English/Italian Bilinguals Switch Gesture Parameters when they Switch Languages

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Abstract

We investigated gestural communication in early bilinguals. In particular, we tested which aspects of gestures were "transferred" from a language to another. Though transfer in spoken languages has been studied extensively, transfer in gesture is understudied. Gesture transfer can provide useful information on the cognitive architecture in bilingualism. In this study our focus is on **gesture rate** and **gesture space** in Italian/English bilinguals. Contrary to previous findings, we have no evidence of transfer. When bilinguals switch language, their gesture parameters switch accordingly. The switch of gesture (cultural) parameters such as rate and salience show that language and gesture are tightly linked. This suggests that a language and the corresponding gesture parameters might be selected in a high level processing stage at which verbal and nonverbal aspects of communication are planned together.

Keywords: bilingualism; gesture rate; gesture space; linguistic transfer; gesture transfer; lexical access.

Introduction

Different languages and cultures use gestures differently. For example, Italian is reported as a high gesture frequency language (Barzini, 1964; Kendon, 1992, 1995), as opposed to (British) English, described as a low gesture frequency language (Graham and Argyle, 1975).

It has been claimed that bilinguals' gesture use is linked to their proficiency in the two spoken languages. A common measure of gesture use is gesture rate (the number of gestures performed over the number of words uttered). Sherman and Nicoladis (2004) found no differences between bilinguals' gesture rate when participants have an equal proficiency in both their languages (Canadian English and Spanish, where Spanish is supposed to be a high frequency gesture rate language). Those studies (Nicoladis et al., 1999; Pika, et al., 2006), however, are not very informative about whether or gestural transfer occurs due to the limitation in the design; for example they lack one of the monolingual control groups (see Nicoladis, 2007).

The evidence for gestural transfer in the literature is mixed. In a study on English/French bilingual children in Canada Nicoladis and colleagues (2005) found that bilinguals tend to gestures more than both the two monolingual control groups, but no evidence for gestural transfer was found. Nicoladis and colleagues explained their results claiming that bilinguals have more "choices" about how to package verbal messages with respect to monolinguals. Therefore, bilinguals gesture more than monolinguals (see also Pika et al., 2006). On the other hand, a study by So (2010) found gesture transfer between American English and Mandarin Chinese in English-Mandarin bilinguals in Singapore. American English monolinguals gestured significantly more than Mandarin speaking monolinguals. Bilinguals gestured more when speaking Mandarin than the Mandarin monolingual control group, and when speaking English, they gestured at about the same rate as English monolinguals.

Another gesture parameter that varies across cultures is gesture size. Since the seminal study of Efron (1941/1972) comparing Jewish and Italian immigrants' gestures, we know that in different cultures gestures differ in how they are performed in the space. In particular, Efron observed that Italian immigrants' gestures were spatially expansive, moving the entire arm from the shoulder joint, and tended to occupy the lateral (transversal) plane. More recently, Müller (1998) compared the gesture space of native Spanish and German speakers involved in a naturalistic conversation task with a language matching confederate. She found that Spanish speakers produced more gestures in the space above their shoulder than German speakers. Interestingly, Müller did not find difference in gesture rates between German and Spanish. She suggested that the difference in gesture salience create an 'illusion' that Mediterranean region cultures gesture more frequently than north European cultures.

Gesture size is an interesting variable to consider for gesture transfer in bilinguals. First, gesture size varies cross-culturally: bigger in Mediterranean cultures than in northern European cultures. Second, gesture size is determined by different psychological processes than gesture rates (Chu, Meyer, Foulkes & Kita, under review). Thus, gestural transfer or lack of transfer for gesture rates and gesture size may shed light on the relationship between speech and gesture production processes. However, no previous studies have investigated gesture size in bilinguals.

Because the evidence for transfer of gesture rates in the

literature is mixed and there are no studies on transfer of gesture space, we investigate transfer of gesture rates and gesture space in Italian-English bilinguals. We tested two monolingual control groups so that we can properly address the question whether parameters of gesture production transfer in bilinguals and whether bilinguals gesture differently from monolinguals. The two monolingual control groups of English and Italian speakers matched with the bilinguals for gender, age and education background. We focused on highly proficient Italian/English early bilinguals (i.e. they learned both languages before age 6) who had a very similar fluency in both languages. Bilinguals and monolinguals described the exact same stimuli in each language to a confederate language matching speaker. Differently from previous studies using long cartoons that were edited in shorter scenes, our stimuli consisted of 10 single-scene cartoons.

