Bachelor's Thesis

The effect of gesture use on L2 word comprehension

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Linda Schellekens

Abstract

This study investigated the effect of gesture use on second language vocabulary learning and aimed at answering the following research question: 'To what extent does gesture use facilitate L2 word comprehension?' In order to find an answer to this question, a total of 66 native Dutch speakers between 19 and 25 years old were randomly assigned to 3 different conditions: viewing gestures, repeating gestures and no gestures. The experiment was conducted online using Qualtrics and the participants were asked to learn 7 Slovakian verbs and 7 Slovakian nouns. Each condition contained a video with two instructors, one Dutch instructor and one Slovakian instructor. These instructors pronounced the Dutch words with their Slovakian translations and, depending on the condition, showed the corresponding hand gestures. The results of a word-recall test showed that verbs were better comprehended than nouns in the gestures viewing condition than in the other two conditions. Additionally, it was found that, contrary to the expectations, repeating the gestures did not improve L2 word comprehension more than just viewing the gestures. The analysis showed that the verbs were significantly better remembered while viewing the gestures than when repeating the gestures. On top of that, this condition scored the lowest average means, even lower than the no gesture condition.

Introduction

Background

When people engage in verbal communication they often produce gestures that go along with their speech. Examples of gestures are: body movements, head nods, hand movements, and facial expressions. These gestures not only help us to convey a certain message, but also help us to find the right words to formulate this message (Gullberg, 2006). This relation between gestures and speech can also be found in learning words in a foreign language (Macedonia, Müller & Friederici, 2011; García-Gómez & Macizo, 2019; Sweller, Shinooka-Phelan & Austin, 2020). Despite the existence of research in the general field, little research has been done exploring the differences between just viewing gestures or simultaneously reproducing them and even less research has been conducted into potential differential gesture effects for various word types for vocabulary learning in a foreign language.

Literature overview

First of all, in the existing literature (co-speech) gestures are defined as ''symbolic movements related to ongoing talk and to the expressive effort or intention (what you are trying to say)'' (Gullberg, 2006, p. 104). A ''gesture serves as both a tool for communication

for listeners, and a tool for thinking for speakers'' (Sueyoshi & Hardison, 2005, p. 662). It helps speakers to facilitate the retrieval of words and to reduce the cognitive burden. For listeners it can facilitate the understanding of a message (Sueyoshi & Hardison, 2005). Furthermore, gestures are subjected to individual diversities, but consistency can exist within a group. Also, they differ in other cultures and thus can hold a different meaning in a different culture. Speech-associated gestures are the most systematically related gestures to language and speech in general, as they express fairly the same meaning at the same time. This close link between gestures, language and speech also plays a role in second language learning (L2 learning) (Gullberg, 2006). Not only vocabulary is remembered more easily when gestures are being used (Macedonia, et al., 2011; García-Gómez & Macizo, 2019: Sweller, et al., 2020), but gesture use also facilitates the comprehension of sentences (Sueyoshi & Hardison, 2005).

Moreover, Sueyoshi and Hardison (2005) made a distinction between gesture types, which consist of: *iconic*, *beat*, *metaphoric*, *representational* and *deictic* gestures. The authors investigated the effects of using gestures and facial cues for L2 listening comprehension. They used four different types of gestures (iconic, deictic, metaphoric and beat) in combination with sentences in a listening comprehension task for learners of English as a second language. For the experiment, three conditions were created: one audiovisual including gestures and facial cues (AV-gesture-face), one audiovisual containing no gestures (AV-face) and one audio only (A-only). The authors concluded that the AV-gesture-face and AV-face groups performed better than the A-only group and that the AV-gesture-face condition overall showed the best results (Sueyoshi & Hardison (2005). Thus confirming the findings by Macedonia et al. (2011) and others that gestures have a beneficial effect towards L2 learning. However, this raises the question if the various types of gestures being shown result in different degrees of gesture effects on the L2 word learning, as the authors did not make such a comparison.

Iconic gestures
Iconic gestures are ''associated with meaning and are used more often when a speaker is describing specific things'' (Sueyoshi & Hardison, 2005, p. 663) and ''they are not arbitrary, and instead convey information that visually represents the concepts to which they refer'' (Kelly, McDevitt & Esch, 2009, p. 314). It has been demonstrated that iconic gestures help remembering vocabulary in a foreign language (Macedonia et al., 2011). Macedonia et al. (2011) focused on the differences between using iconic and meaningless gestures for learning new nouns in 'Vimmi' (an artificial language). The results of their study showed that using

iconic gestures had a greater impact on the memorization of L2 words than using the meaningless gestures. Additionally, the study provided neural evidence to show that using iconic gestures had an effect on vocabulary learning in a foreign language. This was shown by the fact that the recognition of words when using iconic gestures produced an activation pattern involving premotor cortices, whereas the recognition of words when using meaningless gestures activated a network for cognitive control (Macedonia et al., 2011).

Adding to this, Kelly, et al. (2009) investigated iconic gestures versus purely emblematic gestures. In their study they let participants view, but not copy the gestures accompanying the speech, testing whether using gestures increased learning words in a language unfamiliar to them: Japanese. They used 12 Japanese verbs, which were mentioned one at the time in combination with the English translation and repeated twice. Two conditions were included: one containing congruent iconic gestures and one containing incongruent iconic gestures (the emblematic gestures). Twenty-eight adults were exposed to a brief training session with the Japanese words using three memory tests (one after 5 minutes, two days and one week). The results of the study showed that using congruent gestures produced better memory than using incongruent gestures. Additionally, the experiment was repeated with a neural focus in which event-related potentials (ERPs), which measure the timing of electrical brain responses, were included. The authors focused on two components, which are involved in semantic memory: the N400 (a negative-going potential that peaks around 400 ms) and the Late Positive Complex (LPC; a positive-going complex that peaks around 600 ms). The same stimuli and procedure were used as in the first experiment and 24 different adults participated. However, small differences were made in order to fit the ERPs, such as the Japanese words were only mentioned once. In the conclusion the authors stated that, hand gestures facilitated the learning of newly acquired words in a foreign language. The participants learned more words when the congruent iconic gestures were used versus when the incongruent iconic gestures were used. Also, the neural experiment suggests that using gestures can help for people to understand the specific meaning of these foreign words as opposed to making people superficially familiar with the new words (Kelly et al., 2009).

