

# Can gestures change perceived meaning of ambiguous motion events Evidence from Italian verb-particle constructions

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## Abstract

How sensitive are Italian speakers to information provided by co-speech gestures when interpreting ambiguous motion events? Verb + particle constructions are not suitable for expressing telic motion (change of location across a spatial boundary) in verb-framed languages like Italian. However, this constraint may perhaps be disregarded with certain type of manner verbs + complex PPs. The reading often depends on contextual inference or pragmatic clues. We present two experimental judgment tasks in which we first test whether grammatically locative Italian verb + particle constructions can be interpreted as boundary-crossing motion and secondly we investigate the effect of gestural information on the same type of locative events. The study confirms the existence of boundary-crossing interpretations for certain types of Italian manner verb + PP constructions, but more importantly that co-speech gestures can change the reading of events and thus override default meaning expressed only in speech.

## 1 Introduction

Iconic gestures contain a lot of information about what we say and how we say it (Kita et al., 2007; Gullberg, 2011). These types of gestures are tightly linked to language and often reflect the same information as speech (McNeill, 2005). However, gestures may also express different aspects of that meaning (Beattie and Shovelton, 1999) and may therefore reveal more about what the speaker is trying to convey than speech alone (Athanasopoulos and Bylund, 2013). Co-speech gestures may thus help the listener gain information about speaker intentions and ideas especially in noisy environments (Harrison, 2011) or ambiguous situations (Goodrich Smith and Hudson Kam, 2012). Many studies investigating the integration of speech and gesture in comprehension look at situations where there is a mismatch or incongruence between what is expressed in speech and in gestures (Kelly et al., 2014; Holle and Gunter, 2007). However, in this paper we investigate the effects of gesture information on interpretation of information in a truly ambiguous areas of linguistics: the directional reading of locative particles (Folli, 2008; Gehrke, 2007). We set up two experimental judgment tasks to first test the interpretation of ambiguous manner verb + locative particles for expressing directional motion (NO GESTURE CONDITION), and secondly in a GESTURE CONDITION we test whether information in gestures has an effect on, and may alter, how the same motion constructions are interpreted.

## 2 Background

Recent research has indicated that the typology outlined by Talmy (1985; 1991) is too simple and rigid (Beavers et al., 2010). According to (Talmy, 2000), languages are generally classified in respect to how speakers of a particular language most typically express path of motion in lexical items within a clause structure. As is characteristic of a *verb-framed language* (Talmy, 1991), in Italian the path of motion (directionality) is typically expressed in the main verb of a clause and manner of motion, if present at all, is left to be expressed in a separate constituent (here an adverbial gerund) as in (1). However, the

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typology refers to how motion is most frequently expressed and is not an absolute rule (Cadierno and Ruiz, 2006). Languages typically have other possibilities not typical of their framing type (Beavers et al., 2010; Croft et al., 2010), and Italian may frame the path of motion in ways typical of *satellite-framed languages* as in (2), where path is expressed in a satellite position to a main manner verb. Yet, verb-framed languages are constrained by the boundary-crossing constraint not to express telic motion across spatial boundaries with path expressed in satellites to main manner verbs (Slobin and Hoiting, 1994; Aske, 1989). The absence in Italian of inherently directional prepositions expressing change of location with end-goal and boundary-crossing properties (Iacobini and Vergaro, 2014), implies that motion across a spatial boundary cannot be constructed with a manner verb and a path-denoting satellite. In this case the satellite only denotes locative motion and the figure does not change states from outside to within the container (the goal), but only moves inside of the container as shown in (3).

1. Il pallone [FIGURE] **scende** [PATH] per la collina [GROUND] *rotolando* [MANNER]  
'The ball **descends** on the hill *rolling*'
2. Il pallone [FIGURE] **rotola** [MANNER] *giù* [PATH] per la collina [GROUND]  
'The ball **rolls** *down* the hill'
3. Il pallone [FIGURE] **rotola** [MANNER] *dentro* [LOCATION] la rete [GROUND]  
'The ball **rolls** *\*into/inside of* the goal'

