The effect of L1 subtitling in a foreign language narrated instructional video

The effect of L1 subtitles in a foreign language narrated instruction video on task performance, mental effort and attitude.

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Abstract

Instruction videos are special types of infomercials that show the consumer how to assemble a product. Multinational companies often standardize their instruction videos for cost-saving reasons. However, because of the multinational audience, customers often depended on subtitles for their comprehension of the video. Research has suggested that the addition of subtitles might have a negative influence on comprehension of the video, due to an increase in mental effort. An experiment researched the effect of L1 subtitles in a foreign language narrated instruction video on task performance, mental effort and attitude by assigning 53 males and 48 females to either watch an instruction video with or without subtitles. In addition, the study also investigated gender differences with regard to mental effort required to complete the task depicted in the video. Results showed that L1 subtitles had a beneficiary effect on task performance, but not on mental effort or attitude. There was no significant gender difference with regard to mental effort. Based on these results, multinational companies might want to consider adding L1 subtitles to their standardized instruction videos in order to achieve higher performance rates.

Keywords: instruction video, standardization, L1 subtitles, task performance, mental effort, attitude

1. Introduction

The use of instructional videos has become increasingly popular amongst businesses in our digitalized world. An acceleration in technological developments and a reduction in the cost of video equipment have caused video sharing platforms such as YouTube to become a strategic tool for reaching a massive audience (Miles, 2014). As a result, businesses have started to utilize the platform for publishing infomercials or instruction videos. The latter being particularly interesting for manufacturers or retailers of goods that require assembling. Furniture retailer giants such as IKEA or Home Depot have started to release 'Assembly Instruction' videos on their YouTube channel, showcasing users how to put their products together. However, questions such as why companies collectively decide to produce instruction videos, and whether this is actually effective remain unanswered. With the current study we aimed to extent the research on animation versus statics and adaptation versus standardization in an instruction video that revolved around the manipulative task of building with Lego.

1.1 Advantages of animated instruction

Scholars have found that animated instruction (e.g. a video) may have multiple advantages over static instruction (e.g. a manual), in regard to both learning outcomes and task performance (Arguel & Jamet, 2009; Höffler & Leutner, 2007; Watson, Butterfield, Curran & Craig, 2010). Arguel and Jamet (2009) had undergraduate students closely observe either an informative video with spoken commentary on a specific technique of first aid, or a series of static screenshots taken from that same video. They then asked participants to answer questions concerning the learning material. Results showed that the group that studied the video outperformed the group that only examined the screenshots. However, they also included a third condition in which a group of students were able to examine both the video and the screenshots. This format was most successful. Höffler and Leutner (2007) conducted a meta-analysis in which they drew 76 pair-wise comparisons between instructional animations and their static equals. They found that in 21 of these comparisons, the animations had a significant advantage over the statics, and in only two cases statics outperformed animations. Lewalter (2003) suggests that the outperformance of animations relates to psychological mechanisms, as "dynamic illustrations offer a complete model for generating a mental representation of motion, thereby reducing the level of abstraction of temporal ideas, they should support deeper understanding than static visuals do" (Lewalter, 2003, p. 178). Mayer (2014) also states that solely through animation, representations of transitions between the discrete steps in a dynamic system can be made in the learner's mind.

1.2 Type of knowledge as a moderating factor

Höffler and Leutner (2007) also found the type of knowledge depicted in the animation, whether procedural-motor, declarative, or problem-solving in nature, to be a moderating factor in the effectiveness of the animation. Animations depicting procedural-motor knowledge had the highest advantage over their static equals. Procedural-motor knowledge can be described as the type of knowledge that involves 'knowing how to execute a skill' (Thomas, 1994). This type of knowledge is often needed for the correct performance of manipulative tasks, as they involve the moving or manipulation of an object with the hands or feet to achieve a goal, such as e.g. riding a bicycle or assembling a closet (Castro-Alonso, Ayres & Paas, 2015). An example of manipulative task could be derived from Watson et al. (2010), who had 30 participants assemble a complicated mechanical device in five days. There were three conditions, each with a different instruction type: text, static diagram, and animation. Task performance was defined as the sum of a) reference time (amount of times the participant looked at the instructions) and

b) net build time (the overall building time minus the reference time). Findings showed that participants in the animation condition had a significantly shorter reference time, as well as a shorter overall time than participants in the static or diagram condition. However, after the second day, reference time and net built time of the three conditions aligned. Castro-Alonso, Ayres and Paas (2015) introduced another manipulative task that revolved around the construction of a Lego house. They found that learning outcomes, operationalized as task performance (the number of bricks correctly placed in combination with self-reported mental effort), were higher for the group that watched the instruction video than the group that only possessed over a static manual.

