# Bachelor Thesis

*The effect of non-native language use in video instructions on comprehensibility*


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# Abstract

The present study focuses on the language used and the presentation of information in instruction videos that show how to perform a certain task. The aim of this study was to discover whether language use influences the comprehensibility of these instruction videos and whether gender plays a role. Research on the dual coding theory, which states that information is best recalled when it is presented visually and verbally at the same time, has mostly been conducted on information presented in L1. To see if the same results hold for information presented in L2, two instruction videos that showed how to build a Lego were designed: one with spoken Spanish without subtitles and one with spoken Spanish and Dutch subtitles. None of the participants that took part in the present study had any prior experience with the Spanish language. Participants watched either one of the instruction videos and, simultaneously, built the Lego house. The correctness of the house was checked in terms of overall correctness and correctness in terms of the colour, shape, and place used, with higher correctness being due to higher comprehensibility of the video. The results showed that watched the video with subtitled had better overall comprehensibility and used the correct colour and shape more often than participants that watched the video without subtitles. Additionally, male participants showed higher overall comprehensibility and comprehensibility in terms of place and shape. It was also discovered that the attitude towards the video seemed to influence the correctness of the building, and, thus, the comprehensibility. The results of this study could provide insights into the effectiveness of (instruction) videos in a foreign language and of subtitling in instruction videos.

# Introduction

Whereas it was difficult to stay informed in the past, there have been many developments that have made this easier. The Web 2.0 era, which we are in now, trademarked by the surge of social media and the change of the Internet into a means of communication, has offered new possibilities. As a result, it has become increasingly easier for companies to communicate with their consumers through these 'new media', which are characterized by their non-linear structure, the use of many different symbols, and their interactivity (Schwan & Riempp, 2004). The new media can have many different purposes, of which the most prominent one is reaching the intended audience.

Therefore, as a direct result, companies have adapted their strategies to include these 'new media'. An example of this change can be found in the design of instructions. Whereas, in the past, companies could only give out instructions using print, recently, instruction videos have become A well-known example of a company that uses this type of videos is IKEA. The US branch of the company has its own 'How to build' series on their YouTube channel where they explain the correct way of constructing the furniture. The fact that these videos are popular can be observed by the views they have gathered. Their video on how to build the 'IKEA Pax Wardrobe', for example, has amassed over 500,000 views, not counting the number of people who have watched them on the official IKEA website, where the videos are also posted. This example shows the main advantage of instruction videos, namely, they offer a more exciting form of presenting information. Because of this, they could be perceived as attractive, which could lead to a positive evaluation of product and company. Furthermore, video instructions are widely and easily accessible and easier to memorize (Mayer & Anderson, 1991).

Even though instruction videos seem to have many advantages and are popular nowadays, not many studies have been conducted in this field. That is why the present study aims to discover what a good instruction video must look like.

# Theoretical Framework

## Types of instructions

As stated above, the decision of what type of instructions should be used is an important one, and each type has its advantages and disadvantages. While written instructions on paper have proven to be effective in the past, they can be perceived as boring and it can cost companies a lot of revenue if they are not understood by the public. As mentioned before, video instructions could be perceived as more attractive than text-based instructions. Another advantage of the use of instruction videos is that they often use dual coding and present information both verbally and visually. The dual-coding theory states that information will be remembered and transferred better if it is processed verbally as well as visually (Mayer & Anderson, 1991). The reasoning behind this theory is that the information will be stored in the memory twice, and, therefore, the information can be found in two separate ways. Building on that, the integrated dual-code hypothesis predicts that connections can be made between the verbal and visual information (Mayer & Anderson, 1991). Therefore, instruction videos that use dual coding could reduce memory load by using multiple channels, which could make them more effective than text-based instructions.

Several researchers have investigated this field of study. One of the studies was conducted by Choi and Johnson (2005) and looked at whether text-based or video-based instructions worked better for students and found significant differences with respect to students' motivation in terms of attention and retention, which higher for the video-based instructions than for the text-based ones. This could be attributed to people thinking video-based instructions are more attractive than text-based instructions and that test-based instructions are often not read. What could, thus, be concluded from this study is that it is easier to pay attention and to remember video-based than text-based instructions.

However, it should be mentioned that the study by Choi and Johnson (2005) was conducted in an educational context, which differs from the context of the instruction videos used in this study, which shows viewers how to perform a task. There are several differences between these two contexts. The main difference is the purpose of the video. The purpose of an educational instruction video would most likely be to achieve retention, since it intends to teach information that will be remembered. For the instruction videos used in the present study, however, retention could, potentially, be of lesser importance, as the goal is not to have viewers remember the information presented, but to have them perform the task accordingly.

However, for some instruction videos, retention is of importance. This is the case for instruction videos that show how to operate certain (electronic) devices, such as video-cameras or computers. For these kinds of videos, retention is important, since they, essentially, aim to 'teach' consumers how to use the product. Therefore, the studies conducted on educational instruction videos can still be useful in the context of the present study if we keep in mind that the aim might be different from the type of instruction videos used in this study.

Furthermore, another study conducted by Castro-Alonso, Ayres, and Paas (2015) investigated the effectiveness of animation (without audio) or static frames when completing a Lego task. Students viewed instructions with static frames or an animation in either a physical or virtual environment. Participants looked at the instructions, performed the task, then filled in a self-rating scale on mental effort, and then repeated all the steps mentioned before. The researchers found that, for the first time the task was performed, learning outcomes were higher for the video that showed an animation than for the video that showed static pictures. However, the same result was not found for the repeated performance of the task, but this could be due to the fact that this was the second time the participants performed the task. The use of animations in educational contexts seems to have more advantages, since it supports visualization of a dynamic phenomenon, it could help visualize phenomena that are difficult to conceive, and it could enable learners to explore these phenomena (Betrancourt, 2005).

To conclude, the studies mentioned above show the advantages of video-based instructions, whether it be an animation or an actual real-life video. However, it should again be noted that all studies mentioned above were conducted in an educational context, which is different from the context of the instruction videos used in this study.

## The presentation of information

As stated above, according to the dual coding theory, presenting information verbally and visually leads to better retention. This theory is supported by Baggett (1984), who concluded that participants that were provided with both a visual presentation of information as well as a narration lead to better recall. However, arguments can be found for only using one of the two ways of presenting information. For example, visual instructions can be used on multiple markets since they are not restricted to a language, and are, therefore, cost-effective.

Several studies have been conducted on this subject. Mayer and Anderson (1991), for example, focused on the difference between the use of verbal and visual instructions simultaneously and the use of verbal before visual instructions. The visual instructions consisted of an animation, while a male's voice gave the verbal speech instructions. They studied the problem-solving abilities of two groups who had seen an animation showing the operation of a bicycle tire pump with a verbal description either given before or during the animation. The group that saw the animation and received the verbal description at the same time (words-with-pictures) performed better on a test involving questions on the animation they had watched than the group that received the verbal description before seeing the animation (words-before-pictures).

Furthermore, they found that the words-with-pictures group had better results on a problem-solving test involving questions about the operation of a bicycle tire pump than people who saw only saw the animation or only received the verbal instructions (Mayer & Anderson, 1991). This shows that receiving both visual and verbal instructions at the same time when performing a task leads to the best results. However, the participants that took part in this study received all types of instructions in their own language. Another thing that should be noted is that all students that participated were 'mechanically naïve' and were selected for the little experience they had with the use or repair of mechanical devices. This could also be of influence in the study and results could be different if the participants had already had previous experience with the subject of the experiment. For the present study, participants will not be selected on their experience with the task they will perform. Therefore, it is expected that participants will have varying degrees of experience with the task used in this study. This is useful, since the type of instruction video used in this experiment would have to serve all kinds of consumers, ranging from people who have a lot of experience with the subject to people who have little to no experience with the subject. Furthermore, we expect varying degrees of skills, since people's natural ability when performing a task such as the one in this study will differ.

Thus, both studies show that presenting visual and verbal instructions simultaneously leads to the best results regarding immediate recall. As it can be expected that some viewers will watch instruction videos before performing the task, as opposed to watching the video and performing the task simultaneously, immediate recall is important for a successful completion of the task.

## Language use in instruction videos

Now that it has been concluded that presenting verbal and visual information simultaneously has the best results, the question arises of whether the dual coding theory is still relevant if the verbal information is presented in a foreign language (L2). To make comprehension easier when this is the case, the decision can be made to provide a spoken text in the viewer's own language (dubbing) or provide a written text at the bottom of the screen in the viewer's own language (subtitling).

