Encouraging gesture use in a narration task increases speakers' gesture rate, gesture salience and the production of representational gestures

Alice Cravotta[1], Pilar Prieto[2,3], and M. Grazia Busà[1]

[1]Università degli Studi di Padova, Italy; Dipartimento di Studi Linguistici e Letterari (DiSLL)
[2]Institució Catalana de Recerca i Estudis Avançats, ICREA, Barcelona, Catalunya, Spain
[3]Universitat Pompeu Fabra, Barcelona, Catalunya, Spain; Departament de Traducció i Ciències del Llenguatge

alice.cravotta@phd.unipd.it, pilar.prieto@upf.edu, mariagrazia.busa@unipd.it

Abstract

Previous work has shown the positive effect of encouraging gestures in performing various tasks; in these studies, the participants generally appeared to gesture more when explicitly asked to do it. However, little attention has been paid to whether encouraging gestures also affects other gesture features, i.e., gesture type and salience. In this paper we explore this issue. Twenty native Italian speakers described the content of short comic strips to a listener in 2 conditions: Non-Encouraging gestures (N); Encouraging gestures (E). Co-speech gestures were manually coded and classified according to gesture type (Representational vs. Non-Representational) and gesture salience (Salient vs Non-Salient). The results show that instructing speakers to gesture led to an increase in gesture rate, in gesture salience, and in the number of representational gestures. By contrast, in the non-encouraging condition the rate of Non-Salient gestures was significantly higher, but no difference was found for Non-Representational gestures.

1. Introduction

Researchers in previous studies have explicitly instructed participants to gesture in order to explore the effects of encouraging the use of gesture on activities such as problem solving (Beilock & Goldin-Meadow, 2010; Chu & Kita, 2011), learning math (Broaders, Cook, Mitchell, & Goldin-Meadow, 2007), second language pronunciation (Baills, Suárez-González, González-Fuente, & Prieto, 2019; Llanes-Coromina, Prieto, & Rohrer, 2018), speech fluency and narrative abilities (Vilà-Giménez & Prieto, 2018). These studies have shown that gestures have a beneficial role in thinking, learning, remembering, and speaking. As well, they have shown that instructing participants to gesture generally causes an increase in the participants' gesture rate. Nonetheless, to our knowledge, the only study that has directly focused on the impact of encouraging speakers to use gestures on the way they gesture across genres is Parrill, Cabot, Kent, Chen, & Payneau, (2016). The study compared the differences in gesture rate and gesture type of participants that had been and had not been explicitly instructed to gesture while performing three different discourse tasks (i.e., quasi-conversation, spatial problem solving, and narration). In the study, the instruction to gesture did not change gesture rate or gesture type across the different discourse tasks, suggesting that instructing speakers to gesture will not always work (in the sense that it might not lead them to produce more gestures); at the same time, the instruction does not seem to impact on the type of gestures produced. In sum, the study appears to be in contrast with previous findings, mentioned above, that show that the instruction to gesture should at least contribute to increasing gesture rate. Thus, the issue needs to be further explored.

Gesture production may be influenced by a combination of other factors. For instance, it has been shown that gesture rate, together with gesture type and gesture physical forms (size, salience), can change and be adapted depending on (1) the shared knowledge between interlocutors (Gerwing & Bavelas, 2004; Holler & Wilkin, 2009); (2) the interlocutors' (mutual) visibility (Bavelas, Gerwing, Sutton, & Prevost, 2008; Bavelas, Kenwood, Johnson, & Phillips, 2002); (3) the addressee's feedback (e.g., gesture rate lowers when addressees are less attentive (Jacobs & Garnham, 2007)). Moreover, individual differences in gesture production in terms of rate, type and