1.3 Advantages of auditory elements

Auditory components are oftentimes overlooked by scholars researching the effects of instructional animation on task performance. However, some scholars (O'Connor & Hermelin, 1978; Keele & Summers, 1976) have found that auditory elements are hugely effective for the perception and retention of temporal information. Adding auditory elements to instruction videos, which are transient in nature, may therefore yield benefits. Doody, Bird and Ross (1985) conducted an experiment in which a group of students had to displace seven wooden barriers in a prearranged order. Two versions of a pre-recorded instruction video were made: one that included audio and one that did not. Four experimental groups (control, audio, visual, audio and visual) performed the manipulative task. The results showed that the groups presented with the video that included audio produced less errors than the group presented with the version that was stripped from its audio. However, the auditory elements in the study barely included narration. There was solely one spoken phrase. It is therefore questionable whether the audio version could be considered dual-channel, as the lack of narration means that the listener does not really have to process verbal information. Mayer and Anderson (1991) researched whether animation with or without narration is most effective in regards to a problem solving task and a verbal retention task involving the functioning of a bicycle tire pump. They had the same four experimental conditions as Doody et al. (1985). Their results showed that the animation in combination with narration condition outperformed both the narration and animation only conditions on both tasks.

2. Theoretical Framework

2.1 Dual-coding theory

A theory that could explain why animation in combination with narration is more effective than narration or animation on its own is the dual-coding theory, discussed by Paivio (1991), Mayer and Anderson (1991), and Mayer (2002; 2014). According to the dual-coding theory, our working memory (WM) consists of two distinct information-processing channels: the auditory-verbal channel and the visual-pictoral channel. The auditory-verbal channel strictly processes verbal information that has entered through the ears, while the visual-pictoral channel processes visual information that has entered through the eyes. This implies that when a certain media includes both pictoral and auditory elements, the learner is able to process the information over the capacity of two channels, instead of one. On the other hand, in order to do so the learner has to perform more actions: a) build an internal verbal representation from the presented verbal information, b) build an internal visual representation from the presented visual information, and c) make denotative connections between the two.

The distinct information-processing systems each have different capacities with regard to the amount of information that can simultaneously be processed (Mayer, 2002; Baddeley and Hitch, 1994; Sweller and Chandler, 1991; Sweller, 1994). The total cognitive load, according to Plass and Kalyuga (2017), is determined by the sum of cognitive processes that simultaneously take place in our WM, in order to achieve a specific goal, like e.g. the completion of a manipulative task. When cognitive processing exceeds the learner's available WM capacity, cognitive overload occurs, which according to Mayer and Moreno (2003) decreases the chance of meaningful learning. The total amount of cognitive processing in which a learner is engaged is defined by Paas & Van Merriënboer (1993) as mental effort. When one works on one channel, e.g. the visual channel while reading a manual consisting of text and illustrations, chances of experiencing cognitive overload are higher. In case of a narrated instructional video, the learner, who has to process both verbal (narration) and visual information (animation), is able to distribute the load over two channels. The dual processing theory therefore proposes that these two channels compensate each other in a way that basically extends the working memory capacity, making one able to execute more cognitive processing, and having a higher chance of effective learning.

2.2 Multinationals and standardization

Even though the dual coding theory proposes that a narrated video, in which dual-

channel processing can occur within the learners working memory, would be more effective than a non-narrated video, most of the bigger furniture retailers, like IKEA or FLEXA, do not include any narration in their instruction videos. This could be explained by the fact that they are multinationals, with the commercial intention of targetting a wide range of nationalities. Because they operate on a multinational level, their marketing efforts are often costly and time consuming (Jain, 1993; De Mooij, 1994; Walsh,1991, as cited in Gerritsen et al., 2010). One way of cutting down on costs and saving a compelling amount of time is through standardization (Szymanski et al., 1993). Standardization is defined as "the use of a similar marketing strategy in overseas markets as in the home market" (Buzzell, 1968, as cited in Akaah, 1991, p. 40). Publishing an instruction video without any narration could therefore be considered standardization, as the same content is available in both the home market as well as overseas markets. According to Gerritsen et al. (2010), another extreme approach of standardization is narrating the ad in a foreign language, while not including any local translation. Problematic about this type of standardization is that the company can choose only one language of narration, which is likely not to be understood by the entire target audience. In case of an instructional video, this type of standardization would make some of the listeners utterly dependent on the visual information. It could therefore be expected that these listeners are more likely to make mistakes in the assembling process.

Companies often resort to the use of English while standardizing their marketing efforts. According to Gerritsen et al. (2010), English has been shown to be the most frequently used foreign language in product advertisements in countries where it is not the native language. They state that globalness, which is strongly associated with the English language, is one of the underlying motivators for advertisers to opt for English as standardization language. English is perceived to be a global language, as an increasing amount of countries have taken the language up and given it a special place within their communities (Crystal, 2012). Approximately three out of every four users of English in the world aren't even native speakers of the language (Crystal 2003, as cited in Seidlhofer, 2005). In addition, multiple researchers have found that English also evokes feelings of internationalism (Alden et al., 1999;Crystal, 2012;Piller, 2003).