Method

Participants

30 participants (10 English native speakers, Females= 8 Males=2, age mean=22.3 years, recruited at the University of Birmingham; 10 Italian native speakers, Females=8, Males=2 age mean=23.1, recruited at the University of Trento; and 10 English/Italian bilinguals, Females=8, Males=2; age mean=23.8, recruited at the University of Birmingham and Trento) took part to the experiment. All the participants took a test to assess their linguistic background (Gullberg & Indefrey, 2003) and the Controlled Word Association Test (COWAT; see Loonstra et al., 2001 for a review) in English and Italian. The COWAT scores ensured that participants were equally fluent in both languages. The mean fluency score for bilinguals was 62.8 words in English and 62.2 words in Italian. The mean fluency score for Italian native speakers was 63.4 words and for English native speakers was 61.7 words.

The bilinguals enrolled in this study started speaking both languages before age 6, while the native speakers of Italian and English did not learn any other language before age 11 and were not fluent respectively in English or Italian. They were all students enrolled at university bachelor or master degrees.

Materials

Participants watched 10 Tomato man stimuli (Özyürek, Kita, & Allen, 2001) depicting two characters (i.e. Tomato man and the green Triangle) performing some actions (Fig. 1, left panel). The goal of these stimuli was eliciting the description of manner and path in the verbal and gesture modality as the participants described Tomato and Triangle actions. The stimuli were presented on a 13-inch TFT monitor at a resolution of 800x600. Stimulus presentation was controlled by a PC running Power Point. The participants were audio and video recorded with a Sanyo Xacti HD2000 camera at a medium shot (i.e. they were shot from up their head to their knees, Fig. 1, right panel).

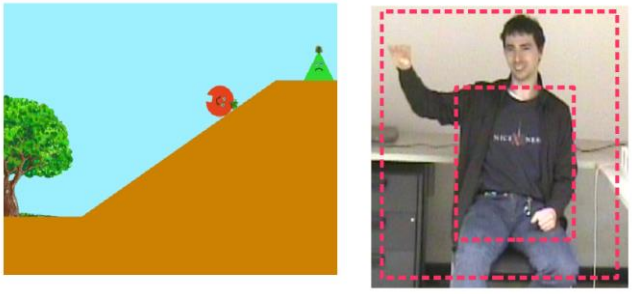

Figure 1: On the left panel, an example of the Tomato man cartoons used to elicit participants' gestures. In this movie Tomato man is "rolling down the hill". On the right panel, a participant describes the cartoon. The two dotted concentric squares define the gesture space: centre (the inner square) and periphery (the outer square).

Procedure

Participants were seated at approximately 40 cm from the computer screen. An assistant pressed the mouse button to start the experiment. After the participants saw the first stimulus they turned toward a listener sitting near the camera and described what they had just seen. The monolingual participants repeated twice the task in the same language to two listeners who are native speakers of the relevant language. The bilingual participants repeated the task once in Italian, talking to a native speaker of Italian, and once in English to a native speaker of English.

The order of the stimuli was counterbalanced. In particular the stimuli run from clip 1 to clip 10 for the forward order and from 10 to 1 for the backward one. For bilinguals, the order of the task repetition was counterbalanced by language across participants.

Data Transcription and Analysis

Transcriptions

Two native speakers of Italian and English transcribed the videotapes following the instruction manual. Disfluencies, repetitions and laughter were transcribed with special fonts. The transcriptions were checked for accuracy by a second fluent speaker. All the transcriptions were reported in Elan 4.3.3 to ensure a correct time alignment with coverbal gestures.

Gesture were transcribed and aligned with videos and transcriptions.

Gesture Coding

We coded the gestures produced by participants when telling the whole cartoon to the listeners.

In this paper we focus on two main aspect of gesture production:

Gesture Rate was calculated as the number of gesture produced by each participant describing each cartoon over

the number of words produced in each cartoon description (Ngestures/Nwords).

Gesture Salience: Gesture salience was coded for the target gesture performed during the cartoon description (e.g. rolls up, tumble down etc.). To code salience we followed McNeill (1992), who divided the gesture space into sectors using a system of concentric squares. Our annotation coding scheme reflects this notation dividing the gesture space in 2 sectors (see Fig. 1, left panel): "centre" and "periphery". When the gesture stroke was produced in the central sector, the gesture was annotated with 0 (not salient), whereas when the gesture stroke was produced in the periphery sector, the gesture was annotated with 1 (salient).

To ensure the reliability of the adopted coding scheme, a subset of the corpus (659 gesture tokens) was annotated by three independent coders. For gesture salience we found a high agreement above the chance level (Kappa = 0.89).

