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Do Iconic Gestures Facilitate L2 Vocabulary Learning?

Dutch Students Learning Slovakian Verbs and Nouns.

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Abstract

Due to globalization, the value of being competent in multiple languages increased, and a large number of people around the world put effort into learning a foreign language. Much research has been conducted on second language acquisition, and some suggest that nonverbal communication could benefit the language learning process. This study explored the effects of highly iconic gestures on the word learning process, and additionally investigated the differences of acquiring novel nouns and verbs. In an experiment, participants learned novel Slovakian words, and were tested on the comprehension of these words. The participants were divided into three different gesture conditions, namely: gesture viewing, gesture viewing AND repeating, and no gesture. The results of this study show that the participants' comprehension differed per gesture condition. However, further analyses were inconclusive. Lastly, the study did show that verbs were memorized significantly better than nouns when presented with congruent iconic gestures. Future research may further explore the differences between learning different word types, and may eliminate limitations of this study by conducting an experiment in a real life educational setting.

1. Introduction

Globalization has increased the value of being competent in multiple languages (Chiesa, 2012). Due to this, a large number of people around the world put effort into learning a foreign language (Ryan, 2006). Language learning is a complicated process and learning foreign vocabulary can be a significant challenge (Quine, 1960). The complexity of acquiring a second language has led to a vast amount of research dedicated to this learning process (Chaudron, 1988; Cook, 2013; Ellis, 1990; McLaughlin, 1987; Mitchell et al., 2019; Nunan, 1999).

Language learning consists of learning verbal as well as nonverbal communication (Allen, 2000). Research shows that a great deal of communication is nonverbal, and experts estimate that in any social situation, at least 65% of the message is nonverbally transferred. In a classroom setting, these percentages of nonverbal communication are even more extensive, namely, 82% of teachers' communication is nonverbal. These findings suggest that nonverbal communication could benefit language learners (Allen, 1999).

One form of nonverbal communication is the use of gestures; in other words, movements of the hands and body that accompany speech (Abner, 2015; Goldin-Meadow, 2007; Krauss et al., 1996). Gestures are visible actions used as an utterance, or part of an utterance (Kendon, 2004). McNeill (1992) makes a distinction between different kinds of gestures and classifies four gesture categories; iconic, metaphoric, deictic, and beat gestures. Iconic gestures are gestures with a close relation to the semantic message in speech. Metaphoric gestures are similar to iconic gestures because they present imagery. However, metaphoric gestures present abstract concepts. Deictic gestures are pointing movements, and beat gestures are movements without a semantic meaning (McNeill, 1992). Deictic gestures transfer directional information to the listener (Austin & Sweller, 2014). Beat gestures are often unconsciously made simple rhythmic hand movements (Austin & Sweller, 2014; Leonard & Cummins, 2011).

A review, based on former research on gestures, has been assembled to answer the question if gestures in combination with speech, in general, communicate information in a more beneficial manner to listeners (Kendon, 1994). The review concluded that gesture use in combination with speech is indeed a beneficial way to communicate information, which indicates a close relation between speech and gestures, and confirms the value of gesture use (Kendon, 1994; Hostetter, 2011).

Gesturing is arguably an innate part of the speaking process, as even blind people gesture when speaking (Iverson & Goldin-Meadow, 1998). Iverson & Goldin-Meadow (1998) videotaped twelve blind participants while responding spontaneously to a series of reasoning tasks that stimulated gesturing for sighted children as well as for all twelve blind participants. Moreover, McNeill (1992)

suggests that gestures and speech form a single system in communication. McNeill (1992) gives the following five reasons to support this claim; '1. gestures occur with speech in 90% of cases, 2. gesture and speech are phonologically synchronous, 3. gesture and speech are semantically, and pragmatically co-expressive, 4. gesture and speech develop together in children, and 5. gesture and speech break down together in aphasia' (Esteve-Gibert & Prieto, 2013, p. 2; McNeill, 1992). More recent studies support the ideas of McNeill (1992) that language and gesture are highly interdependent systems that mutually influence each other, and conclude that gesturing can play an important part in language learning (Esteve-Gibert & Prieto,2013; Macedonia & Kriegstein, 2012).

