

Gestural Semantics*

Philippe Schlenker**

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Abstract. We argue that a large part of the typology of linguistic inferences can be replicated with gestures, including ones that one might not have seen before. While gesture research often focuses on *co-speech gestures*, which co-occur with spoken words, our study is based on *pro-speech gestures* (which fully replace spoken words) and *post-speech gestures* (which follow expressions they modify). We argue that pro-speech gestures can trigger several types of inferences besides entailments: presuppositions and anti-presuppositions (derived from Maximize Presupposition), scalar implicatures and Blind Implicatures, homogeneity inferences that are characteristic of definite plurals, and some expressive inferences that are characteristic of pejorative terms. We further argue that post-speech gestures trigger inferences that are very close to the supplements contributed by appositive relative clauses. We show in each case that we are not dealing with a translation into spoken language because the fine-grained meanings obtained are tied to the iconic properties of the gestures. Our results argue for a generative mechanism that assigns new meanings a specific place in a rich inferential typology, which might have consequences for the structure of semantic theory and the nature of acquisition algorithms.

Keywords: semantics, pragmatics, iconicity, gestures, co-speech gestures, pro-speech gestures, post-speech gestures, gestural inferences, presupposition, Maximize Presupposition, implicatures, Blind Implicatures, homogeneity inferences.

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**Institut Jean-Nicod (ENS - EHESS - CNRS), Département d'Etudes Cognitives, Ecole Normale Supérieure, Paris, France; PSL Research University ; New York University, New York.

1 Introduction

While there has been considerable work on the interaction between language and gestures, only recently has linguistics attempted to study the role of gestures in the typology of meaning operations in language. Traditionally, linguists have focused on *co-speech gestures*, which are produced simultaneously with the spoken words they modify. But recent research has raised two further categories to prominence: *post-speech gestures*, which follow the expressions they modify; and *pro-speech gestures*, which fully replace some spoken words (Ladewig 2011, Schlenker, 2015, 2017, to appear). A natural question is how gestures fit in the typology of linguistic inferences uncovered by contemporary semantics.

Some coarse-grained gestural typologies were proposed in recent work. First, pro-speech gestures (as in (1)a) usually have a 'full-fledged meaning' and must thus make an assertive contribution. Second, while there is agreement that co-speech gestures (as in (1)b) are non-assertive, theorists differ as to their nature: some believe that they display the behavior of appositive relative clauses in contributing supplements (Ebert and Ebert 2014), while others take them to trigger presuppositions of a particular sort (Schlenker 2015, 2017, to appear). However proponents of the latter claim have argued that *post-speech gestures* (as in (1)c) display the behavior of appositive relative clauses.

Notational conventions: (i) A gesture that co-occurs with a spoken word (= a co-speech gesture) is written in capital letters or as a picture (or both) *preceding* the expression it modifies, in brackets – as in (1)a. (ii) A gesture that follows a spoken word (= a post-speech gesture) is written in capital letters or as a picture *following* the expression it modifies, and preceded by a dash (–), as in (1)b. (iii) A gesture that replaces a spoken word (what we call a 'pro-speech gesture') is written in capital letters or as a picture, as in (1)c. (iv) If pro- and post-speech sounds are produced with an onomatopoeic sound, it is transcribed after the gesture, with an 'underscore' connection (_), as in (1)b,c.

- (1) a. **Pro-speech gesture:** His enemy, John will  _<phhh>.
- b. **Co-speech gesture:** John will  [punish] his enemy.
- c. **Post-speech gesture:** John will punish his enemy –  _<phhh>.

(We will not further discuss co-speech gestures in this piece because their special semantic status is likely *sui generis* due to the fact that they co-occur with and are thus parasitic on spoken words.)

In this piece, we argue that a large part of the typology of linguistic inferences found in language can be replicated with gestures, including ones that one has not encountered before. Besides standard entailments, we argue that pro-gestures can trigger scalar implicatures and associated phenomena (Blind Implicatures), presuppositions and associated phenomena (namely anti-presuppositions due to *Maximize Presupposition*), homogeneity inferences that are characteristic of definite plurals, as well as some expressive inferences that are characteristic of some pejorative terms. We further argue that post-speech gestures trigger inferences that are very close to the supplemental inferences obtained with appositive relative clauses. We show in each case that we are not dealing with a translation into words because the fine-grained meanings obtained are tied to the iconic properties of the gestures. Nonetheless, new gestures are easily assigned a specific place in a sophisticated inferential typology.

If correct, these results might have broader consequences. An important achievement of contemporary semantics was to uncover an exquisitely detailed typology of linguistic inferences. But a key question pertains to their origin: are they encoded in rich lexical entries that might be relatively arbitrary and require rich input to be acquired? or are they generated by a productive procedure that takes as input the form and simple (i.e. bivalent, non-multidimensional) semantic contribution of an expression and returns its fine-grained meaning within the inferential typology?

Historically, scalar implicatures were taken to be derived rather than lexically encoded, although the existence of scales may or may not be lexical (Horn 1972, Katzir 2007, Katzir and Fox 2011). By contrast, presuppositions are usually taken to be lexically encoded (e.g. Heim 1983). Our results suggest that productive mechanisms might be needed across the board, which might obviate the need for rich lexical entries. A summary of the extant typology with salient examples and brief comments about the lexical or non-lexical nature of the inferences can be found in (2)

(2) Typology of linguistic inferences

Type	Lexical?	Examples
Standard scalar implicatures	No (Horn 1972), except possibly for the existence of lexical scales	Some group members attended. => not all group members attended
Blind scalar implicatures	No, just like standard scalar implicatures (Magri 2009)	#Some Italians come from a warm country.
Presuppositions	Yes (Heim 1983)	None of my students knows that he is incompetent. (=> all of my students are incompetent)
Anti-presuppositions	Like standard presuppositions, possibly with lexical scales in addition	#John is incompetent and he believes it.
Homogeneity inferences	[not clear yet]	John will/won't find his presents. => he will find all / he will find none
Supplements	Yes, through the comma intonation (Potts 2005)	One/#None of these guys helped his daughter, which saved her.
Expressives	Yes (Potts 2005)	(#) If I were really prejudiced against the French, I wouldn't hire a Frog.