Iconicity is the ''existence of non-arbitrary links between meaning and form'' (Thompson, 2011, p. 603). When this relation is very clear, the words are highly iconic. Iconicity is more common in signed languages than in spoken languages and it is likely one of the first things that is noticed about signed languages when they are being viewed by other people (Thompson, 2011). A sign language is ''a language that employs signs made with the hands and other movements, including facial expressions and postures of the body, used

primarily by people who are deaf'' (Schield, 2018, p.1). Although gestures are an important component of a sign language, differences do exist between them. Generally sign languages are used to describe a spoken language, whereas gestures, especially co-speech gestures, are traditionally being viewed as external to language (Fenlon, Cooperrider, Keane, Brentari & Goldin-Meadow, 2019). A sign as part of a sign language is ''regarded as an equivalent to a lexical item in a spoken language'' (Kendon, 2008, p. 349). Similarly, sign languages contain, just like spoken languages, ''systematic constraints which are sensitive to phonological form, lexical category, rule ordering and semantics'' (Goldin-Meadow & Brentari, 2017, p. 54). Gestures on the other hand, are a nonverbal component of communication that helps the speaker manage turn-taking, to express emotion, to give feedback and to convey their attitude towards the message and/or the listener. But it does not convey the meaning of the message itself, it merely complements it (Goldin-Meadow & Brentari, 2017).

In the present study NGT signs were included as the gestures[1] (obtained from the Global Signbank). Furthermore, only gestures that are high iconic were included. This because it portrays the meaning of a word most evidently, which makes it easier for people to make the link between meaning and form of a word and thus to learn L2 vocabulary. A study conducted by Ormel, Giezen, Snijder, Schiller and Smoll (in preparation) was used to determine the iconicity of the words included in the present study. Their study was based on a serie of 416 signs by 23 deaf proficient signers who rated the iconicity of the signs, using a rating from 1 to 7 of which 6 and 7 are considered to be high iconic. Thus, only words with a 6 or 7 rating were included in the present study.

Verbs and Nouns

All of the studies mentioned above focus on one word type. Little research has been done on potential differences between types of words, such as nouns and verbs, when looking at the benefit of gesture use on L2 word learning. This except for a recent study conducted by García-Gámez and Macizo (2019) who did study the impact of word type (comparing nouns and verbs) and gesture use on L2 vocabulary learning. Four conditions were compared in the study: the learning of L2 words with congruent gestures, incongruent gestures, meaningless gestures, and no gestures, while only including iconic gestures. The results showed that for both verbs and nouns the use of congruent gestures facilitates L2 vocabulary learning in comparison to the other conditions, similar to the results found by Macedonia et al. (2011).

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[1] In this report signs will be referred to as gestures for ease of reading, however please note that signs and gestures are not identical as explained in the text.

The L2 learners showed better acquisition of nouns than of verbs in the no gesture condition. However, the authors observed that this disadvantage for learning verbs disappeared when congruent gestures were included in the training. The authors argue that this occurs because the ''mapping between representational gestures, which involve depicted actions, and the semantic characteristics of verbs, which refer to actions, is stronger than that between gestures and nouns'' (García-Gomez & Macizo, 2019, p. 27). Macedonia and Knösche (2011) mention that it is probable that enactment has a greater effect on an action verb than on an abstract noun, since in an action verb the link between the gestural component and the meaning is clearer because a verb also involves a physical movement. They argue that, differences might also exist between a concrete noun and an abstract noun (with an advantage for concrete nouns), as a concrete noun has a higher sensorial representation than an abstract noun (Macedonia & Knösche, 2011).

Thus, it has been suggested that verbs are learned more easily than nouns when (congruent) gestures are being used, because generally verbs can be enacted better than nouns. Given the limited amount of work that has been carried out on word type combined with gesture use during L2 word learning, the present study will investigate further whether there is a difference in the effects of gesture use during L2 learning between nouns and verbs.

Reproduction

Producing gestures may increase available cognitive resources and may facilitate access to stored information (Swiller, et al., 2020). Additionally, ''studies have shown that memory of simple commands (e.g. roll the ball) is substantially higher if participants enact the action described by each command than if they only read or hear the commands'' (Nyberg, Persson & Nilsson, 2002, p. 835). This is also called encoding enactment and their experiment has shown that this enactment makes the search in memory richer and makes recall easier. Tellier (2008) continued on this work by conducting a study with French children who had to learn 8 words in English. One group of children had to learn the words with the use of pictures, while the other group used gestures, which they also had to re-produce. Although Tellier used gestures instead of enactment, there are great similarities between enactment and gesture production: since both portray an action related to the meaning of a word or sentence. The main difference is: that enactment includes executing the command also with, when needed, corresponding objects such as a book, whereas gestures only use hands to enact the command (Nyberg et al., 2002). The results of Tellier (2008) showed that the group with gestures did significantly better than the group with the pictures. Thus, it seems that when gestures are

being re-produced they have a stronger memorisation than making use of pictures, in line with the enactment in the study by Nyberg et al. (2002). However, taking into consideration that the study included few participants the results should be treated with a little caution. On top of that, the results could be different for adults.

In a more recent study, Morett (2018) investigated the effects of spontaneous gesture production on L2 word Learning. The study included 52 undergraduate students from the Psychology Department at an American University, who were all fluent English speakers. They were asked to learn 20 Hungarian words (a mixture of verbs and nouns) and for each word a video with the corresponding gesture was created. In these videos a fluent Hungarian-English bilingual pronounced the Hungarian words with their English translations with either showing a gesture (gesture presentation condition) or not (no gesture presentation condition). The participants were divided in pairs and asked to participate in a dialogic task in which one person was the explainer who learned the words and who then had to explain them to the other person, the interlocutor. They were not specifically told to use gestures, therefore the gestures that they would use were produced spontaneously and a distinction was being made between a visible interlocutor and a nonvisible interlocutor (Morett, 2018). The results showed that spontaneous gesture production impacted the recall of the L2 words, while nonspontaneous gesture viewing did not improve L2 word learning. Moreover, the results show that gesture reproduction and gesture viewing impact one another, and thus that they work together to shape representations of verbal information (Morett, 2018). However, the study had a couple of limitations as it only studied the effects of producing gestures while explaining the words to another learner, and thus did not study the effects of producing gestures while the participants learned the words themselves. On top of that, participants did not produce any specific type of gestures (Sweller, et al., 2020).

