

# Iconic Presuppositions\*

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First draft, July 17, 2018

**Abstract.** Why are some linguistic inferences treated as presuppositions? This is the 'Triggering Problem', which we attack from a new angle: we investigate highly iconic constructions in gestures (speech-replacing gestures or 'pro-speech gestures') and in signs (classifier predicates in ASL) and show that some regularly trigger presuppositions. These iconic constructions can be created and understood 'on the fly', with two advantages over lexical words: they suggest the existence of a productive 'triggering algorithm', since presuppositions can arguably be generated with no prior exposure to the iconic construction; and they make it possible to minimally modify the target constructions to determine which do and which don't generate presuppositions. Our investigation does not just target standard presuppositions, but also 'cosuppositions', initially defined as conditionalized presuppositions triggered by co-speech gestures. We show that pro-speech gestures and classifier predicates alike can trigger cosuppositions, which are thus an inferential class that goes beyond the confines of co-speech gestures (Aristodemo 2017). Our data argue for a triggering algorithm that generates presuppositions and cosuppositions as special cases (at least in iconic constructions); some, but not all, of our data can be explained by earlier triggering algorithms proposed by Abusch 2010, Simons et al. 2010, and Abrusán 2011, and we speculate on some possible improvements.

Keywords: semantics, pragmatics, iconicity, presuppositions, cosuppositions, gestures, co-speech gestures, pro-speech gestures, gestural inferences, presupposition

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\* Special thanks to Emmanuel Chemla and Lyn Tieu for detailed discussions of every aspect of this piece, and for their considerable patience in discussing examples. Brian Buccola and Rob Pasternak were also very generous in providing numerous acceptability and inferential judgments. Salvador Mascarenhas helped with several examples as well. In addition, I benefited from the suggestions of colleagues at the UCL Workshop on Sign, Gesture and Language (January 31, 2018). I also wish to thank the researchers who, over the years, urged me to compare iconic effect in sign language to iconic gestures (this includes Adam Schembri, Diane Lillo-Martin, Kathryn Davidson, Benjamin Spector and Cornelia Ebert); special thanks as well to Masha Esipova, who made helpful comments on several aspects of this research.

**ASL consultant for this article: Jonathan Lamberton.** Special thanks to Jonathan Lamberton, who provided exceptionally fine-grained data throughout this research; his contribution as a consultant was considerable. I am particularly grateful to him for authorizing me to provide lightly anonymized videos of some crucial examples.

**Grant acknowledgments:** The research leading to these results received funding from the European Research Council under the European Union's Seventh Framework Programme (FP/2007-2013) / ERC Grant Agreement N°324115–FRONTSEM (PI: Schlenker). Research was conducted at Institut d'Etudes Cognitives, Ecole Normale Supérieure - PSL Research University. Institut d'Etudes Cognitives is supported by grants ANR-10-LABX-0087 IEC et ANR-10-IDEX-0001-02 PSL\*.

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# 1 Introduction

## 1.1 Goals

### 1.1.1 Presuppositions and the Triggering Problem

Presuppositional inferences are characterized by their interaction with logical operators, giving rise to specific patterns of 'projection' illustrated in (1). The inference obtained in (1)a just shows that *John knows that he is incompetent* conveys the information that John is in fact incompetent. What makes this inference a presupposition is the fact that, unlike standard entailments, it is preserved in questions, under negation, *if*, and *might*; and that under *none*-type quantifiers, it gives rise to a universal presupposition that each of the relevant individuals is incompetent (see for instance Chemla 2009 for experimental data; Beaver 2001 argued instead for weaker patterns of existential projection in this case).

- (1)
- a. John knows that he is incompetent.  
=> John is incompetent
  - b. Does John know that he is incompetent?  
=> John is incompetent
  - c. John doesn't know that he is incompetent.  
=> John is incompetent
  - d. If John knows that he is incompetent, he'll get depressed.  
=> John is incompetent
  - e. John might know that he is incompetent.  
=> John is incompetent
  - f. None of these ten students knows that he is incompetent.  
=> each of these ten students is incompetent

Most research of the last 50 years has sought to explain and predict how the presuppositions of elementary expressions (which may be stipulated) are inherited by complex sentences; this is the 'Projection Problem'. But why do some linguistic inferences triggered by elementary expressions get treated as presuppositions to begin with? This is the 'Triggering Problem': given some information that a linguistic expression conveys about the world, predict which part is at-issue and which part is presupposed. Within accounts that take presuppositions to trigger a semantic failure, captured by a third truth value # (besides 'true' and 'false'), the problem is to take as input information about the situations in which an expression is true vs. non-true, and to predict which of the 'non-true' situations yield failure, i.e. the third truth value #, as is illustrated in (2). An explicit rule that achieves this result is sometimes called a 'triggering algorithm'.

- (2) Triggering algorithm: input-output relation



While the Triggering Problem has been discussed - sometimes very insightfully - for a long time (Grice 1981, Stalnaker 1974, Abbott 2000, Simons 2003), recent proposals to address it are of three main types (see Abrusán 2011 for a critical discussion). One class of proposals takes (some) presuppositional expressions evoke some alternatives, just like scalar expressions do (Abusch 2002, 2010, Chemla 2010, Schlenker 2010, Romoli 2015); some mechanisms take these presuppositions to be just like implicatures (Romoli 2015), others take them to deal with alternatives in a special way (Chemla 2010, Schlenker 2010), and still others start from pragmatic constraints on focus alternatives (Abusch 2002, 2010).

A second line of research, discussed in Simons et al. 2010 and Tonhauser et al. 2013, among others, starts from the notion of a 'Question Under Discussion'. An entailment of a sentence addresses the Question Under Discussion in case it entails (relative to the context) a complete or partial answer to that question. The main idea is that entailments of a sentence that do not address the Question Under Discussion may end up being presupposed.

A third line, due to Abrusán 2011, focuses specifically on presuppositions triggered by verbal constructions, and takes those entailments of a sentence that are not about the main event to end up being presupposed.

### 1.1.2 Iconic presuppositions

In this piece, we propose to attack the Triggering Problem from a new angle: we investigate highly iconic constructions in gestures (speech-replacing gestures, henceforth 'pro-speech gestures') and in signs (classifier predicates in ASL [American Sign Language]) and show that some regularly trigger presuppositions. These iconic constructions can arguably be created and understood 'on the fly', with two advantages over lexical words.

