and expensive cars?
4. Which colour does the *horse* have on the logo of |Ferrari which often sells fast and expensive cars?

99. 1. In welke *Spaanse* stad kan men het |Colosseum bezoeken?
2. In welke *Italiaanse* stad kan men het |Colosseum bezoeken?
3. In which *Spanish* town can one visit the |Colosseum?
4. In which *Italian* town can one visit the |Colosseum?

100. 1. Met welk liedje vertegenwoordigde Anouk ons land tijdens de finale van *Idols* in 2013?
2. Met welk liedje vertegenwoordigde Anouk ons land tijdens de finale van het *Songfestival* in 2013?
3. With which song did Anouk represent our country during the finals of |*Idols* in 2013?
4. With which song did Anouk represent our country during the finals of the |*Song festival* in 2013?

101. 1. Is de Amerikaanse |*pond* meer of minder waard dan de Euro?
2. Is de Amerikaanse |*dollar* meer of minder waard dan de Euro?
3. Is the American |*pound* more or less valuable than the Euro?
4. Is the American |*dollar* more or less valuable than the Euro?

102. 1. Welke van de volgende *hoofdsteden* ligt niet in Europa: Madrid, Moskou, |Antwerpen of Athene?
2. Welke van de volgende *steden* ligt niet in Europa: Madrid, |Moskou, Antwerpen of Athene?
3. Which of the following *capital cities* cannot be found in Europe: Madrid, Moscow, Antwerp or Athens?
4. Which of the following *cities* cannot be found in Europe: Madrid, Moscow, Antwerp or Athens?

103. 1. Welk land werd verantwoordelijk gesteld voor het neerhalen van het *Franse* vliegtuig de |MH17?

2. Welk land werd verantwoordelijk gesteld voor het neerhalen van het *Nederlandse* vliegtuig de |MH17?
3. Which country has been made responsible for shooting down the *French* plane the |MH17?
4. Which country has been made responsible for shooting down the *Dutch* plane the |MH17?

104. 1. Welk bedrijf brengt jaarlijks vele iPhone |*computers* op de markt?
2. Welk bedrijf brengt jaarlijks vele iPhone |*telefoons* op de markt?
3. Which company sells many iPhone |*computers* every year?
4. Which company sells many iPhone |*telephones* every year?

105. 1. Welke ijzeren toren in de Franse stad |*Lyon* trekt ieder jaar vele bezoekers?
2. Welke ijzeren toren in de Franse stad |*Parijs* trekt ieder jaar vele bezoekers?
3. Which iron tower in the French city of |*Lyon* is being visited many times every year?
4. Which iron tower in the French city of |*Paris* is being visited many times every year?

106. 1. Wat is de naam van het Joodse meisje dat na de *eerste* wereldoorlog bekend werd vanwege haar |dagboek?
2. Wat is de naam van het Joodse meisje dat na de *tweede* wereldoorlog bekend werd vanwege haar |dagboek?
3. What is the name of the Jewish girl who became well-known after the *First* World War because of her |diary?
4. What is the name of the Jewish girl who became well-known after the *Second* World War because of her |diary?

107. 1. Wat voor mythisch dier staat er op de vlag van |*Schotland*?
2. Wat voor mythisch dier staat er op de vlag van |*Wales*?
3. What kind of mythical creature can be found on the |*Scottish* flag?
4. What kind of mythical creature can be found on the |*Welsh* flag?

108. 1. Heeft de *Canadese* vlag meer dan 50 |sterren?
2. Heeft de *Amerikaanse* vlag meer dan 50 |sterren?
3. Does the *Canadian* flag contain more than 50 |stars?
4. Does the *American* flag contain more than 50 |stars?

109. 1. Waarom weigerde Nederland de toegang aan de Turkse minister van |*binnenlandse* zaken?
2. Waarom weigerde Nederland de toegang aan de Turkse minister van |*buitenlandse* zaken?
3. Why did the Netherlands reject the access of the Turkish minister of |*home affairs*?