Due to the close relation between speech and gestures, there have been attempts to implement gestures as a tool for education (Ping & Goldin-Meadow, 2010). These attempts have resulted in proof on the fact that gestures can support learning (Abner et al., 2015; Alibali et al., 1993; Austin & Sweller, 2014; Beaudoin-Ryan & Goldin-Meadow, 2014; Broaders et al., 2007; Gullberg, 2006).

Cook (2010) found that gestures can improve memory and learning, by doing an experiment in which two participant groups had to describe vignettes either with or without the help of gestures. Additionally, Cook (2010) found that instructed and spontaneous gestures can both be equally beneficial to a learning process. More research on gestures' effect on learning suggest that gestures can benefit learners to understand the concept of symmetry (Valenzo et al., 2002), to acquire math (Goldin-Meadow et al., 1999), or to learn science (Roth, 2003).

Thus, gestures seem to aid learning, but how does it influence the language learning process? Children produce gestures before they produce their first words (Bates et al., 1976). Children start to use deictic gestures to point at objects around the age of 10 months, before learning the word for those objects (Özçaliskan et al., 2014). These observations suggest that pointing gestures help children to acquire their first nouns (Iverson & Gold-Meadow, 2005). Verbs are more challenging to acquire in comparison with nouns for children (Gentner, 1982). Verbs convey relational meaning (Gentner, 1982), and children typically produce their first iconic gestures six months after they produced their first verbs (Özçaliskan et al., 2014). These findings show that the use of gestures evolves asymmetrically for nouns and verbs for children. Additionally, the findings suggest that gestures assist children in their language learning process.

Therefore, gestures can assist children in acquiring language, but can gestures also simplify second language learning for adults? Hurford (1991) suggests a critical period for language learning, in which language is more natural to acquire, and which ends around puberty. These findings suggest that language learning is more difficult for adults than for children. Gestures can help adults with this difficulty, as adults who gesture while learning sentences in a foreign language are more likely to remember what they have learned (Allen, 1995). Moreover, research has shown that adults gesture

more in their second language than in their first language (Sherman and Nicoladis, 2004). Besides, speakers use more gestures when trying to remember an uncommon word than when trying to remember frequent words (Beattie & Shovelton, 2000; Krauss & Hadar, 1999). These findings suggest that gestures can help people retrieve words from their memory, and facilitate language encoding as well as decoding abilities. Furthermore, there is evidence that gestures are not only a vital part of language, but can facilitate comprehension and recall for single words (Driskell & Radtke, 2003; So et al., 2012), sentences (Thompson et al., 1998), and reasoning (Church et al., 2000), as explained in the following.

Driskell & Radtke (2003) performed an experiment in which two adult participants had to either explain or guess words written on flip cards and found that gesturing enhanced both speech production (explaining the words) and listener comprehension (guessing the words). In this experiment, the two conditions were 1. using gestures and 2. not using gestures, and there were no restrictions as to what kind of gestures the participants in the gesture condition could use. So et al. (2012) found that iconic gestures improved memory for both children and adults while performing a word recall test. In this experiment, the participants were exposed to either beat gestures, iconic gestures, or no gestures via a video. Furthermore, participants had to hold a ball throughout the experiment to prevent them from reproducing the gestures. Thompson et al. (1998) found that the memory of both children and young adults was aided by visual articulatory information (viewing the lips and face movements) and gestures. In this experiment, participants had to listen to, and view spoken utterances and repeat what they understood in a recall period following each sentence. Church et al. (2000) performed an experiment in which children and adults had to watch videotapes of children speaking and gesturing. After each video, participants had to finish a questionnaire from which the results showed that gestures facilitate reasoning.

Furthermore, Allen (1995) conducted an experiment in which adults had to learn French sentences for ten weeks. The author found that the experimental group who had to view and reproduce the gestures while listening to the sentences, scored significantly better than the other groups. Next to gestures improving memory, Seuyoshi and Hardison (2005) found that gestures facilitate second language listening comprehension. Participants had to watch a videotaped lecture, and afterwards a multiple-choice comprehension task revealed significantly better scores when participants were able to see visual cues, including gestures and facial cues. In addition to second language sentence comprehension, congruent gestures can also improve the recall of novel foreign words. Kelly et al. (2009) found that novel Japanese words could be recalled significantly better by the participants when accompanied by congruent iconic gesture compared to incongruent gestures or no gestures at all (Gluhareva & Prieto, 2017; Kelly et al., 2009). Since the incongruent gestures did not benefit the

participants, it can be concluded that gestures did more than just grasp the participants' attention when learning foreign vocabulary (Gluhareva & Prieto, 2017; Kelly et al., 2009). These studies suggest that gestures can positively influence listener comprehension, speech production, memory, and reasoning in a language learning process, and thus support language learning.