The first advantage of iconic constructions is that they argue for the *existence* of a productive triggering algorithm, since presuppositions can be generated with no prior exposure to the iconic construction. It is unsurprising that general principles of iconicity (as in Greenberg 2013) make it possible to understand the informational content of iconic representations one has never seen before. What *is* surprising, on the other hand, is that one can somehow divide 'on the fly' the resulting informational content into an at-issue and a presuppositional component. In effect, iconic constructions make it possible to create new 'words' that one has never seen before, but whose informational content is immediately clear (thanks to iconicity); this makes it possible to assess how presuppositions are productively generated out of new informational contents.

The second advantage of iconic constructions over lexical words is that they make it possible to minimally modify the target constructions to determine which do and which do not generate presuppositions. In the long term, this should help discover the precise *form* of the triggering algorithm.

Our investigation does not just target standard presuppositions, but also 'cosuppositions', a new type of presuppositional inference that was recently used in the analysis of co-speech gestures. Briefly, the sentence *Will Mary LIFT help her son?*, with a lifting gesture (transcribed as *LIFT*) co-occurring with *help*, was recently argued to trigger a presupposition of the form: *if Mary helps her son, lifting will be involved* (Schlenker to appear a,b). While it was claimed that this is a (weak) presupposition, its conditionalized nature justified the introduction of a new term, *cosupposition*: a cosupposition is a presuppositional inference that is conditionalized on the at-issue content of an expression. It was initially surmised that cosuppositions are triggered because co-speech gestures are somehow parasitic on the spoken words they modify, and thus that they should only be used in a context in which they can be ignored without affecting the truth conditions; a context, in other words, in which it is already presupposed that Mary's helping her son would involve lifting.

On this view, we would not expect cosuppositions to be triggered by iconic constructions that are not co-speech gestures. But the opposite is true: as we will argue in this piece, classifier predicates in ASL can trigger standard presuppositions but also cosuppositions, and the same conclusion extends to pro-speech gestures in English. This finding will lead to a broader typology of presuppositional constructions, as well as a new challenge for future research: can we find algorithms that derive standard presuppositions or cosuppositions depending on the situation?

## 1.2 Structure

The rest of this article is organized as follows. The end of this introductory section presents our main notational conventions pertaining to gestures and to signs. Section 2 summarizes the cosuppositional analysis of co-speech gestures, and introduces some presuppositions triggered by pro-speech gestures; in both cases, we cite relevant experimental data. Section 3 presents our initial paradigms in ASL, in which minimally different constructions trigger standard presuppositions or cosuppositions, as the case may be; presupposition projection is assessed by way of embedding under a variety of operators. In Section 4, we investigate more controlled paradigms in which presuppositional expressions are contrasted with at-issue controls, under a smaller number of operators. In Section 5, we argue that some pro-speech gestures can also trigger cosuppositions. In Section 6, we discuss the behavior of cosuppositions under ellipsis, which might be important to distinguish them from standard presuppositions. We summarize our main findings in Section 7, before drawing consequences for

presupposition theory in Section 8 and for cosupposition theory in Section 9, with concluding remarks in Section 10. (In addition, Appendix I provides further information about the initial paradigms of Section 3, and Appendix II discusses in detail the important but complex behavior of iconic presuppositions and cosuppositions under ellipsis. Raw ASL data appear in the Supplementary Materials A, and the results of a small survey on English gestural inferences are found in the Supplementary Materials B.)

### 1.3 Transcription conventions and methods

#### 1.3.1 Transcription conventions


Our notational conventions for gestures and signs are summarized in (3) and (4) respectively.

#### (3) 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: Johnny SLAP **punished** his enemy.

Johnny SLAP\_  **punished** his enemy.

 Johnny **punished** his enemy.

b. 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\_  <phhh>.

#### (4) Notational conventions: sign language

a. Standard conventions: sign language sentences are glossed in capital letters, as is standard. Expressions of the form *WORD*<sub>-i</sub>, *WORD*<sub>i</sub> and [*..EXPRESSION..*]<sub>i</sub> indicate that the relevant expression is associated with the locus (= position in signing space) *i*. A suffixed locus, as in *WORD*<sub>-i</sub>, indicates that the association is effected by modulating the sign in such a way that it points towards locus *i* (this is different from the addition of a pointing sign *IX*<sub>-i</sub> to a word); a subscripted locus, as in *WORD*<sub>i</sub> or [*..EXPRESSION..*]<sub>i</sub>, indicates that the relevant expression is signed in position *i*. Locus names are assigned from right to left from the signer's perspective; thus when loci *a*, *b*, *c* are mentioned, *a* appears on the signer's right, *c* on the left, and *b* somewhere in between. *IX* (for 'index') is a pointing sign towards a locus, while *POSS* is possessive; they are glossed as *IX*<sub>-i</sub> and *POSS*<sub>-i</sub> if they point towards locus *i*; the numbers 1 and 2 correspond to the position of the signer and addressee respectively. *IX*<sub>-i</sub> is a standard way of realizing a pronoun corresponding to locus *i*, but it can also serve to *establish* rather than to *retrieve* one. Agreement verbs include loci in their realization – for instance the verb *a*-ASK-1 starts out from the locus *a* and targets the first person locus 1; it means that the third person individual denoted by *a* asks something to the signer. *IX*<sub>-arc-i</sub> refers to a plural pronoun indexing locus *i*, as it involves an arc motion towards *i* rather than a simple pointing sign.

b. 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].

c. When it matters, the shape of iconic signs is described (often with iconic means) after the transcription. These are described as we go. For instance, *GO-helicopter-large* l transcribes a classifier predicate representing a large helicopter, and its movement involves an orthogonal detour, hence the notation: l.

### 1.3.2 Elicitation methods

Sign language data from earlier publications are 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 (i.e. semantic) judgments (on separate days) on videos involving minimal pairs (see e.g. Schlenker et al. 2013, Schlenker 2014). An important innovation was to use a 7-point scale to also assess the strength of inferences triggered, with 1 = no inference and 7 = strongest inference (a point to which we return below).

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 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; its obvious limitation is that it solely assesses an individual's idiolect. While 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, in normal cases only average judgments are provided. Acceptability judgments appear as superscripts before the sentences; inferential judgments appear in separate tables. 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. Notations such as *ASL, 34, 1550<sup>a,e</sup>, 5 judgments* indicate that the relevant sentences appeared in ASL video 34, 1550, that only sentences *a* and *e* (i.e. the first and the fifth) from that paradigm are transcribed, and that averages are computed on the basis of 5 judgments (if no letters followed *34, 1550*, this would indicate that the entire paradigm was transcribed).

