The Role of Gesture in Second Language Learning: Communication, Acquisition, & Retention

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Abstract

Previous research has provided evidence that second language (L2) learners use gesture to enhance spoken communication with interlocutors, and that gesture facilitates L2 word learning. The current study investigates how L2 learners use gesture to communicate in conversational settings, and whether their gesturing in these settings facilitates L2 acquisition beyond the immediate context. The results reveal that L2 learners produce more iconic gestures when their interlocutor is visible, and that gesture production predicts their recall for novel words introduced in conversation. As such, they indicate that conversational gesturing enhances acquisition of the target language more broadly, facilitating L2 communication, acquisition, and retention.

Keywords: Second language acquisition, word learning, gesture, mental imagery, embodied cognition

Introduction

Language acquisition, like other aspects of human communication, is profoundly multimodal. Children learning how to speak often use their hands and bodies to express themselves, even before they can speak (Acredolo & Goodwyn, 1988). Once children begin speaking, they begin producing gestures concurrently with speech to help them express themselves (Iverson & Goldin-Meadow, 2005). However, it is less well-known how gesture facilitates second language (L2) learning by adults. Although previous research has provided evidence that isolated gestures can enhance L2 word learning in instructional settings (Allen, 1995; Kelly, McDevitt, & Esch, 2009; Tellier, 2008), it is unclear whether L2 learners' discourse comprehension benefits from conversational gestures. Furthermore, it is unclear whether L2 learners' gestures facilitate communication with interlocutors in the target language, or whether they benefit only the speaker by providing a method of "thinking out loud." The present research addresses these questions by examining how interlocutor visibility and gestural priming affect gesture use among L2 learners. Moreover, this research examines whether enhanced real-time comprehension transfers to other domains, benefiting L2 learning more broadly.

How Gesture Affects L2 Communication

To date, little research has addressed how gesture affects communication between L2 learners and their interlocutors in real-time conversation. Work examining the question of whether speakers use gesture in a communicative sense in general has provided evidence that speakers modify their gesture qualitatively and quantitatively when interlocutors are visible. In particular, this work has revealed that speakers produce gestures that are more iconic, elaborate, and larger when they are speaking to an interlocutor who is present and visible, as opposed to an interlocutor who is present but occluded or an interlocutor who is on the phone (Alibali, Heath, & Myers, 2001; Bavelas, Gerwing, Sutton, & Prevost, 2008). These results suggest that speakers do indeed use gesture as a communicative device.

If speakers use gesture to facilitate communication, then it follows that they should also modify their gestures when conversing with L2 learners, who often encounter difficulty comprehending L2 speech. Indeed, related research has shown that native speakers hyperarticulate vowels when speaking to adult L2 learners, demonstrating that they are aware of L2 learners' comprehension-related needs (Uther, Knoll, & Burnham, 2007). In one of the few studies to examine native speakers' gesture in the presence of L2 learners, native speakers of English produced more deictic and iconic gestures when retelling a narrative to L2 English learners than to English-speaking interlocutors (Adams, 1998). This finding suggests that speakers rely on gesture as a communicative medium to a greater degree with L2 learners than with native interlocutors.

There is also evidence that the gestures that L2 learners produce when speaking the target language differ qualitatively from the gestures that they produce when speaking their native language, as well as from gestures produced by native speakers of the target language. One such difference is that gestures accompanying L2 learners' utterances in the target language tend to be over-explicit. For example, L2 learners are much more likely to produce iconic gestures when referring to entities that they have previously mentioned when speaking the target language

than their native language (Gullberg, 2003). This tendency mirrors their use of nouns rather than pronouns to refer to previously mentioned entities in the target language. Other work has provided evidence that the syntax and semantics of L2 learners' native language influences the gestures that they produce when speaking the target language. As a result, L2 learners' gestures differ in subtle ways from the gestures of native speakers of the target language, such as in the way that path and manner are expressed (Stam, 2006; Yoshioka & Kellerman, 2006). Nevertheless, it is unclear whether native speakers of the target language notice these differences in L2 learners' gesture, and to date, there is no conclusive evidence that they hinder communication between L2 learners and native interlocutors.