Reproducing gestures is another tool that could help language learnings, as Cohen (1981) found that doing an action helps people remind the action, whereas saying words does little to improve memory (Bahrick & Boucher, 1968) (Cook, 2010). As mentioned before, Allen (1995) also found that adults who gesture while learning sentences in a foreign language are more likely to maintain what they have learned. Moreover, Tellier (2008) found that reproducing gestures influences the memorization of second language vocabulary. In her study, participants learned English words by watching a video with either an image of the words or a gesture representing the words. The results show that the gestures facilitated memory of the L2 words, and reproduction of the gestures left an even more vibrant trace in memory (Tellier, 2008). These findings strengthen the theory suggesting that gesturing influences memory. This claim is also supported by another research of Tellier (2005) in which young participants had to memorize words in their first language. The words were shown to the participants with the use of a video, and the words were accompanied by gestures. One group of participants had to repeat the words they heard, while another group of participants had to reproduce the gestures they saw. The group of participants reproducing the gestures remembered the words significantly better than the group of participants repeating the words.

If gesturing is beneficial to foreign vocabulary learning, is it equally beneficial for all word types? Lennon (1996) found that second language learners acquire nouns more easily than verbs in general, irrespective of gesture use. García-Gámez and Macizo (2018) had a similar finding, namely that when learning nouns and verbs in a foreign language, without the use of gestures, young adults acquired nouns more quickly than verbs. However, García-Gámez and Macizo (2018) found that young adults acquired verbs just as efficiently as nouns when both are combined with congruent gestures. Additionally, gestures involve body movements and verbs intrinsically denote motoric information, gestures might directly simulate the meaning of verbs, and as a result of this, benefit the acquisition (García-Gámez & Macizo, 2018).

The theoretical overview presented in this section leads to the following hypotheses:
H1: Using gestures facilitates L2 word learning significantly better than not using gestures at all.
H2: Reproducing gestures facilitates L2 word learning significantly better than viewing gestures.
H3: Gestures facilitate L2 word learning significantly better for verbs compared to nouns.

The hypotheses will be tested through the following research question: To what extent do hand gestures facilitate L2 word comprehension?

2. Method

2.1 Materials

This study includes two independent variables: ‘gesture condition' and 'word type'. The independent variable gesture condition consists out of three levels; 1. gesture viewing, 2. gesture viewing AND repeating, and 3. no gestures. The independent variable word type consists out of two levels; nouns and verbs. The dependent variable of the study was the comprehension of the Slovakian words.

The participants were taught 14 novel Slovakian words (in random order) (see appendix C) with the use of a video. There were three different videos, including two different instructions (see appendix D). The instructions either mentioned whether the participants should reproduce the gestures in the video, or no instructions regarding gestures are given. In video 1, the instructors used iconic gestures, in video 2 the instructors used iconic gestures AND participants were asked to repeat these gestures, and in video 3 the instructors did not use gestures. In one of the videos without gesture instructions (Video 1), gestures were included. In the video including the gesture instructions (Video 2), gestures were present. The second video without gesture instructions (Video 3) did not include gestures; this was the video for the control group.

After the instructions, the videos continued with 14 sequences of a Dutch word followed by the Slovakian translation, which was mentioned twice; for example, 'Bloem. Kvetina. Kvetina.'. A Dutch male instructor pronounced the Dutch words, and a Slovakian male instructor pronounced the Slovakian words. Both instructors were wearing monochrome clothing in order to minimize the differences between the instructors (see figure 1).

Figure 1. A screenshot of one of the videos, showing the Dutch (left) and Slovakian (right) instructors.

After the word sequences, the video continued with testing the comprehension of the words. In this section of the video, the Slovakian instructor pronounced the Slovakian words twice, followed by a fifteen-second timer during which the participants had time to write down the Dutch translation. Half of the novel Slovakian words that the participants learned in the video were verbs, and the other half of the words were nouns. In this experiment, lexical signs were used instead of gestures, due to the availability of iconicity ratings. The signs used in this experiment were all high iconicity signs in Dutch Sign Language (in Dutch Nederlandse Gebarentaal or NGT). The rating of all the signs was either a six or a seven on a 7 point-scale measuring the iconicity of the signs, indicating high iconicity. The iconicity rating of the signs was done by twenty deaf adults, proficient in Dutch Sign Language (Ormel et al., in preparation). An independent samples t-test was conducted to compare the iconicity of the Dutch verbs and nouns. There was not a significant difference between the iconicity of the verbs (M=5.71, SD=.76) and nouns (M=6.00, SD=1.41); $t(12)$=-.47, p=.646.