Results

We analysed our data in a linear (for gesture frequency) and a general (for gesture salience) mixed-effect model, as implemented in the statistical package, R. The analysis was run in R 2.15 using the package lme4, version 0.999999-0 (the function glmer was used for the gesture salience analysis).

Gesture Rate

A linear mixed model was performed on Gesture Rate (observations n=390). We fit the linear mixed model on gesture rate using a "maximum model random slopes" approach, i.e. calculating random (slopes and intercepts) effects for subject and item as well as the following fixed effects: language (Italian vs. English) and language status (bilingual vs. monolingual) and the interaction between language and language status. Because of the high correlation in the random effects (and the consequent danger of over fitting the data), we used a "backward algorithm" to set for the model that best described the variance in the data without over fitting them. Starting from the maximal random slopes and intercepts model, we first tested for the exclusion of random slopes. In this way we set, step by step, for the simpler model that better described the variance of the data. To ensure that the models described the same amount of variance, in each step we confronted the fitting of the simpler model with the previous "more random" ones. The model that better described the variance of the data had random intercepts for subjects, random intercepts for items (cartoons) and Language (Italian or English) varying by subjects random slopes.

We found a significant effect for **Language** (Est. =0.06, S.E.= 0.01, p<0.001), such that the gesture rate is higher in Italian than in English, but no significant effect for Language Status (monolingual or bilingual; Est.=-0.02, S.E=0.02, p=0.19). Interaction between the fixed effects (Language status and Language) was investigated but not found (Est=0.007, S.E.=0.03, p=0.84).

p values were calculated from the t values obtained in the linear mixed effect model output. We treated the t values as they were draw from a normal distribution, using the pnorm function in R. A post hoc power analysis through simulation (n simulations=1000) revealed that 27 participants per group (81 participants in total) would be needed to obtain statistical power at .80 level.

In Fig. 2 we report the mean values of gesture rate for each group (monolingual or bilingual) in each language (Italian and English).

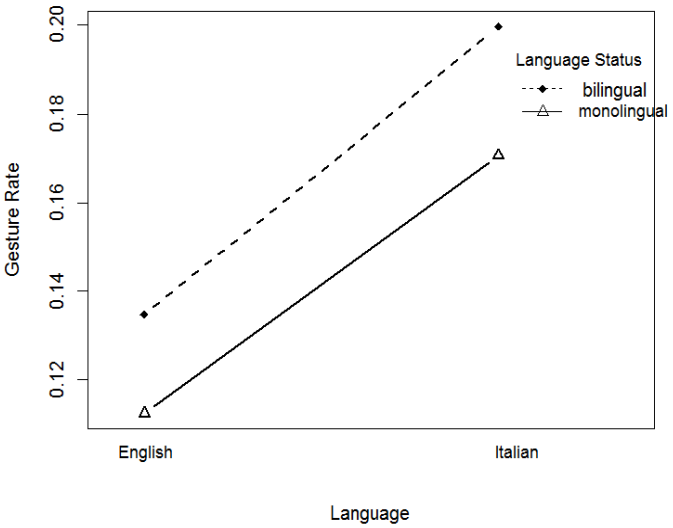

Figure 2: Mean values of gesture rate for Language Status (Bilingual, dotted line or Monolingual, solid line) in each Language (English and Italian).

Gesture Salience

A generalized mixed linear model was performed on gesture salience (sample size n= 390). Following the same procedure described for gesture rate, we set for the model that had by items (cartoons) random intercepts, by subjects random intercepts and Language (English or Italian) varying by subjects random slopes. We found a significant effect for both **Language** (Est=1.85, S.E.=0.38, p<0.001) and **Language Status** (Est.=0.98,S.E.=0.39, p=0.01). Interaction between the fixed effects (Language status and Language) was investigated but not found (Est=0.33, S.E.=0.76, p=0.66). That is, gestures were more salient in Italian than in English and bilinguals' gestures were more salient than monolinguals'.

p values were automatically calculated from z scores by glmer function. In Fig. 3 we report the probability of producing salient gestures in each Language Status (bilingual and monolingual) and each Language (Italian and English). A post hoc power analysis conducted with data simulation (n simulations=1000) revealed that 22 participants per group (monolingual English, monolingual Italian, Bilinguals= 66 participants overall) would be needed to obtain statistical power at .80 level.

