Iconic Pragmatics[*]

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Abstract: Recent comparative semantics suggests that sign language makes use of the same logical resources as spoken language, but has richer mechanisms of iconic enrichment. It is often thought that when speech is analyzed in tandem with iconic gestures, 'expressive parity' is regained between speech and sign. But this comparison between sign-with-iconicity and speech-with-gestures turns out to be complex because iconic enrichments often have a non-at-issue status, as attested by their interaction with logical operators. We argue that the status of iconic enrichments is constrained by two parameters: ±*internal*, ±*separate_time_slot*. If an enrichment is effected by the internal modification of an expression (+*internal*) – e.g. by lengthening the word *loooong* in English, or of the sign *GROW* in ASL – it can have any semantic status and can in particular be at-issue. If an enrichment is an external addition to an expression (-*internal*) – as is the case of co-speech gestures in English – it does not make an at-issue contribution, but it may have the status of a presupposition or of a supplement. If an enrichment has a separate time slot (+*separate_time_slot*), it may not be trivial (= presupposed), and must thus be at-issue or supplemental. The generalization is assessed on the basis of vocal iconicity in spoken language, iconic modulations in sign language, co-speech as well as 'post-speech' gestures and facial expressions in spoken and sign language, and also gestures that fully *replace* words in spoken language. Our typology suggests that there are systematic expressive differences between sign-with-iconicity and speech-with-gestures, and also that the semantic status of iconic enrichments can in part be predicted by parameters pertaining to their form.

Keywords: sign language, gestures, iconicity, presuppositions, supplements, cosuppositions, co-speech gestures, post-speech gestures, post-speech gestures

1   Introduction

1.1   The importance of iconic enrichments

Recent comparative work in semantics suggests that sign language makes use of the same general logical resources as spoken language, but that it has considerably richer mechanisms of iconic enrichment (e.g. Schlenker et al. 2013, Schlenker, to appear a, b).[1] The situation may be summarized by the following two claims (e.g. Schlenker, to appear a).

(i) **Logical Visibility:** When iconic phenomena are disregarded, speech and sign share the same 'logical spine', including in cases where sign language makes visible the 'Logical Forms' of spoken language sentences – for instance by making overt use of logical indices realized as 'loci', whereas indices are mostly covert in spoken languages (Lillo-Martin and Klima 1990).

(ii) **Iconicity:** Sign language makes use of rich iconic resources, including at its logical core. For instance, sign language loci were argued in recent research to be *both* logical variables and simplified representations of what they denote (see Schlenker et al. 2013, and Liddell 2003 and Kegl 1977/2004 for some sources).

This theoretical situation could lead to two conclusions.

• One is that spoken language semantics is, along some dimensions, a 'simplified', iconically defective version of sign language semantics – simply because the iconic potential of the vocal stream is so limited.

• Alternatively, it may be that the 'standard' conception of spoken language semantics was insufficiently inclusive, and that when sign is compared to speech-plus-gesture rather than to speech alone, the two systems display similar expressive resources. In Goldin-Meadow and Brentari's words (to appear), "sign should not be compared to speech – it should be compared to speech-plus-gesture"; and it might well be that speech-with-gestures has in the end similar expressive resources as sign-with-iconicity.

Of course it is unlikely that sign language will be more expressive than spoken language in every domain – for instance, vocal iconicity might be greatly defective in sign language.[2] In addition, spoken language might have all sorts of ways to *paraphrase* in more or less complex ways the iconic enrichments that are found in sign language. The interesting question is whether sentences *which have comparable structures* can also have the same kinds of truth conditions.

To clarify this debate, we need a semantic study of iconic enrichments across modalities. But as soon as the analysis is made precise, it becomes apparent that not all iconic enrichments have the same semantic status. Notably, it has been argued in recent research that iconic modulations in sign language (e.g. the modulation of the size of the sign for *GROW*) can be at-issue (Schlenker 2013a), whereas the enrichments afforded by co-speech gestures in spoken language are not usually at-issue: Ebert and Ebert 2014 take them to be the supplements (similarly to the meaning of appositive relative clauses), whereas Schlenker 2015, 2016b claims that they make a presuppositional contribution. If it iconic modulations in sign language can *only* be at-issue (a claim we will *not* make), whereas iconic enrichments afforded by co-speech gestures can only be not-at-issue (as we will argue), there will be a systematic expressive *difference* between sign and spoken language. If iconic modulations can have a variety of statuses (at-issue, presuppositional, supplemental), sign language might in certain respects be more expressive. The issue is not to declare a winner in a somewhat dubious race, but rather to understand the extent and the sources of semantic variation across modalities. A systematic typology of iconic enrichments is thus needed for a proper understanding of 'Universal Semantics'.

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[1] On the terminological sign, we follow Goldin-Meadow and Brentari, to appear, in sometimes referring to spoken language as 'speech' and to sign language as 'sign'.
[2] This claim is a bit less obvious than it might seem. First, there are numerous mouthings in sign language, which can be accompanied with sounds, including when produced by deaf signers. Second, assessing the claim would require that one study both deaf and hearing signers.

1.2   Cast of characters

While some attention has been devoted to co-speech gestures, we will consider a larger cast of characters, which may be organized among two groups. We call an iconic enrichment *external* if it can be eliminated without affecting the integrity of the sign it modifies, and (therefore) the syntactic acceptability of the resulting sentence. An iconic enrichment is *internal* if this is not the case. At this point we will leave the distinction on this intuitive level, although it should be formalized in future research. The key is that enrichments that are effected by adding to an expression an optional element in a different modality certainly count as external – such is for instance the case of co-speech gestures. By contrast, modulations of a sign or word, obtained for instance by lengthening part of it, should certainly count as an internal enrichment.

For simplicity we will extend the term 'gesture' to facial expressions, as is relatively standard, but also to 'vocal gestures', so that the term will encompass iconic sounds, notably ones that can follow expressions or sometimes fully replace them. Our impression is that our generalizations about standard gestural enrichments extend to vocal enrichments, which will make this terminological move useful (see for instance Grenoble et al. 2015 for related terminology). We will give some examples of these similarities, but a full study is left for future research.

1.2.1   Spoken language

In spoken language, attention is often restricted to co-speech gestures and facial expressions, illustrated in (2), with the notational conventions in (1)a.

(1)   **Notational conventions: spoken language**
    a. 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 (which will be boldfaced, and enclosed in square brackets if it contains several words).

    Examples: John SLAP **punished** his son.

    John SLAP_[picture] **punished** his son.

    John [picture] **punished** his son.

    b. 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: – .

    Examples: John punished his son – SLAP.

    John punished his son – SLAP_[picture].

    John punished his son – [picture].

    c. A gesture that replaces a spoken word (what we call a 'pro-speech gesture') is written in capital letters, if necessary with an onomatopoeic sound following it (with an 'underscore' connection _ between the sound and the gesture, as for words modified by co-speech gestures).

    Example: Your brother, I will SLAP_<phhh>.

    Your brother, I will SLAP_[picture]_<phhh>.

    Your brother, I will [picture]_<phhh>.

    d. The same conventions apply to facial expressions, but we also use the 'smiley' *:-(t*o refer to negative or disgusted

expressions.

(2) **Co-speech gestures in spoken language: external enrichment - no separate time slot**

a. John SLAP_ **punished** his son.

b. John brought LARGE_ **[a bottle of beer]**.

c. Sam went :-(_ **[skiing with his parents]**.

While co-speech gestures are an instance of external enrichment, they are parasitic on the expression they modify because they do not have their own time slot.

In this respect, they differ from gestures that *follow* the expressions they modify – henceforth 'post-speech gestures'. Examples are given in (3), where it is apparent that post-speech gestures come with their own time slot (they are often accompanied with onomatopoeias, a point to which we return below).

(3) **Post-speech gestures in spoken language: external enrichment - separate time slot**

a. John punished his son – SLAP__<phhh>.

b. John brought [a bottle of beer] – LARGE_.

c. Sam went [skiing with his parents] – :-(_.

While in simple examples post-speech and co-speech gestures appear to make the same kind of semantic contribution, we will see that upon closer inspection this is not so. Specifically, we will argue that co-speech gestures trigger a variety of presuppositions, whereas post-speech gestures have the semantics of supplements (as do appositive relative clauses).

The second subfamily of enrichments we consider are internal, in the sense that they cannot be separated from the spoken expressions they modify, either because they are an integral part of the expressions, or because they fully replace some words. The first case is illustrated by (4)a, where the length of the vowel gives an indication of the length of the talk, hence an intensified meaning.

(4) **Iconic modulations in spoken language: internal enrichment - no separate time slot**
a. The talk was loooong.
=> the talk was very long
b. ??The talk was shoooort.

The effect appears to be iconic, as is suggested by the fact that a similar modulation fails in (4)b, which pertains to the adjective *short*. Note that although the enrichment is internal, it shares with co-speech gestures the property of lacking its own time slot, since by definition the modulation co-occurs with the expression it modifies.[3]

A remarkable use of 'internal enrichment' pertains to cases in which the expression cannot be separated from an expression it modifies because it fully replaces some words – and is ineliminable because it fulfills a grammatical function (see Slama-Cazacu 1976, Clark 1996). We use the term 'pro-

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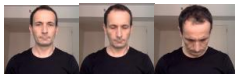[3] Okrent 2002 provides several examples of vocal iconicity:

(i)   a. It was a looooong time.
         b. The bird flew up [high pitch] and down [low pitch].
         c. Work, work, work, rest.

For recent discussions of vocal iconicity, see for instance Clark et al. 2013, Perlman and Cain 2015, and Perlman et al. to appear, Grenoble et al. 2015.

speech gesture' for such cases, as the gesture fully replaces a spoken expression (this is the prefix *pro* we find in *pronoun* and *proconsul).* Examples are given in (5).

(5) **Pro-speech gestures and ideophones in spoken language: internal enrichment - separate time slot**

a. Your brother, I am going to SLAP_____<phhh>.
=> I am going to slap your brother

b. In two minutes, our Chair will DOZE-OFF_____ .
=> in two minutes, our Chair will fall asleep

c. Dessert was DISGUSTING_____.
=> dessert was disgusting

d. At 2pm yesterday, my car engine <phhh>.
=> at 2pm yesterday, my car engine exploded

It is worth nothing that several post- and pro-speech gestures are preferentially accompanied with an onomatopoeia. One reason is probably that this just makes the iconic representation richer and more faithful to the original – and this preference is particularly unsurprising if vocal enrichments are themselves gestures of sorts. In addition, in the case of pro-speech gestures the presence of an iconic sound might help justify the absence of a spoken word, since the iconic sound couldn't co-occur with the word (if it could, this would be a case of iconic modulation). An example is given in (5)a, where the gesture for *SLAP* is naturally accompanied with a sound that evokes the noise of a slapping. In such cases, if one wishes to minimally compare different enrichments, one should choose an onomatopoeia that has a non-specific meaning to ensure that most of the semantic contribution is due to the gesture. Importantly, it is also possible to find examples in which a pro-speech or post-speech gesture is silent, as (5)b, which represents the action of falling asleep (the same gesture can also be used as a silent post-speech gesture). Facial expressions (whether silent or not) can also be used as pro-speech gestures, as is shown in (5)c. Finally, pure onomatopoeias – without special accompanying gestures or facial expressions – can replace speech as well, as illustrated in (5)d.

1.2.2   Sign language

Due to the existence of rich iconic mechanisms in sign language, and the fact that gestures and words occur in the same modality, the specific existence of gestures is harder to study in sign. But we will argue at least part of the same typology of gestural enrichments can be found as in spoken language. One case will be absent at this point, that of pro-speech gestures, as we do not yet know of entirely clear criteria to distinguish this case from that of signs created 'on the fly'; but such criteria will hopefully be developed in the future.

(6) **Notational conventions: sign language**
a. Standard conventions: Sign language sentences are glossed in capital letters, as is standard. Expressions of the form *WORD-i*, *WORD$_i$*, and [*...EXPRESSION...*]$_i$ indicate that the relevant expression is associated with the locus (position in signing space) *i*. A suffixed locus, as in *WORD-i,* indicates that the association is effected by pointing; a subscripted locus, as in *WORD$_i$* or [*...EXPRESSION...*]$_i$, indicates that the relevant expression is signed in position *i*. Examples from the author's work are followed by the codes of the corresponding videos (e.g. *ASL; 4, 179* for an ASL [American Sign Language] video).

b. Iconic modulations are notated as subscripts added to the relevant signs:

POSS-1 GROUP GROW_____ .

c. A facial expression (whether grammatical or not) that co-occurs with some expression is written before that expression (surrounded by square brackets if it contains several words).

Examples: IX-arc-b NEVER :-(_____ [SPEND MONEY].

IX-arc-b NEVER _____ [SPEND MONEY].

IX-arc-b NEVER :-([SPEND MONEY].

d. A facial expression (whether grammatical or not) that follows some expression is written after the expression it modifies, and preceded by a dash: - .

Examples: IX-arc-b NEVER SPEND MONEY]ᵦ – :-(_____ .
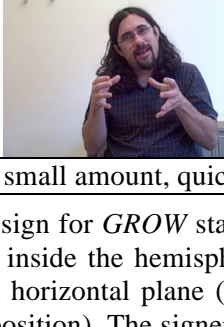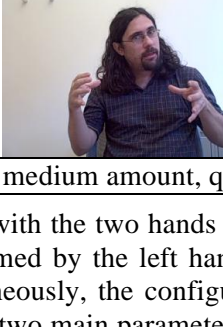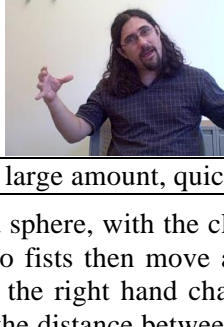
IX-arc-b NEVER SPEND MONEY]ᵦ – _____ .
IX-arc-b NEVER SPEND MONEY]ᵦ – :-(

     The simplest case of iconic enrichment in sign language pertains to iconic modulations. To see an intuitively clear example, consider the verb *GROW* in (7), which can be realized in a variety of ways, six of which were tested in (8); in the 'slow movement' line, we have included pictures of the beginning and endpoint of *GROW*.[4]

(7)   POSS-1 GROUP GROW.
       'My group has been growing.' (ASL; 8, 263)

(8)   Representation of *GROW*

	Narrow endpoints	Medium endpoints	Broad endpoints
Slow movement	small amount, slowly	medium amount, slowly	large amount, slowly
Fast movement	small amount, quickly	medium amount, quickly	large amount, quickly

As is seen in (8), the sign for *GROW* starts out with the two hands forming a sphere, with the closed fist of the right hand inside the hemisphere formed by the left hand; the two fists then move away from each other on a horizontal plane (simultaneously, the configuration of the right hand changes from closed to open position). The signer varied two main parameters in (8): the distance between the endpoints; and the speed with which they were reached (only the first parameter is depicted). All variants were entirely acceptable, but yielded different meanings, shown in (8). Intuitively, there was a mapping between the physical properties of the sign and the event denoted: the broader the endpoints, the larger the final size of the group; the more rapid the movement, the quicker the growth process.