Yet, recent developments in lexical semantics suggests that Italian speakers may overcome this constraint in two specific ways: either by combining certain types of manner of motion verbs with simple PPs, or possibly all types of manner verbs with complex PPs (Folli, 2008). According to Folli & Ramchand (2005, p. 97) some manner verbs in Italian carry an optional diacritic feature '+R' (=result), which licenses the projection of a result phrase (RP) specifying the end-goal of motion. Such verbs (e.g. *correre* - 'run') can in combination with a locative preposition be read as directional motion across a spatial boundary. On the contrary, pure manner verbs, which do not encode a result feature in their lexical specification (e.g. *danzare* - 'dance') only express locative motion when combined with a locative preposition. Folli (2008) extends the hypothesis to include all manner of motion verb types in combination with complex locative prepositions i.e., two or more prepositions (*dentro a*, *dietro a* - 'inside to/at', 'behind to/at') as in (4), and argues that two locative prepositions have a complex functional structure; one encodes a PATH/PROCESS component and the other a PLACE/END-LOCATION component. Thus the combination of a complex PP and a manner verb allows for a boundary-crossing reading of the event regardless of the verb type (Cardini, 2012), but the constructions are ambiguous in the sense that they also can denote locative meaning. The claim is contested by Mateu & Rigau (2010) and Bandecchi (2012) who both maintain that only manner verbs with a '+R' feature can be used to express directional motion with simple and complex PPs in Italian.

4. Il pallone [FIGURE] **rotola** [MANNER] *dentro alla* [PATH/LOCATION] rete [GROUND]  
'The ball **rolls** *into/inside of* the goal'

In fact, the construction is infrequently used in Italian (Wessel-Tolvig, 2015). The infrequency may be ascribed to Slobin's (1996) thinking-for-speaking hypothesis, which focuses on the potential effects language has on conceptualization. According to Slobin (1987; 2004) the language you speak, specifically the way manner and path are most frequently expressed in that language, has an effect on conceptualization in the process of interpreting and verbalizing motion events (Cadierno, 2012; Berman and Slobin, 1994). These thinking-for-speaking patterns may be so deeply rooted in cognition that *possible* manner verb + complex PP constructions may be biased in interpretation towards standard verb-framed locative meanings, i.e. a phrase like (4) is more likely to receive locative meaning than directional meaning. Since the manner verb + complex PP construction is ambiguous in expressing boundary-crossing motion, it may be difficult to infer speaker meanings based on speech alone. The co-expressive semantic content of gestures may provide listeners with an important additional indication of the speaker's intended meaning.

Speech and gesture are tightly related both semantically and temporally in language production (Kendon, 1980; McNeill, 1992). Studies show how speakers' co-speech gestures reflect what information they select for expression and how they express it (i.e. linguistic conceptualization) (Kita and Özyürek, 2003; Özyürek et al., 2005; Stam, 2006). Moreover, recent findings extend claims on the integration of speech and gesture to also hold for language comprehension (Kelly et al., 2010; Kelly et al., 2014; Holle and Gunter, 2007). Listeners incorporate information in speakers' gestures to derive speaker meanings (Dick et al., 2009) and thus attempt to access speaker conceptualizations (Goodrich Smith and Hudson Kam, 2015). Under this perspective, the information in co-speech gestures may help, or guide, the listener when interpreting ambiguous expressions.

## 2.1 Research questions

Based on the recent proposal by Folli (2008) and Folli & Ramchand (2005) that Italian locative particles in combination with with complex PPs may be interpreted as expressing change of location and boundary-crossing movement, and given the tight relation between speech, gesture and cognition (Gullberg, 2011; McNeill, 2005), we ask the following questions:

- Can Italian complex locative PPs be assigned a boundary-crossing interpretation, and is the reading of such verb particle constructions influenced by lexical properties of the verb?
- Do listeners integrate information in co-speech gestures, and may gesture information influence the default interpretation of motion events?

## 3 Methodology

The data come from two independent experimental judgment tasks: a NO GESTURE CONDITION (baseline) and a GESTURE CONDITION involving a total of 212 participants, all native speakers of Italian. The judgment tasks are online questionnaires produced with Google Forms.

### 3.1 Participants

All participants are Italian native speakers recruited from all over the Italian peninsula and the data is collected using convenience and snowball sampling methods through personal and student networks (see table 1).