The rest of this article is organized as follows. We show in Section 2 that standard and 'blind' implicatures arise with gestures – which is unsurprising given standard theories. We turn to presuppositions and anti-presuppositions in Section 3, with less expected results: they seem to be the result of productive procedures. Homogeneity inferences are discussed in Section 4, followed by expressives and supplements in Section 5. In each case, we will select some particularly telling formal properties of the inferences under investigation to make our case, without trying to adjudicate among competing theories of these phenomena: our goal is just to show that the inferential typology can be replicated with gestures.

2 Scalar implicatures: standard and 'blind'

Gricean and post-Gricean theories of scalar implicatures take them to arise as soon as (Horn 1972, Katzir 2007, Katzir and Fox 2011, Goodman and Stuhlmüller 2013, Bergen et al. 2016) a clause is compared to a logically stronger (or just to a non-weaker) one that it evokes. Theories differ about the mechanism by which alternatives are evoked. Horn 1972 took the mechanisms to rely on lexical scales; Katzir 2007 and Katzir and Fox 2011 took the mechanism to be broader and more syntactic in nature, with provisions made for the role of additional alternatives provided by the context; while Bergen et al. 2016 take the mechanisms to be in principle unconstrained, except for a cost incurred by the number of words involved. But on all these theories one may expect that sentences with gestures could evoke further sentences (especially ones with alternative gestures), which would naturally lead to the derivation of implicatures. We will suggest that this is indeed the case, especially when salient alternatives are mentioned in the context.

2.1 Standard scalar implicatures

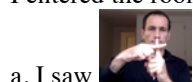
It will prove useful to consider scalar implicatures that depend on contextual scales, as this will play a role in some (though not in all) of our gestural examples. (3)a triggers the implicature that the alternatives *I ate* and *I drank* are false. In this case, the context is crucial: (3)a alone would not trigger these inferences. (3)b' implicates that the speaker drank by negation of the stronger alternative *I didn't drink*, and similarly (3)c' that some people drank by negation of the stronger alternative *Nobody drank*. In this case, the context is not necessary to trigger the inferences, for reasons that Katzir 2007 explains: *drink a lot* is structurally more complex than *drink*, and for this reason the former always evokes the latter (i.e. raises it as an alternative).

- (3) What did you do at the party - did you eat, or drink, or drink a lot?
 a. I drank.
 => the speaker didn't drink a lot

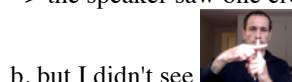
- b. I didn't drink.
- c. Nobody drank.
- a'. I drank a lot.
- b'. I didn't drink a lot.
- => the speaker drank
- c'. Nobody drank a lot.
- => some people drank

We turn to several implicature-like phenomena in gestures. We start with the distinction between gestural singulars and plurals, raised as a point of comparison for some sign language constructions in Schlenker and Lamberton 2017. In (4)a, we obtain an inference that the speaker saw a single cross. By contrast, (4)b involves the unpunctuated repetition (notated *-rep₃*) of three occurrences of the gesture, with movement, and it suggests that there were several crosses in the room (we will come back later to unpunctuated repetitions; suffice it to say that they are realized without clear break between the occurrences, which is crucial to avoid conveying information about a precise number of crosses). This contrast might suggest, of course, that the meaning of the single occurrence of the gesture is akin to 'exactly one cross' rather than 'at least one cross'. But (4)b indicates that this is not the right analysis, for if so we should only obtain a weak reading denying that the speaker saw exactly one cross.¹

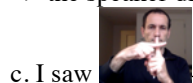
- (4) *Context:* as part of a treasure hunt, the speaker was supposed to look for crosses.
I entered the room and



=> the speaker saw one cross





=> the speaker didn't see any crosses



-rep₃.
=> the speaker saw several crosses

While we believe the inferences are relatively clear, one might bring them into sharper focus by adding at the beginning the discourse in (5), which introduces the relevant gestures in their co-speech use, before using them again as co-speech gestures. This has the effect of explicitly introducing the gestural scales involved in this case.

- (5) –Depending on the room, you should have seen a  [cross] or several  *-rep₃* [crosses].
–Well, ...

Be that as it may, it should be clear that the pro-speech gestures in (4) are not just codes for spoken words. First, depending on where the gestures are signed, one may draw the inference that the relevant objects were high or low, on the speaker's right or on the speaker's left – and one may even be able to provide gradient information in this way.² Second, in the plural case the precise realization of the repetition will convey fine-grained information as well: the *CROSS-rep* gesture may be realized as a line or as a triangle, with corresponding information about its denotation; and 6 unpunctuated iterations (replacing *-rep₃* with *-rep₆* in (4)c) will trigger the inference that there were many crosses.³

¹ Our analysis could be modified by considering further ways to derive the implicature in (4)a. For instance, the competition might be with a punctuated repetition (i.e. *CROSS CROSS*), evoking two (or at least two) crosses. We leave this question for future research, and note that a homologous question for sign language is, to our knowledge, unsolved as well (see Schlenker and Lamberton 2017 for a recent discussion, but one that does not consider the issue of implicatures).