     What about co-speech and post-speech gestures? We will initially focus on non-grammatical facial expressions, which have the advantage of being more easily distinguishable from signs than manual gestures are (this is not an all-or-nothing affair: as we will see, there are reasons to think that in some cases a non-grammatical facial expression can be viewed as an iconic modulation of a sign rather than as a co-speech gesture). In the simplified examples in (9) (which are discussed with a more complete context below), a disgusted facial expression follows a clause, and contributes the information that the fact referred to by that clause is unfortunate (with an alternative understanding

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[4] This section borrows from Schlenker 2013b.

for the co-speech case, namely that the action denoted by the VP is difficult for the entity denoted by the subject).

(9) **Post-speech facial expressions in sign language: external enrichment - separate time slot**

[7]…[POOR STATE-rep IX-arc-b NEVER SPEND MONEY]$_b$ – :-(_   .
"… Poor states never spend money (and that's unfortunate)." (ASL, 34, 1700b; 2 judgments)

(10) **Co-speech gestures in sign language: external enrichment - no separate time slot**

[7]…[POOR STATE-rep IX-arc-b NEVER :-(_   [SPEND MONEY].
"… Poor states never spend money (and it would be difficult or bad for poor states to spend money)."
(ASL, 34, 1700d; 2 judgments)

1.3 Typology and proposed generalization

We summarize in (11) the typology of iconic enrichments we will propose in this piece.

(11) **Typology of iconic enrichments**

	External enrichments (= syntactically eliminable)		Internal enrichments (= syntactically ineliminable)	
	No separate time slot: **Co-speech gestures**	Separate time slot: **Post-speech gestures**	No separate time slot: **Iconic modulations**	Separate time slot: **Pro-speech gestures**
Speech	John **punished** his son.	John punished his son – .	The talk was loooooong.	Your brother, I am going to .
Sign	IX-arc-b NEVER [SPEND MONEY]	IX-arc-b NEVER SPEND MONEY]$_b$ – .	POSS-1 GROUP GROW_	[currently unclear]
Meaning	**cosuppositions** (= presuppositions of a special sort)	**supplements**	**at-issue or not**, depending on the case	**at-issue**, with an additional non-at-issue component in some cases

Except for the last line, this table only summarizes the different cases we have discussed so far. The last line foreshadows the empirical claims we will be making, namely that across modalities:
• co-speech gestures (including facial expressions) have a non-at-issue semantics, and more specifically that they contribute presuppositions of a particular sort, which we call 'cosuppositions' (we differ in this from pioneering work on gesture projection in Ebert and Ebert 2014, who took the co-speech gestures to contribute supplements; we follow instead the conclusions of Schlenker 2016b);
• post-speech gestures and post-speech facial expressions also have a non-at-issue semantics, but a non-presuppositional one: they trigger 'supplements', just as appositive relative clauses do;
• iconic modulations can have any status, and in particular they can make an at-issue contribution;
• pro-speech gestures usually make an at-issue contribution (as most words do), but in addition they may trigger other types of inferences, such as presuppositions.

We will tentatively propose that there is a connection between the form of iconic enrichments and their semantic status, as outlined in (12):[5]

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[5] This is only a first approximation. One key issue in the future will be to distinguish optional modifiers from supplemental ones, since there is a sense in which *both* types can be eliminated without yielding syntactic unacceptability. In Schlenker 2010, 2013a it is argued that appositive relative clauses have a rather special syntax, which allows them to be attached to any propositional node that dominates their surface position – with the result that for matrix appositives, they could be removed without changing anything to the syntactic tree to which they are attached. (By contrast, eliminating a standard modifier would remove a node from the expression it modifies.)

(12) **Proposed generalization**
   a. ±internal
   External enrichments (-*internal*) are not at-issue: because they are external, it should be possible to disregard them without affecting the main, at-issue content of the clause they appear in. By contrast, internal enrichments (+*internal*) can make any semantic contribution – just like standard words.
   b. ±separate time slot
   Enrichments that have a separate time slot (+*separate time slot*) cannot be trivial (= presupposed): because they have their own time slot, they must make a non-trivial contribution to the sentence.

1.4   Elicitation methods: ASL

While English data were elicited informally, with standard introspective methods, more should be said about ASL data. Data from earlier publications were cited as they initially appeared. New data were elicited using the 'playback method' , with repeated quantitative acceptability judgments (1-7, with 7 = best) and repeated inferential judgments (on separate days) on videos involving minimal pairs (see e.g. Schlenker et al. 2013, Schlenker 2014). In a nutshell, the playback method involves two steps. First, the sign language consultant signs sentences of interest on a video, as part of a paradigm (e.g. often with 2 to 6 sentences) signed as minimal pairs. Second, the consultant watches the video, provides quantitative acceptability ratings, and (when relevant) inferential judgments, enters them in a computer, and redundantly signs them on a video. The second step can be repeated on other days, sometimes with a considerable time delay. This method has the advantage of allowing for the precise assessment of minimal pairs (signed on the same video), in a quantitative, replicable way. Even when the judgments are obtained from just one consultant, the repetition of the task makes it possible to assess the stability of the judgments; and if necessary this method could be turned into an experimental one in the future, assessing the same videos with other signers.

        For readability, only the average judgments are given, as well as a summary of the relevant aspects of the inferential judgments (complete quantitative judgments are given when there is more than a 2-point difference in the judgments obtained for a given sentence). Unless otherwise noted, sentences that appear in the same numbered example were assessed as part of the same video. Raw data (obtained during elicitation sessions) are provided in the Supplementary Materials, and specialists are invited to consult them when relevant.

2   Iconic modulations

We motivated our enterprise by highlighting the importance of a detailed comparison between the semantics of sign-with-iconicity and speech-with-gestures, as admonished by Goldin-Meadow and Brentari (to appear). One might initially think that 'expressive parity' between the two modalities can be regained when co-speech gestures are employed in spoken language to match the effects of iconic modulations in sign language. As announced at the outset, things are probably not so, for the following reason: iconic modulations can have all sorts of semantic effects, and in particular they may make an at-issue contribution. By contrast, in most cases co-speech gestures are not at-issue; as we will argue below, they trigger a particular kind of presupposition, which we call 'cosupposition'. If this conclusion is correct, sign with iconic modulations displays rather different properties from speech with co-speech gestures. (A complicating factor is that the presuppositions triggered by co-speech gestures are often easy to 'locally accommodate' and thus to turn into part of the at-issue component; it is only when this further operation is taken into account that some cases of iconic modulations and co-speech gestures can yield the same effects.)

2.1   At-issue iconic modulations

2.1.1   Iconic modulations of spoken words

Let us go back to the simple iconic modulation we introduced in (4), involving *long*. It can be observed by embedding this construction in the antecedent of a conditional or under a negative adverb that the iconic modulation can serve to modify the at-issue component of the clause. (For reasons discussed in Esipova 2016a,b, we try whenever possible to include examples that do not involve contrastive focus, as this sometimes licenses the local accommodation of presuppositions.)

(13) I am normally rather patient. But if the talk is loooong, I'll leave before the end.
     ≠> if the talk is long, the speaker will leave before the end
     => if the talk is very long, the speaker will leave before the end.

Are there other iconic modulations of words? Several have been studied in the literature on ideophones, but these are often considered a distinguished category of words. Okrent 2002 provides the example in (14)a, but unfortunately the iconic effect (= high-pitched for up, low-pitched for down) is redundant with the at-issue content of the modified expressions, hence its effects are hard to tease apart. I am not sure a clear inference is obtained if a high pitch is applied to *fly away*, as in (14)b.

(14) The bird [flew up]_<high_pitch> and down_low_pitch.

But other examples can be constructed. To my ear, (15)b has a slightly different meaning from (15)a: the latter leaves entirely open what kind of business is under discussion, whereas the former suggests that it is a serious kind of business (alternatively, it comes with a quotational component that suggests that John has a very deep voice). Similarly, to my ear (16)b suggests that Mary is going solve the problem in a way which is threatening or at least imposing (and it need not suggest that Mary has a low voice).

(15) a. John wanted to talk about business.
      b. John wanted to talk about business_<low_pitched>.
      John wanted to talk about grave business / the speaker views business as unappealing or grave

(16) a. Mary is going to solve the problem once and for all.
      b. Mary is going [solve the problem]_<low_pitched> once and for all.
      => Mary is going to do something severe

These inferences are arguably due to a very general 'frequency' code', discussed in linguistics by Ohala 1994, according to which lower pitch is associated with larger body size and derivatively imposing effects[6] (as Cross and Woodruff 2008 note, correlation is at the source of important musical effects, a point also discussed in Schlenker 2016f,g).

As Rob Pasternak (p.c.) notes, not all cases of vocal iconic modulations are at-issue (nor do our generalizations suggest that they must be). Thus if the speaker pronounces *talking* in (17)a with a very high pitch, or with great pitch excursions, one may take this to mean that Johnny speaks in a very high-pitched voice, or with great pitch excursions. Importantly, the same inference is or can be triggered in (17)b,c, despite the fact that *talk* is now embedded within the antecedent of a conditional and under *never* – which suggests that it has a non-at-issue meaning contribution.

(17) a. Pay attention – Johnny is about to start talking_<high_pitched>.
      => Johnny has a high-pitched voice
      b. If Johnny starts talking_<high_pitched>, we'll all listen to him.
      Rob: Johnny has a high-pitched voice
      => Johnny has a high-pitched voice
      c. Unfortunately, Johnny never talks_<high_pitched>.
      => Johnny has a high-pitched voice

Since our claim is not that iconic modulations *must* be at-issue but only that they *can* be, we leave for future research a more complete typology.[7]

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[6] This is a sufficiently important inference that some animals apparently evolved mechanisms – specifically, laryngeal descent – to lower their vocal-tract resonant frequencies so as to exaggerate their perceived size (Fitch and Reby 2001).

[7] It is quite possible (as Pasternak observes) that high pitch can in this case trigger what we call a cosupposition, i.e. a conditionalized presupposition of the form: *if Johnny were to talk, he would talk with a high-pitched voice.* This is in particular suggested by the universal inference that is arguably obtained in (i):

(i)   None of these ten guys will start talking_<high-pitched>.
          => for each of these ten guys, if he talks, he does so in a high-pitched voice

2.1.2   Iconic modulations of signs

In a series of influential papers, Wilbur (e.g. 2003, 2008) argued that the distinction between telic and atelic verbs is overtly realized in ASL. In Wilbur and Malaia's (2008) words, the observation was that telic verbs "have a sharper ending movement to a stop, presumably reflecting the semantic end-state of the affected argument (...). These end-states [are] overtly marked in ASL by several mechanisms: (1) change of handshape aperture (open/closed or closed/open); (2) change of handshape orientation; and (3) abrupt stop at a location in space or contact with a body part.". Schlenker, to appear argued that this is only part of the puzzle: in fact, telic and atelic verbs can be iconically modulated in such a way that the movement of the sign can be seen to represent the development of the denoted events. Here we argue that these iconic modulations can make an at-issue contribution, in line with our initial generalization.

❑   Verbal aspect

To start with atelic verbs, the iconic modulations we observed in the ASL example in (4) can make at-issue contributions. (18) and (19) show that iconic enrichments of *GROW* can be interpreted in the scope of *IF* and *NOT* respectively – and do not give rise to presupposition-style (or supplement-style) inferences that 'project' out of the scope of these operators. Importantly, inferential judgments were given for individual sentences, not for discourses that contrasted them (to completely rule out the role of contrast, we recorded the sentences on separate videos). This matters because Esipova 2016a,b shows that gestural cosuppositions (and presuppositions more generally) can become at-issue if this is mandated to make the focus alternatives of the relevant expressions assertible.

(18)   *Context:* we are discussing the future of the speaker's research group.

    IF POSS-1 GROUP _____, JOHN WILL LEAD.
    a. [7] GROW_neutral   (ASL, 34, 1942; 2 judgments)
    b. [7] GROW_large   (ASL, 34, 1944; 2 judgments)
    c. [7] GROW_small   (ASL, 34, 1946; 2 judgments)

    'If my group a. (really) grows / b. grows a lot / c. grows a little, John will lead it.'

(19)   *Context:* we are discussing the recent history of the speaker's research group.

    LAST-YEAR POSS-1 GROUP NOT ____ .
    a. [7] GROW_neutral   (ASL, 34, 1954; 2 judgments)
    b. [7] GROW_large   (ASL, 34, 1956; 2 judgments)
    c. [7] GROW_small   (ASL, 34, 1958; 2 judgments)

    'Last year, my group didn't a. (really) grow / b. didn't grow a lot / c. didn't grow (even) a little.'

       With other atelic verbs, the acceptability and specific meaning of iconically modulated forms varies, but examples with the verb *PLAY-PIANO* gave rise to rich iconic possibilities. Importantly, these enrichments were computed in the scope of the operators *IF* and *NEVER,* and they did not give rise to any presupposition-like (or supplement-like) patterns of projection. This suggests that these enrichments are in fact at-issue.

(20)   IF JOHN_A IX-A
        'If John

        a. PLAY-PIANO
        plays the piano,
        b. PLAY-PIANO_fast
        plays often / at a quick speed,
        c. PLAY-PIANO_slow
        plays the piano slowly,
        d. PLAY-PIANO _fast_slow

plays the piano quickly and then slows down,
e. PLAY-PIANO_slow_fast
plays the piano and then speeds up,

IX-1 GIVE-A $5.
I'll give him $5.' (ASL, 34, 2088; 1 judgment)
=> no inference about the ways (e.g. speed) in which John will play if he does play the piano

(21) JOHN_A IX-A NEVER
'John never

a. PLAY-PIANO
plays the piano.'
b. PLAY-PIANO_fast
plays the piano quickly.'
c. PLAY-PIANO_slow
plays the piano slowly.'
d. PLAY-PIANO_fast_slow
plays the piano changing tempo from quick to slow.'
e. PLAY-PIANO_slow_fast
plays the piano while changing tempo from slow to quick.' (ASL, 34, 2090; 1 judgment)
=> no inferences about (e.g. speed) in which John will play if he does play the piano, apart from those that follow
from the at-issue component (see the Appendix for details)

Related data can be found with telic constructions, although the extent of iconic modulations seems to be more limited than with atelic constructions. ASL examples involving the verb *HIT* are given below.[8]

(22)   IF JOHN_A IX-A
'If John
a. a-HIT-2
hits you,
b. a-HIT-2_fast
hits you hard/fast,
c. a-HIT-2 _slow
hits you softly/slowly,

IX-2 WILL 2-EQUAL-a.
the two of you will have done the same thing.' (ASL, 34, 2102; 1 judgment)

(23)   JOHN_A IX-A WILL NEVER
'John will never
a. a-HIT-2
hit you.'
b. a-HIT-2_fast
really hit you.'
c. a-HIT-2_slow
hit you softly/slowly.' (ASL, 34, 2104; 1 judgment)

We conclude that in ASL atelic and (possibly to a more limited extent) telic verbs can give rise to iconic modulations, ones that can be at-issue and thus take scope under operators such as *IF* and *NEVER*.

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[8] We do not claim that speed modulations of the sign necessarily trigger inferences about the speed of the event; less direct interpretations might be obtained pertaining for instance to the difficulty of accomplishing a particular action.