Table 1: Participant data

Condition	Participants	Gender (Female)	Age Mean(SD)
NO GESTURE	109	61.4%	27.6 (7.8)
GESTURE	103	69.9%	26 (6)

### 3.2 Experimental design

In the NO GESTURE CONDITION participants are shown different Italian manner verb + complex PP sentences in written form (see figure 1), and asked to judge if they understood the sentences as locative or directional motion (i.e. as movement within or into something). TYPE 1 verbs are manner verbs with a result feature encoded in the lexical specification, and TYPE 2 verbs are pure manner verbs that do not encode any result features. In the GESTURE CONDITION participants are asked to judge the same motion sentences as in the NO GESTURE CONDITION, however in a video-based format where the speaker produced either DIRECTIONAL or NON DIRECTIONAL gestures together with the sentences (see figure 2). Manner verbs belonging to the two verb types as defined in Folli & Ramchand (2005, p. 97) are included in both conditions. Verbs from the two groups are combined with the same complex PPs (e.g. *dentro a, fuori da* - 'into/inside of', 'out/outside of'), again in both conditions. Furthermore, in the GESTURE CONDITION half of the TYPE 1 verbs + PP are expressed with a DIRECTIONAL gesture and the other half with a NON DIRECTIONAL gesture (likewise for TYPE 2 verbs) as seen in table 2. All gesture strokes

are aligned with the main manner verb + PP + ground NP. The NO GESTURE CONDITION contains 12 motion event expressions and the GESTURE CONDITION 16. They are, however, equally distributed between verb types and PP types.

Figure 1: Example of elicitation material from the NO GESTURE CONDITION

**Il pallone rotola dentro alla casa**

('The ball rolls into/inside the house')

What did you first understand?

a) Il pallone entra nella casa  
'The ball enters into the house'

b) Il pallone si trova già nella casa  
'The ball is already in the house'

Figure 2: Example of video elicitation material from the GESTURE CONDITION



Table 2: Motion event construction and gesture type combination

Verb type	Verb (examples)	Complex PP	Gesture condition
TYPE 1	Rotolare (roll)	Dentro a (inside/into)	DIRECTIONAL
	Saltare (jump)	Fuori da (outside of/out of)	NON DIRECTIONAL
	Rimbalzare (bounce)	Dentro a (inside/into)	DIRECTIONAL
	Volare (fly)	Fuori da (outside of/out of)	NON DIRECTIONAL
TYPE 2	Galleggiare (float)	Dentro a (inside/into)	DIRECTIONAL
	Danzare (dance)	Fuori da (outside of/out of)	NON DIRECTIONAL
	Zoppicare (limp)	Dentro a (inside/into)	DIRECTIONAL
	Nuotare (swim)	Fuori da (outside of/out of)	NON DIRECTIONAL

## 4 Analysis

In the NO GESTURE CONDITION we collected a total of 1308 responses and in the GESTURE CONDITION we collected 1648.

#### 4.1 NO GESTURE CONDITION

We find that the participants interpret TYPE 1 verbs with complex PPs as directional movement more often than they do TYPE 2 (see table 3). A one-way ANOVA with Verb type and Response frequency as within-group variables and Subject as error term, shows a main effect of Verb type  $F(1,108) = 52, p < 0.001, \eta^2 = 0.0002$ . Bonferroni-Holm corrected pairwise t-tests show significant differences in responses within each verb type. The finding provides evidence for the hypothesis that Italian manner verbs with an inherent directional result feature (TYPE 1) can give rise to boundary-crossing interpretations (Cardini, 2012; Folli and Ramchand, 2005). Yet, we also find that 20% of TYPE 2 verb + PP constructions are interpreted as movement across a spatial boundary even though this interpretation should not be available in theory (Bandecchi, 2012). This finding supports Folli’s (2008) claim that the complex functional structure of the complex PP may give license to boundary-crossing interpretations even when combined with pure manner verbs (TYPE 2).

Table 3: Distribution of answers in the NO GESTURE CONDITION (absolute and relative frequencies)

Interpretation	Manner verb type	
	TYPE 1	TYPE 2
DIRECTIONAL	372 (.57)	134 (.20)
LOCATIVE	282 (.43)	520 (.80)
Sum	654 (1)	654 (1)

#### 4.2 GESTURE CONDITION

In the GESTURE CONDITION we add the gesture variable as seen in the methodological section (table 2). Again we find that listeners are more likely to interpret the manner verb + complex PP constructions as boundary-crossing when the verb itself licenses some form of directional movement (TYPE 1) compared to pure manner verbs (TYPE 2) (see table 4). In a one-way ANOVA with Verb type as within-group variable and Subject as error term, we find a main effect of Verb type  $F(1,102) = 5.47, p = 0.02, \eta^2 = 0.001$ . Bonferroni-Holm corrected pairwise t-tests show significant differences in responses within each verb type.