While some English data were elicited informally, with standard introspective methods, more controlled methods were needed for the subtle cosuppositional data of Sections 5 and 6.5. We modeled our methods on those we used in ASL fieldwork, using quantitative judgments on a 7-point scale for acceptability as well as inferential strength. We relied on three informants, who we consulted by way of a survey with videos (of the author) which we had previously recorded (see Sprouse and Almeida, 2012, 2013, Sprouse, Schütze and Almeida, 2013 on the general validity of introspective methods for standard linguistic judgments, and Tieu et al. 2017a,b, 2018 for experimental replications of several gestural judgments that appeared in the literature).

## 2 Presuppositions triggered by co- and by pro-speech gestures

In this section, we summarize recent results that form the background of the present enterprise: co-speech gestures trigger cosuppositions; and some pro-speech gestures trigger standard presuppositions. We will later see that some classifier predicates in ASL trigger both types of inferences.


## 2.1 Co-speech gestures trigger cosuppositions<sup>1</sup>

### 2.1.1 Main idea

It was recently argued (Schlenker to appear a, b) that co-speech gestures trigger presuppositions that are conditionalized on the meaning of the spoken words they modify. To illustrate, the co-speech gesture *UP* in (5) definitely does not trigger the simple presupposition that some lifting will in fact take place, but rather the conditionalized presupposition or 'cosupposition' that if Mary helps her son, lifting will be involved.

- (5) Will Mary  **help** her son?

One possible motivation goes like this: the context should guarantee that the co-speech gesture merely illustrates the 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 (5), 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 (6).

- (6) If little Johnny takes part in the competition, will his mother  **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 involves lifting. The inference that is in fact derived is narrower: besides the fact that it only applies to Johnny and his mother, it is relativized to the hypothesis that Johnny will take part in the 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. As a first approximation, 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), if an expression *pp'* triggers a presupposition *p* in a sentence *S* uttered relative to a Context Set *C*, *S* is acceptable only if *p* follows from the local context of *pp'* in *S* given *C*. This condition applies 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 yield a presupposition of the rough form: *if x helps y, lifting is involved*.

### 2.1.2 Experimental approach<sup>2</sup>

Numerous logical environments were discussed in the literature to argue that the inferences triggered by co-speech gestures do indeed project like presuppositions. Because there are also cases in which co-speech gestures make an at-issue contribution (especially under focus, as argued by Esipova 2017), co-speech gestures were treated as weak presupposition triggers (Schlenker to appear a). The main claims were put to experimental test in Tieu et al. 2017a, b. Their clearest results pertain to an inferential task (Tieu et al. 2017b), performed in two separate experiments illustrated in (7) and (8) on the example of the quantifier *none*, with the types of inferential questions in (9)

- (7) **Experiment 1: Target Gestures**

<sup>1</sup> This section borrows from Section 3.2 of Schlenker, to appear b.

<sup>2</sup> This section borrows from Section 3.5 of Schlenker, to appear b.



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

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



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

(9) **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 girls, if she were to use the stairs, she would go up the stairs.

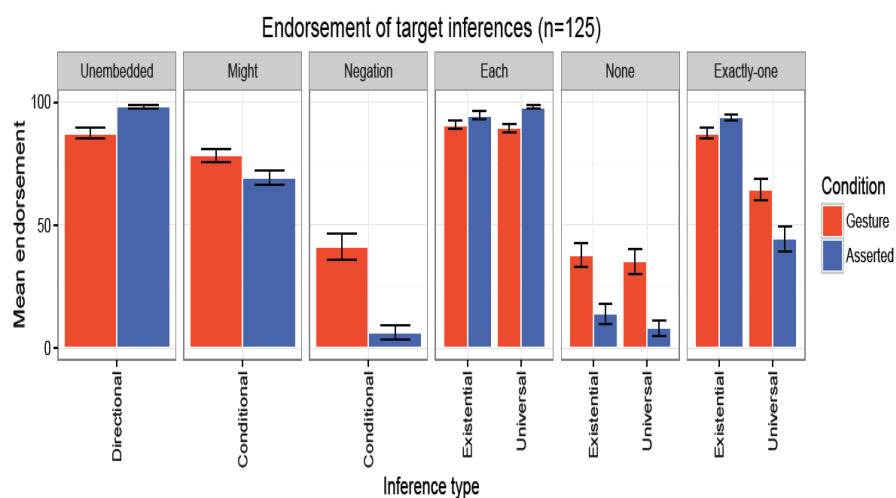
b. Universal inference

To what degree does this video suggest the inference below?

For each of these three girls, 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 (10); the results of the target experiment, involving co-speech gestures, are contrasted with those of the at-issue environments used in the control experiment. Quantified cases were tested both for universal inferences as (9)b and for existential inferences as in (9)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).

(10) **Endorsement rates for different linguistic environments (Tieu et al. 2017b)**



Without getting into too much detail, two main points are worth noting.

(i) First, there are clear and significant differences between target gestural sentences and at-issue controls, which goes in the direction of the cosuppositional theory. Still, cosuppositional inferences are often fairly weak, which suggests that they are indeed weak presupposition triggers.

(ii) Second, in these inferential data there is some evidence of universal projection under *none* and under *exactly one*: despite the relative weakness of this projection behavior, it is significantly different from what is obtained with at-issue controls. Universal projection under *none* is often (though not universally) treated as a characteristic behavior of presuppositions (e.g. in the experimental data from Chemla 2009).

### 2.1.3 Extension to co-sign gestures

Schlenker, to appear b argues that the behavior of co-speech gestures in spoken language has a counterpart in the behavior of co-sign gestures in ASL. The argument is based on the semantic



contribution of non-grammatical facial expressions, as in (11): the disgusted expression co-occurs with the VP *SPEND MONEY*. It is in the scope of *NONE*, but still gives rise to a universal positive inference, namely that it is bad (or difficult) for poor states to spend money; in other words, for each of them, *if it were to spend money, this would be bad (or difficult)*. This behavior is unexpected if facial expressions make an at-issue contribution, but it is expected if they trigger a cosupposition: this explains the conditionalized form of the inference, and also the universal inference under *NONE*.

(11) <sup>6</sup> AMERICA [RICH STATE-rep HELP PEOPLE]<sub>b</sub>. [POOR STATE-rep NONE IX-arc-a :-]\_



[SPEND MONEY]<sub>a</sub>.

=> it is bad (3/4 judgments) or difficult (1/4 judgment) for poor states to spend money

(in one case, it is taken to be bad to for states in general 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, 1670d; 4 judgments)

The important lesson for present purposes is that cosuppositions can arguably be triggered by elements that are extrinsic or parasitic on the modified expressions, be they co-speech gestures or co-sign facial expressions; this will matter when we discuss what is common to all cosuppositions.