❑   *Iconic plurals*

Repetition-based plurals can also give rise to iconic modulations pertaining to the number and arrangement of the denoted objects, some trophies.[9] There were either 3 or 4 iterations of the sign, with slight differences across the two conditions (it wasn't clear that the consequent was predicted to hold in the '4 iterations' condition if only 3 trophies were present). More strikingly, the arrangement of the objects was varied as well: they appeared as a line or as a triangle. In the latter case, the conditional was understood to make specific reference to the arrangement of these objects. The two arrangements are represented in (25).[10]

(24)   *Context:* The speaker will be renting the addressee's apartment; he knows it contains trophies, but he hasn't seen them.
POSS-2 APT IF HAVE _____, IX-1 ADD 20 DOLLARS.
a. [7] TROPHY-rep-3$_{horizontal}$
=> if there at least three or four trophies in a horizontal line, \$20 will be added.
b. [6.7] TROPHY-rep-3$_{triangle}$
=> if there are at least 3 trophies forming a triangle, \$20 will be added.
c. [6.7] TROPHY-rep-≥4-horizontal
=> if there at least three or four or five trophies in a horizontal line, \$20 will be added.
d. [6.5] TROPHY-rep-≥4-triangle
=> if there are at least three or four or five trophies forming a triangle, \$20 will be added.
(ASL, 32, 0096; 4 judgments)

(25)   Plural-based repetition in:
(24)a: 3 unpunctuated iterations, horizontal
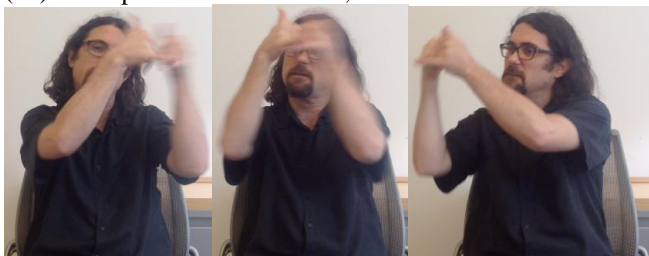
(24)b: 3 unpunctuated iterations, triangular

While the semantics of these iconic plurals is of great independent interest (see Schlenker and Lamberton 2016 for a detailed study), for matters for present purposes is that their iconic modulations can make an at-issue contribution.

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[9] We disregard two further conditions, which involved repeated singular nouns; these were also interpreted in a highly iconic fashion.

[10] We checked in the 4th judgment task that these sentences do not trigger any inference to the effect that *if* there are trophies, they should be arranged in a particular way; in other words, there is no 'projection' outside of the conditional of the inference pertaining to the arrangement of the relevant objects.

❑ *Pluractionals*

Kuhn 2015 and Kuhn and Aristodemo 2016 argue that repetition-based pluractionals in LSF also give rise to iconic effects, and that these too can make at-issue contributions. The difference in realization between the 'accelerating' and the 'decelerating' versions of LSF *GIVE* are represented in (27).

(26) a. MIRKO CHILD BOOK GIVE-rep-accelerating.
'Mirko gave the child a book at an accelerating pace.' (Kuhn and Aristodemo 2016)

b. MIRKO CHILD BOOK GIVE-rep-deceleration.
'Mirko gave the child a book at decelerating pace.' (Kuhn and Aristodemo 2016)

(27) Time-course diagrams of accelerating and decelerating *GIVE-rep* (Kuhn and Aristodemo 2016)
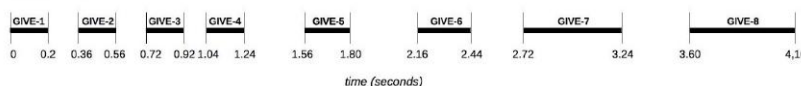
Importantly for our purposes, Kuhn and Aristodemo 2015 show that this iconic enrichment can be at-issue and thus take scope within a conditional, as seen in (28).

(28) SECRETARY IX-a, IF MIRKO PAPERS IX-b GIVE-rep-accel, IX-a HAPPY.
'If Mirko gives papers at an accelerating rate, the secretary will be happy.' (LSF, Kuhn and Aristodemo 2016)

Their results extend to ASL - in this case with a slightly different repetition marker, which involves two-handed repetition (-alt) rather than one-handed repetition (-rep) (both forms exist in ASL and LSF, and there are semantic and distributional differences between them which are discussed in Kuhn and Aristodemo 2016).

(29) IF JOHN PAPERS GIVE-alt-speeding-up, SECRETARY WILL HAPPY.
'If John gives papers at an accelerating rate, the secretary will be happy.' (ASL, Kuhn and Aristodemo 2016)

(Further research should still check that no 'projection' phenomena are found in these cases.)

## 2.2 *Non-at-issue iconic modulations*

Our general claim is that iconic modulations yield enrichments that *may* be at-issue, not that they *must* be at-issue. The intuition we pursue is that iconic modulations are an integral part of an expression, and thus have all the semantic freedom that lexical meanings do: they may be at-issue, presuppositional, etc. While we have not investigated the full range of inferences triggered by iconic modulations, we should mention that in some cases they make a presuppositional contribution. One such case pertains to 'loci', positions in signing space which often realize discourse referents, and are 'indexed' (i.e. pointed at) to realize pronominal meanings. While these are normally realized on a horizontal plane (with different discourse referents located on different parts of the plane), high loci may be used when one talks about powerful or important individuals; low loci may be used to talk about short individuals. Importantly, the contribution of these vertical specifications of loci appears to be presuppositional in nature, as is suggested by the fact that the inferences 'project' under negation, as in the ASL example in (30).[11]

(30) **Vertical locus specifications in ASL** (Schlenker et al. 2013)
YESTERDAY IX-1 SEE R [= body-anchored proper name]. IX-1 NOT UNDERSTAND IX-a$^{\text{high / normal / low}}$
'Yesterday I saw R [= body-anchored proper name]. I didn't understand him.' (11, 24)

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[11] Schlenker et al. 2013 write that they "asked the consultant to provide acceptability judgments in the best context he could imagine for the sentence; this matters because the use of high or low loci in an 'out of the blue' context would normally yield deviance."

a. [7] High locus.   *Inference:* R is tall, or powerful/important
b. [7] Normal locus.   *Inference:* nothing special
c. [7] Low locus.   *Inference:* R is short

The ASL examples in (31)-(32) further show that the relevant inference projects out of negation (thus confirming the observations in (30)a) and *if*-clauses – as is expected for a presupposition.

(31) a. [6] POSS-1 YOUNG BROTHER WANT IX-1 REST. IX-1 UNDERSTAND IX-a^{high}
       Inference: the speaker's younger brother is tall.
       'My younger brother wants me to rest. I understand him.' (10, 41; 44)
      b. 6 POSS-1 YOUNG BROTHER WANT IX-1 REST. IX-1 NOT UNDERSTAND IX-a^{high}
       Inference: the speaker's younger brother is tall.
       'My younger brother wants me to rest. I don't understand him.' (ASL; 10, 42; Schlenker et al. 2013)

(32) [7] IX-1 LIKE POSS-2 BROTHER. IF IX-a^{high} BECOME BASKETBALL PLAYER, IX-1 HAPPY.
       Inference: the speaker's younger brother is tall.
       'I like your brother. If he becomes a basketball player, I'll be happy.' (ASL, 10, 60; Schlenker et al. 2013)

None of this should come as a surprise: as argued in Schlenker et al. 2013, vertical specifications of loci play very much the role of gender specifications of English pronouns, and certainly these trigger presupposition-like inferences, as illustrated in (33).[12]

(33) a. I don't understand her.
       => the third person under discussion is female
      b. If she comes, I'll be happy.
       => the third person under discussion is female

The upshot is that although ASL pronouns pointing upwards can be seen as iconic modulations of a sign (like the modifications of *GROW* discussed in Section 2.1.2), this iconic enrichment makes a presuppositional rather than an at-issue contribution. This might well be because the enrichment targets an expression of referential type. Be that as it may, it is clear that we certainly do not wish to claim that all iconic modulations give rise to at-issue contributions, only that they *may* do so, and can in appropriate situations give rise to presuppositional contributions as well.

2.3   The connection with ideophones

The sign language plurals and pluractionals discussed in Section 2.1.2 are rather different from the iconic modulation of *long* discussed in Section 2.1.1 in that they involve a *grammatical* marker, which both pluralizes a construction and enriches it with an iconic component. There are reasons to think that related constructions can be found in spoken language involving ideophones, as was proposed by Henderson 2016 (for recent discussion of ideophones, see Dingemanse 2013, Dingemanse and Akita 2016, Dingemanse et al. 2016).

Focusing on what Henderson calls 'total reduplication' in the Mayan language Tseltal, which targets ideophones, which he defines as a distinguished lexical category of expressions that have an iconic component (and fall under special rules, in particular on the phonological side). Importantly for our purposes, in 'total reduplication' in Tseltal, "speakers can make multiple demonstrations using the same ideophone stem to demonstrate a plurality of events". As Henderson notes, this is reminiscent of the ASL and LSF pluractionals discussed in Kuhn and Aristodemo 2016. Two examples are given in (34).

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[12] Schlenker et al. 2013 provide preliminary data from ASL that suggest that height specifications of loci also resemble gender features of pronouns in that they trigger presuppositions that are indexical, i.e. evaluated with respect to the context of utterance rather than to the world of evaluation. We disregard this more subtle point here.

(34) Total reduplication in Tseltal (Henderson 2016)

> ja'-Ø   te   **kan**-kon-Ø,   **kan** [pause] **kan** [pause]
> FOC-B3 SUB IDF:sound.wood/drum-C_1on-B3 IDF [pause] IDF [pause]
> **kan** x-chi-Ø=e
> IDF NT-say-B3=ENC
> 'When it knocks [lit. kankon], it goes «kan» [pause] « kan » [pause] «kan
> ».'   Pérez González 2012: p. 242
>
> ja'-Ø   x-**chak'**-lajan-Ø   te   bay
> FOC-B3 NT-IDF:sound.horse.hoofs-lajan-B3 DET where
> **chak'chak'chak'** x-chi-Ø=e
> IDF.IDF.IDF   NT-say-B3=ENC
> 'It's the sound of trotting horses when it goes «chak'»«chak'»«chak'»

Importantly, Henderson writes that "the manner of reduplication in a demonstration-external pluractional utterance [involving full reduplication -PS] iconically reproduces the temporal properties of the event-plurality", and that "this can be shown via the assertion of the (rough) equivalence between kinds of reduplicated ideophones, and kinds of bona fide derived pluractional verbs, which must be event predicates", as was illustrated in (34).

Henderson 2016 characterizes the iconic character of these examples in the following terms: "*IDF IDF IDF* demonstrates events with a different temporal character than IDF [pause] IDF [pause] IDF. In particular, *IDF IDF IDF* demonstrates events that can fall in the extension of a pluractional predicate derived by -C_1on, while *IDF [pause] IDF [pause] IDF* demonstrates events that can fall in the extension of a pluractional predicate derived by -lajan. The facts show that for a demonstration event [involving a repeated ideophone -PS] to be structurally similar to a second event, the demonstration event must not only have the same cardinality, but also a similar temporal profile."

These facts are of course reminiscent of the sign language iconic plurals and pluractionals discussed in Section 2.2. From the present perspective, a key question is whether ideophones have an at-issue or other status. While we do not know of ideophone-related literature that has performed systematic empirical tests, the examples in (34) are certainly indicative of an at-issue use, as the iconic component is crucial to make the main clause informative relative to the *when*-clause. But of course systematic tests should be applied to determine whether the iconic contribution of ideophones is at-issue, presuppositional or supplemental (see Dingemanse et al. 2016, to appear for experimental work on the iconic properties of ideophones – but one which does not address the issue of the at-issue or not-at-issue behavior).

2.4   *Towards a formal analysis of elementary iconic enrichments*

Our focus in this piece is on the ways in which iconic enrichments are *projected*, not on how they are *generated* or 'triggered' in the first place (the same issue arises in presupposition theory, where one distinguishes the 'projection problem' from the 'triggering problem). Still, a word should be added to explain how formal approaches can incorporate iconic conditions. The basis idea, developed in much greater detail in Greenberg's 'pictorial semantics' (e.g. Greenberg 2013), is that an iconic representation is a representation that is true of an object just in case it satisfies certain structural properties of the representation. For this reason, iconic representations enrich Logical Forms by specifying that certain objects that some expressions are true of should also 'preserve' certain structural properties of these expressions. In the case of visual representations, these are usually geometric properties. An example of a formal treatment is provided in Appendix I, applied to the verb *GROW* discussed above. Similar principles could be applied to iconic modulations of *long* by requiring that *the talk is loooong* is true just in case the talk has (at least) a length f_c(*loooong*), where f_c (given by the context c) is an increasing function with respect to the length of the vowel of its argument (so that if a token *looooong* has a longer vowel than another token *looong*, then f_c(*looooong*) is greater than f_c(*looong*)).

3   Co-speech gestures: English

Unlike iconic modulations, which are an integral part of the expressions they modify, co-speech gestures are an external enrichment, and they do not have their own time slot since they are produced simultaneously with the expression they modify. We argue (following Schlenker 2016b) that they do not normally make an at-issue contribution, and trigger a particular kind of presupposition, which we call 'cosupposition'. (We will argue in the next section that some instances of *co-sign gestures* can be found in sign language, and that they pattern with co-speech gestures.)

3.1   Supplements or presuppositions?

Ebert and Ebert 2014 suggested that co-speech gestures should be analyzed as supplements. As we will see in Section 6, post-speech gestures (not discussed by Ebert and Ebert) do indeed display a supplemental behavior, but in our view this makes it all the more striking that co-speech gestures do not. The point is made in Schlenker 2014a by focusing on negative environments in which supplements are degraded – but in which co-speech gestures appear rather freely, as seen in (35)-(36). As we will see shortly, presupposition triggers also freely appear in these environments.

(35) a. It's unlikely that the next speaker will bring LARGE_ **[a bottle of beer]** to his talk.
=>? if the session chairman brings a bottle of beer, it will be a large one

b. #It's unlikely that the next speaker will bring a bottle of beer, which is LARGE_ **this** large.
(Schlenker 2015)

(36) a. No philosopher brought LARGE_ **[a bottle of beer]** to the workshop.
=>? when a philosopher brings a bottle of beer, it is usually a large one

b. #No philosopher brought a bottle of beer, which is LARGE_ **this** large.
(Schlenker 2015)

As mentioned in Schlenker 2015e, a supplemental approach could deal with (35)a-(36)a by taking the gestures to behave like the appositives in (35)b-(36)b, but with *which would be* replacing *which is*. On the assumption that the resulting sentence is more acceptable, one would still need to ask why such an option should be available – and importantly why it *fails* to be available in the case of post-speech gestures, a point to which we will turn in Section 6.

3.2   Cosuppositions[13]

Following Schlenker 2016b, we argue that a broad class of co-speech gestures should be analyzed within a presuppositional framework, albeit with a twist. In standard theories, a presupposition trigger *pp'* (e.g. *it stopped raining*) with presupposition *p* (*it rained*) and at-issue component *p'* (*it doesn't now rain)* comes with a requirement that *p* should be entailed by the local context of *pp'*. By contrast, an expression *p* co-occurring with a co-speech gesture *G* with content *g* comes with the requirement that the local context of *p* should guarantee that *p entails g*. In other words, the co-speech gesture triggers an assertion-dependent presupposition, something we call a 'cosupposition'. To illustrate, the co-speech gesture *UP* in (37) definitely does not trigger the simple presupposition that some lifting will in fact take place, but rather the conditionalized presupposition or 'cosupposition' that if John helps his son, lifting will be involved.