2.3 Subtitling and split-attention effect

The choice for English is therefore often made based on the chance that viewers with a different first language are still able to understand the instruction video. However, when speakers are not able to understand the English language, adaptation might still be necessary. Dubbing and subtitling are two commonly used strategies for adapting a standardized video to

a local market, with subtitling being the most efficient and cost-effective one (Luyken et al., 1999; Koolstra, Peeters & Spinhof, 2002). However, subtitles require the viewer to not only watch and listen, but also read. The addition of this extra element is assumed to have an effect on the mental effort required to watch the video (Koolstra et al., 2002; Marleau, 1982). Additionally, even though according to the dual coding theory, a combination of imagery and verbal information improves information processing, subtitles would also have to be processed within the visual processing system when the audio is not understood by the listener. Since there is no compensation with the verbal processing system, a higher chance of cognitive overload could be expected since only one channel is being used.

The split-attention effect is partly derived from the dual-coding theory and refers to the decrease in performance when viewers have to split their visual attention between two sources of information which are either spatially or temporally separated (Mayer et al., 2001; Sweller, Ayres & Kalyuga, 2011). The simultaneous presentation of animations and textual information in a subtitled video do not only ask the viewer to process more elements via the visual system, but also force a division in attention spent on the distinct elements. According to Sweller et al. (2011), a split-attention format also increases WM load, as switching from one source of information in order to attend to another requires information to be maintained in working memory for longer periods of time. Research into eye movement registrations by D'Yewalle et al. (1987; 1991) has shown that the presence of subtitles is so compelling that paying attention and reading them is an automatic tendency. However, by attending to the subtitles too much, the visual information might get neglected, which could have damaging effects on the assembly performance in case of an instructional video.

2.4 Gender

Research in cognitive psychology has focused on gender differences with regard to working memory capacity. Working memory is a mental function responsible for temporary storage and manipulation of information in order to perform cognitive processes (Baddeley, 1986; Goldman-Rakic, 1987). According to Baddeley and Hitch (1974), the working memory has limited storage and processing capacities. Paas, Renkl and Sweller (2003) state that our working memory is only able to handle a very limited number, likely no more than two or three, interacting elements. The cognitive load, defined by Sweller (1994) as the demand on working memory, that is placed on the working memory thus differs depending on the number of interacting elements in a task (Barrouillet et al, 2007). The more elements (e.g. narration, text, visuals) a task contains, the more performance deteriorates. Speck et al. (2000) researched

gender differences in the functional organization of the brain during four verbal working memory tasks using fMRI[1] technique. They found that woman outperformed men on all tasks. One of the plausible reasons given by Speck et al. (2000) is a difference in problem solving strategies, as the part of the brain vital to problem solving was stimulated significantly more by female participants. Opposing results for this hypothesis were found in a large-scaled experiment by Oakhill and Johnson-Laird (1984), in which 558 male and 578 female participants were tested on their problem-solving skills in nine distinct experiments regarding word problems on spatial ability, verbal ability, mathematics, and social learning. Results showed that the male sex outperformed the female sex by 35% across all experiments. Geiger and Litwiller (2005) measured verbal and spatial working memory for males and females, and also found that males had both a larger verbal as well as a larger spatial working memory capacity. Loring-Meier and Halpern (1999) found that males outperformed females in four laboratory tests measuring different components of visuo-spatial working memory.

If males in fact do have a larger working memory capacity, sex might have influence on the amount of elements one is able to successfully process within the WM capacity without experiencing cognitive overload. Meaning that there could be a superior gender in terms of mental effort required to perform an assembly task while watching a subtitled instruction video.

2.5 The current study

The purpose of the present study is to gain a better insight into the effects of foreign language use in an instruction video. Previous research has shown that animated instructions have multiple advantages over static instruction, and that the addition of auditory elements and narration benefit tasks performance. This study aims to answer the question whether narration in an instruction video is still effective when it is not understood by the viewer. Even though the viewer's verbal comprehension is dependent on the addition of adaptation methods such as L1 subtitles, the dual-coding theory and split-attention effect suggest that by adding them more mental effort is required from the viewer, possibly causing task performance to deteriorate. Therefore the first research question reads:

RQ1: What Is the effect of L1 subtitles on the task performance of a manipulative task.