Table 4: Distribution of answers in the GESTURE CONDITION (absolute and relative frequencies)

Interpretation	Manner verb type	
	TYPE 1	TYPE 2
DIRECTIONAL	441 (.54)	284 (.34)
LOCATIVE	383 (.46)	540 (.66)
Sum	824 (1)	824 (1)

Recall, however, that in this condition we manipulated the expressions with different co-speech gestures to investigate whether the information in gestures (directional or non-directional) could lead listeners to interpret the constructions in a certain way. We now proceed, therefore, to look at the combined effect of verb and gesture type. Figure 3 displays how the interaction of the two variables affects the mean frequency of occurrence of boundary-crossing interpretations. We find that constructions paired with DIRECTIONAL gestures in general receive boundary-crossing interpretations more often than constructions with NON DIRECTIONAL gestures. We also see that the increase, compared to how often the same sentence is interpreted as boundary-crossing when a NON-DIRECTIONAL gesture is present, is particularly large for TYPE 2 verbs.

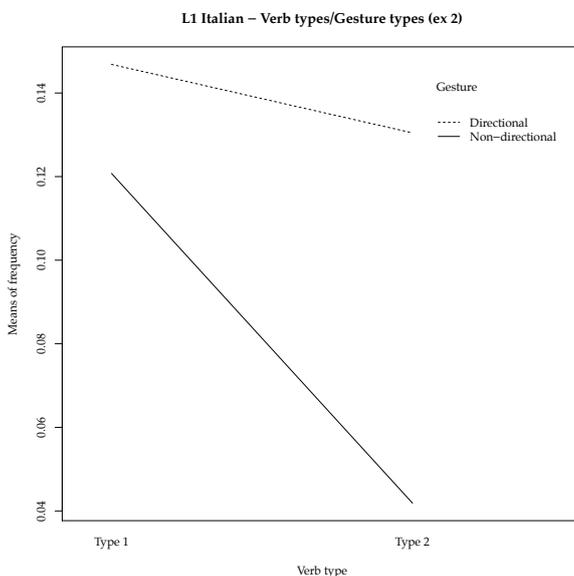
In a repeated measure ANOVA with Verb Type and Gesture Type as within-group variables and Subject as error term, we find main effects for Verb Type and Gesture Type, and an interaction between the two variables. The ANOVA results are reported in table 5. Bonferroni post-tests show pairwise significant

Table 5: Repeated measures 2 x 2 ANOVA results for Verb Type and Gesture Type

Within subject effect	$F(1, 102)$	$p$	$\eta^2$
Verb Type	74.17	< 0.001	0.14
Gesture Type	98.70	< 0.001	0.19
Verb Type * Gesture Type	40.02	< 0.001	0.066

differences between TYPE 1 and TYPE 2 verbs, and between DIRECTIONAL and NON-DIRECTIONAL gestures. To sum up, the co-speech gesture used ‘pushes’ the interpretation of the motion expression towards the meaning of the gesture itself. When TYPE 2 pure manner verbs are expressed with DIRECTIONAL gestures, the interpretation of these construction are thus much more likely to receive a boundary-crossing interpretation than they would otherwise.

Figure 3: Verb Type and Gesture Type mean freq. of boundary-crossing interpretation



### 4.3 Comparing NO GESTURE CONDITION with GESTURE CONDITION

Finally, we compare the response patterns from the NO GESTURE CONDITION and the GESTURE CONDITION to investigate whether gestural information potentially can change the interpretation of events compared to the baseline, i.e. whether gestures can maintain or change the interpretation of events. The question is: are there effects of DIRECTIONAL or NON-DIRECTIONAL gestures on the interpretation of TYPE 1 and TYPE 2 verbs across the two conditions? First of all, to rule out a form-based bias caused by two different questionnaire formats (written vs. video), we tested the interpretation of linguistic fillers across the two experiments. In both conditions the filler were ambiguous goal-of-motion constructions, e.g. *Andrea corse a Palermo* - ‘Andrea ran to/in Palermo’. In the GESTURE CONDITION these constructions were produced without gestures. We find no difference between formats  $\chi^2(1, N = 212) = 0.716, p = 0.4, \varphi = 0.031$ .