Adding on to the research of Morett (2018), is a very recent study conducted by Sweller et al. (2020). Their study focused on the effects of viewing and reproducing iconic gestures on the learning of Japanese verbs, similar to the study of Kelly, et al. (2009). To test this, three conditions were created: speech only, observe gestures and reproduce gestures. Sixty-three first and second year students of the Macquarie University were included in the study of which 60 participants' data was analysed, meaning that in the end there were 20 participants per condition. All participants were native English speakers who had no knowledge about the Japanese language. For the training phase of the experiment, videos were created which consisted of three learning blocks that each presented the 10 Japanese verbs with their English translations. Between each learning block a one-minute break was

given. In the videos, a native Japanese speaker showed the corresponding gestures with the words or not in the no gesture condition. In every condition, the participants were asked to verbally repeat the Japanese and English word pairs while listening to the video. Additionally, in the observe condition the participants also had to observe the gestures shown by the instructor and in the reproduce condition, the participants also had to reproduce these gestures. Following this learning phase, the participants had to complete a demographic questionnaire. Finally, to test how many words the participants remembered, a verbal recall test was conducted which was done at two time points, one at the time of the experiment and the other one after a week (Sweller, et al., 2020). The results showed that the recall of words was better when gestures were observed or reproduced than when no gestures were being shown. However, no difference was found between the recall of the participants who only observed the gestures and the ones that reproduced the gestures while learning. Additionally, over time less words were recalled, as expected, but this did not differ between conditions (Sweller, et al., 2020). Because of the lacking more elaborate evidence on the effects of simultaneously (re-) producing gestures during L2 vocabulary learning, this was included in the present study.

The current study

Taken together, the results of the mentioned studies appear to confirm that using co-speech gestures influences and facilitates L2 vocabulary learning. On top of that, more beneficial effects are being shown when high iconic compared to low iconic gestures are being used. This study elaborates on the existing research about *word type* (in particular nouns and verbs) in combination with high iconicity gestures and at the same time explored the effects of *reproducing gestures* for the learning of vocabulary in the Slovakian language.

The present study tries to fill the existing gap regarding the differences between various word types (nouns and verbs) and on the reproduction of gestures in combination with learning nouns and verbs in a foreign language, with a potential differential effect of the reproduction of verbs. Additionally, foreign languages become more important, also in a business aspect. Knowing how exactly gestures can help you learn vocabulary in a foreign language most optimally will help those people who want to develop their foreign language skills. The research question that was central in the study is: 'To what extent does gesture use facilitate L2 word comprehension?' Corresponding with this question the general hypothesis was:

H1: Using gestures facilitates L2 word learning significantly better than not using gestures at all.

To help formulate a more concrete answer to the main research question, two sub questions were made. The first one is: 'Is there a difference in the effect of gesture use between L2 verb and L2 noun comprehension?' The hypothesis was that L2 learning for verbs shows a greater effect of gesture use than L2 learning for nouns, following from the mentioned studies.

H2: Gestures facilitate L2 word learning significantly better for verbs compared to nouns.

The second sub question was: 'Does simultaneously reproducing gestures facilitate L2 word comprehension more than viewing gestures?' This included the following hypothesis:

H3: Reproducing gestures facilitates L2 word learning significantly better than just viewing the gestures.

Method

Materials

In order to formulate an answer to the research question, two independent variables were included. The first one was 'Gesture type' (consisting of 3 levels: viewing gestures, viewing and repeating gestures, no gestures), which was a between-subjects factor as a comparison had been made between the three different groups. The second one was 'Word type' (consisting of 2 levels: nouns, verbs), which was a within-subjects factor as each participant had been exposed to all the verbs and nouns and thus a comparison within the participants was made. The study included 7 verbs and 7 nouns, which means that a total of 14 words were tested. The second language participants got exposed to was the Slovakian language. These words had been checked on their similarity with Dutch, German, French, and English and the experimenters made sure that the word stimuli were not similar to their translation equivalents in any of these languages, given that the Dutch (L1) participants might have been familiar with any of these languages. On top of that, the words were checked on their concreteness and frequency. The Dutch words with their Slovakian translations can be seen in table 1.

Table 1.   The verbs and nouns included in the study with their Slovakian translations.

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Verbs N = 7		Nouns N = 7	
Dutch	Slovak	Dutch	Slovak
Schieten	Strielat	Bloem	Kvetina
Praten	Rozprávat	Wereld	Svet
Schaatsen	Korčulovat	Gordijn	Záhrada
Mengen	Zmiešat	Varken	Prasa
Liften	Stopovat	Fout	Chyba
Hardlopen	Bežat	Appel	Jablko
Komen	Príst	Vliegtuig	Lietadlo

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The verbs and nouns were carefully controlled for mean word length, concreteness of the words, and lexical frequency. No significant differences were found in the word length of the Slovakian nouns and verbs (t (12) = 1.59, p = 0.137). The mean word length of the Slovakian verbs was 7.43 and for the Slovakian nouns the mean word length was 6.

Based on Brysbaert, Stevens, De Deyne, Voorspoels and Storms (2014) the concreteness of the words had been determined, as can be seen in table 2. All the nouns and verbs showed a more or less equal amount of concreteness. Overall, the nouns were shown to be slightly more concrete. However, no significant difference between the levels of concreteness had been found (t (7) = -0.60, p = 0.566).

Based on Keuleers, Brysbaert and New (2010) and the Subtlex database, the frequency of the words was determined, as can be seen in table 3. Again, no significant difference was found between the levels of frequency (t (6.25) = 1.08, p = 0.319).

Table 2.   Concreteness for the 14 words (1 = abstract, 2 = more abstract than concrete, 3 = equally abstract as concrete, 4 = more concrete than abstract, 5 = concrete) based on 15 ratings.