In fact, despite the nuanced ways in which L2 learners' gesture may differ from the gesture of native speakers, there is evidence that gesture *facilitates* communication between L2 learners and native interlocutors. To this end, one study revealed that L2 learners frequently gestured when they were unable to complete an utterance in Japanese, prompting Japanese interlocutors to suggest semantically appropriate completions (Mori & Hayashi, 2006). Along similar lines, a case study of gesture use between a L2 English learner and his tutor revealed that the learner often gestured when searching for words, cuing the tutor to complete the learner's utterances while simultaneously producing similar gestures (McCafferty, 2002). Taken together, these findings reveal that both L2 learners and native speakers use gesture to convey information that their interlocutors may not be able to comprehend via speech, serving as an alternative channel of symbolic communication. Furthermore, these findings suggest that both L2 learners and native interlocutors can understand and use information conveyed via gesture to rectify incomprehensible or incomplete utterances, thereby facilitating communication in the target language.

How Gesture Affects L2 Acquisition and Retention

Given the evidence that L2 learners can use gesture to facilitate their production and comprehension of the target language in conversational settings, it follows that gesture may facilitate not only communication, but also *acquisition* and *retention* of the target language. Indeed, research has provided evidence that gesture can enhance the acquisition and recall of L2 lexical items. One study showed that first-semester L2 students learned French figurative expressions accompanied by representational gestures more effectively than expressions that were presented without gesture (Allen, 1995). Similarly, individuals unfamiliar with Japanese recalled the meanings of Japanese verbs over the course of a week more accurately when they were presented with representative iconic gestures than when they were presented as speech only, without gesture (Kelly et al., 2009). Finally, during instruction spanning 4 weeks, children learning English recalled more words from this language when they enacted representative iconic gestures than when they learned the word meanings via images. Taken together, these results indicate that iconic gesture may help beginning L2 learners to associate L2 lexical items with their meanings, thereby facilitating L2 word learning.

Despite the preponderance of evidence that gesture facilitates L2 lexical acquisition, research examining the effect of gesture on other aspects of L2 acquisition has been rather sparse and has produced inconsistent findings. The results of several studies have failed to show evidence that beat (simple rhythmic), deictic (pointing), or iconic gestures can enhance the perception of novel L2 phonological contrasts (Hirata & Kelly, 2010; Jesse & Mitterer, 2011; Kelly & Lee, 2011). To date, no published research has investigated whether gesture can facilitate the acquisition of morphosyntax by L2 learners. On a broader level, some work (Lazaraton, 2004; Sueyoshi & Hardison, 2005) has provided evidence that gesture facilitates L2 learners' comprehension of instructional lectures given in the target language. However, it is unclear from this work what types of gestures enhance listening comprehension, as well as which aspects of comprehension they affect.

Although previous research has not directly investigated the cognitive processes responsible for gesture's impact on various aspects of L2 acquisition, it is possible to make some inferences about them by considering the foci and design of the studies discussed above. First, gesture's facilitation of the acquisition of lexical items but not phoneme perception suggests that the benefits of gesture in L2 learning may be localized to individual stimuli, rather than generalizable to related members of a category. This interpretation is particularly plausible in light of the fact that most of the research investigating the effect of gesture on L2 acquisition has been conducted with novice L2 learners, who lack an understanding of how various elements of the target language are related. Second, the observation that representative iconic gestures—but not non-representative iconic gestures or other types of gestures—enhance L2 lexical acquisition suggests that isomorphism between gestures and the visuospatial properties of referents is necessary for gesture to benefit L2 word learning. Third, the more pronounced effect of gesture enactment than gesture viewing on L2 lexical acquisition suggests that the engagement of embodied action may also play a key role in explaining gesture's facilitation of L2 word learning.