Which of these two options fits the video best depends (partly) on the country in which the company wants to show the video, since the appreciation for either of the choices differs among countries (Perego et al, 2016). The countries they analysed were Italy and Spain, where dubbing is most frequently used, and Poland and Dutch-speaking Belgium (Flanders), where subtitling is most frequently used. Perego et al (2016) found that, for films, subtitling was effective for all countries, and that, even though the familiarity with subtitling did not matter, it was not appreciated equally among the participants. The finding that subtitling works no matter the norm regarding subtitling or dubbing is supported by Matamala, Perego, and Bottiroli (2017), who found no significant differences regarding comprehension of films among Spanish young-adults. However, they did find a preference for dubbing over subtitling, which is to be expected, since dubbing is the norm in Spain.

To conclude, there is some support for the effectiveness of subtitling in film, both for countries that mainly use subtitling and for countries that mainly use dubbing. However, all of these studies have investigated dubbing versus subtitling in films, which differs from instruction videos. The main reason why the two differ is that, for films, viewers would be able to understand what is happening even if they do not follow everything that is said. However, for instruction videos, it is much harder to deduce what is happening from the context, and it is, thus, more important that viewers pay attention to the language that is used, since every single detail needs to be understood. Therefore, the cognitive load could be higher.

This cognitive load could be increased even more by subtitling, since it provides the viewer with another channel to store information in besides the visual and spoken information they receive, even though the latter is provided in an L2. This could lead to split attention and, therefore, it could be argued that subtitling distracts from the spoken and visual information. However, Kruger, Doherty, and Soto-Sanfiel (2017) discovered that subtitling, in general, did

not serve as a distraction to the visuals, and did not lower the comprehension of the fictional reality of films. Nonetheless, Perego, Del Missier, and Stragà (2018) found contradicting results. According to them, the higher the complexity of the film was, the higher the processing effort needed was. Moreover, they found that, for more complex subtitled films, cognitive performance was lower, but appreciation was not.

It could be argued that the findings of As Perego, Del Missier, and Stragà (2018) will hold for instruction videos, since it is important to catch every detail that is happening in the video, which is the reason why the cognitive load could be even higher and memory even lower. Additionally, Baddeley and Hitch (1974) found that memory affected reading comprehension. This could mean that the effect of the of subtitles will be lower when cognitive load is high and memory capacity is low, since the reading comprehension will be lower.

## Gender and instructions

When looking at cognitive load, gender could be an interesting aspect to analyse, since gender differences exist in memory capacity. Speck et al (2000) found that the memory capacity of men was higher than that of women. Furthermore, men had a faster reaction time than women. Besides this study, this field is still mainly undiscovered. The few studies that have been done have focused on the relationship between gender and animation in a science context. Yezierski and Birk (2006), for example, looked at whether computing animations showing the particle behaviour of water helped students clear up their perception of the subjects, and whether there was a difference in gender for the effectiveness of these animations. They found that the computer animations were more effective for female students than for male students. They do, however, acknowledge that this difference could be due to gender differences in spatial ability, since men have a higher spatial ability than women (Yezierski & Birk, 2006). This would mean that, while women needed the animations to visualize the behaviour of water particles, men would be able to visualize the concept without the help of animations. Another study by Jacek (1997) discovered that, in learning physical science concepts, the use of animations helped improve the long-term learning of women. However, this was not the case for men.

Wong et al (2015) is one of the very few studies to look at the relationship between gender and instruction videos. They looked at gender differences in learning and performing manipulative tasks. Participants were asked to perform a task after either watching an

animated video or a static video. The women's scores were significantly higher for the animated condition, while men scored better on the static condition. They concluded that gender is an important factor in this specific context (Wong et al, 2015).

To summarize, while some research has been conducted in this field, many things are still unclear and require more research before conclusions can be drawn. Firstly, all studies on the use of dubbing versus the use of subtitling have focused on films, which differ from instruction videos. Therefore, additional research is needed to find out whether the findings for instructions videos are similar to the findings for films.

Furthermore, the studies that have been conducted on the gender aspect have mostly focused on an educational context, except for the study conducted by Wong et al (2015). More research is necessary to find out whether gender differences exist for the comprehensibility of instruction videos.

Moreover, the result that Baddeley and Hitch (1974) found, which states that working memory could influence reading comprehension could be explored more. This study would be especially interesting to look further into, since it ties in well with the study conducted by Speck et al (2000) on gender differences in memory accuracy and reaction time. Since the memory accuracy of men seems to be higher, it could be argued that their reading comprehension could be affected less than that of women, since their memory accuracy was found to be lower. This could lead to men having higher retention and faster reaction time to videos with subtitles.

Since the studies mentioned above have found contrasting results on (the effectiveness) of types of presenting verbal information, the present study aims to offer an insight into these types of verbal information that can be provided in an instruction video. The aim is to find out whether comprehension of an instruction video can be influenced by the language in which the instructions are presented, either visually or verbally. Therefore, the following research question was developed: To what extent does non-native language use in instruction videos influence comprehensibility and to what extent do differences in gender exist?

To analyse the research question, two hypotheses have been set up. The first hypothesis deals with the differences between the two instruction videos. One video has Spanish verbal instructions without subtitles and the other Spanish verbal instructions with Dutch subtitles. The most obvious choice for a non-native language in the Netherlands is most

likely English, as it is a good language for instructions. However, the majority of the Dutch population has at least some experience with the English, and, for the experiment carried out in the present study, it is important that participants have no prior experience with the language used in the video instructions. Therefore, to make the selection of participants easier, the decision was made to use the Spanish language instead. This choice was made, because there are a lot more Dutch persons with low proficiency in Spanish then there are with low proficiency in English. This made it easier to find participants that could take part in the study.

*H1: It is expected that participants that watch the instruction video with subtitles will score higher on the correctness of the building than participants that watch the instruction video without subtitles.*

To analyse the difference between men and women, the second hypothesis was created. Since previous research conducted by Wong et al (2015) showed that women scored higher on task performance after watching an animated video, we expect higher scores for women for the performance of the task that will be used in this study.

*H2: Women are expected to score better on the correctness of the building than men for both the video in the non-native language with subtitles and the video in the non-native language without subtitles.*

To discover whether the attitude towards the instruction videos regarding the video in itself and the audio has an influence on how the Lego house is built, the following hypothesis was developed.

*H3: The attitude towards the instruction videos in terms of video and audio influences the correctness of the Lego house.*

The results of the present study could potentially be useful to companies in discovering whether they should adapt their (instruction) videos to local markets. Furthermore, the analysis could provide the results of the effectiveness of subtitles in instruction videos, and whether their absence in a viewer's native language has an influence on the comprehensibility. Moreover, it could provide an insight into the differences in gender regarding the comprehensibility of video instructions in a non-native language.

# Method

## Materials

The materials used consisted of two instruction videos and a Lego set. The instruction videos were used to inform the participants on how to build a Lego house. The instruction videos were exactly 04:22 minutes long, with one explaining the task in spoken Spanish without subtitles and the other explaining the task in spoken Spanish with Dutch subtitles. The two videos featured the exact same instructions, which made the addition of subtitles the only difference. The subtitles were provided in white letters at the bottom of the video and were a translation of the spoken instructions provided in Spanish.

Furthermore, a Lego set was provided to the participants to build the Lego house with. This Lego set included bricks in five different colours (blue, red, green, white, and yellow) in two different sizes (single or double) and a green plate. In total, participants were given 75 Lego bricks, of which 48 were needed to build the Lego house correctly. The division of the bricks can be found in Appendix 1.

The Lego house consisted of 10 layers, including a rooftop and a chimney. The correct version of the Lego house can be seen in figure 1.

Figure 1. The finished Lego house

## Subjects

In total, 105 participants took part in the experiment. However, 2 participants failed to fill in the questionnaire. Therefore, their data was excluded from the analysis. After removing these participants, the data of 55 men (52%) and 48 women (46%) was analysed. The mean age of the participants was 29.90 (*SD* = 15.48), with ages ranging from 17 to 79. Male participants (*M*= 30.18, *SD*= 15.58) were overall slightly older than female participants (*M*=29.57, *SD*=15.53).