In order to maintain internal validity, it was assured that the Slovakian translation of the words cannot be inferred from other languages the participants could be competent in, such as Dutch, English, German, or French. Additionally, the Slovakian translations of the words were all between 4 and 10 letters (M=6.71, SD=1.7). An independent samples t-test was conducted to compare the length of the Dutch verbs and nouns. There was no significant difference between the length of the verbs (M=7.00, SD=1.63) and nouns (M=6.00, SD=1.63); $t(12)$=1.15, p=.274). Additionally, the frequency of the words was checked by using a frequency measure from Dutch film subtitles (Keuleers et al., 2010) (see appendix C). An independent samples t-test was conducted to compare the frequency of the Dutch verbs and nouns. There was no significant difference in the frequency between verbs (M=5129.71, SD=4931.19) and nouns (M=6390.86, SD=5466.23); $t(12)$=-.453, p=.658). Lastly, the concreteness of the words was checked on a scale rated from 1 (very abstract/language-based) to 5 (very concrete/experience-based) (Brysbaert et al., 2014) (see appendix

C). An independent samples t-test was conducted to compare the concreteness of the Dutch verbs and nouns. There was no significant difference in concreteness between the verbs (*M*=3.92, *SD*=.42) and nouns (*M*=4.16, *SD*=1.01); *t*(12)=-.60, *p*=.561).

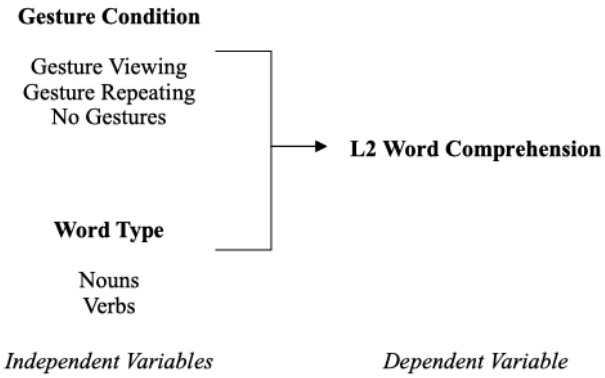
2.2 Subjects

A total of 66 Dutch students were recruited via the personal network of the authors of this study. The students were aged between 19-25 years old ($M = 21.88$, $SD = 1.75$). A one-way ANOVA showed that there was no significant difference between age and gesture condition, meaning that the ages of the participants were comparable among the different gesture conditions. (F (2, 63) = < 1, p = .877). The 66 participants consisted out of 25 men (37.9%), and 41 women (62.1%). A chi-square test showed that there was no significant difference between gender and gesture condition, meaning that the gender of the participants was comparable among the different gesture conditions ($\chi 2$ (2) = 1.41, p = .494). Most participants had a universities' bachelor's or master's educational level (67.6%), and no participants had a lower than high school educational. A chi-square test showed that there was no significant difference between educational level and gesture condition, meaning that the educational levels of the participants were comparable among the different gesture conditions ($\chi 2$ (10) = 14.40, p = .156).

2.3 Design

The design of this study was a 2x3 repeated-measures design, with 'gesture condition' as between-subject factor, and 'word type' as a within-subject factor. The between-subject factor consisted of three levels; 1. viewing gesture, 2. viewing and repeating gesture, and 3. no gestures. The within-subject factor consisted of two levels; verbs and nouns.

Figure 2. Analytical Model



2.4 Instruments

The answers to a word-recall-test were used to test the comprehension of Slovakian words. The Slovakian instructor repeated the Slovakian words twice, after which the participants had maximally 15 seconds to write down the Dutch translation. If the correct Dutch translation was written down, the answer was coded as 'correct'; if no word or a false Dutch translation was written down, the answer was coded as 'false'.