(37) John will UP_ **help** his son?

Why such a conditionalization? Schlenker 2016b discusses several possible motivations. One goes like this: the context should guarantee that the co-speech gesture merely illustrates the

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[13] This section, as well as the following two sections, borrow from Schlenker 2016b.

expression it modifies, and thus that relative to that context the expression entails the content of the co-speech gesture. In unembedded cases, such as (37), one can posit that the relevant inference must follow from the context of the conversation. But in embedded cases a more sophisticated notion is needed, that of a *local context*. To see why it is needed, consider the example in (38).

(38) If little Johnny takes part in the competition, will his mother UP_ **help** him?
    => if little Johnny takes part in the competition, if his mother helps him, lifting will be involved

The requirement that the content of the gesture follow from the meaning of *help* relative to the global context would give rise to an overly strong inference, namely that *in general*, helping is understood to mean 'helping by lifting'. The inference which is in fact derived is narrower: besides the fact that it only applies to Johnny and his mother, it is relative to the hypothesis that Johnny will take part in a competition; and we thus infer that this kind of competition involves some kind of upward movement.

In modern theoretical parlance, the entailment need not hold with respect to the *global* context of the sentence, but only with respect to the *local* context obtained by 'updating' the global one with the antecedent of the conditional. The notion of a 'local context' is standardly used to motivate dynamic approaches to presupposition projection in the tradition of Heim 1983. Informally, the local context of an expression recapitulates the semantic content already contributed by expressions that precede it, combined with the context of the conversation. In various theories of presupposition (e.g. Heim 1983, Beaver 2001, Schlenker 2009), an expression *pp'* triggering a presupposition *p* in a sentence *S* uttered relative to a Context Set C is acceptable only if *p* follows from the local context of *pp'* in *S* given C. This holds in particular if *p* is a cosupposition, of the form p = (p' $\Rightarrow$ q), with conditionalization on the at-issue component *p'*. This means that *x UP help y* can be analyzed as a standard presupposition trigger, which happens to trigger a presupposition of the rough form: *x helps y $\Rightarrow$ lifting is involved.*

Thus the cosuppositional analysis can be combined with standard theories of presupposition projection to account for complex patterns of gesture projection. Without getting into formal details that are developed in Schlenker 2016b, we will now survey the main projection phenomena that are found, and we will emphasize their similarity with standard presuppositions by including whenever possible presuppositional controls.

3.3   *Cosuppositional behavior: propositional cases*

In (39)a(i), a lifting gestures accompanies the verb *helped*, and yields roughly the same informational contribution as the example in (39)a(ii), in which an at-issue modifier is used, referring deictically to the same kind of gesture. The latter example is intended as a control in which the contribution of the co-speech gesture in (39)a(i) is made by a well-understood construction[14] (we could have used just as well the modifier *by lifting him*, but this would have made for a less minimal control). And of course the presuppositional control in (39)c gives rise to the factive inference that one expects given the presence of *realize*. We purposefully focus on a relatively weak presupposition trigger, because we think that various co-speech gestures easily give rise to patterns of 'local accommodation', whereby under special conditions a presupposition is treated as if it were part of the at-issue component of a predicate or clause (but see Esipova 2016a,b for an analysis of gestural and non-gestural presuppositions that develops a more sophisticated theory of marginal at-issue readings of co-speech gestures).

(39)   a. John will (i) UP_ **help** his son (ii) help his son like UP_ **this**.
     (i) => John will help his son by lifting him

     b. John will realize that his son is losing.
     => John's son is/will be losing

---

[14] Since *this* is a demonstrative, it denotes something which is made salient by the context – here the action evoked by the accompanying gesture. The semantics of *this* need not involve explicit gestures, however, and thus it must be handled by a theory of context dependency that does not reduce to gesture semantics.

Now the important observation is that when (39)a(i) and (39)a(ii) are embedded under logical operators, they display sharply different behaviors – and the introspective inferences triggered by co-speech gestures pattern with the presupposition illustrated in (39)b. In questions and under negation, the relevant conditionalized presuppositions (i.e. the relevant cosuppositions) are 'projected' and thus inherited by the matrix clause, as shown in (40)-(41) (the latter is just a more controlled version of the initial example in (37)). The presupposition triggered by *realize* also projects, but of course it is not conditional in nature. We also include controls with *like this*; unless noted otherwise, they clearly *fail* to trigger the relevant inferences.[15]

(40) a. John won't (i) UP_ **help** his son. (ii) help his son like UP_ **this**.
(i) => If John helped his son, he would do so by lifting him

b. John won't realize that his son is losing.
=> John's son is losing

(41) a. Will John (i) UP_ **help** his son? (ii) help his son like UP_ **this**?
(i) => If John helps his son, he will do so by lifting him

b. Will John realize that his son is losing?
=> John's son is/will be losing

To study gesture projection in upward-monotonic environments, it is sometimes useful to embed some of the examples in questions so as to distinguish the presuppositional component (which is preserved or 'projects' under questions) from the at-issue component (which doesn't project). Thus (42) displays a more controlled version of our initial example in (38).

(42) a. If little Johnny takes part in the competition, will (i) his mother UP_ **help** him? (ii) his mother help

him like UP_ **this**?
(i) => if little Johnny takes part in the competition, if his mother helps him, lifting will be involved

b. If little Johnny cheats on the exam, will his mother realize that he committed an extremely serious offense?
=> if little Johnny cheats on the exam, he will have committed an extremely serious offense

As announced, (42)a-b show that in the consequence of a conditional, normal presuppositions and cosuppositions both interact in non-trivial ways with the content of antecedent: it is neither the case that the presupposition 'projects' or 'fails to project'. Rather, it projects *in modified form*, relativized to the antecedent of the conditional. This shows in particular that it won't do to say that co-speech gestures just trigger an inference to the effect that they illustrate the lexical meaning of the expression they modify. Rather, just as for normal presuppositions, the linguistic context must be taken into account, as is guaranteed by standard theories of presupposition.

It is worth noting that the acceptability of co-speech gestures under *unlikely*, as in (35), is unsurprising from a cosuppositional perspective. And it gives rise to the inferences that one would predict on the basis of standard presupposition triggers, as shown in (43): the presupposition/cosupposition is inherited by the matrix clause.

(43) a. It is unlikely that John will (i) UP_ **help** his son. (ii) help his son like UP_ **this**.
(i) => If John helps his son, he will do so by lifting him

---

[15] In some embedded environments, a clause of the form *... help like UP this ...* could trigger an implicature because it has as an alternative the clause *... help like UP this ...* . We disregard implicatures in the present discussion.

b. It is unlikely that John will realize that his son is losing
(i) => John is helping/helps his son

Many other propositional examples are discussed in Schlenker 2016b.

3.4 Cosuppositional behavior: quantified cases

Let us turn to some quantified examples (we henceforth omit pictures from the transcription of the gestures, unless these have not been exemplified before). Under universal quantifiers, we obtain universal projection of a presupposition/cosupposition, as seen in (44)

(44) a. Did each of these 10 guys (i) UP **help** his son? (ii) help his son like UP **this**?
    (i) => for each of these 10 guys, if he helped his son, he did so by lifting him
    b. Did each of these 10 guys realize that his son needed help?
    (i) => for each of these 10 guys, his son needed help.

Embedding under *none*-type quantifiers is particularly informative, for two reasons. First, presuppositions in their scope are believed to give rise to universal positive presuppositions, which is a characteristic behavior of presupposition (see Chemal 2009 for experimental data). Second, unlike presupposition triggers, supplements in the scope of *none*-type quantifiers seem to be degraded, as we saw in (36). As seen in (45), co-speech gestures pattern with presupposition triggers and yield universal cosuppositional inferences, as one would expect.

(45) a. None of these 10 guys (i) UP **helped** his son. (ii) helped his son like UP **this**.
    (i) => none of these 10 guys helped his son; but for each of them, if he had helped his son, it would have been by lifting him
    b. None of these 10 guys realized that his son needed help.
    => for each for each of these 10 guys, his son needed help

Finally, going back to our initial examples in(35)a and (36)a, we can account for the inferences they trigger by postulating that *John brings LARGE [a bottle]* triggers the cosupposition that *if John brings a bottle, it will be a large one.*

3.5 Experimental approach

Tieu et al. 2016a, b investigate the projection of co-speech gestures with experimental means. Their clearest results pertain to an inferential task (Tieu et al. 2016b), performed in two separate experiments illustrated in (46) and (47) on the example of the quantifier *none*, with the types of inferential questions in (48)

(46) **Experiment 1: Target Gestures**

None of these three girls will   **[use the stairs]**.

(47) **Experiment 2: At-issue controls**

None of these three girls will use the stairs in   **[this direction]**.

(48) **Inferential questions (for both experiments)**
    a. Existential inference
    To what degree does this video suggest the inference below?
    For at least one of these three girs, if she were to use the stairs, she would go up the stairs.

    b. Universal inference
    To what degree does this video suggest the inference below?
    For each of these three girs, if she were to use the stairs, she would go up the stairs.

The expected cosuppositional inferences were tested in a variety of environments involving *might*, *not*, *each, none* and *exactly one.* Quantitative results are summarized in the graphs in (49); the results of the target experiment, involving co-speech gestures, are contrasted with those of the at-issue ('asserted') environments used in the control experiments. Quantified cases were tested both for universal inferences as (48)b and for existential inferences as in (48)a, in part because the data are not entirely clear, and in part because there is a debate between proponents of 'existential projection' vs. 'universal projection' in the presupposition literature (e.g. Beaver 2001).

(49) **Endorsement rates for different linguistic environments**

Endorsement of target inferences (n=125)
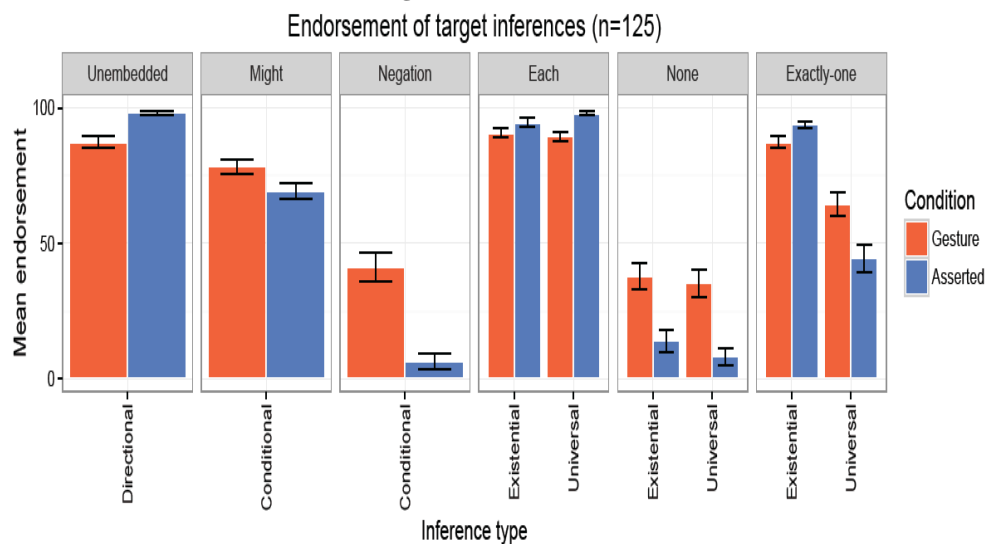
Without getting in too much detail, two points are worth noting. There are clear and significant differences between target gestural sentences and at-issue controls, which goes in the direction of the cosupposition theory. Still, cosuppositional inferences are often far less strong than expected. This might justify treating gestural triggers as very weak triggers, which easily give rise to local accommodation – a point to which we return in Section 5.2. This point also turns out to be important in the detailed debate between the cosuppositional and the supplemental theory of co-speech gestures, as relevant controls with appositives do not seem to give rise to at-issue readings in the cases at hand. Thus Tieu et al. 2016a,b argue that readings with local accommodation offer an important argument against supplemental analyses – a point we do not further develop in this piece.

3.6   *Cosuppositions triggered by facial expressions*

As mentioned in Schlenker 2016b, the same generalizations arguably hold for some co-speech facial expressions. Here *:-(* stands for an unhappy or disgusted face, which we illustrate in (50)a. Importantly, the disgust might be attributed to the speaker or to Sam in (50)a; but what matters for present purposes is that whatever inference is obtained in the simple case is inherited by the complex sentences in the paradigm.

(50) **Propositional examples**

a. Sam went :-(_ ▓▓▓ **[skiing with his parents]**.
=> for Sam to go skiing with Sam's parents would be disgusting (from Sam's / from the speaker's standpoint)
b. Sam won't go :-(**[skiing with his parents]**.
=> for Sam to go skiing with Sam's parents would be disgusting (from Sam's / from the speaker's standpoint)
c. Did Sam go :-(**[skiing with his parents]**?
=> for Sam to go skiing with Sam's parents would be disgusting (from Sam's / from the speaker's standpoint)

d. If Sam goes :-(**[skiing with his parents]**, I'll hear about it.
=> for Sam to go skiing with Sam's parents would be disgusting (from Sam's / from the speaker's standpoint)

We can also obtain examples in which the disgusted facial expression appears in the consequent of a conditional, and the disgust can be relativized to the content of the antecedent, as shown in (51).

(51) Sam loves skiing, but if the snow is as terrible as it is today, he won't go :-(**skiing** tomorrow
=> if the snow is as terrible as it is today, skiing will be disgusting tomorrow (from Sam's / from the speaker's standpoint)

In more complex examples, we can see the effect of a facial modifier co-occurring with an expression that contains a bound variable. The same generalizations hold as in our earlier examples involving manual gestures: in (52)a-b, an inference is triggered to the effect that for the speaker's friends to go skiing with their parents in somehow disgusting. Finally, we can test what happens when the facial expression spans the entire sentence, as in (52)c. While the facts are not entirely clear, our impression is that this can trigger the inference that it is disgusting *that* none of the relevant friends go skiing with his parents (we don't exclude that a reading is available to the effect that skiiing with one's parents is disgusting). This possibility is predicted by the cosuppositional analysis: when the facial expression spans an entire proposition, we predict that that proposition entails the content of the expression, hence disgust in the case at hand. As we will see, a similar contrast can be replicated with facial expressions in ASL.

(52) **Quantified examples**
a. Does each of your friends go :-(**[skiing with his parents]**?
=> for each of my friends, to go skiing with his/her parents would be disgusting (from the friend's / from the speaker's standpoint)
b. None of my friends goes :-(**[skiing with his parents]**.
=> for each of my friends, to go skiing with his/her parents would be disgusting (from the friend's / from the speaker's standpoint)
c. :-(**[None of my friends goes skiing with his parents]**.

4   Co-sign gestures: ASL

Our initial evidence for cosuppositions comes from co-speech gestures in spoken language. It is non-trivial to extend the findings to sign language: since gestures are produced in the same modality as signs, teasing apart the difference between the two requires more sophisticated criteria than in spoken language. We will nonetheless argue that some (non-grammatical) facial expressions display the semantic hallmarks of co-speech gestures.

While we will argue that some such expressions are indeed comparable to co-speech gestures, it must be noted at the outset that in *some* examples facial expressions are naturally interpreted as iconic modulations of a sign. Thus in (53)b the dominant (but not quite the sole) reading seems to be that John never plays the piano badly or with a bad attitude: the disgusted face appears to be preferentially integrated to the sign for *play the piano*, and it thus behaves like an internal enrichment.