## 2.2 *Pro-speech gestures can trigger standard presuppositions*


### 2.2.1 *Main idea*<sup>3</sup>

In a systematic study of inference types triggered by pro-speech gestures, Schlenker to appear e argues that some speech-replacing gestures trigger standard presuppositions. This pertains in particular to gestures that indicates the shape of an object, as in (12): *TURN-WHEEL* triggers the presupposition that the agent has his hand on a wheel; by contrast, a control of the form *get/be behind the wheel and TURN-WHEEL* fails to trigger such a presupposition – an expected result because the first conjunct suffices to satisfy the presupposition of the second conjunct, with the result that the conjunction as a whole doesn't presuppose anything.

(12) a. Is John going to (i) *TURN-WHEEL-small*  (ii) be behind the wheel and *TURN-*

*WHEEL-small* .

(i) => John is currently behind a wheel

b If John (i) *TURN-WHEEL-small*  (ii) is behind the wheel and *TURN-WHEEL-small*



, we'll notice.

(i) => John is currently behind a wheel

c. In this race, none of your friends is going to (i) *TURN-WHEEL-small*  (ii) be behind

<sup>3</sup> This paragraph borrows from parts of Section 4.1.2 of Schlenker to appear e.

the wheel and TURN-WHEEL-small\_



(i) => in this race, each of your friends is behind a wheel  
(Schlenker to appear e)

Similarly, it was argued that the gesture for *REMOVE-GLASSES* in (13) triggers a presupposition that the agent has glasses on at the relevant time, unlike the control *have glasses on* and *REMOVE-GLASSES*, which entails but does not presuppose such a fact.

(13) a. At the end of the meeting, will John (i) REMOVE-GLASSES\_



(ii) have glasses on

and REMOVE-GLASSES\_?



(i) => right before the end of the meeting, John will have glasses on

b. If at the end of the meeting John (i) REMOVE-GLASSES\_



(ii) has glasses on and

REMOVE-GLASSES\_ , we'll notice.



(i) => right before the end of the meeting, John will have glasses on

c. At the end of the meeting, none of your colleagues will (i) REMOVE-GLASSES\_



(ii)

have glasses on and REMOVE-GLASSES\_.



(i) => right before the end of the meeting, each of your colleagues will have glasses on  
(Schlenker to appear e)

We note for purposes of comparison with a helicopter-related paradigm in ASL that Schlenker to appear e provides data involving a gestural verb representing a helicopter take-off, and argues that it gives rise to the same presupposition as the English verb 'take off': in (14) and (15) alike, we obtain that inference that the helicopter is initially on the ground.

(14) a. At 12:05, will the company's plane (i) take off (ii) be on the ground and then take off?

(i) => right before 12:05, the company's plane will be on the ground

b. At 12:05, if the company's plane (i) takes off (ii) is on the ground and then takes off, we'll hear some noise.

(Schlenker to appear e)

(15) a. At 12:05, will the company's helicopter



(i) TAKE-OFF-ROTATING\_



(ii) be on the ground and then TAKE-OFF-ROTATING\_ ?

(i) => right before 12:05, the company's helicopter will be on the ground

b. At 12:05, if the company's helicopter (i) TAKE-OFF-ROTATING\_



(ii) is on the ground and then TAKE-OFF-ROTATING\_ , we'll hear some noise.



(i) => right before 12:05, the company's helicopter will be on the ground (Schlenker to appear e)

### 2.2.2 Experimental approach (Tieu et al. 2018)

Tieu, Schlenker and Chemla 2018 subjected these generalizations to experimental test. Subjects had to indicate their level of endorsement of inferences characteristic of presupposition projection, and of control inferences.

The conditions involved versions of *TURN-WHEEL* and *REMOVE-GLASSES*, as discussed in the previous section and in (16)-(17), as well as a facial gesture for *WAKE-UP* (which worked less well in *None* condition the but is still included in the final results).

(16) Presuppositions triggered by *TURN-WHEEL* (= 'bumper cars' condition)

a. Simple question

Jake and Lily are watching their four children ride bumper cars at the carnival. Each bumper car has two seats. As one of the bumper cars nears a bend in the track, the parents wonder:

**Will Sally TURN-WHEEL?**

- (i) Target inference: Sally is in the driver's seat.
- (ii) Control inference: Sally is in the passenger seat, not the driver's seat.

b. Embedding under *None*

Blake and Diane are watching their group of friends ride bumper cars at the carnival. Each bumper car has two seats. As the various bumper cars near a bend in the track, they worry that:

**None of their friends will TURN-WHEEL.**

- (i) Target inference: Each of their friends is in the driver's seat of a bumper car
- (ii) Control inference: Not every friend is in the driver's seat of a bumper car

(17) Presuppositions triggered by *REMOVE-GLASSES* (= 'glasses' condition)

a. Context (for b. and c.)

During an experimental session, Valerie watches her graduate students use microscopes and says to the lab assistant standing next to her:

b. Simple question:

**For the next phase of the experiment, will our visiting student REMOVE-GLASSES?**

- (i) Target inference: Valerie's visiting student has glasses on.
- (ii) Control inference: Valerie's visiting student doesn't have glasses on.

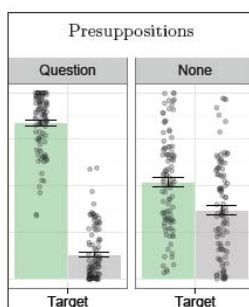
c. Embedding under *None*:

**For the next phase of the experiment, none of my students will REMOVE-GLASSES.**

- (i) Target inference: Each of Valerie's students has glasses on.
- (ii) Control inference: Not all of Valerie's students have glasses on.

Aggregate results for all three conditions are provided in (18). In each condition, the left-hand bar represents endorsement of the target inference and the right-hand bar of the control inference. There are high endorsements of target inferences in simple questions; endorsements are less high under *none*, but still significantly different from control inferences.

(18) Projection of gestural inferences in simple questions and under *none* (Tieu et al. 2018)



% endorsement of target and control inferences across all conditions. Error bars represent standard error of the mean across participants. Experiment with 103 subjects recruited on Mechanical Turk.

### 2.3 Summary and outlook

Standard linguistic methods and experimental results converge on two conclusions. First, co-speech gestures trigger (weak) cosuppositions, and this result may extend to some co-sign gestures in ASL. Second, some pro-speech gestures in English trigger standard presuppositions (with slightly weaker results than expected in the experimental study for embedding under *none*-type quantifiers).

These results raise two questions.

1. First, can cosuppositions be triggered by iconic expressions that are not co-speech or co-sign gestures? In initial analyses, it was speculated that the special pragmatic status of these gestures is due to their 'parasitic' nature, namely the fact that they co-occur with a full-fledged word that can be understood without them. We will argue that this initial view was too strong: iconic constructions that fully replace some words can also trigger cosuppositions.
2. Second, can standard presuppositions be triggered by highly iconic constructions in sign language? If so, one might need a general theory of iconic presupposition generation. We will see that this is indeed the case.