As stated before, two instruction videos were used in the experiment, one with and one without subtitles. The video with subtitles was viewed by 53 participants, of which 28 were male and 25 were female, while the video without subtitled was viewed by 50 participants, of which 27 were male and 23 were female. A Chi-square did not show a significant relation between gender and type of instruction video ($X^2$ (1) = .014, *p* = .905). Therefore, the distribution of gender between the two videos was equal.

Furthermore, the mean age of the participants that viewed the subtitled instruction video was 28.27 (*SD*= 14.80), with an age range between 17 and 79. The mean age of the participants that viewed the video without subtitles was 31.60 (*SD*= 16.14), with the youngest participant being 17 and the oldest being 73 years old. An independent samples t-test did not show a significant difference between the condition without subtitles and the subtitled condition with regard to age (*t* (100) = 1.087, *p* = .280). Therefore, there was an even distribution of age between both videos.

Additionally, the educational level of the participants differed. 20 participants graduated from MBO (19%), 34 from HBO (33%), and 44 went to university (43%). Additionally, 5 participants stated that they still went to high school (5%). A Chi-square showed a significant relation between educational level and type of instruction video ($X^2$ (3) = 7.89, *p* = .048). There were relatively more participants that studied at MBO level in the condition without subtitles (28%) than in the subtitled condition (11%). Furthermore, there were significantly more participants that studied at WO level in the subtitled condition (55%) than in the condition without subtitles (30%).

## Design

A between-subjects design (2x2) was used in the experiment, since there were two instruction videos (spoken Spanish with Dutch subtitles and spoken Spanish without Dutch subtitles) and two groups of participants (men and women). A random selection was made of which subjects will see which video.

## Instruments

Two instruments were used to discover differences between the comprehensibility of the two instruction videos. Firstly, the correctness of the Lego house was measured by using a scoring sheet. For each Lego brick, we measured the colour, shape, and place. Appendix 2 shows the scoring sheet that was used to measure the correctness of the building. Additionally, appendix 3 shows the key to the scoring form.

Furthermore, two questionnaires were used. One was filled in by the participants that watched the instruction video without subtitles and the other one by the participants that watched the instruction video with subtitles. It included various constructs, inquiring about:

- Attitude towards the video

The attitude towards the video was measured using six items. A couple of examples of items used to measure this construct will be provided below. The items were originally provided to the participants in Dutch, but an English translation will be given here.

*I thought the instruction video was clear (strongly agree (1) – strongly disagree (5))*
*I thought the instruction video was not interesting (strongly agree (1) – strongly disagree (5))*

The reliability of 'attitude towards the video', comprising of six items, for the instruction video without subtitles was poor: $\alpha = .55$. However, it improved when the item 'not interesting' was deleted: $\alpha = .63$. For the version with subtitles, reliability was questionable: $\alpha = .67$. It did get slightly better if the item 'not interesting' got deleted: $\alpha = .68$. Therefore, it was decided to compute all the items, except 'not interesting' into one variable.

- Attitude towards the audio

The attitude towards the audio, which was in Spanish, was measured using six items. An example of an item used in this section will be given below. Again, the original items were presented in Dutch, so the examples given here is are translations.

*The spoken language in the instruction video was easy to follow (strongly agree (1) – strongly disagree (5))*
*The spoken language in the instruction video distracted from the task (strongly agree (1) – strongly disagree (5))*

The reliability of 'attitude towards the audio', comprising of six items, for the version without subtitles was questionable: α = .68. For the version with subtitles, it was poor: α = .55. The items were computed into one variable. [1].

All the questions mentioned above were measured on a 7-point Likert scale. Furthermore, we inquired about age, gender and education level. Appendix 4 shows the full questionnaire for the video without subtitles, whereas Appendix 5 shows the full questionnaire for the video with subtitles.

## Procedure

Participants were recruited at convenience. However, special attention was paid to gender and age to ensure a diverse group of participants. Participants were asked kindly to participate in the experiment, but were not given a reward or other incentive.

All experiments were conducted on an individual basis with no one else present except for the participant and the experimenter. Firstly, they were provided with the information document including the aim of the experiment (Appendix 6). After that, they were asked to sign the consent form. Before the experiment began, participants were instructed following the instruction document created so that each participant received the exact same instructions. Participants were, for example, told that they were not allowed to pause or rewind the video. Furthermore, they were told to start building as soon as the video starts. It was also explained that the aim was to follow the instructions to the best of their ability. The document with all the instructions can be found in Appendix 7.

The set-up for the experiment was the same for each participant so it could not influence the correctness of the building. The green plate was placed directly in front of the participants with the Lego bricks on the sides. The laptop on which the instruction video was shown was placed behind the plate and bricks. The entire set-up for the experiment can be seen in figure 2.

[1] We are aware that the Cronbach's α were too low to compute the items into one variable. However, separate analyses would be beyond the scope of this thesis. Therefore, the decision was made to compute the items into one variable.

Figure 2. The set-up of the experiment

After participants finished building the Lego house, they were provided with the questionnaire on a computer screen. All participants were debriefed at the end of the experiment and were asked not to disclose any information about the experiment to other participants that had yet to take part in the study.

On average, the experiment lasted between 10-15 minutes. However, some participants took longer to build the Lego house. Furthermore, some had questions about the experiment or about the correctness of their building.

## Statistical Treatment

To measure the effect of the type of instruction video and/or gender on the comprehensibility of those videos, several two-way univariate analyses of variance with between-subjects factors were used. Furthermore, a multiple regression analysis was used to predict the effect of the attitude towards the video and audio on the correctness of the building.

# Results

Gender and type of instruction video on correctness of building

Firstly, a two-way analysis of variance with gender (men and women) and type of instruction video (with and without subtitles) as factors showed a significant main effect of gender on the correctness of building ($F$ (1, 96) = 8.36, $p$ = .005). Men ($M$ = 87.34, $SD$ = 11.17) scored higher on the correctness of the building than women ($M$ = 79.73, $SD$ = 15.58).

Furthermore, type of instruction video was found to have a significant main effect on correctness of building ($F$ (1, 96) = 4.52, $p$ = .036). Participants who watched the instruction video with subtitles ($M$ = 86.50, $SD$ = 12.82) scored higher on correctness of building than participants who watched the video without subtitles ($M$ = 81.18, $SD$ = 14.44). The table with all means and standard deviations can be found in the table below (Table 1).

There was no interaction effect. Since Levene's test indicated unequal variances ($F$ = 3.54, $p$ = .017), three random participants from the condition with subtitles (one man and two women) were removed from the data set to get an equal number of participants per condition.

Table 1. Means and standard deviations (between brackets) for the correctness of building in function of gender and type of instruction video (in percentages)

| Gender | Type of instruction video | *M* | *SD* | n |
|---|---|---|---|---|
| Male | Without | 86.28 | 9.06 | 27 |
| | With | 88.39 | 13.04 | 27 |
| | Total | 87.34 | 11.17 | 54 |
| Female | Without | 75.19 | 17.27 | 23 |
| | With | 84.27 | 12.45 | 23 |
| | Total | 79.73 | 15.58 | 46 |
| Total | Without | 81.18 | 14.44 | 50 |
| | With | 86.50 | 12.82 | 50 |
| | Total | 83.84 | 13.85 | 100 |

Gender and type of instruction video on correctness of colour

Similarly, to the previous results, Levene's test indicated unequal variances for these data ($F$ =3.73, $p$ = .014). Therefore, the same data set as in the previous section was used. Then, a two-way analysis of variance with gender (men and women) and type of instruction

video (with and without subtitles) as factors showed no significant main effect of gender on correctness of the building in terms of colour ($F$ (1,96) = 2.86, $p$ = .094).

Furthermore, a significant main effect was found of type of instruction video on correctness of building in terms of colour ($F$ (1,96) = 4.21, $p$ = .043). Participants that watched the instruction video with subtitles ($M$ = 93.50, $SD$ = 9.22) scored higher on the correctness of colours than participants that watched the instruction video without subtitles ($M$ = 89.21, $SD$ = 12.58). Additionally, there was no interaction effect. The table with all means and standard deviations can be found in the table below (Table 2).