The two plots in figure 4 show how verb type and gesture vs no-gesture condition together affect the mean response frequencies of boundary-crossing interpretations. We show this separately for DIRECTIONAL gestures (left-hand side), and NON DIRECTIONAL gestures (right-hand side). The data shows how information displayed through gesture affects the perception of ambiguous motion event expressions. TYPE 1 verbs, which as we saw inherently encode a result feature in their lexical specification, receive the same interpretation in both GESTURE condition involving a DIRECTIONAL gesture and NO GESTURE

condition. On the contrary, when DIRECTIONAL gestures are produced with TYPE 2 verbs, which do not encode a result feature, the interpretation shifts from non-boundary-crossing in the NO GESTURE CONDITION) to a boundary-crossing interpretation. Turning now to the NON DIRECTIONAL gestures, they maintain a non-boundary crossing reading when produced with TYPE 2 verbs, whilst they cause the frequency of boundary-crossing interpretations to decrease when co-occurring with TYPE 1 verbs.

Figure 4: Effect of DIRECTIONAL and NON DIRECTIONAL gestures

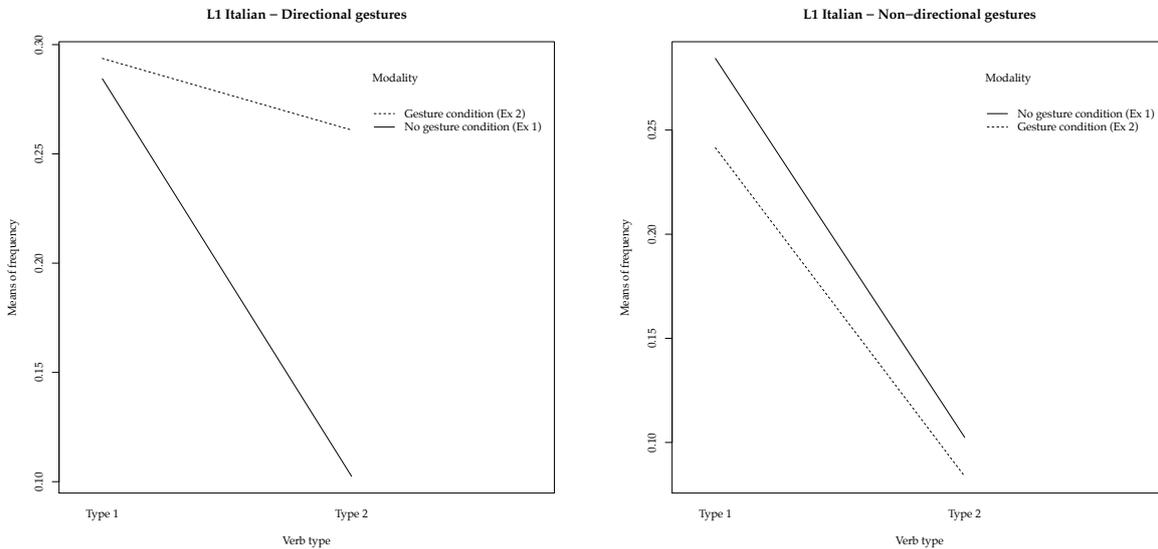


Table 6: Mixed effects 2 x 2 ANOVA results for Experimental Condition and Verb Type (DIRECTIONAL gestures used in the gesture condition)

Main effect	$F(1, 210)$	$p$	$\eta^2$
Experimental Condition (between)	50.59	< 0.001	0.13
Verb Type (within)	143.39	< 0.001	0.199
Experimental Condition * Verb Type	67.85	< 0.001	0.1052

Table 7: Mixed effects 2 x 2 ANOVA results for Experimental Condition and Verb Type (NON-DIRECTIONAL gestures used in the gesture condition)

Main effect	$F(1, 210)$	$p$	$\eta^2$
Experimental Condition (between)	6.99	< 0.01	0.02
Verb Type (within)	357.01	< 0.001	0.39

Mixed effects ANOVAs with Experimental Condition as between-group variable, Verb type as within-group variable and Subject as error term were run to test the significance of these interactions. For the DIRECTIONAL gestures, we found significant main effects for Condition and Verb Type, and a significant interaction between the two. Results are displayed in table 6. Bonferroni post-tests show no significant pairwise difference for TYPE 1 verbs ( $p = 0.5$ ), but it does for TYPE 2 verbs ( $p < 0.001$ ). In constructions with NON-DIRECTIONAL gestures, we found a significant (although smaller) main effect of Condition, a main effect of Verb Type, but no significant interaction between the two  $F(1, 210) = 1.83, p = 0.18, \eta^2 = 0.003$ . Results are displayed in table 7. Bonferroni post-tests show a significant pairwise difference in TYPE 1 verbs ( $p < 0.01$ ), but not between TYPE 2 verbs ( $p = 0.16$ ).