² The ability of subjects to infer the gradient geometric position of an object relative to a ground was u

³ Interestingly, when *CROSS-rep₃* appears under negation, as in (i)a, we might well get the inference that the speaker didn't see *any* crosses (rather than: the speaker didn't see more than one cross); this is also the behavior displayed by existential plurals in English. But the judgments arguably change when *CROSS-rep₃* is replaced with *CROSS-rep₆*, as in (i)b: we arguably obtain an inference that the speaker didn't see a lot of crosses but still saw


A different paradigm is displayed in (6). We believe the facts in (6)a' are complex, possibly with two readings: *you shouldn't turn the wheel at all*, or *you shouldn't turn the wheel just a bit (i.e. as I am showing you)*. If the second reading exists, it need not be very surprising: for an iconic representation to be accurate, it must presumably depict all the relevant elements, and thus a dynamic iconic representation can be taken to include the end of the action it depicts. This entails that gestures could easily have exhaustive readings by virtue of their iconic semantics. If this so, the exhaustive reading we obtain in (6)a might not be due to a scalar implicature but just to the iconic semantics of the construction.

(6) *A driving instructor to a student:*


In order to get out, you

a. will TURN-WHEEL_ 


=> you will turn the wheel a bit but not much

b. will COMPLETELY-TURN-WHEEL_ 

=> you will completely turn the wheel

a'. shouldn't TURN-WHEEL_ 

=> you shouldn't turn the wheel at all, OR you shouldn't turn the wheel just a bit.

b'. you shouldn't COMPLETELY-TURN-WHEEL_ 

=> you shouldn't turn the wheel a lot but you should probably turn it a bit

Things are different in (6)b', however: here the only plausible way to derive the inference that the addressee should turn the wheel a bit is by way of an indirect implicature. We believe that indirect gestural implicatures are particularly easy to trigger when a gesture contains a less informative one as a sub-part. This is the case in (6)b', but also in the examples in (7), which give rise to clear indirect implicatures. (We believe the facts might be less clear when this condition of inclusion is not met. For instance, if the gesture for *TALL* is realized with the dominant hand at the relevant height *without* the accompanying upward movement, we might simply obtain a reading on which it is denied that John has precisely this very height.)

(7) a. John isn't VERY-BIG_ 

=> John is big

b. John isn't TALL_ 

=> John is tall

Finally, it is worth noting that in some or all of these cases, the gestures convey gradient iconic information that would be hard to convey in words. For instances, the gesture for *TURN-WHEEL* may convey information about the position and even thickness of the wheel.

some crosses. This would be expected if *CROSS-rep₃* is evoked as an alternative by *CROSS-rep₆*, which is a strictly more complex gesture. But one would still need to explain why (i)a doesn't evoke the alternative *I didn't see CROSS*, which should trigger the implicature that the speaker did see one cross.

- (i) a. I didn't see *CROSS-rep₃*.
b. I didn't see *CROSS-rep₆*.





We leave this question open here, noting that it is also open in the analysis of sign language unpunctuated and punctuated repetitions (in a recent study, Schlenker and Lamberton 2017 investigate the interaction between logical and iconic properties, but not the implicatures of the relevant constructions).

2.2 *Blind scalar implicatures*

Magri (e.g. 2009) argued that a sentence may trigger the inference that a logically stronger alternative is false even when contextual knowledge guarantees that, *relative to the context*, the utterance and its alternative are contextually equivalent. This yields deviance, as in (8)a, because one obtains a contradiction between the asserted meaning and the negation of the logically stronger (but contextually equivalent) alternative.







- (8) a. #Some Italians come from a warm country.
b. All Italians come from a warm country.

We believe that some instances of Blind implicatures can be found in the gestural domain as well, but one needs to take care to make the relevant alternatives very salient in the context. An initial example is displayed in (9), where co-speech gestures are used to introduce the alternatives.

- (9) I knew that whenever there was a  [cross], it was part of a  [pair]⁴. I entered a room and finally saw
- a. ? 
- b. 

Note that the reading seen in (4)b shows that the unrepeated *CROSS* gesture is compatible with an *at least one* reading (a point which is also made by the co-speech gestures at the beginning of (9)), and thus the deviance observed in (9)a is likely due to a Blind implicature rather than to an obligatory *exactly* reading.

A similar reasoning can be made about the paradigm in (10). The context already establishes that the gesture for *BIG* is compatible with the truth conditions for *VERY-BIG*; and this conclusion also follows from the reading obtained in (11)). Still, deviance is obtained in (10), and it can naturally be explained as a Blind implicature: given the context, *BIG_moving_arms* raises *VERY-BIG_moving_arms* as an alternative, and the ensuing alternative gives rise to a contradiction in view of the context.

- (10) In my Weight Watchers' group, everyone who is  [big] is  [very big].
John is in my group and since he is
- a. ? ,
- b.  [very big],
he is really serious about his diet.
- (11) a. John isn't  [big].
=> John isn't big (let alone very big)
- b. None of my friends is  [big].
=> none of my friends is big (let alone very big)

2.3 *Further issues*

While these remarks only scratch the surface of gestural implicatures, they raise two important questions for future research.

First, how are iconic alternatives computed? The question doesn't really arise when the context ensure that the relevant scales are introduced explicitly. But we saw that some indirect implicatures are

⁴ We use two identical pictures for simplicity, but each occurrence of *CROSS* should in fact be realized in a slightly different part of gestural space.

strongly triggered even in the absence of contextual scales. This was in particular the case when a stronger alternative contained a weaker alternative as subpart of its realization. This suggests that Katzir's theory of alternatives (2007) might be extended to the iconic case: an iconic representation can easily evoke as alternatives representations that it contains as subparts. Precisely this reasoning was applied in (3)b' above to explain why *drink a lot* evokes *drink* even without an explicit context, whereas *drink* needn't evoke *drink a lot*.