Methods

Participants

Sixty undergraduates were recruited in pairs from the participant pool at UCSC. All recruited individuals were fluent English speakers[1] and confirmed that they had no knowledge of Hungarian prior to the experiment. Additionally, all recruited individuals had normal hearing and normal or corrected-to-normal vision.

[1] Participants were not required to be native English speakers, given that the English glosses of the signs were common words that should be comprehensible to non-native undergraduates, who must be sufficiently proficient to understand academic English.

Table 1: Hungarian and English words used in study.

Hungarian	English	Hungarian	English
Betegség	Illness	*Unott*	Bored
Kalapács	Hammer	*Varrni*	To sew
Kulcs	Key	*Öltözet*	Clothing
Löni	To shoot	*Leforgatni*	To record
Mászni	To climb	*Csomó*	Knot
Megütni	To hit	*Hosszú*	Long
Orá	Watch	*Bajusz*	Moustache
Öröm	Joy	*Testgyakorlás*	Sports
Seprű	Broom	*Kezbasiteni*	To deliver
Tréfa	Joke	*Kefe*	Brush

Stimuli

Twenty Hungarian words were selected for use in this study (see Table 1). Prior to this research, 15 English speakers who did not participate in this study were asked to rate the concreteness, imageability, and meaningfulness of the English glosses of 80 candidate words, and to gesture in a way that represented the meaning of each gloss. The 20 words with the most consistent responses from each of the three categories listed above were selected for inclusion in the study. Videos of iconic gestures were created by recording a fluent Hungarian-English bilingual saying these words in each language while enacting the gestures produced by the most participants. In order to control for possible vocal iconicity, audio of the pronunciation of Hungarian and English words was extracted from the iconic gesture videos and was played during presentation of text words in the non-gesture presentation condition.

Procedure

In the learning phase of the experiment, participants were randomly assigned via coin flip to be either the teacher or the learner, and to be in either the visible or occluded condition. Participants were seated on either side of a table that was either unobstructed or was divided by a large, opaque cardboard screen. The teacher was seated in front of an iMac G4 with a 20 in. screen, on which the stimuli were presented. Prior to beginning the experiment, participants were told that the focus of the study was to examine teaching and learning strategies for L2 vocabulary. To this end, the teacher was told that he or she would learn the meanings of twenty Hungarian words one-by-one. The teacher was instructed to teach each word to their partner "however [they] think the learner will learn them best," with the only restriction being that both the teacher and learner must remain seated at the table during the entire learning phase. The learner was told that he or she would be tested after the learning phase to determine how well he or she had learned the words. After ensuring that the participants understood the instructions, the experimenter left the room.

Although participants were informed that their speech would be audio recorded during the learning phase for later analysis, they were not told that they would also be video recorded while learning the words. A video camera hidden behind a one-way mirror oriented perpendicular to the table was focused on participants during the learning phase of the experiment, providing a 180° view of them (see Figure 1). The screen of the computer on which stimuli were presented was oriented at a 180° angle from the camera, in order to ensure that the experimenters were blind to the presentation modality of the words. Participants' interactions were never heard or seen by anyone other than the experimenters.

During trials of the learning phase, a Hungarian word was presented to the teacher for 2500 ms., and after a 1000 ms. interval, its gloss was presented for 2500 ms. Words in both languages were presented to the teacher as speech over headphones connected to the computer. Words were presented visually via either video of a Hungarian-English bilingual saying them while concurrently producing an iconic gesture representing their meaning, or via text displayed on screen; word presentation modality was varied within participants. Following a 2000 ms. interval, the words were repeated once in this sequence, and then a screen instructing the teacher to teach the word to the learner was displayed until the teacher pressed a button to indicate readiness to proceed to the next trial. After all 20 words had been presented, participants were told to summon the experimenter so that the learner could be tested.