Table 2. Means and standard deviations (between brackets) for the correctness of colour of the building in function of gender and type of instruction video (in percentages)

| Gender | Type of instruction video | *M* | *SD* | *n* |
|---|---|---|---|---|
| Male | Without | 92.05 | 8.01 | 27 |
| | With | 94.06 | 7.96 | 27 |
| | Total | 93.06 | 7.97 | 54 |
| Female | Without | 85.87 | 15.98 | 23 |
| | With | 92.84 | 10.66 | 23 |
| | Total | 89.36 | 13.88 | 46 |
| Total | Without | 89.21 | 12.58 | 50 |
| | With | 93.50 | 9.22 | 50 |
| | Total | 91.34 | 11.18 | 100 |

Gender and type of instruction video on correctness of shape

A two-way analysis of variance with gender (men and women) and type of instruction video (with and without subtitles) as factors showed a significant main effect of gender on correctness of the building in terms of shape ($F$ (1,99) = 10.78, $p$ = .001). Men ($M$ = 80.68, $SD$ = 16.42) scored higher on the correctness of the shape of the Lego bricks than women ($M$ = 70.44, $SD$ = 18.56).

Furthermore, type of instruction video was found to have a significant main effect on correctness of the building in terms of shape ($F$ (1,99) = 16.18, $p$ < .001). Participants that watched the video with subtitles ($M$ = 81.96, $SD$ = 15.45) scored higher than participants that watched the video without subtitles ($M$ = 69.50, $SD$ = 18.65). Finally, there was no interaction effect. The table with all means and standard deviations can be found in the table below (Table 3).

Table 3. Means and standard deviations (between brackets) for the correctness of shape of the building in function of gender and type of instruction video (in percentages)

| Gender | Type of instruction video | *M* | *SD* | *n* |
|---|---|---|---|---|
| Male | Without | 76.54 | 16.81 | 27 |
| | With | 84.67 | 15.28 | 28 |
| | Total | 80.68 | 16.42 | 55 |
| Female | Without | 61.23 | 17.55 | 23 |
| | With | 78.92 | 15.37 | 25 |
| | Total | 70.44 | 18.56 | 48 |
| Total | Without | 69.50 | 18.65 | 50 |
| | With | 81.95 | 15.45 | 53 |
| | Total | 75.91 | 18.11 | 103 |

Gender and type of instruction video on correctness of place

Levene's test indicated unequal variances for these data ($F$ =5.38, $p$ = .002). Therefore, the same data set as in the previous sections was used. A two-way analysis of variance with gender (men and women) and type of instruction video (with and without subtitles) showed a significant main effect of gender on correctness of the building in terms of place ($F$ (1,96) = 7.42, $p$ = .008). Men ($M$ = 88.54, $SD$ = 14.02) scored higher on the correctness of the place of the Lego house than women ($M$ = 79.35, $SD$ = 19.46).

Furthermore, no significant main effect was found of the type of instruction video on the correctness of the building in terms of place ($F$ (1,96) <1). Additionally, there was no interaction effect. The table with all means and standard deviations can be found in the table below (Table 4).

Table 4. Means and standard deviations (between brackets) for the correctness of place of the building in function of gender and type of instruction video (in percentages)

| Gender | Type of instruction video | *M* | *SD* | *n* |
|---|---|---|---|---|
| Male | Without | 90.28 | 9.12 | 27 |
| | With | 86.81 | 17.65 | 27 |
| | Total | 88.54 | 14.02 | 54 |
| Female | Without | 77.54 | 22.56 | 23 |
| | With | 81.16 | 16.11 | 23 |
| | Total | 79.35 | 19.46 | 46 |
| Total | Without | 84.42 | 17.71 | 50 |
| | With | 84.21 | 17.02 | 50 |
| | Total | 84.31 | 17.28 | 100 |

Attitude towards the video and audio

A multiple regression analysis showed that the variables entered, Attitude towards the video and Attitude towards the audio, explained 7% of the variance in the correctness of the building ($F$ (2,100) = 4.53, $p$ = .013). Attitude towards the video was shown to be a significant predictor of the correctness of the building (β = -.22, $p$ = .029), but attitude towards the audio was not (β = -.13, $p$ =. 218).

# Conclusion and Discussion

The aim of this study was to measure in what way language use in instruction videos could influence the comprehensibility of these videos. Furthermore, we wanted to look at whether differences could exist between men and women. Therefore, several hypotheses were developed.

Type of instruction video and correctness of building

The first hypothesis assumed that participants who watched the instruction video with subtitles would score higher on the correctness of the building than participants that watched the instruction video with subtitles. This hypothesis looked at the overall correctness of the building and the correctness in terms of colour, shape, and place. For the overall correctness, participants that watched the instruction video with subtitles did indeed score higher on the correctness of the building than participants that watched the video without subtitles. The same result was found for colour and shape, but not for place. Therefore, we can conclude that, overall, support for H1 was found.

These results support the dual coding theory which states that information is best recalled if it is presented verbally and visually at the same time (Baggett, 1984; Mayer & Anderson, 1991). Furthermore, subtitling did not lead to split attention and did not distract from the task, since participants in that condition scored higher on three of the four ways in which we measured the correctness of building. This supports the findings of Kruger, Doherty, and Soto-Sanfiel (2017), but does not support the results of Baddeley and Hitch (1974). However, no support could be found for Perego, Del Missier, and Stragà (2018), who found that higher complexity (of the film), the higher the cognitive load for processing the subtitles. This could, however, be due to participants not experiencing the task at hand as complex.

It should, again, be mentioned that the aim of instruction videos differs from the aim of films, and that both the study by Kruger, Doherty, and Soto-Sanfiel (2017) and the study by Perego, Del Missier, and Stragà (2018) analysed films. The main difference is the fact that, for films, viewers do not have to be able to follow every single detail to understand the message, whereas, for instruction videos, it is important to understand the details. We, therefore, argued that cognitive load would be higher for instruction videos than for films. However, as the study of Perego, Del Missier, and Stragà (2018) dealt with complex subtitled

films, which had a higher processing effort, the results of this study are definitely still relevant for the present study.

Furthermore, even though there was a difference in the correctness in terms of colour between the two conditions, the correctness in terms of colour was the highest out of the four ways we measured the correctness of building. This makes it an interesting topic to investigate further. It could be argued that participants would score equally on the correctness of colour, since it is clearly visible in both videos what colour is used. However, this is not the case. This can partially be explained by the top two layers of the building, where participants had to build a chimney. Red Lego bricks were used to build the chimney in the video, but the spoken and written verbal instructions stated that green Lego bricks should be used if participants had any left. If participants used the correct colours for the other layers, which the results show they did, they should have enough green Lego bricks left to build the chimney using the correct colour. However, participants that watched the instruction video without subtitles missed these instructions. This could be the reasoning behind the difference of correctness in terms of colour.

Another aspect that could have been of influence for the results was the selection of participants. Participants were not selected on their experience with the task at hand, which differs from the study conducted by Mayer & Anderson (1991) which only used participants that were not familiar with the task at hand. For the task used in the present study, it was assumed that familiarity did not influence the comprehensibility and, therefore, not how the task was performed. However, it could be that participants that had performed similar tasks with Lego before the experiment understood the task better than those who had not. This provides an interesting topic for further research.

Gender and correctness of building

Additionally, the second hypothesis assumed that women would score better on the correctness of the building for the instruction videos. However, little support was found for this hypothesis, as the male participants scored higher on the overall correctness of the building and the correctness in terms of place and shape. Nonetheless, they did not score higher on the correctness in terms of colour. However, overall, the correctness in terms of colour was the highest out of the four ways we measured the correctness of building.

The results found on gender differences are intriguing, since they study partially contradict the results of the studies that have been conducted in this field, which discovered

that women scored better than men when provided with an animated video (Jacek, 1997; Wong et al, 2015; Yezierski & Birk, 2006). In contrast, this study found that men performed better than women for both videos. However, the difference between an animated video and the instruction videos used in the present study should be noted. Further research would have to show the difference between animated instruction videos and the type of instruction videos used in this study.

Nonetheless, the results are in line with those found by Speck et al (2000), who found that men had a faster reaction time and higher memory accuracy. It has been argued before that recall and retention is of importance for certain types of instruction videos, such as those showing how to operate electronic devices. Since the aim of these videos differs from the aim of the instruction videos used in the present study, it could be interesting to discover whether the same results with regard to memory accuracy and recall hold for the other type of instruction video.

Attitude and correctness of building

Moreover, the third hypothesis assumed that the correctness of building is affected by the attitude towards the video and the audio. This hypothesis is supported partially, as the attitude towards the video did have an effect on the correctness of the building, but the attitude towards the audio did not. Therefore, it can be concluded that comprehensibility could be influenced by the attitude towards the video.