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physical properties largely depend on the individuals' cognitive abilities, personality traits, cultural and gender differences (Briton & Hall, 1995; Chu, Meyer, Foulkes, & Kita, 2014; Goksun, Goldin-Meadow, Newcombe, & Shipley, 2013; Hostetter & Hopkins, 2002; Hostetter & Potthoff, 2012; Kita, 2009; Nicoladis, Nagpal, Marentette, & Hauer, 2018; O'Carroll, Nicoladis, & Smithson, 2015). These studies suggest that gesture rate, type and salience are key aspects of how gestures are produced, intended and interpreted in the wild. Thus, it seems that instructing participants to gesture can increase their gesture rate, as well as have a more general impact on gesture types and salience. This is interesting from a methodological perspective and deserves further attention: in fact, when setting up an experiment or data collection that requires explicitly asking participants to gesture while speaking, it might be important to assess the possible impact of the instruction to gesture on factors such as gesture salience and type.

To our knowledge, no studies have addressed the question of how encouraging speakers to gesture might affect gesture space or gesture salience. Also, how encouraging speakers to gesture affects gesture rate remains unclear. Thus, the present study will empirically assess, in a narration task, the effects of explicitly asking speakers to gesture on their (1) gesture rate, (2) gesture type, and (3) gesture salience.

2. Methods

The present study used a narration task in which the participants had to watch and describe a set of comic strips in two different conditions: Non-Encouraging (N), in which the participants were given no instructions regarding how to gesture; and Encouraging (E), in which the participants were encouraged to use gestures while telling the story. The experiment has a within-subject design (with a within subject factor: Condition).

2.1. Participants and Materials

Twenty female native speakers of Italian (age *M* = 24.2; *SD* = 2.9) participated in the experiment. They were all female and from the Veneto region (this was done to possibly control for potential gender and cultural differences in gesture production). Sixteen 4-scene comic strips adapted from Simon's Cat by Simon Tofield were used for the narration task (see Figure 1 for an example). The comic strips were carefully selected and adapted so that they were considered equivalent in terms of complexity and length (4-scene narrations). Simon's Cat comic strips do not contain text but feature a variety of characters and show many motion events. The idea was that this characteristic of the selected comic strips would make participants describe the events and spatial relations using gestures.

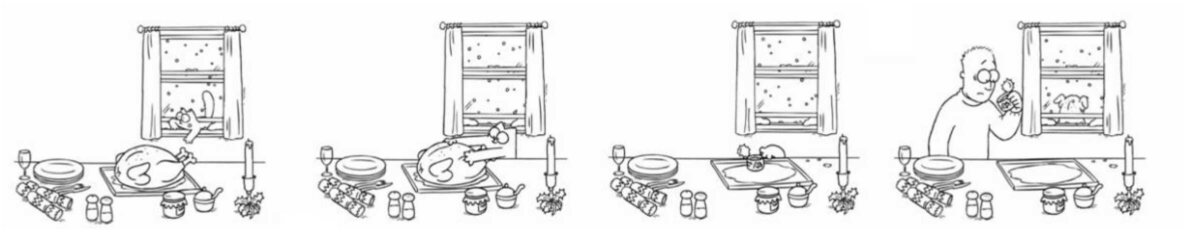

Figure 1. Example of a 4-scene comic strip used for the experiment (from Simon's Cat, by Simon Tofield, reproduced with permission).

2.2. Procedure

The participants were tested individually in a quiet room. Each session was recorded with a HD video camera (JVC GZ-HD7E Everio) connected to a MIPRO wireless head-mounted microphone recorded via a Zoom R16 digital audio mixer. The camera was set in front of the participant (at 2.50 m distance) recording her upper body and face. The participant sat on an office armchair and interacted with a confederate listener that sat in front of her at a distance of 1.50 m. A second video camera was placed in front of the listener and recorded the listener's upper body and face during the whole session. The experimenter (first author) sat at the participant's side. Both the participant and the listener were given written instructions as to how to perform the task (see below). Each participant was introduced to the confederate listener as if he was a fellow participant who did not know the stories in advance. This was done to avoid potential effects of common ground (Holler &

Wilkin, 2009), as well as to give ecological validity to the narration task (the participants would explain the story clearly and fully to their "fellow participant" as he was dependent on them to complete his part of the comprehension task). The confederate listener was instructed to provide basic backchannel and feedback cues to the speaker while listening to the stories as it was shown that speakers' gesture can be adapted depending on the addressee's feedback (e.g., gesture rate is lower when addressees are less attentive, Jacobs & Garnham, 2007).