Second, we noted that some gestures might more easily obtain exhaustive readings than their superficial counterparts in words. We hinted at the fact that the very nature of an iconic semantics might be responsible for this fact, since a picture which omits an object (visible at the relevant level of granularity) is just incorrect. If so, great care must be taken to argue for the existence of an implicature, which is why we systematically included control sentences that showed that the relevant gestures could have non-exhaustive readings in some negative environments. But it is clear that an analysis of gestural implicatures will have to be developed in tandem with a precise iconic semantics for the gestures under consideration.

3 Presuppositions and anti-presuppositions


The existence of gestural scalar implicatures was expected given standard theories. The theoretical situation is far more interesting when it comes to presuppositions: standard frameworks posit that presuppositions are triggered lexically. In other words, a speaker must store in her memory which presuppositions a given word triggers. This position is in part due to the absence of accepted theories of presupposition generation, despite various arguments that there exist 'triggering algorithms' that make it possible to *deduce* the presupposition of an expression once one knows its bivalent (i.e. classical, non-presuppositional) semantics, enriched in some cases with a set of scalar alternatives (e.g. Stalnaker 1974, Simons 2003, Abusch 2010, Schlenker 2010, Abrusan 2011). It is thus interesting to note that some gestures trigger presuppositions (Schlenker 2016a), and that antipresuppositions (due to *Maximize Presupposition*) seem to exist as well.


3.1 Standard presuppositions

Presuppositions yield characteristic patterns of inference: unlike entailments, they are preserved in questions and under negation; and unlike entailments and presuppositions, they give rise to universal positive inferences under *none*-type quantifiers (Chemla 2009). Two examples are given in (12) and (13), involving the factive verb *know* and the change of state verb *take off*.

- (12) a. John knows that he is incompetent.
=> John is incompetent
b. Does John know that he is incompetent?
=> John is incompetent
c. John doesn't know that he is incompetent.
=> John is incompetent
d. None of these ten students knows that he is incompetent.
=> each of these ten students is incompetent
- (13) a. The company's plane will take off.
=> the company's plane is on the ground
b. Will John's plane take off?
=> the company's plane is on the ground
c. The company's plane won't take off.
=> the company's plane is on the ground
d. None of the company's planes will take off.
=> all of the company's planes are on the ground

Presuppositions are triggered in some cases in which a gesture involves the shape of an object, as in (14): *TURN-WHEEL* triggers the presupposition that the agent has his hand on a wheel.


- (14) a. Will John TURN-WHEEL-small_  ?
=> John is next to a wheel

- b. None of your friends will TURN-WHEEL-small_  .
=> each of your friends is next to a wheel


Similarly but possibly less clearly, the gesture in (15), involving a small vodka-style glass, seems to trigger a presupposition about the size of the agent's glass. In particular, it seems to yield patterns of universal projection of *none*, as in (15)b.


- (15) Context: *Will people eat or drink next?*

- a. Will John DRINK-VODKA_  ?
=> John's glass is small


- b. None of our guests will DRINK-VODKA_  .
=> each of the glasses is small


Presuppositions are also triggered by gestures that involve a specific position for an object. This point was discussed in Schlenker and Chemla, to appear, in connection with some verbal gestures that are reminiscent of 'agreement verbs' in sign language (ASL and LSF). Like agreement verbs, these gestures trigger height (or positional) presuppositions when they target a high position. Thus *SLAP-high* in (16)a triggers the inference that the speaker's teammates are very tall - their might for instance be basketball players. The same inference is triggered in (16)b with universal projection of the 'height' presupposition.

- (16) a. My teammate, will you SLAP-high_  ?
=> the speaker's teammate is tall or positioned high

- b. None of your teammates will I ever SLAP-high_  .
=> each of the addressee's teammates is tall or positioned high


A positional presupposition is also triggered by the gesture *UNSCREW-ceiling*, as in (17).

- (17) a. This light bulb, are you going to UNSCREW-ceiling_  ?
=> this light bulb is on the ceiling

- b. None of the light bulbs in this room will I ever UNSCREW_ ceiling_  ?
=> each of the light bulbs in this room is on the ceiling


Gestures use to describe changes of state trigger presuppositions as well, as shown in (18).


- (18) a. Is the company's helicopter going to TAKE-OFF-ROTATING_  ?
=> the company's helicopter is on the ground

- b. None of the company's helicopters is going to TAKE-OFF-ROTATING_  .
=> each of the company's helicopter is on the ground

In addition, the same gesture triggers a presupposition that the subject is helicopter-like in taking off by way of a rotating motion.

- (19) [Pointing in the distance]

- a. Will this thing TAKE-OFF-ROTATING_  ?
=> this thing is helicopter-like, and on the ground

- b. None of these five things is going to TAKE-OFF-ROTATING_  .
=> each of these five things is helicopter-like, and on the ground

3.2 Antipresuppositions

Following Heim (1991) and Sauerland (e.g. 2003, 2008), several researchers have posited a principle, *Maximize Presupposition*, which requires that one choose from a pre-determined set of competitors the Logical Form that *marks the strongest presupposition* compatible with what is assumed in the conversation (see also Percus 2006, Singh 2011 and Schlenker 2012). Without going into technical details that are discussed elsewhere, let us mention that *Maximize Presupposition* as standardly stated has two key properties. First, it compares Logical Forms whose assertive components that are *contextually equivalent*. Second, Among the competitors, *Maximize Presupposition* selects the Logical Form that carries the strongest presupposition compatible with the common ground. When a sentence is uttered which has a presuppositionally stronger competitor, one can thus infer that *this stronger presupposition is not licensed in the context*, which is an antipresupposition; this case is illustrated in (20)a,b. When the stronger presupposition is known to be satisfied in the context but is not marked, deviance ensues, as in (20)c.