There could be several explanations for the reasons why attitude towards the video played a part in the comprehensibility. It could simply be the case that a positive attitude towards the video was due to participants finding the use of a video attractive. Support for this can be found by looking at the instruction videos used in an educational context, which established that video-based instructions tended to lead to higher learning outcomes than text-based instructions or animations (Castro-Alonso, Ayres, & Paas, 2005; Choi & Johnsen, 2005). However, there could be more to it. Since the reasoning behind this result is not completely clear, more research should be done to discover why attitude towards the video played a role in the comprehensibility of the instruction videos.

To conclude, we found that participants that watched the version with subtitles as well as male participants scored higher on the comprehensibility of the task. This could have implications for the further development of instruction videos and videos in general. It showed that the comprehension of these videos will be lower if no instructions are provided in

the native language. Furthermore, it provided an insight into the effectiveness of subtitling in instruction videos, showing that, in this specific context, it helped participants in performing the task.

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# Appendices

## Appendix 1: Division of Lego Bricks

Blue Lego bricks: eleven 2x2 bricks and nine 4x2 bricks

Red Lego bricks: nine 2x2 bricks and twelve 4x2 bricks

Green Lego bricks: seven 2x2 bricks and two 4x2 bricks

White Lego bricks: two 2x2 bricks and four 4x2 bricks

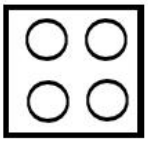
Yellow Lego bricks: eleven 2x2 bricks and eight 4x2 bricks