2.5 Procedure

Participants were tested online and individually. When a participant entered the experiment on Qualtrics, an online survey platform, they could read about the purpose of the study, and had to accept the terms of condition (see appendix E). If the participants accepted the terms of condition, they entered the learning phase. Before having to start the video, the participants read about what they could expect in the learning phase and were first introduced to the Dutch words they were going to learn in Slovakian. Moreover, the participants were asked to wear headphones, in order to minimalize distraction. After reading the Dutch words, the participants could start the first video; the learning video. When the video was over, the participants were asked several demographical questions about their age, gender, educational level, nationality, and language use. Once the participants answered these questions, they could start the second video; again, the learning video.

After watching the learning video for the second time, the participants were asked questions about their language abilities and attitude towards language learning. Subsequently, the participants started the last phase of the experiment; the testing phase. The participants could open the last video, in which the Slovakian instructor repeated the Slovakian words twice, after which the participants had 15 seconds to write down the Dutch translation on a piece of paper. In Qualtrics there was no option to let the participants type in their answers and watch the video at the same time, without scrolling the webpage. Therefore, participants could first write down the answers on a piece of paper, and later type the answers into Qualtrics. After the participants filled in all their answers, the experiment was over. Participants did not receive any incentives, due to the fact that this experiment was conducted on an online platform. The experiment took no longer than 20 minutes.

2.6 Statistics

In order to examine the differences in the comprehension of the Slovakian words between the three gesture condition, and two word types, an ANOVA – Repeated Measures and several One-Way ANOVAs were conducted using SPSS.

3. Results

3.1 Effects of word type and gesture condition on comprehension

A repeated measures analysis for comprehension with word type as within-subject factor and gesture condition as between-subject factor showed a significant main effect of gesture condition (F (2, 63) = 3.69, p = .030). However, the conduction of a post hoc test did not reveal any significant differences between the gesture conditions, as the comprehension in the gesture viewing condition (M = 2.46, SD = .30) was not significantly higher than the comprehension in the gesture viewing and repeating condition (p = .057, Bonferroni-correction; M = 1.41, SD = .31), or the comprehension in the no gesture condition (p = 1.000, Bonferroni-correction; M = 2.43, SD = .32). Furthermore, no significant differences were found between the comprehension of the gesture viewing and repeating condition and the no gesture condition (p = .076, Bonferroni-correction). No significant main effect was found for word type (F (1, 63) = 1.69, p = .198). However, a significant interaction was found between word type and gesture condition (F (2, 61) = 4.677, p = .013).

Table 1. Means and standard deviations (between brackets) for the effect of word type and gesture condition on comprehension (1 = low comprehension, 7 = high comprehension)

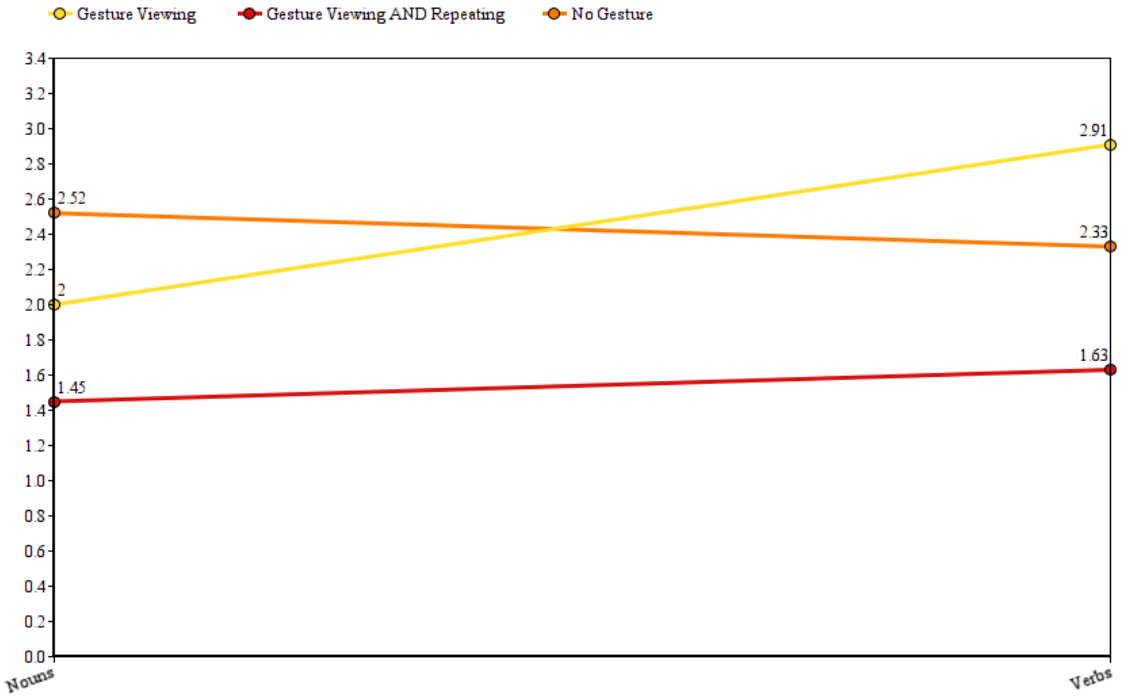
Word Type	Comprehension M(SD)		
	Gesture Viewing	Gesture Viewing AND Repeating	No Gestures
Nouns	2.00 (1.62)	1.45 (1.57)	2.52 (1.44)
Verbs	2.91 (1.83)	1.36 (1.65)	2.33 (1.43)