Research into the sex differences with regard to different types of working memory tasks have shown that oftentimes males outperform females. It could therefore be predicted that

[1] Functional MRI (fMRI) measures brain activity by detecting changes associated with blood flow.

assembling a product based on an instruction video requires less mental effort from males than from females, considering they possess a larger working memory capacity. This larger WM capacity would also compensate an increase in mental effort when L1 subtitles are added to the video. The second research question that follows reads:

RQ2: *What is the effect of gender and L1 subtitles in a foreign language narrated instruction video on the mental effort required to complete the presented task.*

The language in which consumers are being addressed could also have an effect on their attitude towards the video, considering they might want to be addressed in their native language when buying a product. Buying a product often also implies service to be included in the purchase. An instructional video could be considered a service, as it aims to aid assembling of the bought product. The SERVQUAL model by Parasuraman, Zeithaml and Berry (1985) defines service quality as the discrepancy between a customer's expectation of a service and the customer's perception of the received service. When companies fail to tailor their service to the customer's specific expectations and desires, the service quality deteriorates. Even when customers do understand the foreign language in the provided instruction video, they might still have the desire to be approached in their native language. Failure to meet this desire could result in a negative attitude towards the service. The last research question therefore reads:

RQ2: What is the effect of foreign language use on the attitude towards the instruction video?

Results of this study could be of great value and relevance for multinational companies wanting to publish instruction videos on how to effectively assemble their products, as adding subtitles to a standardized video may increase task performance and attitude towards the service. On the other hand, results could also justify the choice for complete standardization in case there is no beneficiary effect of subtitles on both task performance and attitude.

3. Method

2.1 Materials

In order to answer the research questions stated above, a foreign language narrated instruction video was created. The instruction video was narrated in Spanish, Catalan to be specific, by a native Spanish speaker. Spanish in this study was considered a foreign language, as participants did not speak nor understand it. There were two versions of the video, one with L1 subtitles, and one without. Subtitles were a literal translation of the narration. Other than the manipulation with regard to subtitle presence, the videos were identical.

The video instructed participants on how to build a little Lego house (see Figure 1), a manipulative task that closely resembled the task in Castro-Alonso et al. (2015). The task was selected as it reflects the process of assembling a products in an instruction video.

Participants were instructed to watch the four minute and 22 second video while simultaneously building the house. It was not allowed to fast forward, pause or rewind the video while building. They were told that the research revolved around the effectiveness of instruction videos and that they should try to replicate the house in the video as closely as possible.

The house consisted out of 10 layers (see Figure 2), each layer consisted of a distinct composition of bricks. The house consisted out of 48 bricks in total. Bricks could differ with regard to size and colour. There were two brick sizes: a 2x2 square and a 4x2 rectangle, and 5 brick colours: red, white, blue, green and yellow. The order of the bricks and the way they were composed wasn't always logical compared to what one would be used to when building with Lego. In addition, participants were provided with more bricks than necessary in order to complete the Lego house. Bricks were already sorted on the basis of colour before the participant would start the building process (see Figure 3 for the complete set-up).

The instruction video had a medium close shot, with an angle that did not include the builders head. The angle did not rotate during the course of the video. The builder in the video faced the participants in the opposite way in order to make it easier for the participants to mimic the actions. She started off with presenting the different types of brick sizes and colours. She then started building the house, layer by layer. Other than short breaks in between each layer, the video did not include any segmenting.