**Appendix 2: Scoring Form Lego House**

PPNr:_____

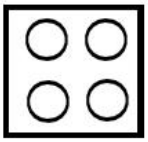
Exp.:_____

**Laag 10**



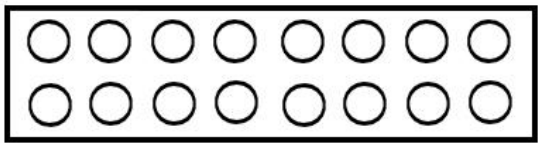
Kleur☐

**Laag 9**



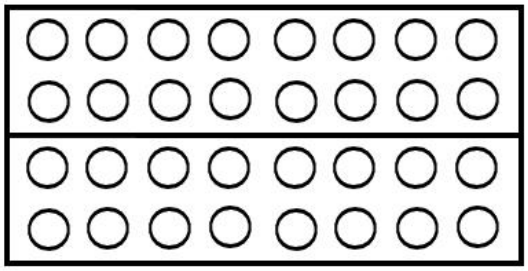
Kleur☐

**Laag 8**



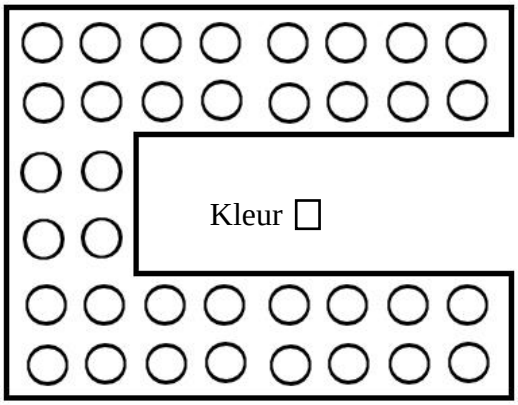
Kleur ☐

**Laag 7**



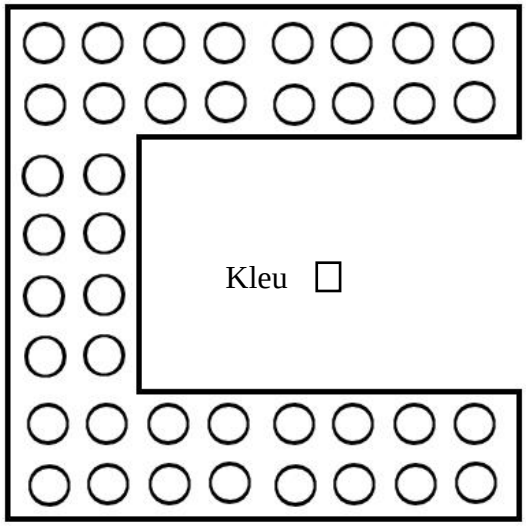
Kleur☐

**Laag 6**



Kleur ☐

**Laag 5**

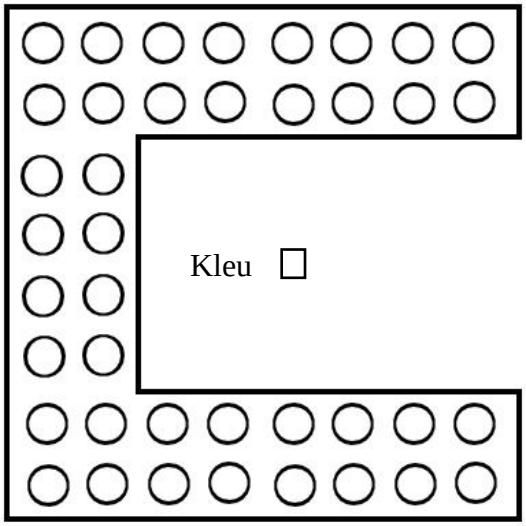


Kleu ☐

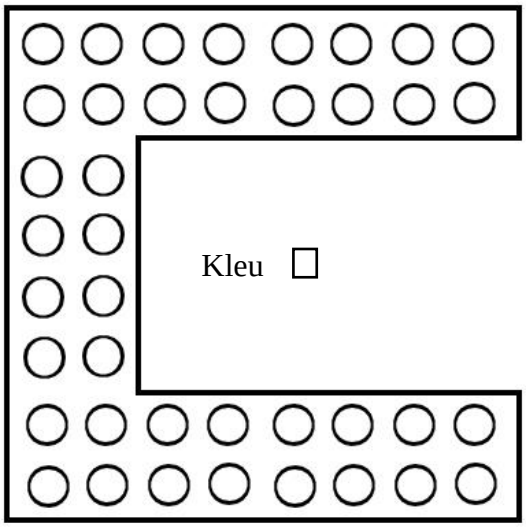
**PPNr:**_____

**Exp:**_____

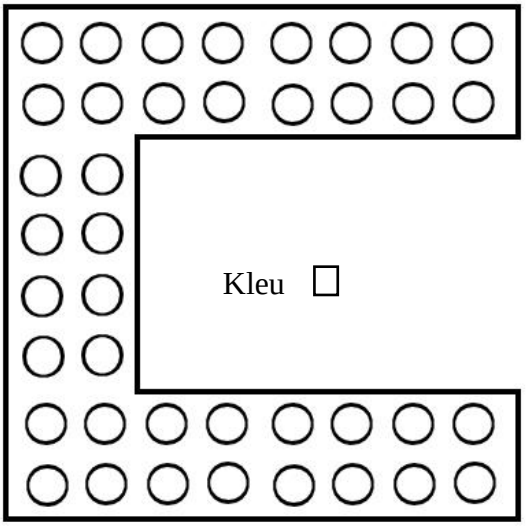
**Laag 4**



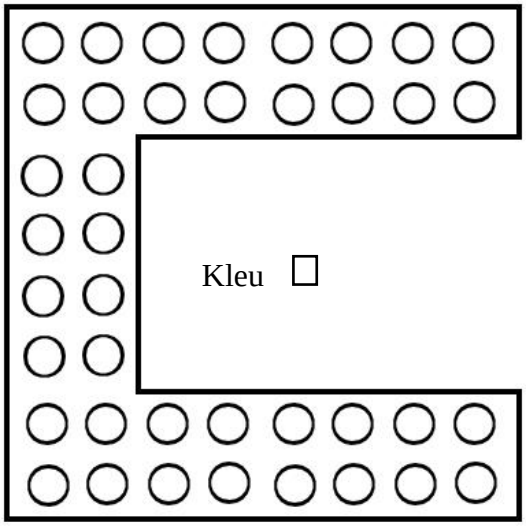

**Laag 3**



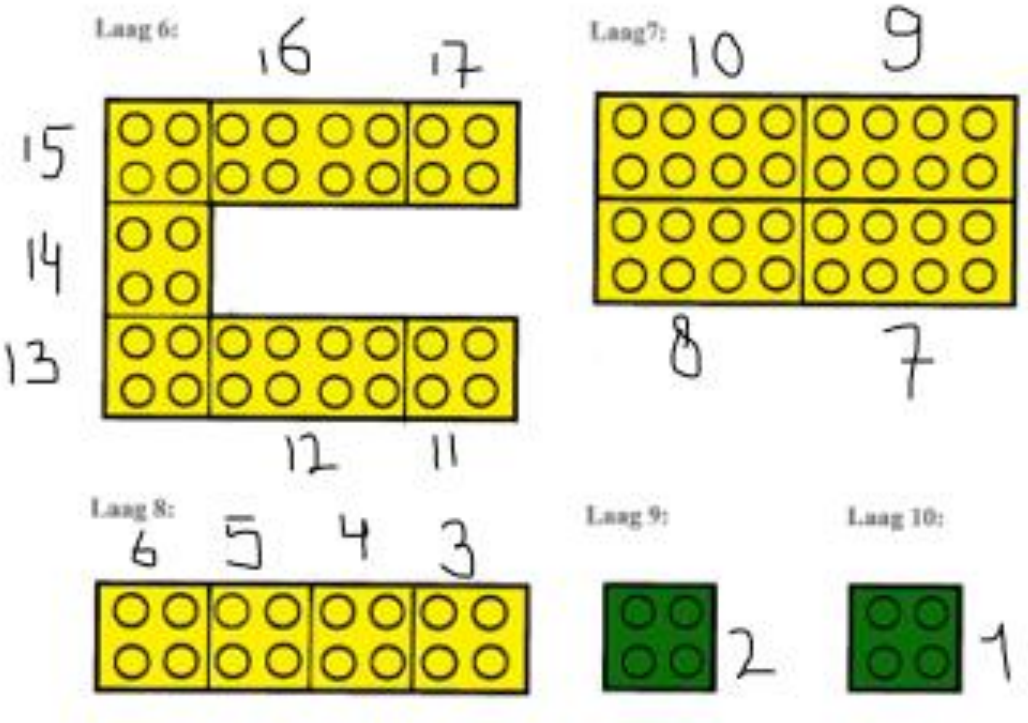

**Laag 2**

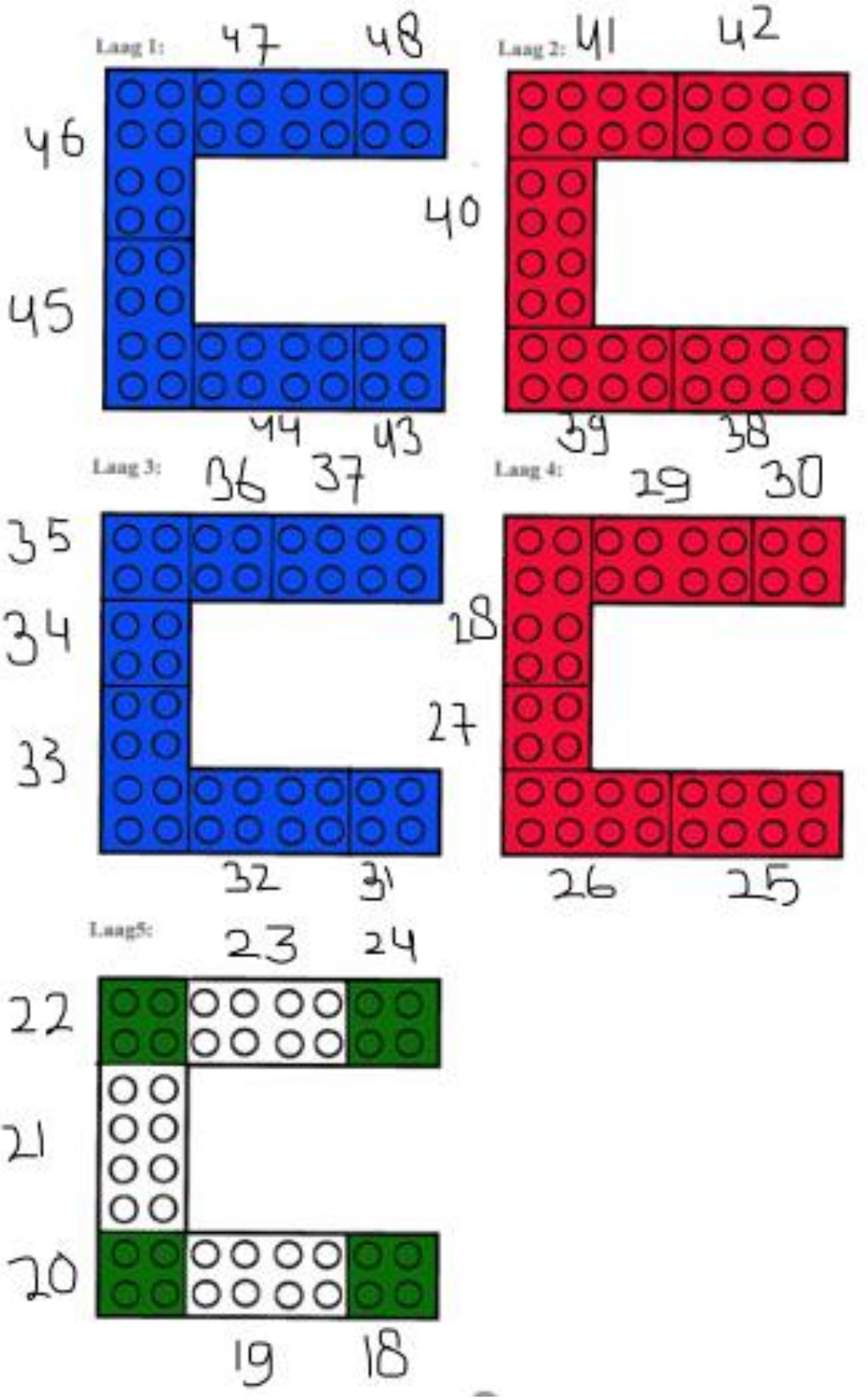



**Laag 1**



## Appendix 3: Key Scoring Form Lego House





Laag 1:
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Laag 2:
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Laag 3:
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Laag 4:
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Laag5:
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## Appendix 4: Questionnaire Instruction Video without Subtitles

Q21 Vul hier je deelnemernummer in.

_____

Q6.2 Wat vond je van de taak? Ik heb de taak...

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | |
|---|---|---|---|---|---|---|
| helemaal begrepen | ○ | ○ | ○ | ○ | ○ | helemaal niet begrepen |
| helemaal goed uitgevoerd | ○ | ○ | ○ | ○ | ○ | helemaal niet goed uitgevoerd |

Q6.3 Geef voor de volgende vragen aan wat je mening het beste weergeeft.

Q6.4 Ik vond de instructievideo

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| goed gestructureerd (1) | ○ | ○ | ○ | ○ | ○ |
| duidelijk (2) | ○ | ○ | ○ | ○ | ○ |
| niet interessant (3) | ○ | ○ | ○ | ○ | ○ |
| makkelijk te onthouden (4) | ○ | ○ | ○ | ○ | ○ |
| van goede kwaliteit (5) | ○ | ○ | ○ | ○ | ○ |
| goed in beeld gebracht (6) | ○ | ○ | ○ | ○ | ○ |

Q6.5 Ik vond de taak in deze instructievideo

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| leuk om te doen (1) | ○ | ○ | ○ | ○ | ○ |
| makkelijk om te doen (2) | ○ | ○ | ○ | ○ | ○ |
| saai om te doen (3) | ○ | ○ | ○ | ○ | ○ |
| moeilijker dan ik had verwacht (4) | ○ | ○ | ○ | ○ | ○ |

Q96
Hoeveel mentale inspanning heb je geinvesteerd in deze taak om het te voltooien?

- extreem kleine hoeveelheid (1)
- kleine hoeveelheid (2)
- gemiddelde hoeveelheid (3)
- grote hoeveelheid (4)
- extreem grote hoeveelheid (5)

Q6.6 De gesproken taal in de instructievideo was ...

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| makkelijk te begrijpen (1) | ○ | ○ | ○ | ○ | ○ |
| moeilijk te volgen (2) | ○ | ○ | ○ | ○ | ○ |
| afleidend van de taak (3) | ○ | ○ | ○ | ○ | ○ |
| ondersteunend aan de taak (4) | ○ | ○ | ○ | ○ | ○ |
| te snel (5) | ○ | ○ | ○ | ○ | ○ |
| te informatief (6) | ○ | ○ | ○ | ○ | ○ |

Q6.7 Wat vond je van de instructievideo in het algemeen?