Verbs	Mean	SD	Nouns	Mean	SD
Schieten	4.47	0.52	Bloem	4.67	0.49
Praten	3.87	1.13	Wereld	3.33	1.45
Schaatsen	4.47	0.83	Gordijn	4.67	1.05
Mengen	3.80	1.01	Varken	4.80	0.56
Liften	3.67	1.11	Fout	2.20	0.68
Hardlopen	3.80	1.21	Appel	4.67	0.90
Komen	3.33	1.05	Vliegtuig	4.80	0.77

Table 3.   Frequency of the 14 words with their word lengths and the amount of times the word appeared in the corpus of 43,8 million words.

Verbs	Word Length	Frequency	Nouns	Word Length	Frequency
Schieten	8	5787	Bloem	5	590
Praten	6	28086	Wereld	6	17230
Schaatsen	9	238	Gordijn	7	195
Mengen	6	199	Varken	6	1082
Liften	6	118	Fout	4	2993
Hardlopen	9	110	Appel	5	466
Komen	5	1143.88	Vliegtuig	9	3923

In total, 4 different videos were made in order to learn and test the 14 Slovakian words mentioned above. This was done using the program Hitfilm Express with a 1080p Full HD template. The first 3 videos[2] (each representing a different condition) gave the participants the opportunity to learn the Slovakian words and the fourth video (which was the same for each group) tested how many they remembered.

The teaching videos started by giving an introduction to the experiment and contained one Dutch and one Slovakian instructor (see Appendix A for the introductions). First, a Dutch word was pronounced followed by the Slovakian translation while both contained the corresponding gesture (or not, depending on the condition). The Dutch words were pronounced once and its Slovakian translation was pronounced twice. For example, the Dutch word 'praten' was first pronounced once by the Dutch instructor followed by the Slovakian translation 'Rozprávat' pronounced twice by the Slovakian instructor. The two instructors were positioned next to each other on screen and were shown from head to waist. In this way the gestures were clearly visible and were presented as precise as possible. NGT signs were used which corresponded with the Dutch words. After the Dutch instructor finished pronouncing the Dutch word, that part of the screen froze and the Slovakian instructor next to it started pronouncing the Slovakian words (twice). The background of the videos had a plain colour in order to prevent any distractions and to show everything as clearly as possible.

Each of the teaching videos represented a different condition. The first video was used for the group that only got to see the gestures. The second video was used for the group that got to see and got to re-produce the gestures. The same video was used again, but the introductions differed since the participants were asked to repeat the gestures themselves while listening to the words. The third video was used for the group that did not get to see any gestures (control group). Again, the same procedure as in the first video was followed with the exception that no gestures were included.

Finally, the testing video started with an introduction as well in order to explain to the participants how they were being tested (see Appendix A for the introduction). During this video the Slovakian instructor pronounced the Slovakian words twice (without including gestures), after which the participants wrote down their Dutch answers.

Subjects

A total of 66 people took part in the experiment of which the age ranged between 19 and 25

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[2] In reality there were only 2 different videos, however each video contained a different introduction. Therefore, the videos referred to the video with the corresponding introduction, which made a total of 3 different teaching videos.

years old ($M = 21.88$, $SD = 1.76$). Out of these participants, 25 were male and 41 were female and they had different educational levels, as can be seen in table 4.

Table 4.   Frequency of the different educational levels of the participants.

Educational level	Frequency
WO Master	15
WO Bachelor	29
HBO Master	1
HBO Bachelor	14
MBO 4	3
VWO	4

Furthermore, the participants had no prior knowledge about the Slovakian language or any other Slavic language (since these languages are quite similar). In order to assure this, only Dutch participants were tested. This way the chances of someone already knowing something about Slovak or any other Slavic language was reduced. On top of that, the participants were asked to indicate their proficiency in their second and third language (if they spoke multiple languages) as can be seen in table 5.

Table 5.   The Means and Standard Deviations of the L2 and L3 proficiency (1 = low proficiency and 10 = high proficiency) of the participants in the different gesture type conditions.

Condition	Viewing Gestures N = 23 M (SD)	Repeating gestures N = 22 M (SD)	No gestures N = 21 M (SD)	Total N = 66 M (SD)
L2 proficiency	7.49 (1.45)	7.13 (3.08)	8.30 (0.79)	7.63 (2.03)
L3 proficiency	4.17 (2.68)	4.15 (3.19)	5.04 (2.96)	4.44 (2.93)

Finally, people who were raised multilingually were not included in the study, as their more extended language knowledge might have given them an advantage in the experiment.

Design

The two independent variables were 'Gesture type' (consisting of 3 levels: viewing gestures, repeating gestures, no gestures), which was a between-subjects factor, and 'Word type' (consisting of 2 levels: nouns, verbs), which was a within-subjects factor. This resulted into the implementation of a 2 x 3 repeated-subjects design. The dependent variable was 'Word comprehension.' Accordingly, the following analytical model was composed:

Independent variables   Dependent variable
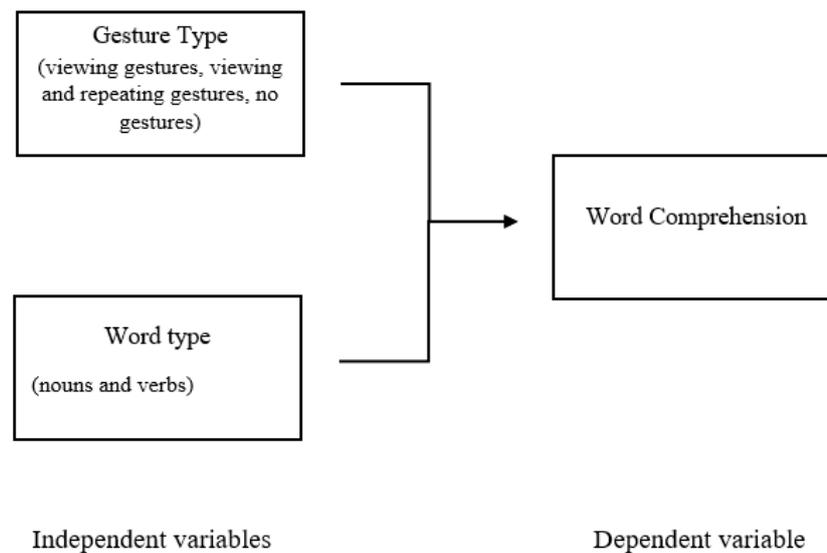
Instruments

In order to test word comprehension, a word-recall test had been conducted. In this test the participants were asked to write down the Dutch translations of the given Slovakian words. The participants heard the Slovakian words twice and after each word they got 15 seconds to write down the Dutch translations. Since all the participants were native Dutch speakers, 15 seconds was more than sufficient to write down the answers. With this test it had been determined how many words the participants had remembered correctly.