4. Why did the Netherlands reject the access of the Turkish minister of |*foreign affairs*?

110. 1. Welke datum komt alleen voor in een schrikkeljaar dat normaal gesproken eens in de |*drie* jaar plaatsvindt?
2. Welke datum komt alleen voor in een schrikkeljaar dat normaal gesproken eens in de |*vier* jaar plaatsvindt?
3. Which date does only occur in a leap year, which occurs once every *three* years?
4. Which date does only occur in a leap year, which occurs once every *four* years?

111. 1. Hoe heet de hogesnelheidstrein die van |*Haarlem* naar Parijs rijdt?
2. Hoe heet de hogesnelheidstrein die van |*Amsterdam* naar Parijs rijdt?
3. What is the name of the high-speed train that drives from |*Haarlem* to Paris?
4. What is the name of the high-speed train that drives from |*Amsterdam* to Paris?

112. 1. Waarom laat *Goudlokje* haar lange blonde haren uit de |toren vallen?
2. Waarom laat *Rapunzel* haar lange blonde haren uit de |toren vallen?
3. Why does *Goldilocks* let down her long blonde hair from the |tower?
4. Why does *Rapunzel* let down her long blonde hair from the |tower?

Appendix D: Filler sentences

1 = Dutch (L1)
2 = English (L2)

1. 1. Op welke datum vieren we in Nederland Pakjesavond?
   2. On which date do the Dutch people celebrate Pakjesavond?

2. 1. In welk sprookje verandert Ariël van een zeemeermin in een mens?
   2. In which fairy tale does Ariël change from a mermaid into a human?

3. 1. Hoe heet het sprookje waarin grootmoeder wordt opgegeten door de grote boze wolf?
   2. What is the name of the fairy tale in which grandmother is eaten by the big bad wolf?

4. 1. In welk land is Prins Claus geboren?
   2. In which country was Prince Claus born?

5. 1. In welke periode leefde Julius Caesar?
   2. In which era did Julius Caesar live?

6. 1. Bij welke Spaanse club voetbalt Lionel Messi?
   2. For which Spanish football club does Lionel Messi play?

7. 1. Welke bekende hotelketen kun je herkennen aan een vogel op het dak?
   2. Which well-known hotel company can be recognised by the bird on the roof?

8. 1. Wat at Eva in het paradijs?
   2. What did Eve eat in Paradise?

9. 1. Welk dier is de beste vriend van Timon uit Disney's The Lion King?
   2. Which animal is the best friend of Timon from Disney's The Lion King?

10. 1. Op welke zender worden Shownieuws en Hart van Nederland uitgezonden?
    2. On which broadcasting channel ca none find programmes like Shownieuws and Hart van Nederland?

11. 1. Welke voorzitter van de D66 wil graag premier worden?
    2. Which party leader of the D66 wants to be minister-president?

12. 1. Wat is de naam van het gemene personage uit Star Wars?
    2. What is the name of the evil major character in Star Wars?

13. 1. Uit hoeveel cijfers bestaat een pincode van de bankpas?
2. How many digits are used for the code of a cash card?

14. 1. Hoe heten de gevechtsvliegtuigen die de regering heeft aangeschaft?
2. What is the name of the combat planes that were bought by the Dutch government?

15. 1. Op welke datum viert prinses Beatrix haar verjaardag?
2. On which date does princess Beatrix celebrate her birthday?

16. 1. Welke Nederlandse voetbalclub speelt zijn thuiswedstrijden in de ArenA in Amsterdam?
2. Which Dutch football club plays its home games in the ArenA in Amsterdam?

17. 1. In welke Nederlandse stad vind je de Erasmusbrug?
2. In which Dutch city does one find the Erasmus Bridge?

18. 1. Welke fastfood restaurantketen serveert voornamelijk kipgerechten?
2. Which fast food restaurant chain normally serves dishes consisting of chicken?

19. 1. Vanuit welke richting komt de zon op?
2. From which cardinal direction does the sun rise?

20. 1. Welke Amerikaanse president is onlangs gekozen?
2. Who has recently been elected as American president?