(53) *Context:* John is an amateur musician. The speaker enjoys good music.
a. [7] JOHN   IX-a   NEVER PLAY-PIANO.
'John never plays the piano.'

b.   [6.4] JOHN   IX-a   NEVER :-(_____ [PLAY-PIANO].
'John never plays the piano badly.'
Meaning 1: John never plays the piano badly or with a negative attitude, hence if he plays, he plays well/seriously (5 judgments out of 5, with 2 mentioning an ambiguity)
Meaning 2: John never plays the piano, but if were to play, the speaker would hate it (2 judgments mentioning this as a possible meaning in addition to Meaning 1).

'John never plays the piano (badly)' (ASL, 34, 1550a,e, 5 judgments)

An alternative reading can to some extent be brought out in a minimally different example in which the signer bends backwards as he realizes the sign (something we write as \), possibly because in this case the facial expression can be seen as an external enrichment of the sign (see the Supplementary Materials for the complex judgments). The result is still ambiguous:

(54)   *Context:* John is an amateur musician. The speaker enjoys good music.

6.6 JOHN IX-a   NEVER \ :-(_▢▢▢▢▢▢   [PLAY-PIANO]
Meaning 1: John never plays the piano badly, hence if he plays, he plays well/seriously (3 judgments mentioning this as a possible meaning, including 1 as the only possible meaning and 2 as a permissible (possibly preferred) meaning)
Meaning 2: John never plays the piano, but if he were to play, the speaker would hate it (4 judgments mentioning this as a possible meaning, including 2 as the only possible meaning and 2 as a permissible (possibly dispreferred) meaning).
   (ASL, 34, 1546e; 5 judgments)

        Still, neither of the foregoing examples provides clear evidence of cosuppositional inferences. Things are different in (57): even though the basic meaning of the facial expression is open to interpretation (in terms of disgust or, more marginally, in terms of difficulty), it gives rise to a universal inference out of the scope of the quantifier *NONE*.

(55) AMERICA [RICH STATES HELP PEOPLE]$_a$.
      a. 6.7 [POOR STATES NONE IX-arc-b SPEND MONEY]$_b$.

       b. 6 [POOR STATES :-(_▢▢▢▢▢   [NONE IX-arc-b SPEND MONEY]]$_b$.
      => it is good for poor and rich states to spend money
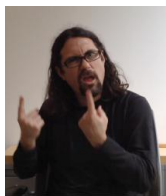
      c. 6 [POOR STATES NONE IX-arc :-(_▢▢▢▢▢   [SPEND MONEY]]
      => it is bad (3 judgments) or difficult (1 judgment) for poor states to spend money
      (in one case, it is taken to be bad to for states in generaly to spend money; see the detailed data in the Supplementary Materials)
      'In the US, rich states help people. But no poor states spend money.' (ASL, 34, 1670a,c,d; 4 judgments)

More precisely, we obtain interpretations that suggest that a disgusted facial expression in the scope of the quantifier *NONE* gives rise to projection effects. To see this, let us consider the full paradigm. When the disgusted facial expression spans the entire clause, as in (55)b, what is taken to be disgusting is the fact that no poor state spends money. But when the facial expression spans the Verb Phrase only, one gets the inference that it would be disgusting (or difficult) for poor states to spend

money (and sometimes this gets strengthened to an inference that also applies to rich states). This contrast replicates our impression of the English data discussed in (52)b-c.[16]

A related case of projection can be see in (56), which has about the same truth conditions as (55), but with a very different structure, involving conditionals and adverbs rather than quantifiers.

(56) AMERICA [IF STATE RICH HELP PEOPLE]$_a$.
    a. [7] [IF STATE POOR NEVER SPEND MONEY]$_b$.

    b. [5.7]:-(_____ [IF STATE POOR NEVER SPEND MONEY]
    => it is good for poor and rich states to spend money

    c. [6.3] [IF STATE POOR NEVER :-(_____ [SPEND MONEY]
    => it is bad (1/3 judgment) or difficult (2/3 judgments) for poor states to spend money

    'In the US, if a state is rich, is helps people. If a state is poor, it never spends money.' (ASL, 34, 1712a,c,d; 3 judgments)

Unsurprisingly, we obtain in (56)b a negative assessment of the fact that if a state is poor it never spends money – in other words: it would be good for poor states to spend money. World knowledge is probably responsible for the further inference that it is good for states *in general* to spend money: if it is good for poor states to spend money, this is *a fortiori* the case for rich states (all the more so in the context of helping people). The interesting observation is that when the disgusted face only appears over *SPEND MONEY*, as in (56)c, the inference triggered by the facial expression 'projects' out of the scope of the *NEVER*, since it is now inferred that it is difficult or bad for poor states to spend money (the ambiguity between 'difficult' vs. 'bad' makes things harder to test, but we can nonetheless ascertain that the inference projects as a cosupposition).

This latter inference can be explained if *SPEND MONEY* comes with a cosupposition of the form: *λx. x spends money => x does something negative/difficult.* The environment is a bit more complex than those we discussed up to this point. The relevant Logical Form involves generalized quantification over situations, akin to: *No situation in which a state is poor is one in which it spends money* (see for instance Lewis 1975 for a – by now standard – treatment of conditionals with adverbials as structures of generalized quantification). This is thus the same type of structure we investigated in (45)a(ii) and (52)b, repeated as (58)a,b.

(58) a. None of these ten guys UP **[helped his son]**.
    => for each of these ten guys, if he had helped his son, he would have lifted him
    b. None of my friends goes :-(**[skiing with his parents]**.
    => for each of my friends, skiing with his parents wouldn't be fun

We posited that the verbal predicate triggers a cosupposition of the form *λx. x helps x's son => x lifts x's son* for (58)a, and *λx. x goes skiing with his parents => x does something disgusting* for (58)b. We

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then made use of the fact that in structures of the form *No NP VP,* if a presupposition is triggered by the VP, it should be satisfied by every object that satisfies the NP – hence the inferences we obtained in (58)a,b. The case of quantification over situations is no different, as can be seen with gestural and non-gestural examples alike in (59): each situation that satisfies the *if*-clause should satisfy the presupposition of the main clause.

(59) a. If a kid goes on winter vacations with his parents, he never notices that skiing with them is ridiculous.
       => it is ridiculous for kids on winter vacations to ski with their parents
       b. If a kid goes on winter vacations with his parents, he never goes :-([skiing with his parents].
       => it is disgusting for kids on winter vacations to go skiing with their parents

Combining these results, we can understand why (56)c triggers the inference that if a state is poor, it is bad for it to spend money.

Finally, and rather unsurprisingly, the inferences seen in (55) and (56) can be replicated with co-speech facial expressions in spoken language, as seen in (60).[17]

(60) a. No poor state should :-(**[spend money]**.
       => it is bad for poor states to spend money
       b. If a state is poor, it should never :-(**[spend money]**.
       => it is bad for poor states to spend money

Similarly, a disgusted facial expression co-occurring with the English VP *play the piano* gives rise to a cosuppositional reading, as seen in (61). Unlike what we saw in (53) and (54), there is no risk that the facial expression can be viewed as an iconic modulation of the sign: it is clearly analyzed as an external enrichment, and we obtain a relatively clear cosuppositional reading.

(61) *Context:* John is an amateur musician. The speaker enjoys good music.
       John never :-(**[plays the piano]**.
       => the speaker doesn't like John's piano playing

5   Co-speech and co-sign gestures: further issues

5.1   Deriving cosuppositions

There are three closely related ways of explaining why co-speech gestures trigger cosuppositions. Here we briefly mention them without seeking to adjudicate the debate.

1. Within standard presupposition theory (e.g. Heim 1983), one could simply take the presuppositional behavior of co-speech gestures to be a lexical fact, by way of lexical entries such as (62), defined for case in which *SLAP* co-occurs with a transitive verb (this is stated for a trivalent framework; adaptations would be needed for a dynamic framework *à la* Heim 1983). The crucial part is boldfaced: a presupposition failure is triggered if the argument that *SLAP* modifies fails to entail the semantic content slap' of *SLAP*.

(62) **Trivalent entry for a co-speech gesture: *SLAP***
       with the semantic contribution of *SLAP* written as: slap'
       $[[SLAP]]^{c, w, s} = \lambda P_{<e, <e, st>>} . \lambda y_e . \lambda x_e .$ # iff $P_w(y)(x) = \#$ or slap'$_w(y)(x) = \#$ or **not: $P_w(y)(x) = 1$ =>**
       slap'$_w(y)(x) = 1$; 1 iff $P_w(y)(x) = $ or $P_w(y)(x) = 1$

Besides the need to adapt the analysis to a full-fledged dynamic framework, one would have to state more general rules for cases in which *SLAP* modifies verbs that are not transitive.

2. One could state more directly a rule intended for dynamic analyses of presuppositions. A key insights of this framework is that *the presupposition of an expression must be entailed by the local context of that expression.* In classic statements of dynamic semantics, such as Heim 1983, the value of local contexts is computed by a recursive system: the meaning of expressions is taken to be

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[17] The inference might be strengthened to 'it is bad for states in general to spend money', or even: 'spending money is bad'. As noted in fn. 16, this falls under the 'proviso problem', i.e. the observation that presuppositions are sometimes stronger than is predicted by standard dynamic analyses.

evaluated with respect to a local context and to output a modified local context. In pragmatic reconstructions of local contexts such as Schlenker 2009, local contexts are computed by a pragmatic algorithm that starts from the syntax and the bivalent (i.e. classical) semantics of any sentence. In either framework, then, there are more contexts than meets the eye: besides the general context of the conversation, the local context of an expression may play a role in its evaluation. In Schlenker 2016b, this analysis is developed in two steps.

• The initial intuition is that a co-speech gesture must illustrate a feature of the meaning of the expression it modifies, in the sense that with respect to the relevant context that meaning must entail the content of the co-speech gesture – and if this is not the case, a presupposition failure is triggered.

• Importantly, the 'relevant context' must be the local context of the modified expression, rather than the general context of the conversation. This is important because otherwise we would fail to account for the interaction between gestural inferences and the linguistic context they appear in, as we argued above in connection with (38).

3. A different direction is explored in Schlenker 2016c, which goes back to a pragmatic analysis of presupposition called 'the Transparency Theory' (Schlenker 2008). Schlenker 2008 argues that the presupposition d of a (predicative/propositional) trigger dd' is a normal entailment that 'wants' to be articulated as a separate conjunct, in accordance with the principle in (1):

(63) **Be Articulate**
   In any syntactic environment, express ... *dd'*... as: ...*(d and dd')*... (unless independent pragmatic principles rule out the full conjunction).

If possible, then, one should say *... it's raining and John knows it...* rather than *...John knows that it's raining.... Be Articulate* is controlled by a Gricean principle of manner, *Be Brief*, which prohibits unnecessary prolixity, *and takes precedence over Be Articulate* – thus ruling out *If it is raining, it is raining and John knows it:*

(64) **Be Brief - Incremental Version**
   Given a context set C, a predicative/propositional occurrence of d is infelicitous in a sentence that begins with *a (d and* if for any expression g of the same type as d and for any sentence completion *b'*,
   C |= a (d and g) b' ⇔ a d b'.

In the end, *dd'* is acceptable in a sentence *a dd' b* just in case the attempt to be 'articulate' satisfies the boldfaced equivalence in (64), thus violating *Be Brief.* Schlenker 2007 proves that this 'Transparency theory' derives the results of Heim 1983 for a fragment with generalized quantifiers, *modulo* technical assumptions (and in turn the Transparency is essentially equivalent to the theory of presupposition based on a pragmatic reconstruction of local contexts in Schlenker 2009).

Now one can observe that often the 'natural' way to articulate explicitly the content of a co-speech gesture is by way of a post-posed modifier rather than by way of an initial conjunct. Thus Schlenker 2016c takes the articulated version of (65)a to be a version of (65)b. But now to ensure that the latter is in violation of Be Brief because it is redundant, one has access to the entire beginning of the sentence, *including the VP,* in this case *punished his son.* As a result, as soon as it is assumed that for each of the relevant individuals x, *x punished x's son* entails *x slapped x's son*, the post-posed modifier will be redundant.

(65) a. None of these 10 guys **punished** his son.

   b. None of these 10 guys punished his son like **this** / by slapping him.

This turn out to offer a relatively principled way of deriving the fact that cosuppositions as presuppositions that are *conditionalized* on the content of the expression they modify. (We write 'relatively principled' rather than 'principled' because we must still stipulate that the 'articulated' competitor of the VP-with-gesture in (65)a is the VP-with-post-posed-modifier in (65)b.)

As mentioned in Schlenker 2016b (following M. Krifka, p.c.), all three analyses should probably be implemented within an event or situation semantics in order to predict appropriate inferences. Consider again the sentences *John SLAP **punished** his son* or *Did John SLAP **punish** his*

son? We predict a presupposition to the effect that *if John punished his son, some slapping occurred.* But this entailment does not specify what kind of connection, if any, there should be between the punishment and the slapping. We clearly want something stronger, namely: *if John punished his son, slapping was involved in the punishment in question.* As Krifka points out, this more adequate inference can be obtained by integrating cosuppositions to an event semantics, one in which *punished* holds true of events and individuals rather than just of individuals; we refer the interested reader to a slightly more detailed discussion of this point in Schlenker 2016b.

5.2 *At-issue use of some co-speech gestures*

Presupposition triggers can often contribute to the at-issue component of a sentence if the circumstances are right. Thus *his girlfriend* normally triggers a presupposition that the relevant male has a girlfriend, and *x has stopped smoking* triggers the presupposition that x used to smoke; but not so in (66) and (67), where these contributions are at-issue and interpreted in the scope of a modal and a question operator respectively (see also Beaver 2010 for relevant examples).

(66) A: I wonder why that guy is looking so glum.
    B: Maybe his girlfriend jilted him. (Fauconnier 1985, cited in Beaver and Geurts 2011)

(67) I notice that you keep chewing on your pencil. Have you recently stopped smoking? (Geurts 1994, cited in Simons 2001)

There are ill-understood differences among presupposition triggers; some triggers, called 'weak triggers', make it particularly easy to turn their presuppositional component into an-issue contribution (for analyses, see Abusch 2010 and Abrusan 2016). *Realize*, which we used as a presuppositional control in our discussions above, is an example.

 We mentioned in Section 3.5 that recent experimental results suggest that co-speech gestures are indeed weak triggers. Another possibility, due to Esipova 2016a,b, is that quite generally when a presupposition trigger is focused, its presupposition is locally accommodated if this is necessary to ensure that the alternatives can be asserted. Esipova argues that this generalization holds both of standard presuppositions and of gestural cosuppositions (see also Simons et al., to appear); but it does not seem to be sufficient to account for the at-issue readings of examples discussed in Section 3.5, where focus seemed irrelevant.

 In addition, there are cases in which there might be pragmatic pressure to use a co-speech gesture to express a part of the at-issue meaning that would be too 'dangerous' otherwise.[18] Thus in (68)a, there need not be a general inference that smoking involves pot. Rather, the co-speech gesture appears to make it into the at-issue contribution of the *if*-clause, possibly because one does not was to use the expression 'smoke pot', which refers to a prohibited action.
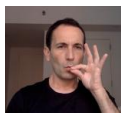
(68) If you need to _SMOKE_POT **smoke**, you should go outside.