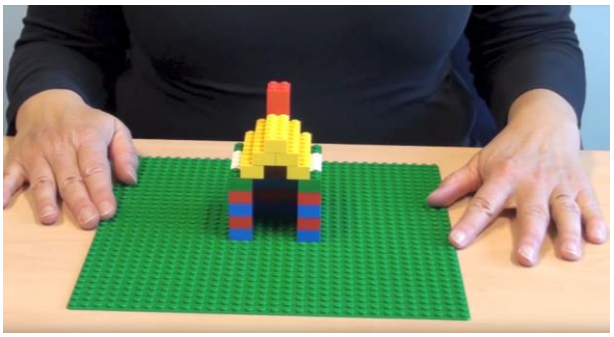

Figure 1. The finished Lego house

Figure 3. The complete set-up

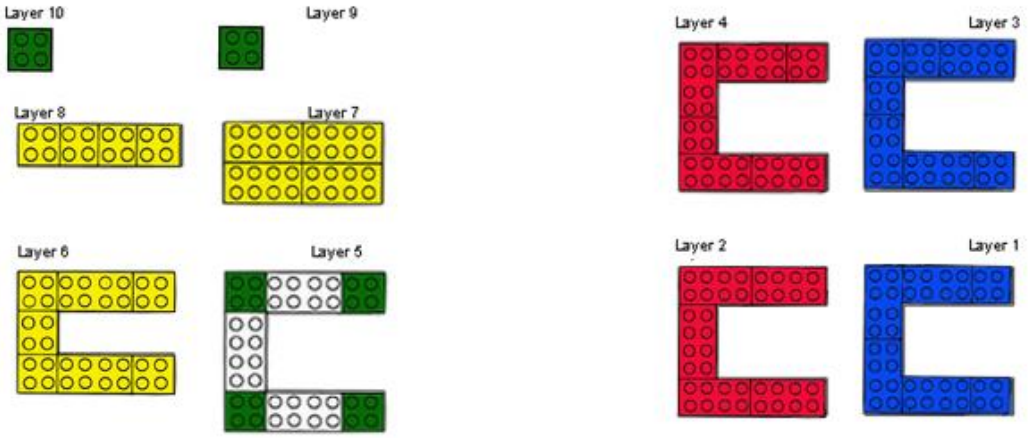

Figure 2. Layers of the Lego house

2.2 Subjects

In total, 103 participants took part in the experiment. Participants were Dutch and Frisian native speakers with little or no competency in the Spanish language. Two participants (1.9%) indicated that Frisian was their mother tongue. Frisian is a minority language spoken in the north of The Netherlands. However, both participants were also native Dutch speakers and were therefore considered as bilinguals. Other than being a native Dutch or Frisian speaker with little to no competency in Spanish, there were no sampling restrictions. This selection was made in order to make sure participants in the without subtitles condition were fully dependent on the visual information in the video, as they would not be able to comprehend the Spanish narration.

Gender was equally distributed between the two versions of the instruction video ($\chi 2$ (1) = 0.01, p = .905). There were slightly more male participants (53%) than female participants. Age was also equally distributed between the two versions of the instruction video (t (101) = .92, p = .361). Participants had an average age of 29.90 (SD = 15.48; range 17-79). Education level was not distributed equally between the two versions of the instruction video ($\chi 2$ (3) = 7.89, p = .048). The majority of participants indicated that WO (41.9%) was their

highest level of education, followed by HBO level (32.4%), MBO level (19%), and high school (4.8%). Participants were recruited through personal connections to the researchers. All participants were volunteers and did not receive compensation.

2.3 Design

This experiment had a 2 (subtitle presence: with or without) x 2 (gender: male or female) between-subjects design. Each participant was only exposed to one instruction video.

2.4 Instruments

After reading the introductory text and signing the consent form, respondents were asked to build the little Lego house on the basis of simultaneously watching the instruction video. Upon completing the building, they were asked to fill in the online questionnaire in which they also had to fill in personal information, including their gender, age, highest level of education and their mother tongue.

Task performance was measured through calculating the sum of correctness scores of all individual bricks. All 48 bricks were separately rated (1= correct, 0 = incorrect) on their colour, size and position. When a brick had the correct colour, size and placement, 3 points were awarded. A completely correct replica of the Lego house, with an accuracy score of 100%, was rated with 144 (48x3) points.

Attitude was divided into four constructs: attitude towards the video, attitude towards the audio, attitude towards the task, and attitude towards the subtitles. Attitude towards the video measured with six items: ‘structured well’, ‘clear’, ‘not interesting’, ‘easy to remember’, ‘of good quality’, and ‘portrayed well’, each anchored by a 5-point Likert scale that ranged from 1 (completely agree) to 5 (completely disagree). The item ‘not interesting’ was worded negatively and was therefore recoded. The reliability of attitude towards the visuals was unacceptable ($\alpha = .49$), but got slightly better after deleting the recoded item ‘not interesting’ ($\alpha = .66$). This item was therefore deleted.

Attitude towards the audio was measured with six 5-point Likert scales on the items: ‘easy to understand’, ‘difficult to follow’, ‘distracting from the task’, ‘aiding in the task’, ‘too fast’, and ‘too informative’. The Likert scales had a range from 1 (completely agree) to 5 (completely disagree). The item ‘easy to understand’ was positively formulated and therefore recoded. The reliability of attitude towards the audio was questionable ($\alpha = .63$), but got faintly

better after deleting the item 'too informative' (α = .64) [2]. The item 'too informative' was therefore deleted.

Attitude towards the task was measured with four items: 'fun to do', 'easy to do', 'boring to do', and 'harder than anticipated'. Each item was anchored in a 5-point Likert scale ranging from 1 (completely agree) to 5 (completely disagree). Even though the items 'boring to do' and 'harder than anticipated' were positively recoded, the reliability of attitude towards the task was still unacceptable (α = .47), even if the recoded item 'boring to do' would be deleted (α = .52). The different items were therefore analysed separately.

Attitude towards the subtitles was measured with six 5-point Likert scales on the items: 'Difficult to understand', 'Easy to follow', 'Too slow', 'Aiding in the task', 'Distracting from the narration', and 'Distracting from the animation'. Answer options ranged from 1 (completely agree) to 5 (completely disagree). 'Easy to follow' and 'aiding in the task' were negatively recoded. The reliability of attitude towards the subtitles was questionable (α = .62), but got slightly better upon deleting 'too slow' (α = .64) [2]. This item was therefore deleted.

Mental effort was measured via self-assessment based on a 5-point Likert scale, reduced from the 9-point Likert scale from Castro-Alonso et al. (2015). The scale read: How much mental effort was needed in order to complete the task?. Answer options ranged from 1(an extremely small amount) to 5(an extremely large amount).

The question "When was the last time you used Lego?" was used as a measure for participants' dexterity with Lego. Answer options ranged from 1 (last week) to 5 (more than 10 years ago). This question was added as the last time one built with Lego might have an influence on their general dexterity with Lego and thus task performance on the current manipulative task.