Our next step is to systematically study a highly iconic construction in ASL, based on classifier predicates. We will see that, depending on its particular realization, it can trigger cosuppositions or standard presuppositions. We will then extend the main findings to pro-speech gestures in English.

## 3 Presuppositions and cosuppositions of ASL classifier predicates: initial approach

We turn to an investigation of the presuppositions and cosuppositions triggered by some classifier predicates in ASL. We briefly summarize experimental results on the iconic nature of classifier predicates, and then turn to predicates involving the horizontal or vertical movement of a helicopter: by modulating the classifier predicate and its path in various way, we show that standard presuppositions or cosuppositions may be triggered.

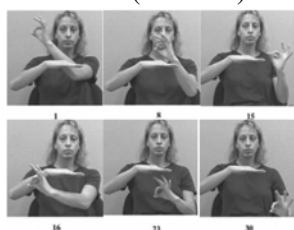
### 3.1 The iconic nature of classifier predicates<sup>4</sup>

Classifier predicates are sign language constructions in which a sign represents the position or movement of an entity in a highly iconic fashion. Emmorey and Herzig 2003 displayed with experimental means the gradient and iconic nature of the information conveyed by such constructions to native signers. They studied a construction involving a classifier representing a small object (a sticker) relative to a handshape representing a flat object (a bar): "participants were asked to place a dot (a 1/2 inch round sticker) in relation to a bar (a line) drawn in the center of a square frame. Where the sticker should be placed was indicated by a native signer (on videotape), who produced a classifier construction in which the F-handshape (specifying a small round object—the dot sticker) was positioned in signing space either above or below a horizontal B-handshape (specifying a flat, surface-prominent object—the bar)." 6 of the 30 ASL stimuli are represented in (19)a. The average positions selected by the deaf signers appear in (19)b; positions 1, 8, 15, 16, 23 and 30 correspond to the stimuli in (19)a.

<sup>4</sup> The content of this summary is similar to one that appears in Schlenker, to appear c.

(19) **Small object classifier positioned relative to a surface handshape** (Emmorey and Herzig 2003)

a. 6 stimuli (out of 30)



b. Responses of deaf signers



The results suggest that deaf signing participants placed the dot in a position that roughly corresponded to the position of the *F*-handshape classifier relative to the *B*-handshape, with effects that were both iconic and gradient (to the extent that gradience can be assessed on the basis of 30 examples).

Zucchi 2011 discusses further examples involving the movement of an object, as in (20)a, which describes the movement of a car; it is paraphrased in (20)b (for Zucchi 2011 and Davidson 2015, classifier predicates genuinely have a demonstrative component, but here we are interested in the data rather than in the analysis).

## (20) a. CAR CL-vehicle-DRIVE-BY

b. 'A car drove by *like this*', where the demonstration is produced by the movement of the classifier predicate in signing space (after Zucchi 2011)

The movement of the classifier predicate *CL-vehicle-DRIVE-BY* in signing space tracks in a gradient fashion the movement performed by the relevant car in real space.

In the next sections, we investigate how modulations of the vertical or horizontal path of a classifier predicate representing a helicopter movement can trigger presuppositions or cosuppositions, as the case may be.

### 3.2 Comparing iconic triggers and lexical triggers in ASL: initial attempts

In a series of initial attempts, we compared the projection of iconic inferences to standard presuppositions triggered by the verb *CONTINUE*. The data are discussed in greater detail in Appendix I. Besides comparing iconic presuppositions to lexical presuppositions, they have the advantage of testing projection under diverse embeddings, involving *DOUBT*, *MAYBE*, *IF*, and *NONE*. They also have two disadvantages. First, they do not contain at-issue controls, i.e. constructions with explicit modifiers that convey comparable information but are not expected to trigger presuppositions. Second, one of our constructions, involving a sudden detour, could potentially be thought to include some kind of focus marking because it involves acceleration of part of a sign; such focus, if real, could affect projection results (M. Esipova, p.c).<sup>5</sup>

We considered two paradigms, one involving a horizontal path of a helicopter, from a locus referring to Boston to one referring to New York, and one involving a helicopter take-off (more controlled paradigms will be investigated in Section 4). In the horizontal paradigm, we investigated a form of the classifier which, for our consultant, serves to represent a large, 2-rotored helicopter. As we will see, this too triggered presuppositions.

As announced in Section 1.3.2, an important innovation consisted in using quantitative judgments (on 7-point scale) to assess the strength of inferences. There were several reasons for this choice. First, inferences that are due to presupposition projection (rather than to normal entailments) can be subtle and of varying strengths. Presuppositions triggers notoriously vary in their ability to give rise to 'local accommodation', the phenomenon by which, at some cost, a presupposition gets turned into an at-issue contribution and fails to project (see Beaver 2010 for numerous examples, and Tonhauser et al. to appear for an experimental approach). When local accommodation is particularly easy, projection may be weak, and thus fine-grained methods can be helpful. Second, this quantitative

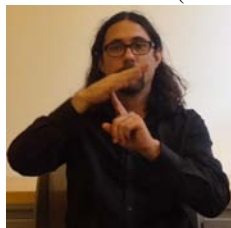
<sup>5</sup> Typically focus in ASL also involves raised eyebrows, which are not present in our examples. We prefer to err on the side of caution, thus studying paradigms in which the detour is realized without a sudden acceleration; as we will see, this does weaken the results.

method has proven helpful in experimental work. Thus Cremers and Chemla 2010 write that graded inferential judgments "may help detect otherwise hidden effects", and that [quantitative] "differences they reveal call for an explanation". Third, our ASL consultant (who has years of experience with quantitative acceptability judgments) noted that the inferential part of his task was made easier, not harder, by using quantitative judgments of inferential strength; without these, he had to reflect at length about how to categorize judgments of intermediate strength; the quantitative method allowed for less arbitrary decisions in such cases.

### 3.2.1 Horizontal paradigm

The horizontal movement paradigm is illustrated in (23) with embedding under *DOUBT*. In all cases, the lexical word for *HELICOPTER* was introduced with the standard form in (21), but the classifier predicate was represented with two hands, as shown in (22) (we turn in the next section to a more standard helicopter classifier predicate, which is just a moving version of (21)). For our consultant, this represented a large helicopter with two rotors, with each hand representing one rotor. We have linked some of the relevant examples to anonymized videos in order help the reader appreciate the details of the iconic representation of the helicopter path.