- (20) Competition between *believe* and *know*
a. John believes that he is competent.
=> it is not established that John is competent
b. Each of my students believes that he is competent.
=> it is not established that each of my students is competent
c. #John believes that Paris is in France.

Anvari (in progress) argued that antipresuppositions exist with gestures. In order to display the effect, one needs to find two competing expressions, one of which triggers a stronger presupposition than the other. This condition is satisfied by the alternatives {believe, know}. It is also satisfied by the alternatives {2nd, 3rd}, the second and third person features found on some English pronouns. While third person features often cannot be used to refer to the speaker or addressee, this is not invariably the case, as seen in (21): the mere possibility that the person seen in the mirror is neither the speaker nor the addressee suffices to license the use of a third person pronoun, as seen in (21)a. And in (21)b the third person reflexive *himself* ranges over various individuals including the addressee.

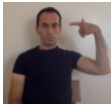




- (21) a. [Uttered by a speaker with bad eyes in front a mirror].
He looks like you.... in fact, he is you!
b. Every individual (including you) admires himself.

The key is that in both cases the presuppositions of the first or second person pronouns could not be marked without triggering a presupposition failure. As a result, the third person pronoun can be used. But the key to this analysis is that a third person pronoun does not itself trigger a presupposition that its

denotation isn't the speaker or addressee; rather, it is because of *Maximize Presupposition* that in some cases but not in others the non-first, non-second person arises.





We will now argue that instances of *Maximize Presupposition* arise in the gestural domain. As was the case for some implicatures, it will often prove important to make the competing alternatives highly salient in the context. In addition, we will have to take great care to find presuppositionally weak gestures that can compete with presuppositionally stronger ones.

We start with a relatively easy case, discussed in Schlenker and Chemla, to appear. As mentioned, *SLAP* in (16) has been compared to sign language agreement verbs. This is because these include in their realization a position in signing space (called a locus) that denotes one of their thematic roles. Schlenker and Chemla (to appear) focus on object agreement verbs in sign language, and gestural verbs with object agreement in spoken language. The distinction between first, second and third person is realized in sign language by loci that correspond to the signer's position, to the addressee's position, or to a variety of third person positions. Schlenker and Chemla argue that a first/second/third person distinction can also be realized in gestures, as is illustrated in (22). A complicating factor is that the second person form, which targets a position in front of the signer, also seems to do double duty as a neutral form (without person object marking); this is the reason this form is glossed with (-2) in parentheses. On the other hand, attempts to use a third person locus to refer to the addressee yield rather sharp deviance, as shown in (22)b (Schlenker and Chemla provide experimental evidence for this type of acceptability contrasts in gestures).

- (22) a. I am going to SHOOT-1_  .
- b. You, I am going to SHOOT(-2)_  / ?? SHOOT-a_  .
- c. John, I am going to SHOOT(-2)_  / SHOOT-a_  .

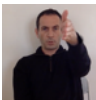


But what is the source of this deviance? As in English, it probably lies in a competition between a presuppositionally weak third person form and presuppositionally strong first and second person forms. The reason is that a third person form *can* be used to refer to the addressee if a second or first person form could not be used without triggering a presupposition failure, as seen in (23)a,b. But if one attempts to use the third person form to refer to the addressee in the simple sentence in (23)c, deviance ensues: the second person form must be used instead.

Notation: in the following examples, *IX-2* is a pointing (co-speech) gesture towards the addressee, and *IX-(2)-high* is a pointing sign towards a neutral position (towards the addressee), pointing upwards to refer to a tall individual.

- (23) a. This person I saw in the mirror, I wanted to SLAP-a_  - right before realizing that it was IX-2 [you]!
- b. I am so angry at my friends... Each of them, I'd like to SLAP-a_  – including IX-2 [you]!
- c. You, I am going to #SLAP-a_  / SLAP(-2)_  .

Anvari (in progress) raises the possibility that a similar effect might hold with height presuppositions. An attempt to test Anvari's suggestion is displayed in (24), where the competing gestures are first introduced as co-speech gestures.

(24) *Context*: the addressee's very tall brother is present at some distance behind him.


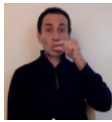

I'd like to  [slap] you, I'd even like to  [slap] your giant brother. In fact, **all the people in this room, I'd like to**  . And umh.... IX-(2)-high [your giant brother]... him too I will




The boldfaced clause shows that that the neutral form of *SLAP* can be used to refer, among others, to tall individuals (since the brother is in the room). The question is whether the neutral form in (24)a might be dispreferred to refer to the tall brother. We are currently agnostic, as we think the data would need to be investigated in greater detail.⁵

In (25) we consider a different paradigm, based on the gesture *DRINK-VODKA* used in (15). We contrast it with an all-purpose gesture *DRINK*, used as a neutral, all-purpose form. It can be checked by way of the boldfaced quantified statement that *DRINK* can indeed be applied to a variety of drinking events, including ones that involve vodka glasses. Still, with this highly salient scale in place, it seems to be preferable to use the specific, vodka-related form when it is applicable. As noted above, the difference is presuppositional in nature, and thus the slight deviance obtained in (25) is a good candidate for an effect of *Maximize Presupposition*.

(25) At a bar:

I might DRINK_  [enjoy a glass of coke] or DRINK-VODKA_  [drink some vodka]... Hard choice. In fact, **everything you have, I'd love to DRINK_**  . To start with, this glass of vodka,

a. ?I am going to DRINK_ 

b. I am going to DRINK-VODKA_ 

We conclude that anti-presuppositions might well exit with pro-speech gestures.