21. 1. Van welke Nederlandse bank was Gerrit Zalm de topman?
2. Of which Dutch bank has Gerrit Zalm been the top executive?

22. 1. Van welk land was François Hollande tot voor kort de president?
2. Of which country has François Hollande been president until recently?

23. 1. Door wie werd de zevenmijlslaars van de reus gestolen?
2. Who stole the seven-league boot that belonged to the giant?

24. 1. In welke stad vond de vliegtuigcrash ook wel bekend als de Bijlmerramp plaats?
2. In what city did the plane crash known as the Bijlmerramp take place?

25. 1. Hoe heet het Mexicaanse drankje dat je drinkt met een beetje zout op je hand?
2. What is the name of the Mexican drink that one takes with a little bit of salt on their hand?

26. 1. Waar werd Jezus geboren?
2. Where was Jesus born?

27. 1. Uit welk land komt George R. R. Martin die de boeken van Game of Thrones schreef?
2. From which country does George R. R. originate, author of the Game of Thrones books?

28. 1. Met welk typisch Zuid-Nederlands feest gaan volwassenen en kinderen verkleed de straat op?
2. During which typical Southern Dutch feast do adults and children dress up?

29. 1. Uit welk land komt Sinterklaas volgens de meeste liedjes?
2. From which country does Sinterklaas originate according to most songs?

30. 1. Hoe heet de zanger van de Ierse rockband U2?
2. What is the name of the singer of the Irish rockband U2?

31. 1. Wat staat er op de gang bij juffrouw Jansen?
2.What animal can be found in the corridor of Miss Jansen?

32. 1. Hoe heet de kat die het vogeltje Tweety altijd wil vangen?
2. What is the name of the cat who wants to catch the bird Tweety?

33. 1. Stond het huis van de grootmoeder van Roodkapje aan het meer of in het bos?
2. Was the house of Red Riding Hood's grandmother located near the lake of in the forest?

34. 1. Wat is de naam van de King of Rock n' Roll die stierf aan een overdosis?
2. What is the name of the King of Rock n' Roll who died because of an overdose?

35. 1. Wanneer wordt het Chinese nieuwjaar gevierd?
2. When do the Chinese celebrate New Year?

36. 1. Heeft Nederland in zijn geheel meer of minder dan 15 miljoen inwoners?
2. Does the Netherlands have more or fewer than 15 million inhabitants?

37. 1. Welk land in Azië werd in 2004 getroffen door een enorme vloedgolf?
2. Which country in Asia has been hit by an enormous tsunami in 2004?

38. 1. Hoe heet de eerste Pokémon van Ash uit de gelijknamige serie?
2. What is the name of the first Pokémon of Ash in the equally named animation series?

39. 1. Ligt Luxemburg aan een zee of bevindt het zich op het vasteland?
2. Is Luxembourg located next to a sea or next to another country?

40. 1. Is de grootste haven van Europa te vinden in Nederland of niet?
2. Is the biggest harbour in Europe located in the Netherlands or not?

41. 1. Door welke Nederlandse misdadiger werd Natalee Holloway vermoedelijk vermoord?
2. By which Dutch criminal has Natalee Holloway allegedly been killed?

42. 1. Wat is de naam van de oprichters van de politieke partij DENK?
2. What is the name of the founders of the political party DENK?

43. 1. Welke Amerikaanse acteur is mede bekend door zijn rol in de Nespresso reclames?
2. Which American actor is partly famous because of his role in the Nespresso advertisements?

44. 1. Wat is de naam van het dier dat een hoofdrol speelt in de film King Kong?
2. What is the name of the animal that played the main character in the film King Kong?

45. 1. Voor welke zender presenteert Piet Paulusma elke dag het weer?
2. For which broadcasting channel does Piet Paulusma present the weather?

46. 1. Aan welke grens moet volgens president Trump een muur worden gebouwd?
2. Against which border should a wall be built according to president Trump?

47. 1. Welk land ligt er ten noorden van het Verenigd Koninkrijk?
2. Which country can be found in the northern of the UK?