(21) HELICOPTER (ASL 34, 3530a)



(22) Horizontal movement of a 2-rotored helicopter classifier, transcribed as: *GO-helicopter-large* (ASL 34, 3530a)



(23) *Context*: our company has one helicopter and one airplane.  
 WITHIN 1-HOUR OUR COMPANY BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>b</sub> DOUBT a-\_\_\_-b .  
 'I doubt that within an hour our company's big helicopter will ... from Boston to New York.' (ASL, [34, 3530](#); 3 judgments) Video: <http://bit.ly/2GLPsOG>

Condition (ASL, <a href="#">34, 3530</a> ; 3 judgments)	Words (replacing ___) and acceptability	Translation (replacing ...)
a. neutral path	<sup>6.3</sup> GO-helicopter-large_	fly
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-large_	continue to fly
c. swaying movement	<sup>5.7</sup> GO-helicopter-large_∧∧_	fly a swaying movement
d. smooth detour	<sup>7</sup> GO-helicopter-large_∩_smooth	fly (with the assumption that this would involve a smooth detour)
e. abrupt detour	<sup>6.7</sup> GO-helicopter-large_∧_abrupt	make an abrupt detour on its way

Throughout all embedding conditions, acceptability was high, scoring between 6 and 7, with the exception of the c. condition (swaying cosupposition), which was occasionally rated as 5.

What matters for present purposes are the inferences that these constructions gave rise to. It is important to remember that embedding under *DOUBT*, *MAYBE*, *IF*, and *NONE* was chosen because

these are classic presupposition tests: an at-issue entailment would not be expected to project from these environments, but a presupposition (or cosupposition) would. While details are discussed in Appendix I, a summary of the main results is provided in (26). But some explanations are needed first.

For propositional embeddings, inferences were assessed in a quantitative fashion by way of the questions in (24) .

(24) **Inferential questions: propositional case**

Does the sentence suggest that any of the following is the case? (1 = no inference; 7 = strongest inference)

*Meaning 1:* the helicopter has 2 rotors

*Meaning 2:* the helicopter has been on its way from Boston to NYC

*Meaning 3:* the helicopter will go from Boston to NYC within the next hour

*Meaning 4:* if the helicopter were to go from Boston to NYC within the next hour, it would

a. have a swaying-like motion

b. make a smooth detour

c. make an abrupt detour

(only pick the strongest inference among a, b, c)

For embedding under the quantifier *NONE*, questions were subdivided so as to assess both an existential inference and a universal inference, as in (25).

(25) **Inferential questions: embedding under NONE**

Does the sentence suggest that any of the following is the case? (1 = no inference; 7 = strongest inference)

*Meaning 1:* a. each b. at least one helicopter has 2 rotors

*Meaning 2:* a. each b. at least one helicopter has been on its way from Boston to NYC

*Meaning 3:* a. each b. at least one helicopter will go from Boston to NYC within the next hour

*Meaning 4:* a. for each b. for at least one helicopter, if it were to go from Boston to NYC within the next hour, it would

a. have a swaying-like motion

b. make a smooth detour

c. make an abrupt detour

(only pick the strongest inference among a, b, c)

There were two reasons for this more complicated statement of the questions, which a version testing universal projection ('each') and in one testing existential projection ('at least one'). First, as alluded to in Section 2.2.2, some theorists (e.g. Beaver 2001) argue that presuppositions project existentially under quantifiers, others argue that they project universally (e.g. Heim 1983, Schlenker 2008, 2009), and still others that this depends on the quantifier (Chemla 2009, 2010). Second, although Chemla 2009 found strong universal inferences under *none*-type quantifiers in French, even with the lexical presupposition trigger *CONTINUE* our ASL consultant derived fairly weak universal inferences in this case: he endorsed 'At least one helicopter has been on its way from Boston to New York' fairly strongly, but not 'Each helicopter has been on its way from Boston to New York'. This suggested that existential inferences might be informative.

(26) **Inferences: modulations of a horizontal path for the paradigm such as (23)** (see Appendix I for the full paradigms involving *MAYBE*, *IF*, *NONE*)

When there was more than a 2-point difference among scores for a given question, the raw scores appear in parentheses. (*Note:* average acceptability, which is not reported here, ranged from 5.7 to 7.)

Target sentence / Inferences	Inference type	Inference about the helicopter	DOUBT	MAYBE	IF	NONE	
Video			34, 3530	34, 3540	34, 3518	34, 3552	
Number of judgments			3 judgments	4 judgments	3 judgments	Universal inference 2 judgments	Existential inference 2 judgments
a. neutral path	presupposition	it has 2 rotors	5.7	7	6	3.5	4
b. CONTINUE	lexical presupposition [+ 2-rotored presupposition]	it has been on its way from B to NYC	6.3	6.5	6.3	5	6.5



<b>c. swaying movement</b>	<b>at-issue?</b> <b>cosupposition?</b> [+ 2-rotored presupposition]	if it were to fly, it would have a swaying motion	3.3 (2, 3, 5)	3.8 (3, 2, 5, 5)	4.7	3 (5, 1)	3.5 (6, 1)
<b>d. smooth detour</b>	<b>cosupposition</b> + 2-rotored presupposition	if it were to fly it would make smooth detour	<b>6</b>	<b>6</b>	<b>6</b>	<b>6.5</b>	<b>6.5</b>
<b>e. abrupt detour</b>	<b>presupposition</b> + 2-rotored presupposition	it will fly from B to NYC	<b>6.3</b>	<b>5.5</b>	<b>5.7</b>	4	<b>5.5</b>

Let us explain how the table in (26) should be read. First, it only includes the main inference of interest in each example (more complete results appear in Appendix I). We selected in each case an inference that we believe to be triggered, and thus these ratings are, by construction, rather high. But it can be checked in Appendix I and in the raw data that this is not at all a systematic strategy on the consultant's part (= 'endorse everything'): many further inferences have very low endorsement strengths (we will discuss in Section 4 more controlled paradigms in which the inferences for our target sentences are contrasted with those obtained in at-issue controls).

The type of the target inference (e.g. presupposition, cosupposition, at-issue) is boldfaced in the second column; additional inferences that are not reported here appear in square brackets. The third column summarizes the nature of the inference in question. The following columns to the right display the strength of the relevant inference in environments that are classic presupposition projection tests: under *DOUBT*, *MAYBE*, *IF*, *NONE*.