In the test phase, the teacher was informed that he or she would also be tested to gauge how well he or she had learned the words. Both participants were placed in separate rooms for this part of the experiment. During test trials, each Hungarian word that participants had learned was presented as text and speech. Participants responded by saying the corresponding English word or by saying "skip" if they could not remember it. After having completed the test phase, participants were debriefed and informed of the actual purpose of the experiment, and were given the opportunity to have their recordings destroyed. All declined.

Coding

Participants' speech was transcribed verbatim, and all gestures were identified. Gestures were classified as one of three types: iconic (handshape and/or motion resembles referent attributes), beat (non-iconic emphasizing), or deictic (pointing). Individual gestures were distinguished from one another by a change in hand shape or motion. For

Figure 1: Screenshot of video captured during learning phase of participants assigned to occluded condition.

Table 2: Average amount of speech and target words produced during learning task, by participant and condition.

PP	Measure	Visible	Occluded
Teach	Total speech	633.30 (305.89)	856.83 (486.37)
	Target words	103.70 (14.10)	94.54 (22.04)
Learn	Total speech	352.00 (214.97)	584.67 (370.83)
	Target words	110.10 (18.89)	106.35 (33.43)

example, an extension of the hand forward with the palm up produced concurrently with the word "to deliver" was coded as one iconic gesture. If a similar movement occurred as the first motion of a sequence in which the fingers of the hand closed and the hand moved in a lateral turning motion (for key), this entire sequence was coded as one iconic gesture.

Results

Learning task

In order to investigate the relationship between speech and concurrent gestures produced during the learning task, we first examined the quantity and content of participants' speech. A univariate ANOVA conducted on total amount of speech produced in the learning task revealed main effects of participant role, $F(1, 59) = 6.22$, $p = .02$, $\eta_p^2 = .14$, and visibility, $F(1, 59) = 4.23$, $p = .05$, $\eta_p^2 = .10$. However, the interaction between these factors failed to reach significance. Bonferroni-corrected post hoc tests showed that teachers spoke significantly more than learners, ($p = .02$), and that occluded interlocutors spoke more than visible interlocutors ($p = .05$; see Table 2). Nevertheless, all participants repeated the target words with comparable frequency across the visible and occluded conditions, suggesting that differences in speech were caused by verbal elaboration rather than repetition of target words.

Prior to analysis, the distribution of gesture data was examined to determine whether it was normal. Shapiro-Wilk tests revealed that none of the distributions of any of the gesture types for either participant were normal. As can be seen from Table 3, this was primarily due to the skewness and kurtosis of the data. Because analysis of variance is robust against violations of normality (Hays, 1973), it was used as the primary method of analysis. However, non-parametric tests were also conducted to ensure the validity of the results obtained using parametric statistics.

Before conducting the main analyses, it was necessary to determine whether the number of gestures produced by teachers and learners differed reliably for pairs assigned to the visible and occluded conditions. Independent-samples t tests revealed that the difference between the number of iconic gestures produced by teachers and learners whose interlocutor was visible was marginally significant, $t(29) = 1.92$, $p = .07$, $d = .86$ (this was confirmed by a Mann-Whitney U test, $U(29) = 22.50$, $p = .04$). No other significant differences were found between teachers' and learners' production of iconic, beat, or deictic gestures. Based on the results of these preliminary analyses, teachers' and learners' iconic gestures were analyzed separately, but beat and deictic gestures were collapsed across participants.