2.5 Procedure

Participants performed the experiment in single sessions under the guidance of one of the researchers. Before executing the task, subjects read an introductory text which explained they were going to watch a four and a half minute instruction video about building a little Lego house. The text clearly stated that they should aim to replicate the house in the instruction video as closely as possible, and that pausing, rewinding or fast-forwarding the video was not allowed. When needed, the researchers provided them with headphones. The researchers set up the

[2] Even though the alpha is insufficient, it was still decided to compute attitude towards the audio and attitude towards the subtitles after consultation with the supervisor and the group.

laptop or tablet, the Lego bricks, and the base form according to the set-up in Figure 3. After participants finished building the house, they filled out the questionnaire via the online questionnaire software Qualtrics (see Appendix 2 for full questionnaire). While they were filling in the questionnaire, the researchers coded the building performance on a scoring sheet. After answering the online questionnaire, participants were thanked for their cooperation and were given the opportunity to leave their e-mail address in case they would like to receive more information about the purpose and aim of the study. The procedure was the same for all participants and participants were free to leave and stop the experiment at any given point.

2.6 Statistical treatment

First of all, an ANCOVA was conducted in order to determine whether there was an effect of L1 subtitles on task performance, controlling for the 'last time built with Lego'. Secondly, a factorial ANOVA was conducted to measure the effects of L1 subtitles and gender on participants' mental effort required in order to compete the task. Lastly, multiple one-way ANOVA's were conducted to measure the effect of L1 subtitles on participants' attitude towards the video, audio, and task.

4. Results

The purpose of the present study was to investigate the effect of L1 subtitles on task performance (controlling for last time built with Lego), mental effort invested in the task, and attitude towards the instruction video. The study also investigated whether gender had an effect on the invested mental effort. The dependent variables were task performance, mental effort, attitude towards the video, attitude towards the audio, attitude towards the task, and attitude towards the subtitles.

4.1 Effect of L1 subtitles on task performance

The analysis of covariance (ANCOVA) for task performance with L1 subtitles as factor, controlling for last time build with Lego, found a significant effect of L1 subtitles on task performance ($F(1,100) = 3.97$, $p = .049$). Participants in the with L1 subtitles condition had a higher accuracy score (in percentages) for task performance (M =86.46, SD = 12.75) than participants in the without subtitles condition (M = 80.71, SD = 14.88). All means and standard deviations of the ANCOVA can be seen in Table 1.

Table 1. Means and standard deviations for the overall task performance of participants in the with and without subtitles condition.

		Task Performance in percentages *M* (*SD*)
With subtitles	(*n* = 53)	86.46 (12.75)
Without subtitles	(*n* = 50)	80.71 (13.37)

4.2 Effect of L1 subtitles and gender on mental effort

The factorial ANOVA on mental effort required to complete the task with L1 subtitles and gender as factors found no significant main effect of subtitle presence ($F(1,97) < 1$), nor gender ($F(1,97) < 1$). The interaction effect between subtitle presence and gender was not statistically significant either (F (1, 97) = 1.144, p = .287). All means and standard deviations for the factorial ANOVA are shown in Table 2.

Table 2. Means and standard deviations for mental effort of male and female participants in the with and without subtitles condition.

		Mental effort *M* (*SD*)
With subtitles (*n* = 52)	Male (*n* = 27)	2.85 (.86)
	Female (*n* = 25)	2.68 (.75)
	Total	2.77 (.81)
Without	Male	2.69

subtitles (*n* = 49)	(*n* = 26)	(.79)
	Female (*n* = 23)	2.87 (.87)
	Total	2.78 (.82)
Total	Male (*n* = 53)	2.77 (.82)
	Female (*n* = 48)	2.77 (.81)

4.3 Effect of L1 subtitles on attitude

None of the one-way ANOVA's found a significant effect of L1 subtitles on attitude towards the video, ($F(1, 101) < 1$), audio ($F(1, 101) = 2.37$, $p = .127$), task: 'fun to do' ($F(1, 101) < 1$), 'easy to do' ($F(1, 101) = 1.50$, $p = .223$), 'boring to do' ($F(1, 101) < .1$), 'harder than expected' ($F(1, 101) < 1$). All means and standard deviations for the one-way ANOVA's are shown in Table 3.

Table 3. Means and standard deviations for the evaluations of attitude on the video, audio, task and subtitles for the with and without subtitles conditions (1 = totally agree, 5 = totally disagree).

	With subtitles (*n* = 53)	Without subtitles (*n* = 50)
	M (SD)	*M (SD)*
Attitude video	2.23 (.58)	2.32 (.58)
Attitude audio	2.95	3.15

	(.60)	(.76)
Attitude task ‘fun to do’	1.62	1.68
	(.77)	(.79)
Attitude task ‘easy to do’	2.28	2.52
	(.89)	(1.07)
Attitude task ‘boring to do’	1.96	1.98
	(.98)	(1.00)
Attitude task ‘harder than expected’	3.40	3.22
	(1.29)	(1.36)
Attitude subtitles	3.49	.
	(.62)	.