48. 1. Waaraan zijn mensen gelijk volgens Darwins theorie?
2. What kind of species is comparable to human beings according to Darwin's theory?

49. 1. In welk jaar begon voor Nederland de Tweede Wereldoorlog door Hitlers regime?
2. In what year did the Second World War start for the Netherlands because of Hitler's regime?

50. 1. Wat is heet logo op de auto's van Audi?
2. What does the logo of the cars by Audi look like?

51. 1. Welke stad in Frankrijk werd in 2015 geteisterd door een reeks aanslagen door IS?
2. Which town in France has been assaulted by a series of attacks by IS?

52. 1. Door welke Amerikaanse rockband wordt het liedje Nothing Else Matters gezongen?
2. Which American rockband wrote the song Nothing Else Matters?

53. 1. Wat is de naam van het beroemdste schilderij van Rembrandt van Rijn?
2. What is the name of the most famous painting by Rembrandt van Rijn?

54. 1. Hoe heet het land dat grenst aan België, Duitsland en Frankrijk?
2. What is the name of the country that has boundaries with Belgium, Germany, and France?

55. 1. Hoeveel graden zitten er in een cirkel volgens de wiskunde?
2. How many degrees does a circle have according to mathematics?

56. 1. Welke rivier stroomt er door de provincie Limburg?
2. Which river streams through the province of Limburg?

57. 1. Ligt Zeeland in het oosten of in het westen van Nederland?
2. Is Zeeland located in the east or in the west of the Netherlands?

58. 1. Wat is de naam van het Italiaanse ovengerecht dat opgebouwd is uit laagjes?
2. What is the name of the Italian oven dish that is made up of different layers?

59. 1. Wat is de naam van de hbo-campus in Nijmegen?
2. What is the name of the hbo campus in Nijmegen?

60. 1. Welk bekend beeld is te zien vanuit Manhattan?
2. Which famous monument can be seen from Manhattan?

61. 1.Op welke verdieping bevindt zich de Radboud Docenten Academie in het Erasmusgebouw?
2. On which floor can the Radboud Docenten Academie be found in the Erasmus building?

62. 1. Waarom is de Toren van Pisa zo bekend?
2. Why is the Tower of Pisa famous?

63. 1. Waaraan is de 27-jarige Amy Winehouse overleden?
2. What is the cause of death of the 27-year-old Amy Whinehouse?

64. 1. Is de Euro meer of minder waard dan de Britse Pond?
2. Does the Euro have more or less value than the British pound?

65. 1. Wat is de naam van de schrijver van Lord of the Rings?
2. What is the name of the author of the Lord of the Rings?

66. 1. In welk jaar vlogen er twee vliegtuigen in het World Trade Center in Amerika?
2. What is the exact year in which two planes hit the World Trade Centre in America?

67. 1. Hoe noemt men de situatie bij schaken waardoor de tegenstander geen kant meer op kan?
2. How does one call the situation during chess when the opponent has no moves left?

68. 1. Wat voor soort muziek speelde de Britse band One Direction?
2. What kind of music did the British band One Direction play?

69. 1. Welk Joods meisje uit Duitsland werd beroemd door haar dagboek?
2. Which Jewish girl from Germany became famous because of her diary?

70. 1. Welk dier blies twee van de drie huisjes van de biggetjes om in het bekende sprookje?
2. Which animal blew two out of three little houses of the piglets away in the well-known fairy tale?

71. 1. Wat gebeurde er tijdens de Koude Oorlog tussen Amerika en de Sovjet-Unie?
2. What happened during the cold war between the USA and the Soviet-Union?

72. 1. Hoe heet de grootste tegenstander van Harry Potter in de gelijknamige filmreeks?
2. What is the name of Harry Potter's biggest enemy in the films?

73. 1. Hoe noemt men de knal die volgens velen uiteindelijk leidde tot het ontstaan van de aarde?
2. How does one call the bang that supposedly led to the creation of the earth?

74. 1. Hoeveel spelers zijn er nodig om een volledig voetbalteam te vormen?
2. How many players are needed to form an entire football team?