In order to further explore the interaction between word type and gesture condition the data was split by gesture condition, and an additional repeated measures analysis was conducted with word type as within-subject factor. The repeated measures analysis showed a significant difference between nouns and verbs in the gesture viewing condition (F (1, 22) = 13.25, p = .001), as the comprehension of verbs (M = 2.91, SD = 1.83) was better than the comprehension of nouns (M = 2.00, SD = 1.62). No significant interaction was found between word type and comprehension in the gesture viewing and repeating condition (F (1, 21) = .11, p = .747), or for word type on comprehension in the no gesture condition (F (1, 20) = .37, p = .550).

Additionally, a one-way analysis of variances confirmed the significant condition effect for the verbs, (F (2, 63) = 5.04, p = .009). Verbs were better comprehended in the gesture viewing condition (p = .008, Bonferroni-correction; M = 2.91, SD = 1.83) than in the gesture viewing and repeating condition (M = 1.36, SD = 1.65). There was no difference between the no gesture condition and the gesture

viewing condition (p = .747, Bonferroni-correction), or the gesture viewing and repeating condition (p = .176, Bonferroni-correction). No significant main condition effect was found for the comprehension of nouns (F (2, 63) = 2.57, p = .085). [1]

Figure 3. A visualization of the interaction between word type and gesture condition.



4. Conclusion and Discussion

Due to globalization, competence in multiple languages is valued, and a large number of people around the world put effort into learning a foreign language (Chiesa, 2012; Ryan, 2006). A lot of research has been conducted on second language acquisition, and findings such as those by Allen (1999) suggest that nonverbal communication could benefit the language learning process. The present study was conducted in order to broaden the scope of the studies on nonverbal communication in language learning. More specifically, this study explored the effects of incorporating high iconicity gestures on the L2 word learning process, and additionally investigated the differences of acquiring novel nouns and verbs with the use of congruent gestures. The research question of this study was

[1] The covariate *language proficiency* did not change the overall pattern of the analyses; there is an interaction, but no main effect for gesture condition or word type. Therefore, future research will have to further explore the effects of language proficiency.

the following: To what extent do hand gestures facilitate L2 word comprehension? In order to answer this research question, the following three hypotheses were constructed:

H1: Using gestures facilitates L2 word learning significantly better than not using gestures at all.
H2: Reproducing gestures facilitates L2 word learning significantly better than viewing gestures.
H3: Gestures facilitate L2 word learning significantly better for verbs compared to nouns.

In short, the results of this study show that the participants' comprehension differed per gesture condition. However, further analyses were inconclusive, and thus the first hypothesis cannot be confirmed. Furthermore, the display of comprehension means show that participants in the gesture viewing condition comprehended the Slovakian words better compared to participants in the gesture viewing and repeating and the no gesture condition. Therefore, it can be assumed that gesture reproduction does not support second language word learning. Thus, the second hypothesis cannot be confirmed. Lastly, the results reveal that verbs were significantly better comprehended than nouns in the gesture viewing condition. Hence, the third hypothesis can be partly confirmed.