5.3 *At-issue use of some co-sign gestures*

The reader will have noticed that all of our co-sign gestures involve facial expressions. This is because co-sign gestures raise complex problems pertaining to their identification (how do we distinguish a gestures from a sign created 'on the post') and to their projective status (at-issue or cosuppositional, in particular).

 We believe that there are relatively clear cases in which co-sign manual gestures have an at-issue use, as is illustrated in (69), where the one-handed sign for *SCOLD* was accompanied with a gesture of slapping, performed with the non-dominant hand, either simultaneously or with a slight delay, or performed after *SCOLD* with the dominant hand. In all cases an at-issue meaning was obtained.

Notation: manual gestures are transcribed in lowercase letters, and they are subscripted before a sign if they are produced simultaneously with it ($_{slap}$SCOLD), and subscripted after a sign if their beginning if slightly delayed (SCOLD $_{slap}$). A gesture with its own time slot is transcribed in lowercase letters but is not subscripted.

(69)   JOHN$_a$ IX-a POSS-a SON IX-b IX-a NEVER
        'His son, John never

> a. [7] SCOLD.
> scolds.'
> b. [6.5] $_{slap}$SCOLD.
> slaps while scolding him.'
> c. [6] SCOLD $_{slap}$.
> scolds and/and then slaps with his non-dominant hand'.
> d. [7] SCOLD slap.
> scolds and/and then slaps.' (ASL, 34, 2116, 2 judgments)

We believe there are other cases that pattern differently[19], but we cannot reach a firm conclusion on this matter, which requires further investigations. There are two main theoretical directions to explore.
1. One possibility is that manual gestures are more easily seen as integrated with the manual signs they modify, which would imply that they are often seen as internal modulations rather than as external enrichments. While this possibility is compatible with the present analysis, we would still expect to find *some* manual gestures that are not so easily viewed as internal; whether some can be found remains an open question.
2. An alternative possibility is that integration occurs in all cases, and that it is for semantic reasons that the expressive component contributed by facial expressions often gives rise to a cosuppositional-type reading. If so, we would need to modify out typology to explain why we do no find instances of *bona fide* external enrichment in sign language.[20]

6   Post-speech and post-sign gestures: English and ASL

Little attention has been devoted to iconic enrichments that come *after* the expressions they modify. We call these 'post-speech gestures', and argue that in both modalities they have the same semantic status as appositive relative clauses, at least in some salient cases. In the terms of Potts 2005, they are 'supplements' (we also explore an alternative view according to which they are just cosuppositions that are more constrained than those triggered by co-speech gestures).

6.1   Post-speech gestures: English[21]

Schlenker 2015e provides initial arguments against a supplemental analysis of co-speech gestures by focusing on negative environments in which supplements are degraded but co-speech gestures are acceptable; a fuller typology is discussed in Schlenker 2016b, which we follow here. Our focus is on size-denoting gestures that modify NPs, as these make a comparison with appositives particularly easy. It is immediate in the paradigms in (70)-(75) that the distribution of indicative appositive relative clauses does *not* mirror that of co-speech gestures, but rather that of post-speech gestures. It is of course important to pronounce the appositives as is appropriate for non-restrictive clauses; the relevant reading can be brought out by adding *by the way* right after the relativizer.[22] Overall, and with a possible exception in (75), the acceptability of post-speech gestures tracks that of appositive relative

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[19] We tested examples involving the one-handed sign for *COOL* performed with the gesture for a big belly, with some projection effects – but not ones that are captured by theories under discussion here.
[20] See Esipova 2016a,b for further discussion of this matter in connection with possibilities of local accommodation of inferences triggered by facial expressions.
[21] This section borrows from Section 4.2.1 of Schlenker 2016b.
[22] Thanks to Miloje Despić for making this suggestion.

clauses. Since at this point we are interested in the distribution of these expressions rather than in the inferences they give rise to, we omit the latter from the present discussion.

(70) a. Some/No philosopher brought LARGE **[a bottle of beer]**.
b. Some/#No philosopher brought a bottle of beer, which (by the way) was LARGE **this** large. (Schlenker 2015e)
c. Some/#No philosopher brought a bottle of beer – LARGE.

(71) a. It's likely/It's unlikely that the previous speaker brought LARGE **[a bottle of beer]** to his talk.
b. It's likely/#It's unlikely that the previous speaker brought a bottle of beer, which (by the way) was LARGE **this** large.[23]
c. It's likely/# It's unlikely that the previous speaker brought a bottle of beer – LARGE.

(72) a. One/None of these 10 guys UP **helped** his son.
b. One/#None of these 10 guys helped his son, which (by the way) he did by lifting him.
c. One/#None of these 10 guys helped his son – UP.

(73) a. It's likely/It's unlikely that John UP **helped** his son.
b. It's likely/#It's unlikely that John helped his son, which (by the way) he did by lifting him.
c. It's likely/#It's unlikely that John helped his son – UP.

(74) a. One/None of these 10 guys SLAP **punished** his son.
b. One/#None of these 10 guys punished his son, which (by the way) he did by slapping him.
c. One/#None of these 10 guys punished his son – SLAP.

(75) a. It's likely/It's unlikely that John SLAP **punished** his son.
b. It's likely/#It's unlikely that John punished son, which (by the way) he did by slapping him
c. It's likely/(?) It's unlikely that John punished his son – SLAP.

As mentioned in Schlenker 2015e, a supplemental approach could deal with(36)a-(35)a by taking the gestures to behave like the appositives in (36)b-(35)b, but with *which would be* replacing *which is*. On the assumption that the resulting sentence is more acceptable, one would still need to ask why such an option should be available. But the crucial problem is that *this approach does not explain why such a strategy* fails *to be available in the case of post-speech gestures* (we come back below to a potential explanation). A more natural account is afforded by positing that post-speech gestures are supplements and that they cannot involve a covert counterfactual mood.

Importantly for purposes of comparison with sign language, related contrasts can be obtained on the basis of facial expressions. (76)a is an example we already discussed to highlight the presuppositional effect of facial expressions co-occurring with a predicate under the quantifier *no*. In (76)b, the same facial expression is post-posed. We believe this yields several readings, which can be paraphrased with different supplements, depending on the size of the constituent that the post-speech gesture modifies. One possible reading is that the fact that none of my friends goes skiing with his parents is assessed as negative. We believe that this reading is also available in (77)b, which will provide a convenient point of comparison for our sign language data.

(76) a. None of my friends goes :-(**[skiing with his parents]**.
=> for each of my friends, skiing with his parents wouldn't be fun
b. None of my friends goes skiing with his parents – :-(.
c. None of my friends goes skiing with his parents,
(i) which is sad [i.e. it is sad that none of my friends goes skiing with his parents];
(ii) which is unpleasant [i.e. it is generally unpleasant to go skiing with one's parents].

(77) a. No poor state :-(**[spends money]**.
=> it would be bad for poor states (and states in general?) to spend money
b. No poor state spends money – :-(.
=> it is bad that no poor state spends money, hence it would be good for poor states to spend money

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[23] Note that here and in the other b-examples one might expect a slight pragmatic oddity with *likely* due to the fact that this expression implicates that it's not established that the relevant event took place, whereas the *which*-clause presupposes its existence. But in any vent the version of the sentence with *unlikely* is far worse.

6.2   Post-sign gestures: ASL

While several of the co-sign facial expressions we explored in ASL were a bit degraded, post-sign facial expressions were quite acceptable, and displayed the same kind of interaction with logical operators as in English. Importantly, there appear to be cases of ambiguity, which can be explained by allowing for different attachment sites for the post-speech gesture, as was discussed in connection with (76) in English.

Each of the paradigms in (53)-(56) can be complemented by considering a condition in which a version of the co-speech gesture appears as a post-speech gesture instead, at the end of the sentence. We note that they usually give rise to the same inferences as a co-speech facial expression on the *entire* sentence, a point we will revisit in Section 7.

Our initial examples involving piano playing give rise to somewhat ambiguous inferences, as shown in (78)-(79). The ambiguity found in (78)a and (79)a can be explained if there an attachment ambiguity pertaining to the post-posed facial expression-qua-supplement, which can be linked to the entire sentence or just to the verb *PLAY-PIANO* (on the other hand, we cannot account for the one judgment - out of five trials - of ambiguity with (78)b).

(78)   Post-sign version of (78), with a co-sign control
        Context: John is an amateur musician. The speaker enjoys good music.

a. ^{6.6} JOHN IX-a   NEVER PLAY-PIANO - :-(_

=> John never plays the piano
=> ambiguous: speaker would be happy / disappointed if John played the piano (2/5 judgments: ambiguous; 2/5 judgments: speaker would be happy; 1/5 judgment: no inference)

b. ^{6.8} :-(_   [JOHN   IX-a   NEVER PLAY-PIANO].
=> John never plays the piano
=> speaker would be happy if John played the piano (3/5 judgments); or: ambiguous (1/5 judgment): likely: speaker would be disappointed, possibly: he would be happy (no inference on 1/5 judgment).
'John never plays the piano (badly)' (ASL, 34, 1550b,c, 5 judgments)

(79)   Post-sign version of (54), with a co-sign control
        Note: \ encodes a backwards movement of the signer
        Context: John is an amateur musician. The speaker enjoys good music.

a. ^{6.8} JOHN IX-a   NEVER PLAY-PIANO - \:-(_   .
=> John never plays the piano
=> the speaker would be happy if John played the piano (4/5 judgments; 1/5 judgment: John would also be disgusted, see Supplementary Materials)

b. ^{6.6} \ :-(_   [JOHN IX-a   NEVER PLAY-PIANO]

=> John never plays the piano
=> the speaker would be happy if John played the piano (5/5 judgments)
'John never plays the piano.' (ASL, 34, 1546b,c; 5 judgments)

For what it's worth, we believe that similar readings are available with disgusted or unhappy expressions in English sentences such as (80), although we might have an ambiguity between two readings:

(80)   a. John never plays the piano – :-(.
       => either (i) it is is gross/weird that John never plays the piano, or (ii) by the speaker's or John's judgment, playing the piano is gross/weird
       b. :-(**[John never plays the piano]**.
       => either (i) it is is gross/weird that John never plays the piano, or (ii) by the speaker's or John's judgment, playing the piano is gross/weird

      The post-sign (and co-sign control) versions of the examples in (55)-(56) give rise to clearer inferences: the post-sign facial expression is understood to apply to the entire clause, and it gives rise to the same inferences as a co-speech facial expression spanning the entire clause. Strikingly, the inferences obtained in (81) and (82) are the opposite from the ones we saw in (55)c and (56)c when only the VP *SPEND MONEY* co-occurred with a disgusted facial expression. The latter case gave rise to the inference that it is bad for porr states to spend money. By contrast, in (81)-(82) we get the inference that is bad that no poor states spend money – in other words, it would be *good* for poor states to spend money.

(81)   Post-speech version of (55), with the same co-speech control
       AMERICA [RICH STATES HELP PEOPLE]_a.
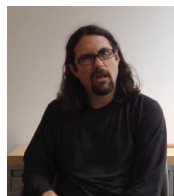
       a. [7] [POOR STATES NONE IX-arc-b SPEND MONEY]_b - :-(_   .

       => the speaker would be happy if poor (and rich) states spend money
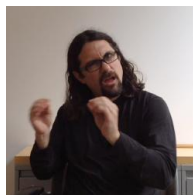
       b. [6] [POOR STATES :-(_   [NONE IX-arc-b SPEND MONEY]]_b.
       => it is good for poor (and rich) states to spend money

       'In the US, rich states help people. But no poor states spend money.' (ASL, 34, 1670b,c; 4 judgments)

(82)   Post-speech version of (56), with a post-speech control
       AMERICA [IF STATE RICH HELP PEOPLE]_a.
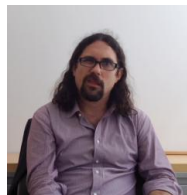
       a. [7] [IF STATE POOR NEVER SPEND MONEY]_b - :-(_   .
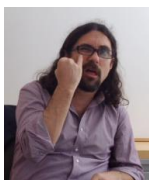   => the speaker would be happy if poor (and rich) states spent money

b. [superscript 5.7] :-([IF STATE POOR NEVER SPEND MONEY]
=> it is good for poor (and rich) states to spend money

'In the US, if a state is rich, is helps people. If a state is poor, it never spends money.' (ASL, 34, 1712b,c; 3 judgments)

6.3 Post-speech vocal gestures

For completeness, we mention that post-speech 'vocal gestures' seem to pattern with standard post-speech gestures (which are often accompanied with onomatopoeias to begin with). In particular, we believe post-speech vocal gestures are acceptable after positive operators, but not so much after negative operators.

(83) a. John encountered an obstacle – phh.
      => there was a crash
      b. It's likely that John will encounter an obstacle – phh.
      => if John encounters an obstacle, there will be a crash
      c. # It's unlikely that John will encounter an obstacle – phh.
      d. One of these ten guys encountered an obstacle – phh.
      => the guy who encountered an obstacle crashed into it
      e. #None of these ten guys encountered an obstacle – pff.
      f. John often encountered obstacles – phh.
      => when John encountered obstacles, he crashed into them
      g. #John never encountered obstacles – pff.

7 Post-speech and post-sign gestures: further issues

We explore two main analyses of post-speech and post-sign gestures. One, which had our preference in Schlenker 2016b, posits that post-speech gestures have the semantics of supplements (just like appositive relative clauses), and thus do not introduce presuppositions. An alternative, suggested by Manfred Krifka and Rob Pasternak (p.c.), extends the cosuppositional analysis to post-speech/sign gestures, but it posits that post-speech/sign gestures differ from co-speech/sign gestures in that they must recover their antecedent by an anaphoric mechanism. Before we get there, however, we should discuss an even simpler theory, according to which post-speech gestures have an at-issue semantics.[24]

7.1 An at-issue semantics?[25]

If post-posed gestures had an at-issue semantics, they should presumably be able to take scope under operators. The deviance of the negative version of the c-examples in (70)-(74) already suggests that under the negative quantifier *No NP* this is difficult. But one could argue that the post-speech gesture is in this case attached 'too high' to be in the scope of the quantifier, possibly because it can only be conjoined with full-fledged clauses. This, however, would fail to account for the cases of embedding under *unlikely*. Similarly, to the extent that (84)a is interpretable, it seems to us that its differs sharply from the controls with at-issue modifiers in (84)b-c: the latter are interpreted in the scope of *deny*, but the post-speech gesture *SLAP* isn't.

(84) a. ?? I deny that John punished his son – SLAP.
      b. I deny that John punished his son (and [that he] did so) like SLAP this.
      c. I deny that John punished his son (and [that he] did so) by slapping him.

Similar remarks hold for (85)a: to the extent that it is acceptable, it seems to us that it does not raise the question but rather assumes that punishment would involve slapping – unlike the at-issue controls in (85)b-c.

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[24] Thanks to Cornelia Ebert (p.c.) for discussion of this point.
[25] This section borrows from Section 4.2.2. of Schlenker 2016b.

(85) a.?(?) Do you think that John punished his son – SLAP?
    b. Do you think that John punished his son (and [that he] did so) like SLAP this?
    c. Do you think that John punished his son (and [that he] did so) by slapping him?