_____

_____

_____

_____

_____

Q6.8 In vergelijking met een papieren handleiding is de instructievideo

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| makkelijker (1) | ○ | ○ | ○ | ○ | ○ |
| leuker (2) | ○ | ○ | ○ | ○ | ○ |
| informatiever (3) | ○ | ○ | ○ | ○ | ○ |

Q6.9 Stel dit was de handleiding voor het in elkaar zetten van een kast, wat had je liever?

- ○ instructievideo (1)
- ○ papieren handleiding (2)
- ○ beide (3)

Q6.10 Wanneer heb je voor het laatst met LEGO gebouwd?

- ○ Afgelopen week nog (1)
- ○ Afgelopen maand nog (2)
- ○ Langer dan een jaar geleden (3)
- ○ Langer dan 5 jaar geleden (4)
- ○ Langer dan 10 jaar geleden (5)

Q6.11 Welke van de volgende talen spreek je en hoe goed?

| | heel goed (1) | goed (2) | matig (3) | niet goed (4) | helemaal niet (5) |
|---|---|---|---|---|---|
| Engels (1) | ○ | ○ | ○ | ○ | ○ |
| Duits (2) | ○ | ○ | ○ | ○ | ○ |
| Spaans (3) | ○ | ○ | ○ | ○ | ○ |
| Nederlands (4) | ○ | ○ | ○ | ○ | ○ |

Q94 Als ik een taal hoor die ik niet ken, voel ik mij:

| | | | | | |
|---|---|---|---|---|---|
| Comfort (1) | ○ comfortabel (1) | ○ redelijk comfortabel (2) | ○ neutraal (3) | ○ redelijk oncomfortabel (4) | ○ oncomfortabel (5) |
| Gevoel (2) | ○ goed (1) | ○ redelijk goed (2) | ○ neutraal (3) | ○ redelijk slecht (4) | ○ slecht (5) |

Q95 Het herkennen van een taal buiten mijn moedertaal is:

| | | | | | |
|---|---|---|---|---|---|
| Belang (1) | ○ belangrijk (1) | ○ redelijk belangrijk (2) | ○ neutraal (3) | ○ redelijk onbelangrijk (4) | ○ onbelangrijk (5) |
| Bruikbaarheid (2) | ○ bruikbaar (1) | ○ redelijk bruikbaar (2) | ○ neutraal (3) | ○ redelijk onbruikbaar (4) | ○ onbruikbaar (5) |

Q97 Identiteit

| | Eens (1) | redelijk eens (2) | neutraal (3) | redelijk oneens (4) | oneens (5) |
|---|---|---|---|---|---|
| Ik ben trots dat ik Nederlands ben (1) | ○ | ○ | ○ | ○ | ○ |
| Ik voel me verbonden met de Nederlandse cultuur (2) | ○ | ○ | ○ | ○ | ○ |
| Ik kan me vinden in andere Nederlanders (3) | ○ | ○ | ○ | ○ | ○ |

Q6.12 Je bent

- ○ man (1)
- ○ vrouw (2)
- ○ zeg ik liever niet (3)

Q6.13 Hoe oud ben je?

_____

Q6.14 Wat is je moedertaal?

- ○ Nederlands (1)
- ○ Engels (2)
- ○ Duits (3)
- ○ anders, namelijk (4) _____

Q6.15 Wat is je opleidingsniveau?

- ○ MBO (1)
- ○ HBO (2)
- ○ WO (3)
- ○ Ik zit nog op de middelbare school, namelijk (vul hier je schooltype in bv. VMBO) (4) _____

## Appendix 5: Questionnaire Instruction Video with Subtitles

Q22 Vul hier je deelnemernummer in.

_____

Q3.2 Wat vond je van de taak? Ik heb de taak...

| | 1 (1) | 2 (2) | 3 (3) | 4 (4) | 5 (5) | |
|---|---|---|---|---|---|---|
| helemaal begrepen | ○ | ○ | ○ | ○ | ○ | helemaal niet begrepen |
| helemaal goed uitgevoerd | ○ | ○ | ○ | ○ | ○ | helemaal niet goed uitgevoerd |

Q3.3 Geef voor de volgende vragen aan wat je mening het beste weergeeft.

Q3.4 Ik vond de instructievideo

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| goed gestructureed (1) | ○ | ○ | ○ | ○ | ○ |
| duidelijk (2) | ○ | ○ | ○ | ○ | ○ |
| niet interessant (3) | ○ | ○ | ○ | ○ | ○ |
| makkelijk te onthouden (4) | ○ | ○ | ○ | ○ | ○ |
| van goede kwaliteit (5) | ○ | ○ | ○ | ○ | ○ |
| goed in beeld gebracht (6) | ○ | ○ | ○ | ○ | ○ |

Q3.5 Ik vond de taak in deze instructievideo

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| leuk om te doen (1) | ○ | ○ | ○ | ○ | ○ |
| makkelijk om te doen (2) | ○ | ○ | ○ | ○ | ○ |
| saai om te doen (3) | ○ | ○ | ○ | ○ | ○ |
| moeilijker dan ik had verwacht (4) | ○ | ○ | ○ | ○ | ○ |

Q41 Hoeveel mentale inspanning heb je geinvesteerd in deze taak om het te voltooien?

- extreem kleine hoeveelheid (1)
- kleine hoeveelheid (2)
- gemiddelde hoeveelheid (3)
- grote hoeveelheid (4)
- extreem grote hoeveelheid (5)

Q3.6 De gesproken taal in de instructievideo was ...

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| makkelijk te begrijpen (1) | ○ | ○ | ○ | ○ | ○ |
| moeilijk te volgen (2) | ○ | ○ | ○ | ○ | ○ |
| afleidend van de taak (3) | ○ | ○ | ○ | ○ | ○ |
| ondersteunend aan de taak (4) | ○ | ○ | ○ | ○ | ○ |
| te snel (5) | ○ | ○ | ○ | ○ | ○ |
| te informatief (6) | ○ | ○ | ○ | ○ | ○ |

Q3.7 De ondertiteling van de instructievideo was

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| moeilijk te begrijpen (1) | ○ | ○ | ○ | ○ | ○ |
| makkelijk te volgen (2) | ○ | ○ | ○ | ○ | ○ |
| te langzaam (3) | ○ | ○ | ○ | ○ | ○ |
| ondersteunend aan de taak (4) | ○ | ○ | ○ | ○ | ○ |
| afleidend van de gesproken taal (5) | ○ | ○ | ○ | ○ | ○ |
| afleidend van het beeld (6) | ○ | ○ | ○ | ○ | ○ |

Q3.8 Wat vond je van de instructievideo in het algemeen?

_____

_____

_____

_____

_____

Q3.9 In vergelijking met een papieren handleiding is de instructievideo

| | helemaal eens (1) | (2) | (3) | (4) | helemaal oneens (5) |
|---|---|---|---|---|---|
| makkelijker (1) | ○ | ○ | ○ | ○ | ○ |
| leuker (2) | ○ | ○ | ○ | ○ | ○ |
| informatiever (3) | ○ | ○ | ○ | ○ | ○ |

Q3.10 Stel dit was de handleiding voor het in elkaar zetten van een kast, wat had je liever?

- ○ instructievideo (1)
- ○ papieren handleiding (2)
- ○ beide (3)

Q3.11 Wanneer heb je voor het laatst met LEGO gebouwd?