Procedure

The experiment was conducted online using Qualtrics and since the participants were Dutch the survey was created in the Dutch language. Convenience sampling was used to recruit the participants. Additionally, the experiment was done on an individual basis and the participants were divided randomly across the 3 different conditions, so every time someone clicked on the link a different condition started. Consequently, the participants were not fully aware

about what they were getting tested on. This was done deliberately, so that the participants would not be biased when making the survey. However, since most of the participants were known to the researchers, some of them would have known to some extend that there existed different conditions. On the other hand, the word type factor was more unknown to the participants, since this could also not have been derived from the survey. The procedure was the same for all of the participants and filling out the survey took approximately 20 minutes.

The first part of the experiment was conducting a pilot session with a total of 8 people, who were divided across 3 separate small sessions. The three people from the first pilot session had less answers correct than the overall average test score ($M = 4.18$, $SD = 3.04$). Meaning that the experiment was too difficult. After making some adjustments, the other 5 participants had average or above average scores. According to the remarks of the participants there were various problems with the experiment: (a) the instructions were not clear enough, (b) the test was too difficult and more repetition was needed, (c) it was not clear enough that the Dutch words were not going to be present in the testing video, (d) the quality of the video was not great and (e) the question 'How often do you use multiple languages simultaneously?' was misunderstood. As a result, the following changes were implemented:

1. The instructions were improved and extended so that they were as clear as possible.
2. To make the test easier, the teaching videos were repeated twice instead of showed just once, with the other (demographic) questions asked in between.
3. The Dutch words were put above all the videos so that the participants knew which words they had to learn and had to fill in.
4. The quality of the videos had been improved a little bit with some editing, however it was still not completely optimal.
5. The question 'How often do you use multiple languages simultaneously?' was changed to 'How often do you use multiple languages during a certain period?'

After implementing these changes, the experiment was conducted. The survey started with an introduction to the online experiment, in which it was explained which steps the participants had to follow and which criteria they had to meet (see Appendix B for the complete survey). They could either agree or disagree to this and in case the participant disagreed he or she could not proceed with the experiment. When agreed the participant was directed to the next screen, which contained the first learning opportunity.

Depending on the condition, one of the three different teaching videos, as described under the materials headline, was played. Additionally, a list of all the Dutch words was

added above the videos in order to remind the participants of the words. After the video was played once, the participants were asked to fill in some demographical questions (such as age, gender, educational level, study program, whether he or she had a job and whether he or she was born in the Netherlands). This way it could be made sure that the participants fitted the given criteria, as mentioned under the subjects headline. Subsequently, the same teaching video was displayed again with the corresponding Dutch words. After this, the participants were asked to fill in another set of questions based on the languages that they know (see Appendix B for the questions included in the survey). These questions were asked in between the video sessions in order for the participants to take their mind of the test for a little bit.

The last part of the survey consisted of the word-recall test in which the Slovakian words were given, twice, and in which the participants had to write down the Dutch translations. For this part, the words were given in a randomized order with respect to the teaching video in order to prevent the participants from remembering the last words better and again the list of Dutch words was given. At the end of the survey the participants were thanked for their participation and they could see how many correct answers they filled in. The participants did not receive a reward for their participation.

Statistical treatments

Two independent variables, of which one between-subjects factor and one within-subjects factor, were included in the study. Because of the within subjects factor a two-way repeated measures ANOVA was used to analyse the obtained data. An additional one-way ANOVA was included as well in order to interpret the interaction effect.

Results

First of all, a repeated measure analysis with word type as a within-subjects factor and gesture type as a between-subjects factor showed no significant main effect for word type (F (1, 63) = 1.69, p = .198). It did however show a significant main effect for gesture type (F (2, 63) = 3.69, p = .030). These main effects were qualified by a significant interaction effect between word type and gesture type (F (2, 63) = 4.83, p = .011). An additional repeated measures analyses per gesture type showed that the difference between the two types of words was only found significant for the gestures viewing condition (F (1, 22) = 13,25, p = .001): verbs (M = 2.91, SD = 1.83) were better remembered than nouns (M = 2.00, SD = 1.62), which can be seen in table 6 and graph 1. There was no significant difference between the two types of words for the gestures repeating condition (F (1, 21) < 1) and for the no gestures condition (F (1, 20) < 1).

Table 6.   Mean and standard deviation of the types of words for the different gesture types (conditions).

	Nouns n = 7 M (SD)	Verbs n = 7 M (SD)
Viewing gestures	2.00 (1.62)	2.91 (1.83)
Repeating gestures	1.45 (1.57)	1.36 (1.65)
No gestures	2.52 (1.44)	2.33 (1.43)