An at-issue semantics for post-speech gestures would need to posit that they somehow cannot take scope under operators. This could be done by positing that they are connected to their antecedent by an anaphoric device that strongly favors matrix resolution; why this should be so is currently unclear (the import of such an anaphoric mechanism is revisited in the cosuppositional theory of post-speech gestures, which we discuss below). In addition, it is not clear that this 'matrix only' requirement would account for the data in (86): it seems to us that a post-speech gesture in the antecedent of a conditional, as in (86)a, yields the same kinds of inferences as an appositive or parenthetical attached to the antecedent, as in (86)c,d (which differ from an at-issue modifier, as in (86)b). By contrast, a post-speech gesture following the entire sentence, as in (86)e, does not yield a very coherent reading – or possibly one on which the speaker's scream would be accompanied by a slapping. But if matrix attachment is the only possibility there is for post-speech gestures, it is hard to see how the contrast between (86)a and (86)e could be derived.

(86) a. If John punishes his son – SLAP, I might scream.
    => if John punishes his son, slapping will be involved
    b. If John punishes his son by slapping him, I might scream.
    ≠> if John punishes his son, slapping will be involved
    c. If John punishes his son, which will/would involve some slapping, I might scream.
    => if John punishes his son, slapping will be involved
    d. If John punishes his son (this would involve some slapping), I might scream.
    => if John punishes his son, slapping will be involved
    e. <??> If John punishes his son, I might scream – SLAP.

It is striking that the post-speech gestures in (70)-(74) have the same distribution as appositive relative clauses in the indicative mood. This led Schlenker 2015, 2016b to propose that post-speech gestures are supplements and thus display the same type of behavior as appositive relative clauses.

Still, it should be noted that full parentheticals also display a non-at-issue behavior, and hence a variant of this theory could treat post-speech gestures as parentheticals. For instance, (70)b, repeated as (87)b, displays the same behavior as (87)a, which involves a clausal parenthetical in lieu of an appositive relative clause. The point generalizes across examples and thus at this point it cannot be excluded that post-speech gestures are parentheticals.

(87) a. Some/#No philosopher brought a bottle of beer (it was LARGE **this** large).
    b. Some/#No philosopher brought a bottle of beer, which (by the way) was LARGE **this** large.
    (Schlenker 2015e)

7.2   A cosuppositional analysis (Krifka, Pasternak, p.c.)?[26]

An alternative was suggested by Manfred Krifka (p.c.), and independently by Rob Pasternak (p.c.). Krifka's proposal is that post-speech gestures have a cosuppositional semantics, but come with an anaphoric element that must be resolved – hence the deviance of the negative version of the c-examples in (70)-(74). This approach could immediately account for the similarity between the behavior ASL (and English) post-speech/sign facial expressions and facial expressions that span an entire sentence: on the proposed analysis, the two cases are entirely similar, but the post-speech/sign version does by way of anaphora what the co-speech/sign version does by way of simultaneous production.

Without fully implementing the proposal, it could be made concrete along the lines of (88):

(88) Cosuppositional analysis of post-speech gestures and facial expressions (informal statement)
    a. A post-speech gesture or facial expression G takes a null anaphoric expression, hence has the form:
    $G\ pro_i$
    b. It yields a semantic failure unless, relative to the local context of $G\ pro_i$, pro_i entails the (bivalent) content of G ('generalized entailment' must be used if these expressions

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[26] This section borrows from Section 4.2.2. of Schlenker 2016b.

c. If it does not yield a failure as in b., *G pro$_i$* makes a trivial (tautologous) contribution: it has a purely cosuppositional meaning.

As an example, consider again the example in (52)c, repeated in (89).

(89)   None of my friends goes skiing with his parents – :-(.

There are at least two conceivable ways to resolve the anaphoric element *pro$_i$* introduced by the post-speech gesture.

• If *pro$_i$* has is a proposition-denoting pronoun, it is natural to take it to be coindexed with the entire proposition that *none of my friends goes skiing with his parents.* This should yield a cosupposition to the effect that this fact is disgusting – hence it would be good for my friends to go skiing with their parents.

• If *pro$_i$* is a property-denoting pronoun, it is natural to take it to corefer with the property of going skiing with one's parents. There is a technical issue involved at this point: one must determine (i) what the local context of the post-speech gesture is, and (ii) what it means for the property of going skiing with one's parents to entail disgust. Without fully deciding these questions, it is plausible that the local context of the post-speech gesture is the initial context updated with the propositional content of the main sentence. As a result, the predicted inference should be that skiing with one's parents in general should be disgusting (an alternative would be that it is only the case for each of my friends x, x's skiing with x's parents is disgusting; it' isn't quite clear how this could be derived).

To the extent that (89) is ambiguous, the cosuppositional analysis of post-speech gestures could be maintained. But it encounters difficulties in several cases. In a nutshell, the problem is that post-speech gestures have a more restricted distribution than one might expect on a cosuppositional analysis.

(i) Our initial argument against Ebert and Ebert's (2014) supplement-based analysis of co-speech gestures was that these are less constrained that appositive relative clauses. But as we saw in (70)-(74) post-speech gestures are constrained in exactly this way. The cosuppositional analysis of post-speech gestures would have to posit that the antecedent of the covert pronoun is constrained to be propositional in nature. However this measure won't be enough for examples (71) and (73) above, where a full clause is embedded under *it is unlikely/it is likely that*, but can apparently not be targeted by the post-speech gesture. So one would need to posit there is a general preference for resolving the null pronoun to a matrix proposition, [27] but this would raise the same issues for the paradigm in (86) as was the case for the at-issue analysis with resolution to the matrix proposition. We leave such explorations for future research.

(ii) In order to compare this cosuppositional analysis of post-speech gestures with the supplemental analysis, we would need to be more precise about the semantics and pragmatics of supplements. Some analysts take them, following Potts 2005, to be radically different from presupposition triggers in that supplements fail to interact scopally with logical operators. By contrast, Schlenker 2010c, 2013 takes supplements to give rise to *bona fide* projection phenomena reminiscent of presuppositions, but with one important proviso: syntactically, appositive relative clauses tend to attach high, with the result that it is only in the rare cases in which they are in the scope of logical operators that supplement projection can be observed. Due to this potential similarity between supplement projection and presupposition projection, more research would be needed to compare the cosuppositional and the supplemental analysis of post-speech gestures.

(iii) There are important epistemic differences between presuppositions and supplements: the former can and usually are trivial, the latter should make a non-trivial contribution, as shown by (90).

(90)   Lance Armstrong survived cancer. #When reporters interview Lance, <u>who survived cancer,</u> he often talks about the disease.   (after Potts 2005)

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[27] One possible way to develop theory (possibly along M. Krifka's lines) would be to take the pronoun *pro$_i$* in (88) to be a definite description of events, one that triggers an existence presupposition that the relevant exists. (I believe this point was made by seminar participants at NYU in Fall 2016.)

A key question is whether the anti-triviality requirements are different for co-speech and post-speech gestures. Relevant data are discussed in Schlenker 2016b, but they are not clear.
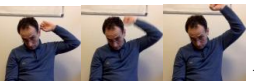
7.3 Intermediate conclusion

At this point, the supplemental (or parenthetical) analysis can explain a lot of the behavior of post-speech gestures. At-issue and co-suppositional analyses have difficulties accounting for the deviance of post-speech gestures in some contexts. They may posit that that the antecedent of the post-speech gesture must be a matrix proposition, but this raises an explanatory question (why should this be the case?), and might run into difficulties with come conditional examples in which the antecedent rather than the matrix clause seems to serve as an antecedent.

8   Pro-speech gestures

In some cases (Slama-Cazacu 1976, Clark 1996), a gesture can *replace* rather than enrich a word. We call such expressions 'pro-speech gestures' (with *pro* meaning: 'replacing', as in *pronoun* and *proconsul),* and we argue that they should play a systematic role in gesture studies, for three reasons: (i) they enrich the typology of iconic inferences ; (ii) they provide a way to create words 'on the fly', and thus to test how some inferences, notably presuppositions, are generated in the first place; (iii) in some limited cases, they make it possible to replicate within spoken language some properties of sign language (see Schlenker 2016e).

8.1   Pro-speech gestures can be at-issue

Unlike co-speech gestures, pro-speech predicates make an at-issue contribution. Thus as noted in Schlenker 2016d, (93)a contrasts with (93)b, which triggers a universal conditional presupposition (of the form: 'if punished, then hanged'). As is the case for post-speech gestures, acceptability seems increased when an onomatopoeia is produced concurrently with the gestural predicate, and thus makes the iconic representation more complete. In addition, in the case of pro-speech gestures this might help justify the absence of a spoken word. We can complete the paradigm by noting that, as expected, the post-speech version of the gesture yields deviance in this context, as shown in (93)c.

(93)   a. None of these ten traitors was HANG_.
        =>none of these ten tratits was hanged

       b. None of these ten traitors was HANG_ **punished**.
       =>none of these ten traitors was punished, and for each, punishment would have meant hanging

       c. #None of these ten traitors was punished – HANG_.

        There are ill-understood constraints on the syntax of pro-speech gestures. Our impression is that they are happiest at the end of a clause, and thus with transitive constructions it is helpful to move the object to a pre-verbal position. This makes it possible to extend the paradigm in (93) to cases involving *SLAP*. In unembedded cases, as in (94)b, we obtain inferences that are close but not identical to those we would obtain with co-speech and post-speech gestures – for the simple reason that the latter trigger an inference about the relation between the content of an overt predicate (e.g. *punish*) and the content of the gesture, whereas pro-speech gesture have no overt predicate to modify. In quantified examples, we regain the contrast we just observed with *HANG*: under the time quantifier *never*, *SLAP* has an at-issue contribution in (95)b, a cosuppositional contribution in (95)b, and it is deviant in (95)c.

(94)   a. Your brother, I am going to SLAP_ **punish**.
        => I will punish your brother by slapping him (hence: slapping will be a punishment)

b. Your brother, I am going to SLAP_.
=> I will slap your brother (no inference that this is a punishment)

c. Your brother, I am going to punish - SLAP_.
=> I will punish your brother by slapping him (hence: slapping will be a punishment)

(95) a. Your brother, I will never SLAP_ punish.
=> if I punished your brother, this would involve some slapping

b. Your brother, I will never SLAP_.
=> I will never slap

c. #Your brother, I will never punish - SLAP_.

8.2 *Pro-speech gestures need not be associated with covert spoken words*

Since speech normally involves spoken words rather than gestures, one might think that in the examples under investigation a covert word accompanies the pro-speech gesture. Two reductionistic theories suggest themselves: according to one, the pro-speech gesture is in fact a *co*-speech gesture that accompanies a covert word; according to the other, the pro-speech gesture is a code for a spoken word. Neither is convincing, as we will now see.

First, are gestural predicates just co-speech gestures modifying covert words? As noted in Schlenker 2016d, this is unlikely to be the case, because the covert word would have to be as specific as the gesture, which in some cases is implausible due to the rich iconic contribution made by the gesture.

We start by noting that that unless the covert word in (93)b is ~~hanged~~ rather than ~~punished,~~ we won't explain why the gestural contribution is at-issue in (93)b but presuppositional in (93)a. With a covert ~~hanged~~, the desired at-issue meaning is predicted, since ~~hanged~~ will produce the appropriate at-issue contribution, and the cosupposition triggered by the gesture will be vacuously satisfied. To obtain the right inferences, then, the covert word has to be as specific as the gesture.

Another argument yields the same conclusion. As noted in Schlenker 2015, co-speech gestures can be disregarded under ellipsis and in the focus dimension under *only*,[28] as is illustrated in (96).

(96) I had two guys standing in front of me, one of them very short and the other one very tall.

a. The tall one allowed me to remove **[his glasses]**, but the short one didn't.

b. The tall one allowed me to remove **[his glasses]**, but the short one didn't allow me to remove

#**[his glasses]**/ok **[his glasses]**)

c. Only the tall one allowed me to remove **[his glasses]**.

---

[28] In this respect, co-speech gestures resemble height specifications of sign language loci, as studied by Schlenker et al. 2013 and Schlenker 2014b.

But pro-speech gestures cannot be ignored under ellipsis resolution: in (97)a, the elided VP is preferably understood as *hanged,* hence the need for a specific covert word: ~~hanged~~ but not ~~punished~~; this case contrasts with that of the co-speech gesture in (97)b, which can be disregarded under ellipsis.

(97)

    a. A traitor should be HANG_   . A whisteblower shouldn't be.
Preferred interpretation: whistleblowers shouldn't be hanged

    b. A traitor should be HANG_   **punished**. A whisteblower shouldn't be.
Preferred interpretation: whistleblowers shouldn't be punished

       The conclusion at this point is that *if* pro-speech gestures are analyzed as co-speech gestures that modify a covert expression, the latter must be as specific as the content of the gesture. However positing such specific covert words lacks plausibility in the general case because pro-speech gestures have iconic specifications that normal words usually don't. Thus the gestural predicate (98)a has an iconic ('rotating') contribution, but it is not clear which simple expression would have exactly the same one. Certainly 'take off' doesn't, as is suggested by the ellipsis facts in (98): in (98)a the co-speech gesture can be ignored in the course of ellipsis resolution, as expected – and thus the elided clause involving a plane is acceptable. Not so in (98)b, presumably because there is no covert *take off* that could be recovered by the elided clause (to the exclusion of the iconic gesture).

(98) a. This helicopter will soon   **[take off]**, and this plane will too.

     b. #This helicopter will soon   , and this plane will too.

       Now one could posit a more complex expression than ~~take off~~ to play the role of a covert VP. But in the general cases, this is not plausible because the gesture might be just too specific, so that the covert VPs would have to become implausibly complicated. Thus in (99), the gesture makes clear that the first two pies should be cut in a specific way (probably in 9 parts); a *very* convoluted expression would be needed to approximate this content.

(99) The first pie should be   , the second one should be as well, but the third one shouldn't be.

       Turning to the second (code-based) theory that could come to mind, the considerations adduced in (98) and (99) also make it implausible that pro-speech gestures function as codes for spoken expressions. In these examples, it is very unclear what expressions the gestures would be codes for.

8.3   *Pro-speech gestures can trigger presuppositions (just like normal words)*

While pro-speech gestures must have an at-issue component, nothing prevents them from also having a presuppositional contribution, just like normal words (Schlenker 2016d). In simple cases, their presuppositional contribution seems rather similar to that of words with a comparable bivalent content as in (100)-(102). By 'bivalent content', we mean the (so-called 'classical') truth conditions obtained by lumping together presupposition failure and falsity. For instance, the bivalent content of *John stopped smoking* is equivalent to: *John used to smoke and doesn't now smoke,* and similarly the bivalent content of *This helicopter took off* is equivalent to *this helicopter was on the ground and took off.*)

(100) a. In two minutes, our Chair might DOZE-OFF_ .
=>our Chair is currently awake

b. Within a few minutes, the helicopter we took yesterday might TAKE-OF_
=>the helicopter we took yesterday is currently on the ground

(101) a. If in two minutes our Chair were to DOZE-OFF, everybody would notice.
=>our Chair is currently awake
b. If in a few minutes the helicopter we took yesterday were to TAKE-OFF, I'd be surprised.
=>the helicopter we took yesterday is currently on the ground

(102) a. None of our ten subjects will DOZE-OFF.
=>each of our ten subjects is awake
b. None of your five helicopters will TAKE-OFF
=>each of your five helicopters is on the ground

As with presuppositions, the relevant inferences fail to project if they are locally justified:

(103) a. If our Chair is awake, I am sure he'll soon DOZE-OFF.
≠>our Chair is currently awake
b. If our Chair is awake, I am sure he'll soon fall asleep
≠>our Chair is currently awake

Since it is unlikely that the presuppositions are triggered by covert spoken words, for reasons mentioned above, there are two main possibilities to explain how they are triggered – although a detailed investigation is beyond the scope of this study.
(i) One possibility is that the presupposition might be triggered by the iconic semantics of the gesture –possibly because its starting point corresponds to a presupposed state.[29] But in (104), there is no discernible inference corresponding to the initial state of the *SMOKE-WEED* gesture. Thus this theory would require a distinction among different kinds of gestural boundaries, possibly along the lines of Wilbur 2003, 2008, Strickland et al. 2015.