To determine whether interlocutor visibility and word presentation mode affected iconic gesture production, iconic gesture data was submitted to two repeated measures ANOVAs (one for the teacher and one for the learner). The analysis of teachers' iconic gesture showed a main effect of word presentation mode, $F(1, 29) = 21.33$, $p < .001$, $\eta_p^2 = .50$, and interlocutor visibility, $F(1, 29) = 6.95$, $p = .02$, $\eta_p^2 = .25$; however, the interaction between these two factors failed to reach significance (see Figure 2). The effect of word presentation mode on teachers' iconic gesture was confirmed by a Wilcoxon signed-rank test, $Z(29) = 3.61$, $p < .001$, and the effect of visibility was confirmed by a Mann-Whitney U test, $U(29) = 23.50$, $p = .02$. Bonferroni-corrected post hoc tests revealed that teachers produced a significantly greater number of iconic gestures when conveying the meanings of words that they had learned via iconic gesture than words that they had learned via text ($p < .001$), and that they produced more iconic gestures when communicating with visible interlocutors than occluded interlocutors ($p = .02$). The analysis of learners' iconic gesture failed to show a main effect of either presentation mode or interlocutor visibility; similarly, the results of a Wilcoxon signed-rank test and a Mann-Whitney U test failed to reach significance. However, in this case, the interaction between word presentation mode and interlocutor visibility reached significance, $F(1, 29) = 4.71$, $p < .04$, $\eta_p^2 = .18$; see Figure 2. Taken together, these results provide evidence that the acquisition of novel word meanings via iconic gestures and the presence of a visible interlocutor cause L2 learners to increase their production of iconic gestures, thereby facilitating communication.

To determine whether interlocutor visibility and word presentation mode affected participants' production of beat and deictic gestures, data for each of these gesture types was examined using a repeated measures ANOVA.

Table 3: Descriptive statistics and normality test results for gesture types, by participant role.

	Teacher			Learner		
Gesture	Iconic	Beat	Deictic	Iconic	Beat	Deictic
Mean (SD)	11 (10.17)	20.17 (26.63)	3.96 (4.25)	5.13 (7.61)	18.09 (37.10)	1.96 (5.10)
Range	0-40	0-121	0-15	0-129	0-177	0-24
Skewness	1.24	2.87	0.86	2.01	3.88	4.00
Kurtosis	1.62	9.44	0.17	3.83	16.71	17.38
Shapiro-Wilk	.89, $p = .01$	.66, $p < .001$	.85, $p = .003$	.71, $p < .001$	.50, $p < .001$	.43, $p < .001$

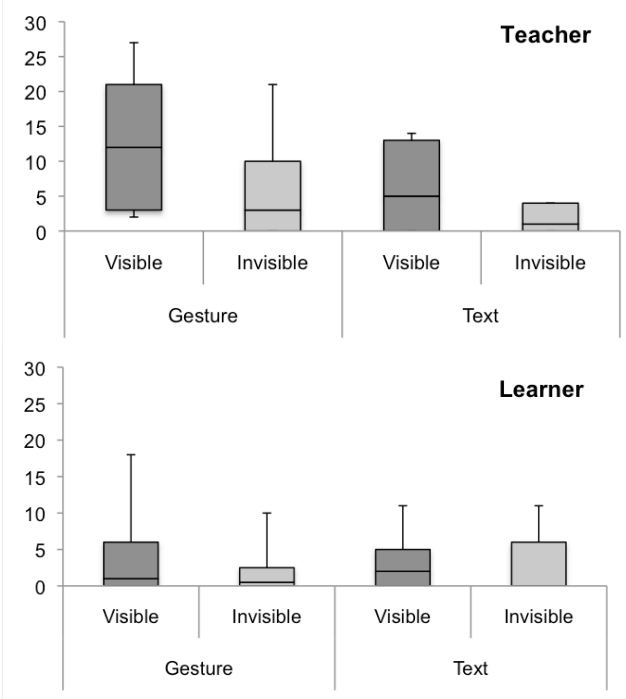

Figure 2: Boxplots showing number of iconic gestures produced by teachers and learners, by word presentation mode and interlocutor visibility.

This analysis revealed no significant effects of either interlocutor visibility or presentation mode, indicating that participants produced beat and deictic gestures with similar frequency, regardless of these factors.

L2 Word Recall

L2 word recall was quantified using a binary coding scheme for each word (1 = correct, 0 = incorrect/skipped), which was summed across words to yield a total number of words recalled out of twenty for each participant. Prior to investigating the gesture data, we first examined whether total amount of speech and target word repetitions predicted word recall accuracy.