Each participant had to retell a total of 16 stories. The experiment was preceded by 2 familiarization trials so that participants could get acquainted with the task and the setting. Each trial consisted of a three-step sequence: (1) the participant examined a four-scene comic strip to learn the story it depicted; (2) the comic strip was then concealed and the participant told the story to the listener; (3) the listener was then given four cards, each showing one scene of the comic, and had to reconstruct it by putting the four images in the correct order based on the speaker's story.

The participants had to retell the first half of the comic strips set in the N condition and the second half in the E condition (the order of the comic strips was counter-balanced across conditions). The order of the two conditions was kept the same (N, E) for all the participants (as in Parrill et al. (2016), since we believed that telling participants to "come back" to a N condition after having encouraged them to gesture would lead to carryover effects between E and N). In the E condition the participants were given the following instructions (translated from Italian): "Tell each story and use hand gestures to help you do so". The written instructions were kept visible in the E condition to remind the participants about the task. The experiment lasted approximately 30 minutes. Audio-visual recordings of a total of 200 short narratives were obtained (20 participants × 10 target trials) lasting a total of 81.2 minutes (39.1 minutes in the N condition and 42.1 in the E condition).

2.3. Gesture annotation

Any instances of co-speech gestures were identified and manually coded with the software ELAN (Wittenburg, Brugman, Russel, Klassmann, & Sloetjes, 2006) by the first author. The annotation criteria consisted in counting any gestural strokes (i.e., the most effortful part of the gesture that usually constitutes its semantic unit, e.g., two hands shaping together a rounded table; Kendon, 2004; McNeill, 1992), and to exclude any non-gestural movement like self-adaptors (e.g., scratching, touching one's hair). The speakers produced a total of 2396 gestures (1015 in N and 1381 in E). Gesture rate was calculated per every story told as the number of gestures produced per story relative to the number of spoken words in the narrative (Gestures/words*100).

To check whether instructing speakers to gesture also changes the type of gestures performed, the gestures performed were distinguished between Representational (R) vs Non-Representational (NR) gestures. Representational gestures are those gestures that represent semantic information via form, (handshape), trajectory, or location. They can be distinguished from non-Representational gestures which include those that do not primarily serve to depict information and do not refer to a clear referent but which primarily have pragmatic and interactive functions (e.g., presentational, interactive, epistemic; Kendon, 2004; Bavelas, Chovil, Coates, & Roe, 1995; Cooperrider, Abner, & Goldin-Meadow, 2018). Representational gesture rate per story told was computed relatively to the number of words per story (representational gestures/words*100). The same was done for Non-Representational gesture rate.

Furthermore, to assess whether instructing speakers to gesture also changes gesture salience, each stroke was further classified depending on where it was performed (in fact, gestures performed at different height, and span are different in terms of communicativeness and salience; Bavelas et al., 2008; Mol, Krahmer, Maes, & Swerts, 2009; Streeck, 1994). Salience classification was done by using McNeill (1992)'s representation of the gesture space, which is divided into sectors delimited by concentric squares. For the present coding, a simplified 2-sectors version of it was used (as illustrated in Figure 2):

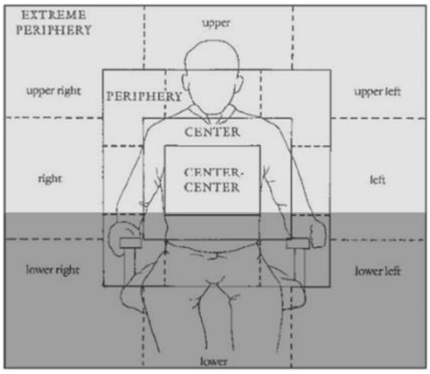

Figure 2. Gesture space. Adapted from McNeill, (1992) with the addition of two shades of gray that highlight the gesture areas of interest for the present study.