(104) None of the ten guys will ever SMOKE-WEED_ .

(ii) An alternative (and possibly complementary) possibility is that some presuppositions are not triggered lexically, but are produced by a general 'triggering algorithm' that takes as input the bivalent content of atomic elements, be they words or gestures (Stalnaker 1974, Simons 2003, Abusch 2009, Schlenker 2010, Abrusan 2011). It would then be unsurprising that two atomic expressions with the same bivalent content give rise to the same presuppositions.
The formal study of pro-speech gestures is just in its infancy. For present purposes, it completes out typology by providing gestures that are not syntactically eliminable and seem, possibly for that reason, to come with an at-issue contribution.[30]

8.4 *Pro-speech vocal gestures*

Unsurprisingly, pro-speech vocal gestures appear to have an at-issue component, as illustrated in (105) with an explosion-like onomatopoeia.

(105) a. Yesterday, as I was driving, suddenly my engine prr.
b. Hopefully this new engine will never prr.

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[29] In fact, *TAKE-OFF* in (100)b triggers another shape-related presupposition, namely that the subject denotes a helicopter: if *helicopters* is replaced with *aircraft* in (102)b, we get an inference that each of the aircraft is a helicopter.
[30] See Schlenker 2016e for an attempt to use pro-speech gestures to within English some properties of sign language object agreement verbs.

c. Be careful – your engine might prr.
d. Don't worry – it's unlikely that your engine will prr.

We leave a study of vocal pro-speech gestures for future research.

9   Typology and Theoretical Consequences

9.1   Typology

We can now revisit the typology we announced in (11), highlighting this time the role of the hypothesis stated in (12) by organizing the table according to the two parameters we introduced: ±internal enrichment, ±separate time slot. As announced in (12), and repeated in (106), we believe there are two main constraints on this typology.

(106) **Proposed generalization**
a. ±internal
External enrichments (-internal) are not at-issue: because they are external, it should be possible to disregard them without affecting the main, at-issue content of the clause they appear in. By contrast, internal enrichments (+internal) can make any semantic contribution – just like standard words.
b. ±separate time slot
Enrichments that have a separate time slot (+separate time slot) cannot be trivial (= presupposed): because they have their own time slot, they must make a non-trivial contribution to the sentence.

Both parts raise difficulties that are further discussed in Section 9.2.2. For the moment, let us see how they explain parts of the table in (107).

(107) **Typology**	**External enrichments (= syntactically eliminable)** => not at-issue		**Internal enrichments (= syntactically ineliminable)**	
	Cosuppositions		**Anything goes: at-issue, etc.**	
	Speech	**Sign**	**Speech**	**Sign**
No separate time slot	Co-speech gestures and facial expressions John [img] **punished** his son.	Co-speech facial expressions IX-arc-b NEVER [img] [SPEND MONEY].	Iconic vocal modulations The talk was loooong.	Iconic modulations of signs POSS-1 GROUP GROW_[img].
	Supplements		**Usually have an at-issue component**	
	Speech	**Sign**	**Speech**	**Sign**
Separate time slot => not presuppositional	Post-speech gestures and facial expressions John punished his son – [img].	Post-speech facial expressions IX-arc-b NEVER SPEND MONEY]_b – [img].	Pro-speech gestures Your brother, I am going to [img].	[currently unclear]

• The main observation is that the column called 'external enrichments' does not include at-issue meaning contributions, as is expected on the basis of (106)a: external enrichments that don't have their own time slot are cosuppositional, external enrichments that do have their own time slot have the status of supplements. (As noted in Section 5.3, some co-sign manual gestures either refute this generalization or are viewed as internal rather than external enrichments.)
• Within that the column 'external enrichment', we can also predict on the basis of (106)b that post-speech gestures and facial expressions should not be presuppositional or cosuppositional. This constraint is indeed satisfied if our main theory is correct (it would not be satisfied if we took post-speech gestures and facial expressions to make a cosuppositional contribution, on the other hand).
• The column called 'internal enrichments' isn't much constrained by the generalization in (106), except for the part corresponding to pro-speech gestures: since these come with their own time slot,

they shouldn't be entirely presuppositional. But since they replace full words and these rarely have a purely presuppositional contribution[31], this is not a particularly surprising result.

9.2 Theoretical consequences

9.2.1 Consequences for pragmatics

In the extant literature, at-issue meanings, presuppositions and supplements are normally triggered by different expressions. Iconic enrichments are rather remarkable in that one and the same gesture – for instance *SLAP*, discussed at some length above – triggers a presupposition (more specifically: a cosupposition) if it co-occurs with an expression; it triggers a supplement if it follows it; and it makes (at least) an at-issue contribution if it fully replaces a word.

　　While these facts could be handled within a lexicalist account in which each construction (co-speech, post-speech, pro-speech) comes with a different interpretive rule, this might well miss a generalization, specifically the one we stated in (106): across modalities, enrichments that are external to an expression do not initially make an at-issue contribution (although further mechanisms, such as local accommodation, may eventually yield an at-issue contribution); and enrichments that come with their own time slot are not presuppositional. This could argue for a pragmatic analysis in which, in some cases at least, one and the same expression (such as *SLAP*) contributes at-issue, presuppositional or supplemental information depending on considerations of form (possibly following from maxims of manner).

　　We already discussed in Section 5.1 two possible ways of deriving the fact that co-speech gestures trigger cosuppositions. But it remains to explain how the supplemental contribution of post-speech gestures could be connected to their cosuppositional contribution as co-speech gestures. For theories such as Potts 2005, which take supplements to be an entirely separate class of meanings, this might require positing a covert lexical element to derive the desired meaning. This need not be a serious theoretical problem, since Potts 2005 already assumed that the 'comma intonation' was endowed with a lexical meaning that was crucial to the derivation of the meaning of appositive constructions. It would make excellent sense to posit, within this framework, that post-speech gestures also come with this comma intonation. Alternatively, one might take supplements and presuppositions to form a natural class, as argued in Schlenker 2010, 2013a. On this view, supplements differ from presuppositions in that they should not be trivial in their local context. But they resemble presuppositions in that they give rise to the same kind of projection phenomena, at least when they are attached in the scope of logical operators (a syntactic part of the theory argues that appositives can be attached to any propositional node that dominates their surface position).[32]

9.2.2 Consequences for the comparison between spoken and sign language

The generalization we developed in (106) does not make specific reference to spoken or to sign language, but it makes use of categories that cut across modalities, namely whether an enrichment is internal or external; and whether it has a separate time slot. If this analysis is on the right track, there is no need for semantic or pragmatic stipulations tailored to one modality or to the other (although as noted in Section 5.3 there remains much work to be done on manual gestures in ASL).

　　But from this it does not follow that iconic enrichments behave in the same way across the two modalities. We noted that external enrichments do not normally make at-issue contributions. But since the iconic possibilities of the vocal medium are quite limited, most iconic enrichments in spoken language are effected by way of external enrichments, and hence they are not at-issue. As a consequence, *the expressive possibilities of sign an spoken language should in the end be quite different*. This will not come as a surprise to signers, who are often keenly aware of the fact that iconic enrichments play a greater role in sign than in spoken language.

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[31] Exceptions include the presuppositional particles *too* and *again*.

[32] The proposal in Schlenker 2013a was that supplements should be non-trivial in their local context, but they should be 'easy' to accommodate, in the sense that the global context C could 'easily' be turned into a strengthened context C^+ relative to which a supplement becomes locally trivial.

Finally, the under-studied category of pro-speech gestures should be useful in future comparisons of sign and spoken language, since they resemble iconic modulations in being able to make at-issue contributions. But it should be kept in mind that they also differ from iconic modulations in being pure gestures, rather than modified words as in the case of sign language constructions we studied.

10 Conclusions

Our typology of iconic enrichments was stated in a modality-free fashion, by way of two main categories: the internal or external nature of the enrichments; their appearance with a separate time slot or not.

While these categories should be refined (notably that of internal vs. external enrichment), our main generalization has consequences for the comparison between the expressive possibilities afforded by spoken and by sign language. Many iconic enrichments in sign language are realized by way of iconic modulations. These exist in spoken language as well (as was made clear by the example of *loooong*), but due to the representational limitations of the vocal stream, they are by force limited in nature. Co-speech gestures and post-speech gestures, by contrast, have rich representational possibilities, but if our generalizations are on the right track, they are not initially at-issue (although general mechanisms that turn presuppositions into at-issue contributions can make their effects felt, as discussed in much greater detail in Esipova 2016a,b). By contrast, pro-speech gestures make at-issue contributions (as well as additional contributions, as we saw in the case of presupposition-inducing pro-speech gestures). But they differ from iconic modulations in sign language in not being based on words. Thus there should in the end be significant expressive differences between spoken and sign language when iconicity is properly taken into account.

This study also raises questions for formal pragmatics. Popular accounts of presuppositions and supplements are currently based on lexical stipulations. Since these are relatively unconstrained, they can in principle be extended to account for our data as well. But this might be missing two generalizations, to the effect that (i) external enrichments are not (initially) at-issue, and (ii) enrichments that have their own time slot are not presuppositional. One could hope that such generalizations could be derived in future pragmatic research (we outlined above some possible research directions, particularly in connection to co-speech gestures and cosuppositions).

Finally, we leave one important questions for future research. Focus can notoriously affect the meaning contribution of an expression. We briefly discussed this in connection with local accommodation of presuppositions, which in some cases seems to be facilitated by focus (Simons et al., to appear, Esipova 2016a,b). In addition, in 'out of the blue' contexts, focus on an expression can yield the impression that the meaning component which is given (not focused) is presupposed. Much research has argued that these 'givenness' effects are in fact different from presuppositions (e.g. Büring 2012). But we would need to study more controlled paradigms in order to rigorously isolate the potential contribution of focus. In particular, future studies might get some mileage from the observation that enrichments that come with a separate time slot are easily interpreted as focused, whereas this is probably more difficult for expressions that do not have a separate time slot.

Appendix. Example of a formal treatment of an iconic enrichment

Several examples of formal treatments of iconic enrichments were given in Schlenker et al. 2013 and Schlenker, to appear d. Consider the case of the iconic modulations of *GROW* discussed above, writing as *GROW^i* a particularly instance of *GROW*, realized with an iconic modulation (hence the superscript *i*). To handle this case, we assume the context of utterance c makes available a relation of similarity between some signs and their denotations, as is illustrated in (108). In (108)a, *GROW* appears without a superscript and thus gets its normal interpretation, taking as argument *MY GROUP*, which we take to denote a certain group g. In (108)b, *GROW^i* is iconic modulation of *GROW*, and as a consequence its normal interpretation is enriched with an iconic requirement to the effect that the amount and speed of the growth correspond to those represented by the sign. The key to that enrichment is a condition $sim_{c,w}(grow', GROW^i, g)$ which requires that in the situation of evaluation w, a similarity relation given by the context c should hold between the property of growing as applied to g and the iconically interpreted sign *GROW^i*.

(108) Let c be a context, s an assignment function, and w a situation, and assume that $[\![\text{MY GROUP}]\!]^{c, s, w} = g(w)$.
We assume that the normal and the iconic meaning of *GROW* are total functions.
a. Normal meaning
$[\![\text{[MY GROUP] GROW}]\!]^{c, s, w} = [\lambda x_e. \text{grow}'_w(x)](g(w)) = \text{grow}'_w(g(w))$

b. Iconic meaning
$[\![\text{[MY GROUP] GROW}^i]\!]^{c, s, w} = [\lambda x_e. 1$ iff $[\![\text{GROW}]\!]^{c, s, w}(x) = 1$ and $sim_{c,w}([\![\text{GROW}]\!]^{c, s}, \text{GROW}^i, [\![\text{MY GROUP}]\!]^{c, s}) = 1; 0$ otherwise$](g(w)))$
$= 1$ iff $\text{grow}'_w(g(w)) = 1$ and $sim_{c,w}(\text{grow}', \text{GROW}^i, g) = 1 ; 0$ otherwise

It remains to explain what it means for the function *grow'* to be similar to the token *GROW^i*. We can think of $sim_{c,w}(grow', GROW^i, g)$ as meaning that the property of growing applied to object g(w) in situation w is similar to the token *GROW^i* along dimensions that are specified by the context c.[33] A possible example of a specification is given in (109); it implements the requirement that if something grows in the situation of evaluation, it grows by an amount and at a speed that are compatible with the iconic specifications of the verb. (Combined with the assertion that something grows in the situation of evaluation, this will yield the (at-issue) meaning that something grows by an amount and at a speed determined by the iconic specifications of the verb, as is desired.)

(109) We assume that the context of utterance c makes salient an 'amount' function am_c and a 'speed' function sp_c, used as follows:
a. For every situation w, iconic index i, and individual concept g (of type <s, e>),
$sim_{c,w}(\text{grow}', \text{GROW}^i, g) = 1$ iff if $\text{grow}'_w(g(w)) = 1$, then **in w g(w) grows by amount $am_c(\text{GROW}^i)$ and at speed $sp_c(\text{GROW}^i)$**; $= 0$ otherwise.
b. Preservation requirements on the functions a_c and s_c
(i) If the endpoints of *GROW^k* are more distant than the endpoints of *GROW^i*, $am_c(\text{GROW}^k) > am_c(\text{GROW}^i)$.
(ii) If the speed of *GROW^k* is greater than the speed of *GROW^i*, $sp_c(\text{GROW}^k) > sp_c(\text{GROW}^i)$.

We can simplify the truth conditions in (108)b by replacing $sim_{c,w}(grow', GROW^i, g)$ with the boldfaced condition in (109):

(110) $[\![\text{[MY GROUP] GROW}^i]\!]^{c, s, w} = 1$ iff $\text{grow}'_w(g(w)) = 1$ and $sim_{c,w}(\text{grow}', \text{GROW}^i, g) = 1 ; 0$ otherwise
$= 1$ iff $\text{grow}'_w(g(w)) = 1$ and in w g(w) grows by amount $am_c(\text{GROW}^i)$ and at speed $sp_c(\text{GROW}^i)$; 0 otherwise

The final effect is to ensure that the particular realization of the sign *GROW* provides information about the amount and speed of the growth – as is desired.

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[33] It is for technical reasons having to do with the particular framework used in Schlenker to appear d that the similarity function makes reference not just to the form and to the denotation of *GROW*, but also to its argument.

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