4.1 Effects of gesture condition on comprehension

The results of a post hoc test regarding the effects of gesture condition showed no effect of gesture condition on comprehension. Thus, the findings of this study oppose the findings of former research suggesting that gestures facilitate language learning (Driskell & Radtke, 2003; Kelly et al, 2009; Seuyoshi & Hardison, 2005; So et al., 2012). Furthermore, the display of comprehension means showed that participants in the gesture viewing and repeating condition scored lowest compared to the gesture viewing and no gesture condition. These findings oppose the findings by Tellier (2008) who found that reproducing gestures influences the memorization of second language vocabulary. However, the study by Tellier (2008) was focused on long-term memorization, and the current study was short-term oriented, which could have been the reason for the differences in results. Therefore, future studies may incorporate a longer timeframe, as language learning is a difficult process. Additionally, the current experiment was conducted online, it could not be assured if the participants really repeated the gestures, and thus, the results lack internal validity.

4.2 Effects of word type on comprehension

The results regarding the effects of word type showed no effect of word type on comprehension in the gesture viewing and repeating and the no gesture condition. However, an

interaction revealed that an effect was found of word type on comprehension in the gesture viewing condition, as participants in the gesture viewing condition comprehended verbs better than nouns. Additionally, verbs were better comprehended in the gesture viewing condition compared to the gesture viewing and repeating condition, and the no gesture condition. These findings support the findings of García-Gámez and Macizo (2018), confirming that verbs are acquired just as efficiently as nouns when both are combined with congruent gestures. In this study, verbs are even acquired more efficiently as nouns when both are combined with congruent gestures. This may be due to the fact that gestures involve body movements and verbs intrinsically denote motoric information. Thus, gestures might directly simulate the meaning of verbs, and as a result of this, benefit the acquisition (García-Gámez & Macizo, 2018).

Although not significant, the results of the current study show that nouns were more easily acquired than verbs in the no gesture condition, supporting the findings of Lennon (1996) that nouns are in general more easily acquired than verbs. However, nouns were better comprehended than verbs in the gesture viewing and repeating condition as well, opposing the findings of both García-Gámez and Macizo (2018) and Lennon (1996). This could be due to the fact that it could not be checked whether the participants really repeated the gestures in this condition as our experiment was conducted online, and thus, the results lack internal validity.

Lastly, although not significant, there was a large difference of the comprehension between the gesture viewing and the no gesture condition compared to the gesture viewing and repeating condition. Again, this could be due to the fact that it could not be checked whether the participants really repeated the gestures in this condition as our experiment was conducted online, and thus, the results lack internal validity. Additionally, repeating the gestures could have distracted the participants rather than support their vocabulary learning process.

4.3 The effect of foreign language proficiency on comprehension

The results regarding the effects of foreign language proficiency show no effect of foreign language proficiency on comprehension. In order to maintain internal validity, the Slovakian translation of the words was not to infer from other languages the participants could be competent in, such as Dutch, English, German, or French.

4.4 Limitations

Possible explanations for some of the findings acknowledge some limitations of this study. First of all, due to the fact that this experiment was conducted online, there was no supervision of the participants. Thus, the participants could not have listened to the instruction regarding the

reproduction of gestures in the gesture viewing and repeating condition. Additionally, the sound quality of the videos was not optimal, and due to the fact that this experiment was conducted online, it could not be checked whether participants were wearing headphones in order to minimize the influence of poor sound quality. Moreover, the videos used in the experiment could only be uploaded via YouTube and could be paused or replayed at any time. Again, due to the fact that this experiment was conducted online, it could not be checked whether this happened consistently across participants. Furthermore, the participants were asked to participate voluntarily, without receiving any incentives, which might have had a negative effect on the participants' motivation. Furthermore, the findings of this study are not generalizable for a larger population, since all participants were Dutch, and most of them were students of the Radboud University in Nijmegen. Cultural and linguistic differences may influence the ability to acquire certain word types, or the familiarity of certain words, which could influence the overall findings. Lastly, the experiment was short-term oriented, and due to the fact that language learning is a difficult process, a longer time frame could have been more appropriate.

4.5 Future research

The findings of the present study contribute to the scientific knowledge about acquiring different word types, with the use of gestures. In order to further explore the benefits that gestures could have on language learning, more research should be conducted. Future research should eliminate the limitations of this study, by for example conducting an experiment in a real-life educational setting or re-recording the videos. This way, poor sounds quality cannot be an issue, and full supervision over the participants in guaranteed. Moreover, studies should include a more generalizable group of participants, in which multiple cultural backgrounds, ages, and educational levels are represented. Furthermore, this study was conducted on a rather short time frame, in which participants had to learn and test their comprehension in a time frame of 20 minutes. Language learning is a difficult process, and a longer time frame could influence the findings.