When the gesture stroke was produced in a more central, higher and visually prominent area (Streeck, 1994) of the gesture space (the lighter grey area), the gesture was coded as salient, whereas, when the gesture stroke was produced in a less visually prominent area (the lower darker sector), it was coded as non-salient. Salient Gesture (S) rate was computed per every story told as the number of salient gestures produced per story relative to the number of spoken words in the narrative (Salient gesture/words*100). The same was done for Non-Salient (NS) gesture rate.

The effect of gesture encouragement (within-subjects factor) on gesture behaviour was tested via 5 Linear Mixed Effects Models (henceforth LMEMs; R function *lmer* in *lme4* package; see Bates, Mächler, Bolker, & Walker, 2014). Each model included one of the following 5 dependent variables: Gesture (G) rate, Representational (R) gesture rate, Non-Representational (NR) gesture rate, Salient (S) gesture rate, Non-Salient (NS) gesture rate; and had *Condition* (N, E) as a fixed effect and both *Story* and *Participant* as random intercepts. P-values are obtained by likelihood ratio tests of the full model against the model without the fixed effect of interest (i.e., Condition).

3. Results

The instruction to gesture had effects on gesture rate, on gesture type and salience, as shown in Table 1 and in Figure 3. The boxplots in Figure 3 represent the different rates per gesture category per condition.

As shown in Table 1, Gesture rate was higher in the E condition (est.=4.134, S.E =0.708, $p < .001$). Regarding the effect on the type of gestures, the rate of Representational Gestures was higher