75. 1. Wat wordt er gezongen tijdens Nederlandse evenementen en bij overwinningen door Nederlanders?
2. What song is sung during Dutch events and during victories by Dutch people?

76. 1. Tegen wat voor soort dier moet men vechten in de film Jaws?
2. Against what kind of animal did people have to fight in the film Jaws?

77. 1. Wie was er voor Willem-Alexander degene die op de troon zat?
2. Who was in charge of the Dutch country before Willem-Alexander?

78. 1. Welke nationaliteit heeft de schrijver Charles Dickens?
2. What nationality does the author Charles Dickens have?

79. 1. In welk verhaal begraaft het jongetje Sjakie zijn magische bonen?
2. In what story did the boy Jack bury his magical beans?

80. 1. Welk voorwerp zorgt er in het sprookje van Doornroosje voor dat ze honderd jaar zal slapen?
2. What kind of object causes Sleeping Beauty to sleep for a hundred years?

81. 1. Wie redde Roodkapje nadat ze werd opgegeten door de grote boze wolf?
2. After Red Riding Hood has been eaten, who saves her from the wolf?

82. 1. De bekende uitspraak “carpe diem” betekent wat precies?
2. What does the famous statement “carpe diem” mean?

83. 1. Uit hoeveel kleuren bestaat een regenboog?
2. Of how many colours does a rainbow consist?

84. 1. Hoeveel eieren zijn er nodig om een dozijn te vormen?
2. How many eggs are needed to form a dozen?

85. 1. Welke Nederlandse schaatser staat bekend om zijn foute wissel tijdens de Olympische Spelen in Vancouver?
2. Which Dutch skater is famous because of his wrong lane switch during the Olympic Games in Vancouver?

86. 1. In welke plaats in Nederland ligt het pretpark de Efteling?
2. In which town in the Netherlands can one find the amusement park the Efteling?

87. 1. Hoe heet het grote reuzenrad dat zich in Londen bevindt?
2. What is the name of the big wheel that is located in London?

88. 1. Welk muziekfestival wordt er elk jaar georganiseerd op 5 mei?
2. What music festival is being organised every year at the fifth of May?

89. 1. Welke planeet staat bekend door de ringen die eromheen draaien?
2. What planet is famous because of the enormous rings surrounding it?

90. 1. Wat is de thuisstad van de voetbalclub NAC?
2. What is the home city of the football club NAC?

91. 1. Wat is de naam van de roze panter uit de beroemde tekenfilmserie?
2. What is the name of the pink panther from the famous animation series?

92. 1. Wat is de naam van het vriendinnetje van Mickey Mouse?
2. What is the name of Mickey Mouse’s girlfriend?

93. 1. Wat organiseert het radiostation 3FM ieder jaar om geld in te zamelen voor het goede doel?
2. What is organised by 3FM every year in order to raise money for charity organisations?

94. 1. Wat is de naam van de Limburgse violist die regelmatig in Maastricht optreedt?
2. What is the name of the Limburgian violist who often plays in Maastricht?

95. 1. De Eiffeltoren is in welke bekende stad te vinden?
2. The Eiffel tower can be found in which famous city?

96. 1. Wat is de naam van de beste roodharige vriend van Harry Potter uit de gelijknamige filmreeks?
2. What is the name of the red-haired friend of Harry Potter in the equally named films?

97. 1. In welke hoofdstad in Nederland bevindt zich het theater Carré?
2. In what capital city in the Netherlands can one find the theatre of Carré?

98. 1. Wat is de naam van de politieke partij van Jesse Klaver?
2. What is the name of the political party of Jesse Klaver?

99. 1. In welke maand wordt de Dodenherdenking in Nederland gehouden?
2. In what month does the Netherlands organise Commemoration Day of the Dead?

100. 1. Welk soort soep wordt meestal klaargemaakt met stukjes worst erin?
2. What kind of soup is normally eaten with pieces of sausage in it?

101. 1. Wat is de naam van de oudste dochter van Willem-Alexander en Máxima?
2. What is the name of the oldest daughter of Willem-Alexander and Máxima?