⁵ See Schlenker et al. 2013 for a discussion of the optionality of height marking with sign language pronouns. (Note that their examples do not involve similar attempts to make very salient the competition between a high and a normal locus.)

4 Homogeneity inferences

Recent research has uncovered another class of inferences, termed 'homogeneity inferences' (e.g. Löbner 2000, Spector 2013, Križ 2015, Križ 2016). They primarily arise with definite plurals such as *his presents*, and are characterized by four key properties. (i) In positive environments (= (26)a, a'), they give rise to the same type of inferences as *all of his presents* (modulo the fact that they allow for exceptions in pragmatically constrained fashions, studied by Križ 2015). (ii) In negative environments (= (26)b, b'), they give rise to the same type of inferences as *any of his presents*. However, this stops being the case when *his presents* is replaced with *all of his presents* (= (26)c). In addition, (iii) cases of infelicity or uncertainty are obtained when some but not all of the presents have the relevant property (in (26)a, a', b, b').

- (26) a. John found his presents.
 => John found (nearly) all of his presents
 a'. John always finds his presents.
 => John always (nearly) all of his presents
 b. John didn't find his presents.
 => John found (nearly) none of this presents
 b'. John never finds his presents.
 => John always finds (nearly) none of his presents
 c. John didn't find all of his presents.
 ≠> John found (nearly) none of this presents
 d. If John finds his presents, we'll start to have dinner.
 => John has presents waiting for him
 ≠> John will either find all or none of his presents

Some have tried to account for these inferences by positing that *x finds his presents* triggers a presupposition that *x finds all or none of his presents*. But (iv) a final property suggests that this is unlikely to be correct: such an inference fails to project out of the antecedent of conditionals, unlike standard presuppositions. As a result, there is a sharp contrast in (26)d between the existence presupposition of *his presents*, which does project, and the homogeneity inferences, which does not.

In order to find homogeneity inferences with pro-speech gestures, we will combine two mechanisms we already discussed. First, we will introduce plurals by way of repetition of a gesture, as in (4)c (we will investigate diverse types of repetitions, as is done in Schlenker and Lamberton 2017). Second, we will use gestural verbs with object agreement to realize definite anaphora, and we will later reproduce the effect with simple pointing gestures.

Since the details of plural gestures will matter, we should say a bit more about their realization. In sign languages and in home signers, punctuated repetitions are made of the discrete iteration of the same sign. By contrast, unpunctuated repetitions involve iterations with shorter and less distinct breaks between them, which makes these iterations less distinct and sometimes harder to count (similar devices were investigated in home signers by Coppola et al. 2013 and Abner et al. 2015, in sign languages by Pfau and Steinbach 2006 and Schlenker and Lamberton 2017, and in gestures by Feldstein 2015 and Schlenker and Lamberton 2017). As Schlenker and Lamberton 2017 argue, in unpunctuated and punctuated repetitions alike, the iterations are typically made in different parts of signing space, and their arrangement provides iconic information about the shape of the denoted group. Schlenker and Lamberton 2017 further argue that in default situations each iteration of a punctuated repetition stands for a separate object (a condition that can be overridden), whereas unpunctuated repetitions stand for pluralities with vague with vague numerical threshold conditions.

Let us consider the paradigm in (27). An unpunctuated repetition of *CROSS* (written as +) appears in position *a* as the object of *see*; this has the function of introducing an indefinite plural. The gesture *TAKE_2-handed-a* then targets this same position, realizing a meaning akin to *take them*.


Notation: We write + for the *CROSS* gesture, as in (4)c; below we will also use *o* for an O-shaped gesture representing medallions. + + + refers to three punctuated iterations, +-rep₃ and +-rep₆ to three and six unpunctuated iterations respectively. — indicates that the repetitions are arranged on a horizontal line, ^ that they are arranged as a vertical triangle. In (27), the subscript *a* in [+rep₃—]_a indicates that the gesture is made in position *a*, which we take to be realized roughly in front of the

speaker. When two gestures appear in different loci, *a* represents a position on the speaker's dominant side and *b* represents a position on the speaker's non-dominant side.


(27) *Context*: in a treasure hunt, the speaker is supposed to find a particular cross.

You will enter a room. You will see $[+rep_3_]_a$

=> the addressee will see some crosses (horizontally arranged)

a. **and you will TAKE_2-handed-a** 

=> the addressee will take them (all)

b. **but you will not TAKE_2-handed-a** 

=> the addressee will take none

c. **and if you TAKE_2-handed-a**  **, you will win the prize.**

≠>? you will take all or none

The plural gesture (boxed) triggers the inference that the addressee will see some crosses (horizontally arranged). We can then check that the four properties discussed above in connection with definite plurals hold in this case as well: (i) (28)a intimates that the addressee should take (nearly) all crosses. (ii) (28)b intimates that she should take none. (iii) It's not very clear whether the order was or wasn't fulfilled if the addressee took some but not all crosses. (iv) Finally, there need not be an assumption in (27)c that the addressee will take either all or none of the crosses. If anything, the context leads one to expect the addressee should take just one cross.

Importantly, it is very unlikely that the plural gesture is a code for an English expression, as it can be modulated to have fine-grained iconic and quantitative and iconic implications that it would be difficult to translate precisely. Thus the boxed part of (27) (= (28)a) can be replaced with (28) b to indicate that the addressee will see *quite a few* crosses (arranged horizontally). The same quantitative inferences are obtained in (28)c,d, but with the understanding that the crosses are arranged as a triangle. Finally, in (28)e,g we obtain an inference that three crosses will be seen, arranged on a horizontal line or as a triangle, as a case may be. If the gesture for *TAKE_2-handed-a* is broad enough to target the entire area in which the plural gesture is realized, the same inferences are obtained as in (27).