For instance, line b. in (26) can be read as follows. It assesses the lexical presupposition triggered by *CONTINUE*, as seen in the 1st and in the 2nd columns, to the effect that the helicopter has been on its way from Boston to New York, as seen in the 3rd column. Since all sentences involved a 2-rotored helicopter classifier, they also trigger a presupposition that the helicopter has two rotors, but it is not assessed in line b. (it is assessed on line a., by contrast). We see that the lexical presupposition triggered by *CONTINUE* projects strongly under *DOUBT* (= 6.3), *MAYBE* (= 6.5) and *IF* (= 6.3), with a weaker universal inference under *NONE* (= 5), and a stronger existential inference (= 6.5). For readability, inferential strengths of 5 or more have been boldfaced throughout, but it should be kept in mind that this an arbitrary threshold.

Several conclusions can be drawn by inspecting this summary table:

- (i) The inference that the helicopter has two rotors projects roughly like the presupposition triggered by *CONTINUE*, albeit more weakly under *NONE*. (Data are provided for the a. sentence only in (23), but the '2-rotored' inference was also tested in other conditions, as seen in Appendix I).
- (ii) The same conclusion applies to the 'abrupt detour' sentence type in (23)e: a presupposition seems to be triggered to the effect that the helicopter will in fact fly from Boston to New York. For instance, in the case of embedding under *DOUBT*, what is denied is that there will be such an abrupt detour, but not that the trip will take place.
- (iii) Very different results are obtained in the 'smooth detour' condition illustrated in (23)d: here no strong inference is obtained that the trip will take place (as can be checked in Appendix I), but a cosupposition seems to be triggered to the effect that *if the helicopter were to go from Boston to New York, it would have a curved path*.
- (iv) The 'swaying' condition illustrated in (23)b does not trigger a significant cosupposition, contrary to our initial expectation (which is the reason we report the purported cosuppositional inference in this case): projection strength is very weak.

Thus using *CONTINUE* as a baseline, we can conclude that in this case iconic presuppositions pertaining to shape (two rotors) and to movement (the helicopter will fly from Boston to New York) can be triggered depending on the realization of the classifier predicate, and that further modifications can trigger cosuppositions as well (to the effect that if the helicopter were to fly from Boston to New York, it would have a curved path).

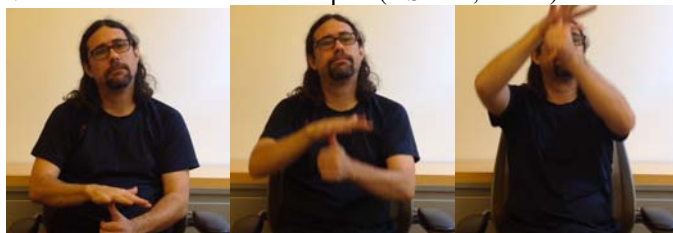
### 3.2.2 Vertical paradigm

Related conclusions can be reached on the basis of a different paradigm, involving a vertical (take-off) movement of a helicopter. Here too, we investigated presupposition projection under *DOUBT*, *MAYBE*, *IF*, and *NONE*. The paradigm is illustrated in the case of embedding under *MAYBE* in (28). The helicopter predicate classifier is now a moving version of the noun *HELICOPTER* illustrated in



(23), and correspondingly the inference that the helicopter has two rotors stops being relevant. But because the movement corresponds to a take-off, we can assess instead a different inference, to the effect that the helicopter is currently on the ground. The simple version of the take-off, corresponding to (28)a, is illustrated in (27).

(27) Vertical movement of a helicopter (ASL 34, 3556a)



(28) *Context:* our company has one helicopter and one airplane.  
 WITHIN 5-MINUTES OUR COMPANY HELICOPTER MAYBE \_\_\_\_\_.  
 'Within the next five minutes, maybe our company's helicopter will \_\_\_\_.' (ASL, 34, 3556; 3 judgments)  
 Video: <http://bit.ly/2CI2BQF>

Condition (ASL, 34, 3556; 3 judgments)	Words (replacing ____ ) and acceptability	Translation
a. neutral path	<sup>7</sup> GO-helicopter-up_	take off
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-up_	continue to take off
c. circling motion	<sup>7</sup> GO-helicopter-up_circling	take off (with the assumption that this would involve a circular motion)
d. undulating motion	<sup>7</sup> GO-helicopter-up_undulate_smooth	take off with a swaying motion
e. abrupt detour	<sup>6,7</sup> GO-helicopter-up__^__abrupt	make an abrupt detour during take off

The helicopter is initially represented as being on the ground (although the movement starts at slightly different heights in different conditions). The lexical trigger *CONTINUE* gives rise to the presupposition that the helicopter has been taking off, which makes it unlikely that it still on the ground.<sup>6</sup> In all cases except under *CONTINUE*, the representation of the helicopter as being initially on the ground triggers a presupposition that it is currently on the ground. This 'on the ground' presupposition might be viewed as purely iconic, or it might be lexical in nature, as is often assumed for the English verb *take off*, as illustrated in (14). But it is worth noting that in English a pro-speech gesture representing a helicopter take-off, as in (15), can also trigger this presupposition – and in this case its source is probably iconic rather than lexical, since the gesture isn't a conventional one. Thus we could just as well analyze the ASL 'on the ground' presupposition as being triggered by iconic means.

Presuppositional and cosuppositional inferences obtained for our ASL 'take-off' paradigm are summarized in (29) (see Appendix I for further details).

(29) **Inferences: modulations of a vertical path**

When there was more than a 2-point difference among scores for a given question, the raw scores appear in parentheses. (*Note:* average acceptability, which is not reported here, ranged from 6 to 7.)

Target sentence / Inferences	Inference type	Inference about the helicopter	DOUBT	MAYBE	IF	NONE
Video			34, 3562	<a href="#">34, 3556</a>	<a href="#">34, 3568</a>	34, 3570
Number of judgments			2 judgments	3 judgments	3 judgments	<b>Universal inference</b> 2 judgments
<b>a. neutral path</b>	<b>on ground presupposition</b>	it is currently on the ground	<b>6.5</b>	<b>6.3</b>	<b>6.3</b>	3 (1, 5)
						<b>Existential inference</b> 2 judgments
						3.5 (2, 5)

<sup>6</sup> In addition, the predicate classifier starts a bit higher in this case than in some other conditions.