Lastly, the present study's main finding is the fact that verbs were better comprehended in the gesture viewing condition compared to the other conditions, and verbs were better comprehended in the gesture viewing condition compared to nouns. As nouns are generally more easily acquired than nouns, future research should further explore the advantages of using gestures when learning or teaching novel foreign verbs.

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Appendix A

Table 2. The fourteen words used in the experiment including the level of concreteness and frequency.

Dutch Words	**Slovakian Translation**	**English Translation**	**Verb/Noun**	**Concreteness**	**Frequency** (/ million words)
Schieten	Strielat'	Shoot	Verb	4,47	132.34
Praten	Rozprávat'	Talk	Verb	3,87	642.27
Schaatsen	Korčulovat'	Ice Skate	Verb	4,47	5.44
Mengen	Zmiešat'	Blend	Verb	3,80	4.55
Liften	Zdvihnút'	Hitchhike	Verb	3,67	2.69
Hardlopen	Bežat'	Run	Verb	3,80	2.52
Komen	Prísť	Come	Verb	3,33	1143.88
Bloem	Kvetina	Flower	Noun	4,67	13.49
Wereld	Svet	World	Noun	3,33	10.50
Gordijn	Záhrada	Curtain	Noun	4,67	4.46
Varken	Prasa	Pig	Noun	4,80	24.74
Fout	Chyba	Mistake	Noun	2.20	5.28
Appel	Jablko	Apple	Noun	4,67	10.20
Vliegtuig	Lietadlo	Airplane	Noun	4,80	89.92

Appendix B

Editing Software: Hitfilm Express

Template: 1080p Full HD

Frame Rate: 25 fps

Video Width x Height: 1920x1080 pixels

File Type: MP4

Table 3. The instructions per gesture condition in Dutch.

	Gesture Viewing	Gesture Viewing + Repeating	No Gestures	Testing
	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 23 ord uitspreken. Daarna zal de Slowaakse instructeur twee maal de Slowaakse vertaling van het 23ord 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!	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 23 ord uitspreken. Daarna zal de Slowaakse instructeur twee maal de Slowaakse vertaling van het 23 ord 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!	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 23 ord uitspreken. Daarna zal de Slowaakse instructeur twee maal de Slowaakse vertaling van het 23ord 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!	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 23 ord 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!

Table 4. The instructions per gesture condition in English.

	Gesture Viewing	Gesture Viewing + Repeating	No Gestures	Testing
	In this video you are going to learn 14 Slovakian words. You will see two instructors: one Dutch, and one Slovakian. First, the Dutch instructor will pronounce a Dutch word. After that, the Slovakian instructor will translate the Dutch word to Slovakian, and repeat this translation twice. Remember the words well, because after you have heard all the words and translations, there will be a test. In this test it is expected from you that you can write down the Dutch translations of the Slovakian words. Later, this will be further explained. For now, good luck with learning!	In this video you are going to learn 14 Slovakian words. You will see two instructors: one Dutch, and one Slovakian. First, the Dutch instructor will pronounce a Dutch word. After that, the Slovakian instructor will translate the Dutch word to Slovakian, and repeat this translation twice. Remember the words well, because after you have heard all the words and translations, there will be a test. In this test it is expected from you that you can write down the Dutch translations of the Slovakian words. Later, this will be further explained. The instructors will also use hand gestures. Try to repeat this gestures as well as possible during the word learning. For now, good luck with learning!	In this video you are going to learn 14 Slovakian words. You will see two instructors: one Dutch, and one Slovakian. First, the Dutch instructor will pronounce a Dutch word. After that, the Slovakian instructor will translate the Dutch word to Slovakian, and repeat this translation twice. Remember the words well, because after you have heard all the words and translations, there will be a test. In this test it is expected from you that you can write down the Dutch translations of the Slovakian words. Later, this will be further explained. For now, good luck with learning!	Now that you have learned the words, we are going to test how many words you have remembered. In this video the Slovakian instructor will say out loud every word twice. After each sequence of words, you have 15 seconds to write down the Dutch translation on your answer sheet. De words will be in a different order than in the previous videos. Good luck!

Appendix C

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