- ○ Afgelopen week nog (1)
- ○ Afgelopen maand nog (2)
- ○ Langer dan een jaar geleden (3)
- ○ Langer dan 5 jaar geleden (4)
- ○ Langer dan 10 jaar geleden (5)

Q3.12 Welke van de volgende talen spreek je en hoe goed?

| | heel goed (1) | goed (2) | matig (3) | niet goed (4) | helemaal niet (5) |
|---|---|---|---|---|---|
| Engels (1) | ○ | ○ | ○ | ○ | ○ |
| Duits (2) | ○ | ○ | ○ | ○ | ○ |
| Spaans (3) | ○ | ○ | ○ | ○ | ○ |
| Nederlands (4) | ○ | ○ | ○ | ○ | ○ |

Q38 Als ik een taal hoor die ik niet ken, voel ik mij:

| | | | | | |
|---|---|---|---|---|---|
| Comfort (1) | ○ comfortabel (1) | ○ redelijk comfortabel (2) | ○ neutraal (3) | ○ redelijk oncomfortabel (4) | ○ oncomfortabel (5) |
| Gevoel (3) | ○ goed (1) | ○ redelijk goed (2) | ○ neutraal (3) | ○ redelijk slecht (4) | ○ slecht (5) |

Q39 Het herkennen van een taal buiten mijn moedertaal is:

| | | | | | |
|---|---|---|---|---|---|
| Belang (1) | ○ belangrijk (1) | ○ redelijk belangrijk (2) | ○ neutraal (3) | ○ redelijk onbelangrijk (4) | ○ onbelangrijk (5) |
| Bruikbaarheid (2) | ○ bruikbaar (1) | ○ redelijk bruikbaar (2) | ○ neutraal (3) | ○ redelijk onbruikbaar (4) | ○ onbruikbaar (5) |

Q40 Identiteit

| | Eens (6) | Redelijk eens (7) | neutraal (8) | redelijk oneens (9) | oneens (10) |
|---|---|---|---|---|---|
| Ik ben trots dat ik Nederlands ben (1) | ○ | ○ | ○ | ○ | ○ |
| Ik voel me verbonden met de Nederlandse cultuur (2) | ○ | ○ | ○ | ○ | ○ |
| Ik kan me vinden in andere Nederlanders (3) | ○ | ○ | ○ | ○ | ○ |

Q3.13 Je bent

- man (1)
- vrouw (2)
- zeg ik liever niet (3)

Q3.14 Hoe oud ben je?

_____

Q3.15 Wat is je moedertaal?

- Nederlands (1)
- Engels (2)
- Duits (3)
- anders, namelijk (4) _____

Q3.16 Wat is je opleidingsniveau?

- MBO (1)
- HBO (2)
- WO (3)
- Ik zit nog op de middelbare school, namelijk (vul hier je schooltype in bv. VMBO) (4) _____

## Appendix 6: Information Document

CLS | Centre for Language Studies
Radboud University

**INFORMATION DOCUMENT**

***Title of the research study:*** *How well do you build Lego with instructions in a foreign language?*

***Researcher responsible:*** *Béryl Hilberink, Ulrike Nederstigt*

**Aim and procedure of the research study**
In this research study, you will be watching an instruction video on an IPad using a headphone. The video will tell you how to build a Lego house. You will be asked to follow this instruction as closely as possible and build the Lego house. Once your house is completed we will ask you to answer a few questions concerning the video and the task you just performed. We will also check together whether you build the house correctly.

**Risks and discomfort**
There are no health or safety risks.

**Confidentiality of the research data**
The data we collect during this study will be used by scientists for articles and presentations. Of course, these data will be made fully anonymous. Anonymized data is accessible to the scientific community for a period of at least 10 years.

**Voluntariness**
You participate voluntarily in this research. Therefore, you can withdraw your participation at any time during the research. All data we have collected from you will be deleted permanently.

**When is it advisable to not participate in this research?**
Children under the age of 6 years will not be able to take part in this research study. People with a visual or auditory handicap will also not be able to participate.

**More information**
Should you want more information on this research study, now or in future, please contact

*Ulrike Nederstigt*
Radboud University
Postbus 9103
6500 HD Nijmegen
Tel: 024-3612875
u.nederstigt@let.ru.nl

*or*

*Béryl Hilberink*
Radboud University
Postbus 9103
6500 HD Nijmegen
Tel: 024-361875
b.hilberink@let.ru.nl

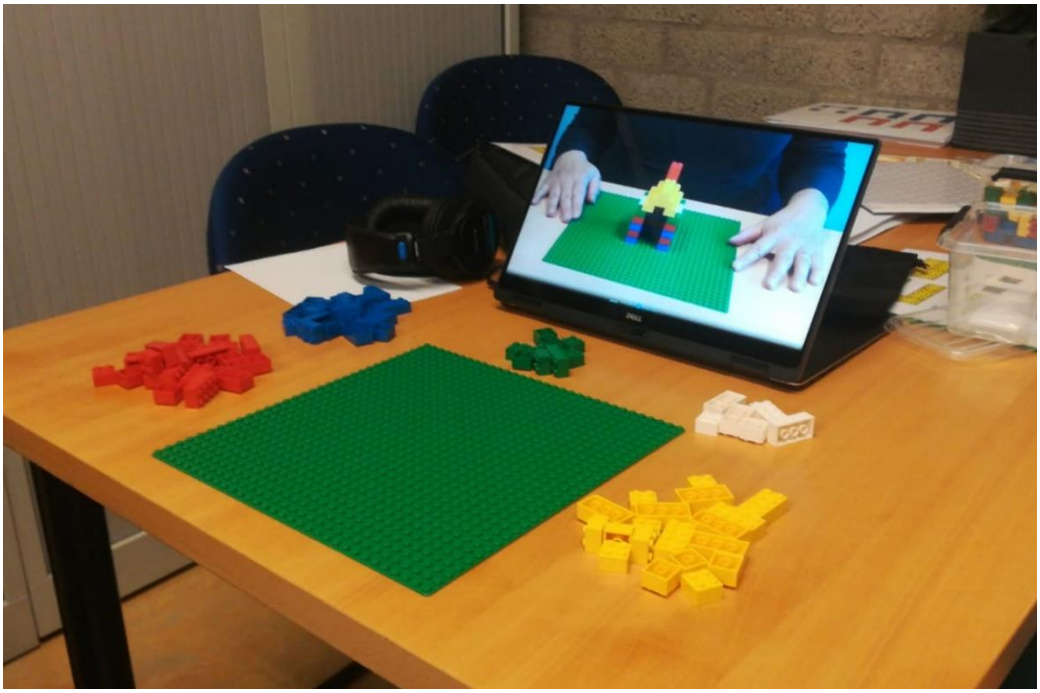
Should you have any complaints regarding this research, please contact:

Margret van Beuningen, secretary Ethics Assessment Committee
Radboud University
Postbus 9103
6500 HD Nijmegen
Tel: 024-3615814
m.vanbeuningen@let.ru.nl

## Appendix 7: Instructions of the experiment

### Instructions experiment

1) Set up the laptop/tablet and the Lego bricks according to the picture below.



2) Inform participants about the aim of experiment using the script Manon prepared (this ensure you all give the same instructions).
3) Let participants sign the consent form. There are two versions of the form (back and front page), for participants younger than 18 years not only the participant, but also a parent has to sign the form.
4) Instruct participants that they
   a) are not allowed to pause the video
   b) are not allowed to rewind the video
   c) can start building as soon as the video starts
   d) that this experiment is about following the instructions
5) Use headphones in noisy environments.
6) Once participants finished building the house, start the questionnaire and make sure you enter the participant's participant number.
7) Note down particularities with the respect to the duration of building, whether they started on the house again, the orientation of the building (the majority of participants will build the house with the opening facing them, note down if that is not the case, you might want to ask these participants whether they are left handed), comments participants make etc.
8) If participants are interested in the results, they can leave their email address, so that you can contact them later.
9) Note down the participant number and the version (under Exp.) with or without subtitles.
10) Deconstruct the building, noting down the position, colour and form of the bricks on the scoring form. If a house is very deviant from the actual house take a picture before you start on the deconstruction process
11) Enter the data in the Excel sheet on you Google drive.

## Appendix 8. Statement of own work

Print and sign this *Statement of own work* form and add it as the last appendix in the final version of the Bachelor's thesis that is submitted as a hard copy to the first supervisor.

Student name: Manon Derks
Student number: S4713001

PLAGIARISM is the presentation by a student of an assignment or piece of work which has in fact been copied in whole or in part from another student's work, or from any other source (e.g. published books or periodicals or material from Internet sites), without due acknowledgement in the text.

DECLARATION:
a. I hereby declare that I am familiar with the faculty manual (http://www.ru.nl/stip/english/rules-regulations/fraud-plagiarism/) and with Article 16 "Fraud and plagiarism" in the Education and Examination Regulations for the Bachelor's programme of Communication and Information Studies.
b. I also declare that I have only submitted text written in my own words
c. I certify that this thesis is my own work and that I have acknowledged all material and sources used in its preparation, whether they be books, articles, reports, lecture notes, and any other kind of document, electronic or personal communication.

Signature: 

Place and date: Nijmegen, 07/06/2019