5. Conclusion and discussion

The aim of the study was to determine the effects of L1 subtitles in a foreign language narrated instruction video. This was measured in the Netherlands, with Spanish as foreign language and with Dutch subtitles. The effect of L1 subtitles on task performance was investigated through calculating the correctness percentages of the manipulative task participants had to execute. This effect was controlled for the last time participants had built with Lego as a measurement of their Lego dexterity. Self-assessed mental effort required to complete the task was also researched between participants who watched the video with or without subtitles and between males and females. The study also investigated whether the presence of L1 subtitles had an effect on the attitude towards the instruction video. Attitude was subdivided into 7 constructs (video, audio, task[3], and subtitles).

5.1 The effect of L1 subtitles on mental effort and task performance

On the basis of Paivio’s (1991) dual-processing theory, Baddeley and Hitch’s (1974; 1994) and Goldman-Rakic’s (1987) working memory theory, Sweller and Chandler’s (1991; Sweller, 1994) cognitive load theory, and Mayer et al. (2001) and Sweller et al.’s (2011) split-attention theory, it could be predicted that the addition of L1 subtitles would increase the amount of mental effort necessary in order to complete the manipulative task depicted in the instruction video, and would therefore negatively affect task performance. The present study

[3] ‘Fun to do’, ‘easy to do’, ‘boring to do’, ‘harder than expected’

found opposing results for this prediction. Participants in the with L1 subtitles condition outperformed the participants in the without subtitles condition in terms of correct execution of the task. In addition, the difference in self-assessed mental effort between the with and without subtitles condition was not found to be statistically significant. Even though L1 subtitles add another interacting element to the task which according to Mayer (2002) would also have to be processed via the visual-pictoral channel, they likely did not cause participants to experience cognitive overload since task performance was significantly higher for the with subtitles condition.

A reason for the outperformance of the with subtitles condition in terms of task performance might be that the participants were non-competent in the language of narration (Spanish), making them completely dependent on the subtitles for their verbal comprehension of the task. It could therefore be argued that even though the addition of subtitles increases the amount of interacting elements in the task, it still allows viewers to comprehend the task better as it provides verbal comprehension.

Additionally, for the layers 9 and 10 (the chimney) the verbal information (narration/subtitles) deviated from the visual information, as the visuals showed the woman building the chimney with two red 2x2 squared bricks, while in the narration she stated that she opted for the red bricks since she had no more green bricks left to build with. She also stated that when the viewer does have access to two 2x2 green bricks, these bricks should be used instead. The contradicting verbal and visual information might have caused participants in the without subtitles condition to miss points for color on layers 9 and 10, which may have contributed to the outperformance of the with subtitles group, as the without subtitles group would have had no way of knowing these layers had to be green. Unfortunately, it would be beyond the scope of this thesis to analyze the correctness of layers 9 and 10 for the with and without subtitles condition. Further research would have to show whether there is an effect of discrepancy between visual and verbal information on task performance.

The lack of significant difference in self-assessed mental effort between the with and without subtitles group could be explained by the task not being difficult enough. Indications for this explanation are that participants reported an overall low score on the task attitude items ‘harder than expected’ and ‘easy to do’. Difficulty of the task might therefore have a moderating effect on mental effort required to complete a task. Future research might want to look into the effect of varying degrees of task complexity on mental effort.

It should however be noted that the researchers did not have access to brain activity monitoring machines such as EEG or MRI. These techniques would produce more scientifically

accurate scores on invested mental effort, since they gives insight into which parts of the brain are stimulated. Compared to the use of EEG or MRI, self-assessment of mental effort is a rather simple method.

5.2 The effect of L1 subtitles on attitude

According to the Parasuraman et al. (1985) service quality deteriorates when there is a gap between the customer's expectation of a service and the customer's perception of the received service. Customers might expect that the service (the instruction video) they receive with buying the product is in their native language or is at least adapted to their native language. Results of the current study did not show an effect of L1 subtitles on the attitude towards the video, audio, or task. This could mean that customers do not expect to be addressed in their native language when buying a product and watching the accompanying instruction video. However, the indifference in attitude could also be due to the fact that participants did not actually buy the little Lego house, and therefore did not have expectations of the service. In order to investigate the effects of L1 subtitles on service attitude, future research might want to alter the design of the instruction video in order to make it more commercial, as well as ask the participants to imagine they actually bought the product.

5.3 The effect of Gender on mental effort

Based on the findings of Oakhill and Johnson-Laird (1984), Geiger and Litwiller (2005), and Loring-Meier and Halpern (1999), it was expected that males would report having to invest less mental effort in performing the manipulative task as a result of their larger working memory capacity. Results of the current study showed no significant difference in reported mental effort between males and females, and therefore suggest that there is no superior sex in terms of working memory capacity. Again, in order to gain a more holistic perspective on sex differences with regard to mental effort, a combination of methods should be used, e.g. a combination of EEG, self-assessment and MRI.