## 5 Discussion

The data from our experimental judgment task provides evidence for the Folli (2008) proposal that Italian manner verbs *can* receive boundary-crossing interpretation when paired with complex locative PPs. From the NO GESTURE CONDITION we found that both with TYPE 1 and TYPE 2 can be interpreted as motion across a spatial boundary, i.e. the figure changes location from one state to another (Berman and Slobin, 1994). However, verbs with an inherent result feature (TYPE 1) are more likely to receive boundary-crossing interpretations than pure manner verbs + complex PP, where, at least according to Bandecchi (2012) neither verb nor any element in the complex PP encode any directional features (see also Iacobini (2014)). In 20% of the cases, however, also examples involving TYPE 2 verbs are given a boundary-crossing interpretation, suggesting that the complex functional structure of the complex PP can give rise to directional interpretation across a boundary even with such verbs, see also Cardini (2012). In essence this finding indicates that the boundary-crossing constraint proposed by Slobin & Hoiting (1994) can be overcome in Italian by using complex PPs to denote a process (path) as well as an end-goal of motion (place). However, since both types of verb + complex PP construction are ambiguous between directional and locative meaning, many participants also interpreted them as purely locative motion (e.g. as motion within a container). As stated in the introduction, the manner verb + complex PP construction is not widely used in Italian to express boundary-crossing movement, yet modern spoken Italian has seen an increased tendency to express directional motion in non-boundary-crossing situations with manner verbs and path-denoting satellites (e.g. *rotola giù* - 'rolls down') (Hijazo-Gascón and Ibarretxe-Antuñano, 2013; Iacobini and Masini, 2006; Wessel-Tolvig and Paggio, 2016). Deeply rooted thinking-for-speaking patterns (Slobin, 1996), linguistic habits (Cardini, 2008) and a tendency to avoid ambiguity may all contribute to Italian speakers not choosing these atypical, yet grammatically available manner verb + complex PP constructions.

In the GESTURE CONDITION we tested the effects of gestural information when interpreting the manner verb + complex constructions. Listeners integrate the information to build a more complete picture of the expressed situation (Kelly et al., 2010; Kelly et al., 2014) especially in those situations where the content is ambiguous and there are no anaphoric cues to a context (Holle and Gunter, 2007; Dick et al., 2009). Listeners are influenced by the additional information provided by gestures and the interpretation of the expressions is shifted towards their content. When the speaker in the videos used a DIRECTIONAL gesture with the manner verb + complex construction, listeners were more likely to interpret the expression as movement across a boundary as opposed to movement that did not cross any spatial markers. This effect was stronger for TYPE 2 verbs, where it can be said that the default locative interpretation of the verb is overridden. NON DIRECTIONAL gestures, similarly, increased the probability of a non-boundary crossing interpretation for both verb types, however the effect was stronger with TYPE 1 verbs. In essence, the most striking effect of gestures occurs when there is some sort of semantic 'incongruence' between speech and gesture information.

When we compared the response patterns across conditions we found that the strongest effects are found when we combine DIRECTIONAL gestures with TYPE 2 verbs ( $p < 0.001$ ) and NON DIRECTIONAL gestures with TYPE 1 verbs ( $p < 0.01$ ). DIRECTIONAL gestures significantly increased boundary-crossing interpretations and NON DIRECTIONAL gestures significantly decreased boundary-crossing interpretation. The other two combinations maintained scores of interpretation across conditions (\*ns).

To summarize our findings, the study confirms earlier claims that boundary-crossing interpretations of the manner verb + complex PP construction are possible in Italian (Folli and Ramchand, 2005; Cardini, 2012), but more importantly, we find that the information provided by gestures can affect the interpretation of these ambiguous expressions and 'override' the default meaning expressed only in speech. The data thus provides important knowledge of how listeners integrate gestural information in comprehension to derive speaker meanings and thus construct a more complete picture of the content of an utterance (McNeill, 1992; McNeill, 2000).

## Acknowledgements

We would like to thank Maria Grazia Busà and Alice Cravotta at LCL in Padova (Italy) for help with data collection, Lorenzo Menon at University of Copenhagen for his acting in the elicitation materials, and all the subjects who participated in the studies. This research was funded by the Danish Council for Independent Research.

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