- (28) a. $+rep_3_$
 b. $+rep_6_$
 c. $+rep_3_\wedge$
 d. $+rep_6_\wedge$
 e. $+++$
 f. $+++rep_3_\wedge$

We note that the same result can be obtained without making use of a gestural verb. In (29), a contrast is established between three medallions (represented on the speaker's non-dominant side) and some crosses (represented on the dominant side). A pointing gesture (by way of a pointing index or an entire hand) towards the dominant side is then understood to refer to the crosses, and this gives rise to the same homogeneity inferences as (27).

(29) *Context*: in a treasure hunt, the speaker is supposed to find medallions or crosses.

You will enter a room. You will see $[ooo_]_b$, and also $[+rep_3_]_a$,

=> the addressee will see three medallions (horizontally arranged), and some crosses (horizontally arranged),

a. **and you will take IX-a / IX-hand-a.**

=> the addressee will take (all) the crosses

b. **but you will NOT take IX-a / IX-hand-a.**

=> the addressee will take none of the crosses

c. **and if you take IX-a / IX-hand-a, you will win the prize.**

≠> the addressee will take either all or none of the crosses

Here too, the boxed part can be replaced with any of the realizations in (28) to yield slightly different quantitative or iconic inferences.

We conclude that homogeneity inferences can be reproduced with pro-speech gestures, and this is not just the result of a linguistic translation involving definite descriptions.

5 Supplements and expressives

Another broad class of inferences is triggered by appositive relative clauses ('supplements') and some derogatory terms such as 'honkey' ('expressives') (Potts 2005). While they don't quite display a unified behavior, these inferences differ from entailments, implicatures and presuppositions in yielding little interaction with logical operators, as if they were interpreted without regard to them. We discuss them in turn, focusing on some of their most characteristic properties.

5.1 Supplements

Unlike presuppositions, supplements must be make a non-trivial contribution (Potts 2005). And unlike all the expressions discussed so far, their acceptability is restricted: they do not easily to appear right under a negative expression, as in (30)c. One might attribute this behavior to the meaning of *which*, as it might play a role akin to anaphoric *this* in the second conjunct of (30)c'. But under embedding, for instance under *if*, the behavior of a conjunct is very different from that of a supplement: the former but not the latter is interpreted within the scope of the *if*-clause, as shown in (31).

- (30) a. John helped his daughter, which saved her.
 b. One of these guys helped his daughter, which saved her.
 c. #None of these guys helped his daughter, which saved her.
 c'. #None of these guys helped his daughter, and this saved her.
- (31) a. If John helps his daughter, which will save her, our problem will be solved.
 => if John helps his daughter, this will save her
 b. If John helps his daughter and this saves her, our problem will be solved.
 => if John helps his daughter, this will save her

Schlenker 2015, 2017, to appear argues that in these respects post-speech gestures display the behavior of appositive relative clauses.⁶ To give but one example, *SLAP* used as a post-speech gesture has the same distribution as the appositives in (30)-(31), as shown in (32)-(33). Schlenker 2017 argues that in English as well as in ASL, the generalizations can be extended to post-speech and post-sign facial expressions.⁷

⁶ Appositive relative clauses display a behavior which is very close to that of clausal parentheticals, as shown in (i)-(ii), and for this reason more sophisticated data would be needed to decide whether post-speech gestures behave like parentheticals or like appositives (as is granted by Schlenker 2017, to appear).

- (i) a. John helped his daughter (this saved her).
 b. One of these guys helped his daughter (this saved her).
 c. #None of these guys helped his daughter (this which saved her).
- (ii) If John helps his daughter (this will save her), our problem will be solved.
 => if John helps his daughter, this will save her

For present purposes, the difference doesn't matter, since both classes exhibit varieties of 'supplemental' meanings. (In some restricted environments, appositives can take narrow scope with respect to some logical operators, whereas this is difficult for clausal parentheticals. See Schlenker 2010, 2013a,b for discussion.)

⁷ Schlenker 2017, to appear argues that co-speech gestures and co-speech/sign facial expressions display a very different behavior: they are not prohibited in the immediate scope of negative expressions, as shown in (i), and they do not trigger supplements, but rather presuppositions whose content is conditionalized on the meaning of the modified expression.

- (i) a. None of these 10 guys will SLAP [punish] his enemy.
 => for each of these 10 guys, if he were to help his enemy, slapping would be involved
 b. # None of these 10 guys will punish his enemy – SLAP.

These assertion-relative presuppositions are called 'presuppositions'. Since their presuppositional contribution stems from their *interaction* with words, they are not further discussed in this piece.

- ≠> the speaker is prejudiced against the French
- b. I won't hire a Frog.
- => the speaker is prejudiced against the French

Our goal is not to explain why expressives display this behavior (it could be that they should be analyzed along the lines of Potts 2005, or that they are a non-standard variety of presupposition triggers). Rather, we will note that several pro-speech gestures display the same offensive behavior, as is shown in (39)-(40).⁸

- (39) I won't hire a
- a. ELONGATED-EYES.
=> the speaker is prejudiced against Asian people
 - b. EFFEMINATE-HAND.
=> the speaker is prejudiced against gay people
 - c. HANDICAPPED-HAND.
=> the speaker is prejudiced against people with disabilities
- (40) Will you hire a
- a. ELONGATED-EYES?
=> the speaker is prejudiced against Asian people
 - b. EFFEMINATE?
=> the speaker is prejudiced against gay people
 - c. HANDICAPPED-HAND.
=> the speaker is prejudiced against people with disabilities

Importantly for our purposes, these expressions display the same interaction with conditionals as *bona fide* expressives, as shown in (41). Specifically, these examples seem nearly contradictory because the counterfactual implies that the speaker does not hold the relevant prejudice, but the speaker's use of a slur in the consequent leads to the opposite conclusion.