Graph 1.   Mean distribution of the types of words across the different conditions.
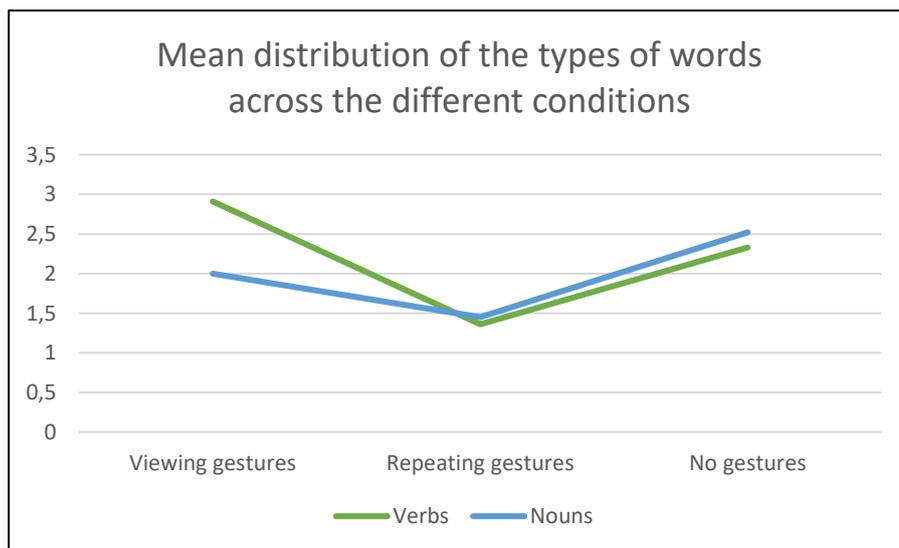
Furthermore, an additional one-way ANOVA showed a significant gesture type effect for the comprehension of verbs ($F (2, 63) = 5.04$, $p = .009$). A post hoc analysis showed that verbs were better comprehended while viewing the gestures ($M = 2.91$, $SD = 1.83$) than when repeating the gestures ($M = 1.36$, $SD = 1.65$). There was no significant difference between viewing the gestures and not viewing gestures ($p = .747$, Bonferroni correction) and between repeating the gestures and not viewing gestures ($p = .176$, Bonferroni correction).

Another, one-way ANOVA did not show a significant effect for the comprehension of nouns ($F (2, 63) = 2.57$, $p = .085$).

Conclusion

This study was aimed at finding an answer to the following research question: 'To what extent does gesture use facilitate L2 word comprehension?' To formulate an answer to this question, the conducted research suggests that using gestures helps to some extend in L2 word comprehension. This was especially shown for the comprehension of verbs in the gesture viewing condition and thus H1 was partly confirmed. On top of that, the study found evidence that verbs were indeed remembered better than nouns, so H2 has been confirmed. But this was only the case in the gesture viewing condition. However, even though there was no significant difference for nouns, the *p*-value was still below 10% meaning that there is a trend. This trend shows that nouns would be better comprehended in the no gesture condition that in the gesture repeating condition. Additionally, as can be seen clearly in graph 1, reproducing the gestures showed the lowest means for both verbs and nouns. On top of that, the analysis showed that verbs were remembered significantly better while viewing the gestures than when repeating them. This means that H3 has been rejected, as the study showed that reproducing the gestures did not facilitate L2 word learning better than when just viewing the gestures, as was expected.

Discussion

According to the studies of Macedonia, et al. (2011), Sueyoshi and Hardison (2005) and García-Gómez and Marcizo (2019) vocabulary is remembered better when gestures are being used. The present study only found some evidence that this is the case as it applied only to verbs and only to the gestures viewing condition. Furthermore, the study of García-Gomez and Macizo (2019) showed that the recall of nouns was better in the no gesture condition and they proposed that using congruent gestures helps with the learning of verbs since the characteristics being shown in the gestures refers to an action. Similarly, according to Macedonia and Knösche (2011) the enactment that is being portrayed has a greater effect on an action verb, because a representation is being shown in the gesture. The present study also found evidence for this as nouns were better recalled in the no gestures condition, but verbs were better remember than nouns when the gestures are being viewed. Additionally, Nyberg, et al. (2002) showed that encoding enactment makes recall easier. Following up on this topic of enactment, Tellier (2008) found some evidence that repeating gestures facilitated L2 word learning for French children more than just viewing pictures. Additionally, the study of Morett (2018) found some evidence that spontaneous gesture production leads to better word recall of L2 words than nonspontaneous gesture viewing. On top of that, a recent study of

Sweller et al. (2020) suggests that the recall of words was better when gestures were observed or reproduced than when no gestures were being shown. But they did not find a difference in the recall of L2 words between viewing gestures and reproducing gestures. The present study investigated if repeating the gestures facilitated L2 word learning more than viewing the gestures. However, contrary to what was expected, this does not seem to be the case. Verbs were better remembered while viewing the gestures than when reproducing them. On top of that, the repeating gestures condition had the lowest mean scores overall, unlike the findings of Sweller et al. (2020). Furthermore, there was no significant difference between viewing gestures and repeating gestures, in line with the results of Sweller et al. (2020). This could have been the result for a couple of reasons. First of all, as suggest by Morett (2018) spontaneous gestures lead to better recall, but the gesture reproduction in the present study did not happen on a spontaneous basis. On top of that, it is probable that not every participant copied the gestures the way it should have been done, since the experiment was conducted online there was no control on this. However, it could also be the case that reproducing gestures while trying to learn vocabulary works distracting as you need to focus on multiple things at the same time, and thus it can have the opposite effect. This was actually mentioned by one of the participants after conducting the experiment, who found reproducing the gestures while trying to learn the vocabulary distracting. Lastly, as can be seen in table 5, the participants were asked to indicate their L2 and L3 proficiency, but this data was not included in the results because more investigation is necessary regarding this topic. However, an extra analysis with L2 and L3 proficiency as co-variates showed that the interaction effect did not change and the main effect for condition became less significant. A possible explanation for this could be that when the overall language skills of the participants were better the gestures did not help that much when learning vocabulary in a new foreign language. But further research in this area is required.

One of the biggest limitations in the study were the consequences of the outbreak of the COVID-19 (corona) virus. Due to the outbreak getting together in groups was not allowed and thus the experiment had to be transferred into an online platform instead. As a result of this, there was less overview over the experiment, which could have had an effect on the results. As mentioned above, it was not possible to check whether the participants actually reproduced the gestures, which could have affected the results for this condition. Similarly, it was also not possible to check if, even after the improvement made from the pilot study, the participants fully understood all of the instructions and thus if they acted correctly accordingly. It also made it impossible to check whether the participants took notes during the

learning process or whether they replayed the videos more than once. Another limitation in the study was the fact that the video quality was not completely optimal, as there was a bit of an echo. Therefore, it could have been possible that the participants scored a little bit lower because of this. Although this does not necessarily have to be the case, since there were still quite some participants who scores high above average.