102. 1. Wat is de beroemdste uitspraak van de overleden voetballer Johan Cruijff?
2. What is the most famous statement of the late football player Johan Cruijff?

103. 1. In welke plaats in Zuid-Holland ligt de Technische Universiteit?
2. In which city in South Holland can one find the Technical University?

104. 1. Wat voor soort programma jureert de Nederlandse zangeres Eva Simons?
2. For what kind of programme is the Dutch singer Eva Simons a judge?

105. 1. Wat is kenmerkend aan het logo van de auto's van Jaguar?
2. What is a feature of the logo of the Jaguar cars?

106. 1. Welk Chinees symbool omschrijft twee tegengestelde principes die overal in de wereld te vinden zijn?
2. Which Chinese symbol describes two opposite principles and can be found everywhere in the world?

107. 1. In welke Engelse stad vindt men de beroemde klokken van de Big Ben?
2. In which English city can one find the Big Ben?

108. 1. Met welk liedje werd zangeres Adèle in één klap beroemd?
2. With which song did Adèle suddenly become famous?

109. 1. Hoeveel Euro zou 1 Gulden waard zijn?
2. For how many Euros could one Gulden be exchanged?

110. 1. Welke van de volgende steden is de hoofdstad van Duitsland: Keulen, Bonn, Berlijn of Düsseldorf?
2. Which of the following cities is the capital city of Germany: Köln, Bonn, Berlin, or Düsseldorf?

111. 1. Welke president regeerde de VS tijdens de aanslagen van 9/11?
2. Which president reigned the VS during the attacks of 9/11?

112. 1. Welke Amerikaanse miljardair is bekend om zijn computerprogramma Microsoft?
2. Which American billionaire is famous because of his software programme Microsoft?

Appendix E: Practise trials Dutch

1. Wat werd er gezongen tijdens de bekende kinderserie toen de bedelaar Swiebertje arriveerde?
2. Wat voor soort muziek speelde de bekende saxofonist Miles Davis?
3. Wat is de naam van de Portugese club waar Cristiano Ronaldo op dit moment voor speelt?
4. Welk symbool kan worden gevonden op het hoofd van de gele teletubbie Lala?
5. Welke Russische stad werd voor een lange tijd belegerd tijdens de tweede wereldoorlog?
6. Wat gebeurde er met de Libische leider Khadaffi na de start van de revolutie?
7. Welke kleuren heeft de Duitse vlag?
8. Uit hoeveel kamerleden bestaat ons kabinet?
9. Heeft China meer of minder inwoners dan Rusland?
10. Waarom werd ex-president Barack Obama niet voor een derde keer president?

Appendix F: Practise trials English

1. What is the name of the president of Germany?
2. What happened to Dasher's nose when he was helping Santa with his sleigh?
3. Against what kind of mills did the hero Don Juan fight in the famous Spanish novel?
4. What is the name of the Dutch group consisting of three sisters that represented our country during the Eurovision contest in 2017?
5. Of which country is Madrid the capital city?
6. What is the name of the Dutch presenter of De Wereld Draait Door?
7. What is the name of the politician who was minister-president of the Netherlands before Mark Rutte?
8. How many days can normally be found in a year?
9. What is the name of the biggest railway company in the Netherlands?
10. Why does the mean stepmother in Snow White want to kill her?

Appendix G: Questionnaire behavioural study (sentential judgement task)

Vragenlijst MA Thesis Experiment

Geslacht: 0 man 0 vrouw

Leeftijd: _____

Welke studie doe je momenteel? _____

Moedertaal: _____

Spreek je nog andere talen?: _____

_____

Hoe goed zou je je Engels inschatten? (1 = heel slecht; 7 = heel goed)

0	0	0	0	0	0	0
1	2	3	4	5	6	7

Hoe goed zou je je eigen algemene kennis inschatten, ten opzichte van je medestudenten? (1 = heel slecht; 7 = heel goed)

0	0	0	0	0	0	0
1	2	3	4	5	6	7

Heb je enig idee wat het doel van dit experiment was? _____

_____

Bedankt voor je deelname!