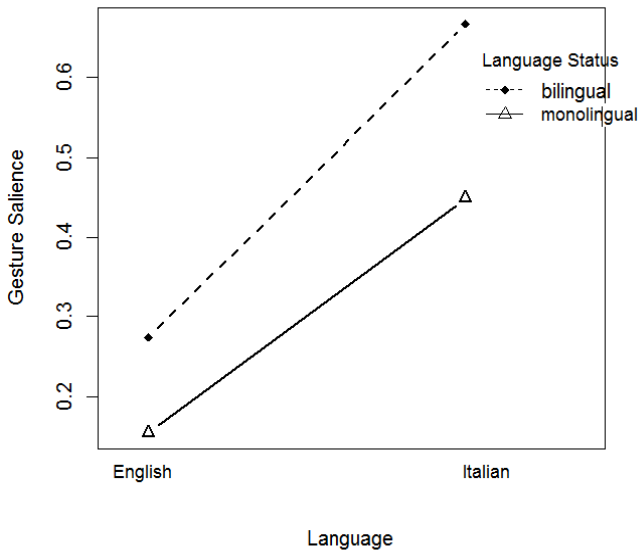

Figure 3: Probability of producing a salient gesture by Language Status (Bilingual, dotted line or Monolingual, solid line) in each Language (English and Italian).

Discussion

The aims of this study were to investigate gesture frequency and gesture space in Italian/English bilinguals and the relationship between gesture and language in bilinguals. In addressing this question, the data from a bilingual and two monolingual control groups have been collected and analysed.

A first result was that Italian speakers gestured more frequently and that their gestures were more salient than English speakers. As observed by Kendon (1992) and Efron (1972) Italian is indeed a "high gesture culture". With regard to gesture rate, we found no evidence of transfer when bilinguals switch between Italian and English. With regard to salience, we found, again, no evidence of transfer but, overall, bilinguals' gestures were more salient with respect to the gestures performed by the two control groups. From our results we can conclude that when English/Italian bilinguals switch language, their gesture parameters switch accordingly with the language they talk.

Whether or not one finds gestural transfer in bilinguals may depend upon many variables. First of all, the societal context for bilingualism and the bilingualism level of the participants can affect transfer. Unlike the current study, So (2010) found evidence of transfer for representational gestures only from American English (high gesture rate) to Mandarin-Chinese (lower gesture rate) in Singapore. In Singapore multilingualism is a long established and prominent feature of the society, encouraged by laws. The bilinguals who took part in the present study mostly grew up in non bilingual communities (in Italy or the UK) where one of the two languages was mostly spoken with parents, family members and friends. Although bilingual participants in this study reported in the Linguistic Background questionnaire that to them it was important to speak well both languages and they equally liked to speak in both, it might be that it is easier for the bilinguals tested in our study to "keep apart" the two linguistic systems.

In contrast, bilinguals in Singapore might have been much more exposed to two or more languages in daily life and it has been documented that transfer of words occurred together with gesture frequency transfer (So, 2010). The bilinguals in this study had some tip-of-the-tongue phenomena but did always choose to talk in the target language. The societal and linguistic context may account for the lack of gestural transfer found in Nicoladis et al. (2005) and for the lack of difference in gesture frequency between the two monolingual control groups. Their English-French bilingual children were recruited in Alberta, which is an English speaking province of Canada. Thus, just like our English-Italian bilinguals, one of the two languages (French) was mostly spoken with parents, family members and friends. Differently, the French monolingual group was recruited in Quebec, a bilingual area of Canada where French Canadians are highly exposed to English too.

One of the most interesting findings of this study is that bilinguals' gestures were overall more salient than monolinguals' gestures**.** One possible explanation is that bilinguals may often be in a communicative situation where some people are weak in Italian and others are weak in English. In such situations, bilinguals may make their gestures more salient in order to facilitate communication. This might become a habitual feature of bilinguals' gestures. This speculation though needs to be substantiated by future studies.

Our results indicate that language and gesture, even gesture "cultural" parameters such as frequency and salience, are tightly linked. In addition to that, our results suggest that the selection of those parameters happens at a pre-linguistic level, as these parameters have no strictly communicative meaning. The features specifying a language and the corresponding gesture parameters might be selected at a high level processing stage in which verbal and nonverbal aspects of communication are planned together. This is compatible with the idea that bilinguals specify the language at a conceptual level, as suggested by La Heij's concept selection hypothesis (2005). La Heij stated that the semantic system directly activates target-language lexical nodes over lexical nodes in the non-target language. Thus, the intended language is selected at the conceptual stage after a series of communicative aspects have been taken into account (e.g. who is the interlocutor, in which communicative situation we are etc.).

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