Future research could follow a similar approach, but then the experiment should be conducted in person with the participants. This way better results could be expected. Additionally, further research should be done on the effect of reproducing gestures while learning L2 vocabulary, to see whether this actually can help more than just viewing the gestures or if it actually works distracting. Also, the difference between concrete and abstract nouns should be studied, as the present study included both abstract and concrete nouns. As mentioned by Macedonia & Knösche (2011) a concrete noun has a higher sensorial representation than an abstract noun, thus there could exist a potential difference in this area as well. Finally, future research should investigate the effects of the existing L2 and L3 of the participants on the use of gestures for L2 vocabulary learning. Future studies should continue to explore the effects of gestures use on L2 vocabulary learning.

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Introductions of the teaching and testing videos

Video group 1 (viewing gestures)

In deze video ga je 14 Slowaakse woorden leren. Je krijgt twee instructeurs te zien: één Nederlandse en één Slowaakse. Eerst zal de Nederlandse instructeur een Nederlands woord uitspreken. Daarna zal de Slowaakse instructeur twee maal de Slowaakse vertaling van het woord geven. Onthoud de woorden goed, want nadat alle woorden zijn geweest zal er een test komen. In deze test wordt verwacht dat je aan de hand van de Slowaakse woorden de Nederlandse vertaling opschrijft. Dit wordt later verder uitgelegd. Voor nu, succes met leren!

Video group 2 (repeating gestures)

In deze video ga je 14 Slowaakse woorden leren. Je krijgt twee instructeurs te zien: één Nederlandse en één Slowaakse. Eerst zal de Nederlandse instructeur een Nederlands woord uitspreken. Daarna zal de Slowaakse instructeur twee maal de Slowaakse vertaling van het woord geven. Onthoud de woorden goed, want nadat alle woorden zijn geweest zal er een test komen. In deze test wordt verwacht dat je aan de hand van de Slowaakse woorden de Nederlandse vertaling opschrijft. Dit wordt later verder uitgelegd. Ook zullen de instructeurs handgebaren gebruiken. Probeer deze, tijdens het leren van de woorden, zo nauwkeurig mogelijk na te doen. Voor nu, succes met leren!

Video group 3 (no gestures)

In deze video ga je 14 Slowaakse woorden leren. Je krijgt twee instructeurs te zien: één Nederlandse en één Slowaakse. Eerst zal de Nederlandse instructeur een Nederlands woord uitspreken. Daarna zal de Slowaakse instructeur twee maal de Slowaakse vertaling van het woord geven. Onthoud de woorden goed, want nadat alle woorden zijn geweest zal er een test komen. In deze test wordt verwacht dat je aan de hand van de Slowaakse woorden de Nederlandse vertaling opschrijft. Dit wordt later verder uitgelegd. Voor nu, succes met leren!

Testing video

Nu je de woorden hebt geleerd, gaan we testen hoeveel woorden je hebt onthouden. In deze video zal de Slowaakse instructeur alle woorden twee keer zeggen. Na elk woord heb je 15 seconden om de Nederlandse vertaling op je antwoordenblad te schrijven. De woorden staan in een andere volgorde dan in de vorige video. Succes!

Appendix B

The survey

Beste deelnemer,

Bedankt voor uw bereidheid om deel te nemen aan dit onderzoek van studenten van de Radboud Universiteit over het leren van een vreemde taal.

De procedure van dit onderzoek bestaat uit de volgende stappen: 1) het bekijken van een video waarin u de Slowaakse vertaling van 14 woorden zult leren, 2) het invullen van een korte algemene vragenlijst, 3) het nogmaals bekijken van dezelfde video als in stap 1, waardoor u de kans heeft om de woorden nog eens te leren, 4) het invullen van een vragenlijst over uw taalachtergrond, en 5) het bekijken van een video waarna we benieuwd zijn van hoeveel Slowaakse woorden u de betekenis hebt onthouden.

Het is belangrijk dat het volume op uw computer of telefoon goed werkt en dat u de video in optimale omstandigheden, zonder afleiding, kunt bekijken. Daarvoor heeft u een hoofdtelefoon nodig. Voor de testfase heeft u pen en papier nodig. Deelnemen aan deze studie duurt ongeveer 20 minuten.

Uw deelname aan dit onderzoek is vrijwillig en u kunt zich op elk moment terugtrekken. Al uw antwoorden blijven vertrouwelijk, worden anoniem verwerkt en worden alleen gebruikt voor deze studie.

Als u hieronder op de knop 'Ik ga akkoord' klikt, betekent dit dat:
- U de bovenstaande informatie heeft gelezen
- U vrijwillig instemt met de deelname
- U minimaal 18 jaar oud bent

Indien u niet wenst deel te nemen aan deze studie, kunt u de deelname weigeren door deze webpagina te verlaten.

Voor meer informatie over deze studie kunt u contact opnemen met j.chan@student.ru.nl.

Nogmaals hartelijk bedankt voor uw deelname. Wij zijn hier bijzonder mee geholpen!

Rivka van den Berg, Iris Kattar, Benthe Meijer, Linda Schellekens, Leonard Lauko, Jimi Lee Chan
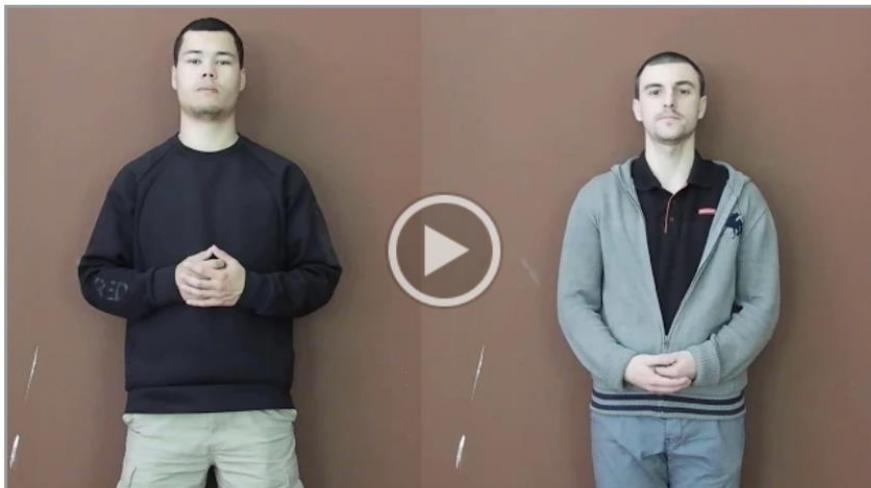
○   Ik ga akkoord (doorgaan met het onderzoek)

○   Ik ga niet akkoord (stoppen met het onderzoek)

Learning phase 1

U gaat van de volgende 14 woorden de Slowaakse vertaling leren:

Mengen	Appel	Schaatsen	Fout
Praten	Gordijn	Schieten	Liften
Vliegtuig	Varken	Bloem	
Wereld	Komen	Hardlopen	

Bekijk alsjeblieft de volgende video en volg de instructies

Demographical questions

Nu u de woorden heeft geleerd krijgt u een paar minuten pauze. In deze tijd kunt u alvast de volgende gegevens invullen.