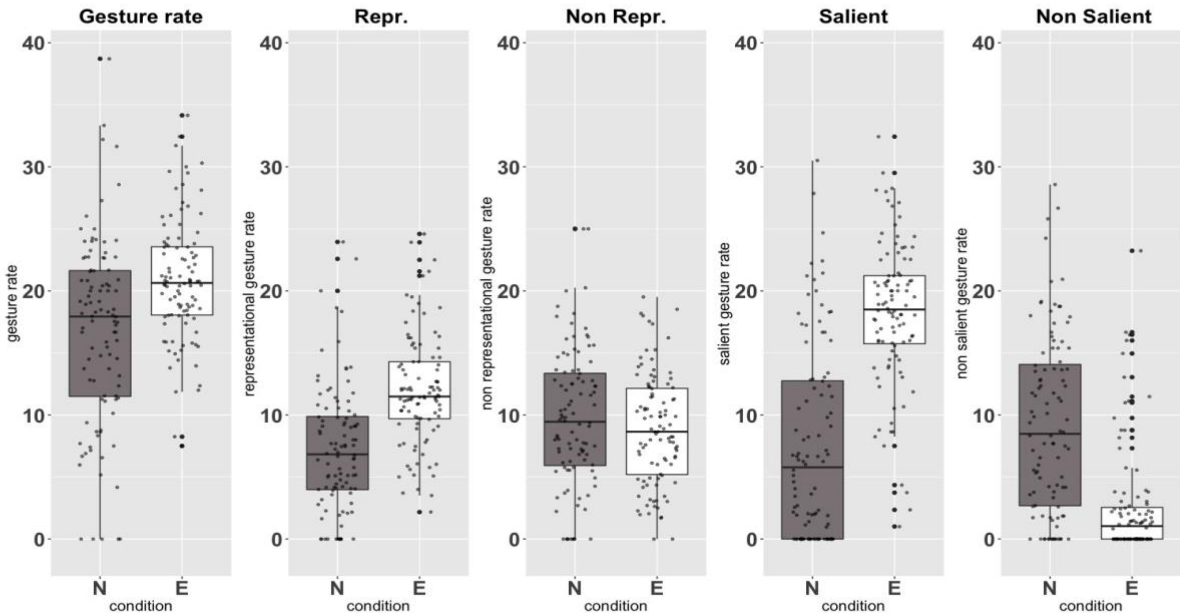

Figure 3. Boxplots representing Gesture rate, Representational, Non-Representational, Salient and non-Salient gesture rates in the two conditions, Non-Encouraging and Encouraging (N, E).

in the E condition (est. = 4.776, S.E =0.586, p <.001), while for Non-Representational gesture rate there was no significant difference between the two conditions.

Moreover, there was an effect of *Condition* on Salient gesture rate (est. =10.723, S.E =0.794, *p* <.001) that was found to increase in the E condition. The same applies, in the opposite direction, for Non-Salient gesture rate which is lower in the E condition than in the N condition (est. = - 6.589, S.E =0.65, *p* <.001).

The results show that the instruction to gesture (a) leads speakers to use more gestures; (b) leads to an increase of representational gestures; (c) makes speakers gesture in a higher and more salient gesture space. The latter, to our knowledge, had not been directly investigated before.

Table 1

LMEMs for the effects of Condition on the five measures of gesture rate (per 100 words)

Variable	Estimate	S. E.	C.I		t	Chisq	p
			Lower	Higher			
G rate	4.134	0.708	2.742	5.526	5.838	31.217	<.001
R gesture rate	4.776	0.586	3.624	5.929	8.149	56.306	<.001
NR gesture rate	-0.784	0.588	-1.94	0.371	-1.335	1.781	.182
S gesture rate	10.723	0.794	9.162	12.283	13.51	125.57	<.001
NS gesture rate	-6.589	0.65	-7.868	-5.311	-10.13	80.71	<.001

G: gesture; **R:** Representational; **NR**: Non-Representational; **S:** Salient; **NS:** Non-Salient; **Note:** Models: R function lmer in lme4 package (Bates, Mächler, Bolker, & Walker, 2014). Each model included Condition (N, E) as a fixed effect and both Story and Participant as random intercepts. N. of obs: 200; Groups: participants, 20 | Story, 10. C.I.: Lower 2,5%; Higher 97,5% (R package: *confint*). Levels "N" (baseline) and "E" were recoded by contrasts (i.e., 0 was in between each level, instead of being equal to N).

4. Conclusion

The aim of this study was to assess whether instruction to gesture can increase gesture rate as well as impact on gesture features such as gesture type and salience. The results show that in the gesture encouraged condition participants gestured more and in a higher gesture space. Also, they made more representational gestures than in the non-encouraging condition. These findings suggest that encouraging gesture in a speaking task can drive to effects other than the mere increase in gesture rate. It might be the case that encouraging the use of gestures leads speakers to automatically produce gestures that are more communicative and intended for the listener (Bavelas et al., 2008; Mol, Krahmer, Maes, & Swerts, 2009; Streeck, 1994) (e.g., produced in a higher more visible gesture space). Also, it might well be that explicit instructions on gesture can trigger an unconscious interpretation by speakers to use transparently iconic gestures, leading to an increase in representational gestures rate. It could also be that a narrative task itself is more likely to elicit more iconics compared with other speech tasks and this is worth further investigation. From a toretical perspective, our results open a number of questions related to how the instruction to gesture have an impact in the process of speech planning and production.

The present study suggests that encouraging speakers to gesture in an experimental setting can effectively lead them to produce more gestures; this can limit the presence of speakers that provide no data, or just help achieving the goal of having the speakers gesture more. However, it should be considered that the prompt can lead speakers to make use of more iconics than they would naturally do and make use of space differently. This information, depending on the scope of the study, can be relevant when setting up an experiment using the instruction to gesture.

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