Three separate linear regression analyses revealed that the amount of speech produced by teachers and learners significantly predicted their word recall, and that the amount of teachers' speech also predicted learners' recall. However, additional analogous analyses failed to show that repetitions of target words by teachers and learners during the learning phase predicted their own word recall at test, or that teachers' target word repetitions during learning predicted learners' recall at test (see Table 4).

In order to examine whether the viewing of iconic gestures during the learning phase affected L2 word recall for the teacher, word recall data was submitted to a paired-samples *t* test using word presentation modality as a within-participants factor. This analysis showed that teachers recalled words with comparable accuracy regardless of whether the words had been presented with iconic gestures or text in the learning phase, $t(29) = 1.08$, $p = .29$, $d = .20$. In order to examine whether gesture viewing during the learning phase affected word recall for the learner, learners' word recall scores were regressed on number of iconic gestures produced by teachers during the learning phase. This analysis showed that teachers' iconic gestures failed to predict learners' word recall accuracy, $b = -.28$, $t(29) = 1.04$, $p = .31$. Together, these results indicate that simply viewing iconic gestures during L2 word learning is insufficient to promote word recall.

Finally, in order to determine whether gesture enactment affected L2 word learning, teachers' and learners' word recall scores were regressed on the number of gestures (iconic, beat, and deictic) that they produced during the learning phase. This analysis revealed that teachers' beat and deictic gestures positively predicted their recall of L2 words, but that their iconic gestures negatively predicted L2 word recall. Moreover, this analysis failed to reveal that learners' gestures predicted their word recall at test (see Table 4).

Discussion

The current study examined the impact of gesture production on communication and acquisition of a novel second language. The results showed that participants produced more iconic gestures when the meanings of L2 words are conveyed to them via gesture, and when they are communicating with a visible interlocutor. This indicates that viewing iconic gestures primes the production of iconic gestures. More importantly, however, it demonstrates that interlocutors use iconic gesture to facilitate communication in a novel second language, corroborating the findings of other studies of

Table 4: Word recall, as predicted by teachers' and learners' speech and iconic, beat, and deictic gesture production.

		Teacher			Learner		
Predictor	Dependent variable	*b*	*SE b*	*β*	*b*	*SE b*	*β*
Speech	Constant	1.95	1.21		4.02	1.52	
	Total speech	.008	.001	-.77	.006	.003	.46
	Word repetitions	-.04	.03	-.29	.02	.02	.20
Gesture	Constant	5.84	.97		5.03	1.21	
	Iconic gestures	-.18	.08	-.45	.24	.17	.44
	Beat gestures	.08	.03	.49	.07	.08	.23
	Deictic gestures	.62	.21	.63	-.09	.27	-.11

L2 learners' conversational interactions (Adams, 1998; McCafferty, 2002; Mori & Hayashi, 2006). Furthermore, the results of the current study revealed that participants produced more gestures when their interlocutor was visible, but more speech when their interlocutor was occluded. This dissociation indicates that interlocutors are aware of the communicative properties of each modality, and use them appropriately when conveying L2 words.

More interestingly, however, the results of the current study provide evidence that participants' use of beat and deictic gesture during conversational interactions enhanced their L2 acquisition beyond the immediate communicative context, whereas their use of iconic gestures did not produce this effect. Considered as a whole, these results suggest that gesture effectively supplements information conveyed via speech, but cannot replace it. Moreover, the lack of facilitation of gesture viewing for both teachers and learners is inconsistent with work showing that mere exposure to gesture facilitates L2 word learning (Allen, 1995; Kelly et al., 2009), but is consistent with work showing that gesture enactment enhances L2 word learning more effectively than gesture viewing (Tellier, 2008). Future research should investigate the circumstances under which gesture enactment and viewing differentially benefit L2 acquisition, further clarifying its role in the communication, acquisition, and retention of a novel second language.

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