Wat is uw leeftijd?

_____

Wat is uw geslacht?

○   Man

○   Vrouw

○ Anders, namelijk _____

Wat is uw opleidingsniveau?

○ WO Master

○ WO Bachelor

○ HBO Master

○ HBO Bachelor

○ MBO 4

○ MBO 3

○ MBO 2

○ MBO 1

○ VWO

○ HAVO

○ VMBO

Indien u studeert, wat is de naam van uw opleiding?

_____

Indien u werkt, wat is uw beroep?

_____

Bent u geboren in Nederland?

○   Ja

○   Nee

The next 3 questions were only being shown when the answer to the previous question was no.

In welk land bent u geboren?

_____

Hoe oud was u toen u naar Nederland kwam?

_____

Hoeveel jaren woont u al in Nederland?

_____

Learning phase 2

Om ervoor te zorgen dat u de woorden goed onthoudt, vragen wij u om nog eens op dezelfde manier de 14 woorden te leren door middel van dezelfde video.

Het gaat hierbij dus weer om deze woorden:

Mengen	Appel	Schaatsen	Fout
Praten	Gordijn	Schieten	Liften
Vliegtuig	Varken	Bloem	
Wereld	Komen	Hardlopen	

Bekijk alsjeblieft de volgende video en volg de instructies.

Language Background

Nu u de woorden heeft geleerd krijgt u een paar minuten pauze. In deze tijd kunt u alvast de volgende gegevens invullen.

Wat is/zijn uw eerste taal/talen?

☐ Nederlands

☐ Engels

☐ Duits

☐ Frans

☐ Vlaams

☐ Anders, namelijk _____

Geef alstublieft aan welke andere talen u nog meer kent. Noteer de talen die u nog veel in het dagelijks leven gebruikt of voor een langere periode in het verleden hebt gebruikt. Probeer een schatting te maken van de beheersing die u hebt over elke taal. Gebruik hierbij de volgende schaal: Niet goed 1 2 3 4 5 6 7 8 9 10 Heel goed

	Spreken	Luisteren	Schrijven	Lezen
Taal 1				
Taal 2				
Taal 3				
Taal 4				
Taal 5				

Geef alstublieft aan welke taal/talen u gebruikt voor de volgende activiteiten:

Taal/talen

Lezen   _____

TV Kijken   _____

Luisteren naar de radio/

muziek   _____

E-mail/Internet   _____

Hoeveel houdt u ervan om nieuwe talen te leren?

	1	2	3	4	5	6	7	8	9	10	
Ik hou er totaal niet van	○	○	○	○	○	○	○	○	○	○	Ik hou er heel erg van

Hoe makkelijk vindt u het om nieuwe talen te leren?

	1	2	3	4	5	6	7	8	9	10	
Moeilijk	○	○	○	○	○	○	○	○	○	○	Makkelijk

Hoe vaak maakt u gebruik van meerdere talen gedurende een periode?

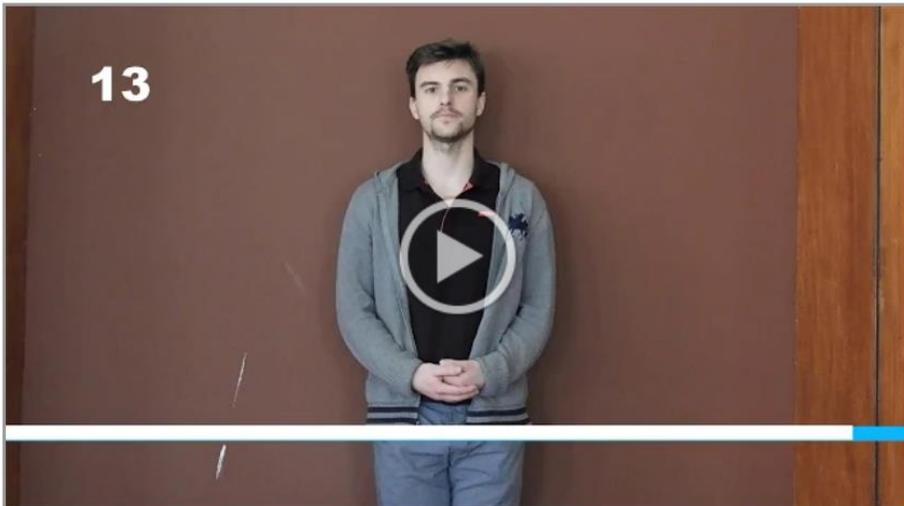|	1	2	3	4	5	6	7	8	9	10	
Bijna nooit	○	○	○	○	○	○	○	○	○	○	Heel vaak

Testing phase

We zijn nu benieuwd van hoeveel Slowaakse woorden u de betekenis nog weet. U krijgt nu alleen de Slowaakse woorden te horen, waarvan u de Nederlandse vertaling moet geven. Het gaat hierbij om deze Nederlandse woorden:

Mengen	Appel	Schaatsen	Fout
Praten	Gordijn	Schieten	Liften
Vliegtuig	Varken	Bloem	
Wereld	Komen	Hardlopen	

Schrijf eerst de Nederlandse vertaling op een kladblaadje en vul deze daarna in onder de video, zodat u te allen tijde de Slowaakse spreker ziet.

Bekijk alstublieft deze video en volg de instructies.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Appendix C

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: _____

Student number: _____

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: _____