- (41) There's plenty of implicit bias, but...
- a. if I were really prejudiced against Asian people, I wouldn't hire a ELONGATED-EYES.
=> the speaker is prejudiced against Asian people
 - b. if I were really prejudiced against gay people, I wouldn't hire a EFFEMINATE-HAND.
=> the speaker is prejudiced against gay people
 - c. if I were really prejudiced against handicapped people, I wouldn't hire a HANDICAPPED-HAND.
=> the speaker is prejudiced against people with disabilities

The same facts carry over to the crucial tests involving disjunction, as shown in (42). This suggests that the expressions under study share the fine-grained behavior of expressives.

- (42) There's plenty of implicit bias, but...
- a. either I am not really prejudiced against Asian people, or I won't hire a ELONGATED-EYES.
=> the speaker is prejudiced against Asian people
 - b. either I am not really prejudiced against gay people, or I won't hire a EFFEMINATE-HAND.
=> the speaker is prejudiced against gay people
 - c. either I am not really prejudiced against handicapped people, or I won't hire a HANDICAPPED-HAND.
=> the speaker is prejudiced against people with disabilities

Richard 2008 noted that the pragmatic effects of expressives and of presuppositions are rather different. (43)a explicitly introduces a presupposition that the speaker has a negative attitude towards Caucasians – and yet (43)b appears to be far more offensive. Irrespective of the reason, we believe that the same observation carries over to expressive gestures.

- (43) a. Everybody knows that I hate Caucasians. Are you one?
b. Are you a honkey?

Finally, can expressive gestures simply be codes for English words? Unlike most of the other gestures we considered in this piece, the cases we considered might be conventionalized, at least in part. Still, we believe that some of them have iconic-like implications that might not be so easy to translate

⁸ Needless to say, our examples are mentioned, not used. We fail to include pictures to reduce any offensiveness. We apologize for any offense these examples may cause despite these precautions.

very concisely – e.g. *HANDICAPPED-HAND* is indicative of a particular kind of disability (one that affects the arm), rather than something more general. It would be important to determine in the future whether the semantic behavior of these initial expressive gestures can be replicated with further gestures that are not conventionalized and are used without prior exposure.

6 Conclusion

If our analysis is on the right track, there are striking similarities between the typology of inferences triggered by pro-speech gestures and by normal words. With the possible exception of expressive gestures, one is able with little or no prior exposure to place inferences triggered by pro-speech gestures within a rich typology; furthermore, the fine-grained iconic implications of pro-speech gestures make it unlikely that the relevant inferences are drawn by way of translation into English words. The same general conclusions apply to the similarity between post-speech gestures and appositive relative clauses.

For scalar implicatures, our findings are unsurprising, as implicatures are expected to arise as soon as there are differences of informativity among alternative expressions. For presuppositions, our findings are more interesting, as they might argue for a productive 'triggering algorithm' that divides the global informational contribution of an expression between a presupposition and an at-issue content. It cannot be excluded, however, that part of our gestural effects stem from the iconic semantics of gestures rather than from more general principles (for instance, it could be that stable parts of a dynamic iconic representation are understood to correspond to presupposed information); for this reason, the future study of gestural semantics should involve a far more detailed analysis of iconic meanings, possibly along the lines of Greenberg 2013. For homogeneity inferences, our results suggest that that appropriate theories should eschew lexical stipulations, or that these should be extended to some gestures. For supplements, things are complex: Potts 2005 placed the source of their non-standard semantics in a 'comma intonation', and one could argue that it applies to post-speech gestures as well. For expressives, while the data seem clear, their theoretical import has yet to be determined, in part because their conventionalized status makes it hard to argue that their meaning is inferred without prior exposure.

While our findings have different implications in each case, they also suggest general lessons.

(i) First, gestures can profitably be investigated with the methods of formal semantics: the fine-grained typology we outlined would not have been possible without tests developed in contemporary formal work.

(ii) Second, with the possible exception of expressives, pro-speech gestures make it possible to create 'on the fly' new 'words' that have a clear meaning, thanks to their iconic semantics. This could be a powerful tool to determine how new meanings interact with the rest of the linguistic system. Creating new spoken words would be much more arduous because one would have to find ways to teach subjects their intended semantics; iconicity obviates this difficulty.

(iii) Third, this method suggests that there are productive principles at work in nearly all domains we surveyed: pro-speech gestures seem to immediately find their place in a rich inferential typology. In some cases, such as presuppositions, researchers have been tempted to encode much of the behavior of expressions in their lexical entries. Our findings suggest that there are broader principles that makes it possible to *deduce* what these properties are, at least in some cases. While this does not rule out the existence of rich lexical entries, this might make them unnecessary, as one might make do with far simpler meanings that encode bivalent (classical, unidimensional) truth conditions: the broader principle might then be left to deduce the more fine-grained properties, just as it seems to do in the gestural case.

(iv) Fourth, this conclusion might suggest a question for the acquisition of semantics: could the development of the rich inferential typology surveyed above be almost entirely non-lexical? In our discussion, the key ingredients were the informational content of a gesture, sometimes its timing (to distinguish pro- from post-speech gestures), and the expressions it competed with (to derive scalar implicatures and anti-presuppositions). Since most gestures were categorized on the basis of 'zero-shot learning', rich lexical meanings were unlikely to play a role. Does this reflect the way semantic acquisition works outside of gesture semantics?

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