5.4 Limitations

In all conditions, the standard deviation for building correctness was relatively high. It would have therefore been better to have more participants. However, given time limits this was not achievable. Having more participants would also allow for a better assessment of mental effort, since only 101 participants filled in the mental effort scale in the questionnaire. Additionally, since researchers were university students themselves, majority of participants

were also students aged between 17 and 24, making homogenization of the results only possible to a certain extent.

The coding process was quite complex, given that each brick had to be rated on three dimensions. The dimensions placement and size were sometimes intertwined, resulting in confusion amongst the different coders. It can therefore not be certain whether brick position and brick size were uniformly coded.

Lastly, since popular video sharing platforms such as YouTube allow users to utilize control functions (e.g. fast forward, rewind or pause), the inability to control the pace and direction of the succession of frames in this experiment might not have been in line with real world settings.

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Appendix 1. 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: Renske Bours
Student number: s4810864

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 ownwords

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: 6-6-2019

Appendix 2. Questionnaire with subtitles

Q22 Vul hier je deelnemernummer in.

_____

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

	1	2	3	4	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				helemaal oneens
goed gestructureed	○	○	○	○	○
duidelijk	○	○	○	○	○
niet interessant	○	○	○	○	○
makkelijk te onthouden	○	○	○	○	○
van goede kwaliteit	○	○	○	○	○
goed in beeld gebracht	○	○	○	○	○

Q3.5 Ik vond de taak in deze instructievideo

	helemaal eens				helemaal oneens
leuk om te doen	○	○	○	○	○
makkelijk om te doen	○	○	○	○	○
saai om te doen	○	○	○	○	○
moeilijker dan ik had verwacht	○	○	○	○	○

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

- ○ extreem kleine hoeveelheid
- ○ kleine hoeveelheid
- ○ gemiddelde hoeveelheid
- ○ grote hoeveelheid
- ○ extreem grote hoeveelheid

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

	helemaal eens				helemaal oneens
makkelijk te begrijpen	○	○	○	○	○
moeilijk te volgen	○	○	○	○	○
afleidend van de taak	○	○	○	○	○
ondersteunend aan de taak	○	○	○	○	○
te snel	○	○	○	○	○
te informatief	○	○	○	○	○

Q3.7[4] De ondertiteling van de instructievideo was

	helemaal eens				helemaal oneens
moeilijk te begrijpen	○	○	○	○	○
makkelijk te volgen	○	○	○	○	○
te langzaam	○	○	○	○	○
ondersteunend aan de taak	○	○	○	○	○
afleidend van de gesproken taal	○	○	○	○	○
afleidend van het beeld	○	○	○	○	○

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

_____

_____

_____

_____

[4] Q3.7 was only included in the survey for the with subtitles condition.

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

	helemaal eens				helemaal oneens
makkelijker	○	○	○	○	○
leuker	○	○	○	○	○
informatiever	○	○	○	○	○

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

- ○ instructievideo
- ○ papieren handleiding
- ○ beide

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

- ○ Afgelopen week nog
- ○ Afgelopen maand nog
- ○ Langer dan een jaar geleden
- ○ Langer dan 5 jaar geleden
- ○ Langer dan 10 jaar geleden

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

	heel goed	goed	matig	niet goed	helemaal niet
Engels	○	○	○	○	○
Duits	○	○	○	○	○
Spaans	○	○	○	○	○
Nederlands	○	○	○	○	○

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

Comfort	○ comfortabel	○ redelijk comfortabel	○ neutraal	○ redelijk oncomfortabel	○ oncomfortabel
Gevoel	○ goed	○ redelijk goed	○ neutraal	○ redelijk slecht	○ slecht

Q39 Het herkennen van een taal buiten mijn moedertaal is:

Belang	○ belangrijk	○ redelijk belangrijk	○ neutraal	○ redelijk onbelangrijk	○ onbelangrijk
Bruikbaarheid	○ bruikbaar	○ redelijk bruikbaar	○ neutraal	○ redelijk onbruikbaar	○ onbruikbaar

Q40 Identiteit

	Eens	Redelijk eens	neutraal	redelijk oneens	oneens
Ik ben trots dat ik Nederlands ben	○	○	○	○	○
Ik voel me verbonden met de Nederlandse cultuur	○	○	○	○	○
Ik kan me vinden in andere Nederlanders	○	○	○	○	○

Q3.13 Je bent

- ○ man
- ○ vrouw
- ○ zeg ik liever niet

Q3.14 Hoe oud ben je?

_____

Q3.15 Wat is je moedertaal?

- ○ Nederlands
- ○ Engels
- ○ Duits
- ○ anders, namelijk _____

Q3.16 Wat is je opleidingsniveau?

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

_____