<b>b. CONTINUE</b>	<b>lexical presupposition</b> [+ on ground presupposition]	it is currently taking off	<b>6</b>	<b>6</b>	<b>5.3</b>	4.5	<b>6</b>
<b>c. circling motion</b>	<b>cosupposition</b> [+ on ground presupposition]	if it were to take off within the next 5 minutes, it would do so with a circular motion	<b>5</b>	<b>5.7</b>	4.3	<b>5</b>	<b>6</b>
<b>d. undulating motion</b>	<b>cosupposition</b> [+ on ground presupposition]	if it were to take off within the next 5 minutes, it would do so with an undulating motion	<b>5.5</b>	<b>5.3</b>	4.7	4.5	<b>5.5</b>
<b>e. abrupt detour</b>	<b>presupposition</b> [+ on ground presupposition]	it will take off in the next 5 minutes	<b>5</b>	<b>5</b>	4	3	4.5

Several conclusions can be drawn by inspecting this summary table:

(i) Under propositional operators (*DOUBT*, *MAYBE*, *IF*), the inference that the helicopter is currently on the ground projects roughly like the presupposition triggered by *CONTINUE* (data are provided for the a. sentence type in (28), but the 'on the ground' inference exists in the other conditions as well except under *CONTINUE*, as can be seen in Appendix I). Projection of the 'on the ground' presupposition appears to be weaker (and variable) under *NONE*.

(ii) A weak presuppositional inference that the take-off will take place is to some extent triggered in the 'abrupt detour' condition in (28)e, especially under *DOUBT* and *MAYBE*. By contrast, it can be checked in Appendix I that the c. and d. conditions ('circling motion' and 'undulating motion') do not give rise to a significant inference that the take-off will in fact take place.

(iii) In the 'circling movement' and in the 'undulating motion' conditions illustrated in (23)c,d, a cosupposition seems to be triggered to the effect that if the helicopter were to take off, this would involve a circling movement or an undulating motion, except under *IF* (for reasons that we do not understand).

### 3.3 Summary and outlook

Taken together, these results suggest that representing the helicopter with two rotors or as being initially on the ground triggers presuppositions that are comparable to those obtained with *CONTINUE*, except under *NONE*. Furthermore, both the 2-rotored inference and the 'on the ground' inference may be iconic, although the latter may be likened to the lexical presupposition of English 'take off'. Adding an abrupt detour to a horizontal or vertical displacement tends to trigger a presuppositional inference that the horizontal or vertical movement will in fact take place, with at-issue information provided about the presence, or absence, of the abrupt detour. Finally, realizing the movement with a curved path, or with a circling or swaying motion, appears to trigger cosuppositions in most cases.

These paradigms have two weaknesses, however. The main one is that they do not compare presuppositions to comparable at-issue inferences. Ideally, one would want to show that the crucial inferences we obtain are genuinely due to presuppositions rather than to complex reasoning that would take place even if these inferences were linguistically at-issue. While it is not trivial to see how the reasoning would go, it would be reassuring to have more controlled paradigms in which presuppositional information is *contrasted* with comparable at-issue information.

Less importantly, the 'abrupt detour' condition might raise a question: as noted by M. Esipova (p.c.), the abruptness of the realization might conceivably make the 'detour' part prominent. As Wilbur 1999 notes, in ASL "the primary indicator of stress marking is the significant increase in peak velocity of prominent signs". One could thus take this abrupt detour to be prominent or even focused (it should be noted, however, that focus-related constructions often involve raised eyebrows, which are absent in this case (Wilbur 2012, Schlenker et al. 2016)). This, in turn, could interact with the inferential task, because elements that are given (not in focus) can trigger what we may call 'pseudo-presuppositions'. Consider a sentence such as *Maybe the helicopter will fly FAST tomorrow*, with

focus on *fast*. The non-focused part of the clause is 'given'. But it has often been observed in the literature that given material can be treated as presupposed if its 'given' status is not justified by the preceding discourse. This doesn't entail that givenness effects are intrinsically presuppositional, as emphasized by several researchers (see for instance Büring 2012). But this could cloud the source of some of the effects. As we will see in the next section, when the detour is less abrupt (and larger) while remaining orthogonal, the presuppositional effect is weakened.

#### 4 Presuppositions and cosuppositions of ASL classifier predicates: Controlled paradigms

In order to address the concerns raised at the end of the preceding section, we investigated more tightly controlled paradigms which included both target presuppositional and cosuppositional conditions, and controls involving explicit modifiers that are expected to be at-issue. Due to the large number of questions involved, we restricted attention to two particularly informative environments: embedding under *IF*, and embedding under *MAYBE*. As was the case in Section 3.2, we explored both a paradigm involving the horizontal movement of a 2-rotored helicopter, and the vertical movement of a normal helicopter. We discuss each in turn.

##### 4.1 Horizontal movement

Our paradigm with horizontal movement and embedding under *IF* appears in (30) with acceptability judgments.

(30) *Horizontal movement, IF*

*Context:* our company has one helicopter and one airplane.

WITHIN 1-HOUR OUR COMPANY BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>b</sub> **IF** a-\_\_\_\_\_-b,  
2-EMAIL-1.

'If within the next hour our company's big helicopter ... from Boston to New York, e-mail me.'

(ASL, [34, 3637](#); 3 judgments) Video: <http://bit.ly/2CGIYhD>

Condition (ASL, <a href="#">34, 3637</a> ; 3 judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. neutral path	<sup>7</sup> GO-helicopter-large_	flies
b. curved path	<sup>7</sup> GO-helicopter-large_∩_smooth	flies (with the assumption that this would involve a curved path)
c. at-issue control of curved path	<sup>5.3</sup> GO-helicopter-large_ WITH _∩_smooth	flies with a curved path
d. orthogonal detour	<sup>6.7</sup> GO-helicopter- large_ _no_acceleration	makes an orthogonal detour on its way
e. at-issue control of orthogonal detour	<sup>5.7</sup> GO-helicopter-large_ WITH _ _no_acceleration	flies with an orthogonal detour on its way
f. pause in the middle	<sup>6.7</sup> GO-helicopter-large__ _	pauses to hover on its way
g. at-issue control of pause in the middle	<sup>6.7</sup> GO-helicopter-large__ WITH PAUSE __ _	flies with a pause to hover

In all parts of the paradigm, the helicopter predicate classifier is two-handed and represents a 2-rotored helicopter, as was the case in (22). Besides a condition involving a neutral path in (30)a, three targets and three controls are considered.

- (30)b involves a classifier predicate following a curved path. The control in (30)c involves the predicate classifier with the neutral path in (22)a, but with an explicit modifier *WITH* \_ \_∩\_smooth, where *WITH* is the lexical preposition, and \_∩\_smooth traces a curved path with the index finger of the dominant hand.

- (30)d involved an orthogonal deviation from the main path, but contrary to the abrupt deviations of Section 3.2, it was realized smoothly, without acceleration. (30)e is a control in which the classifier predicate with a neutral path is used, together with an explicit modifier *WITH* \_|\_no\_acceleration, tracing with the dominant hand the excursion from the path (represented by the non-dominant hand).

- (30)f is a modification of the neutral path in which there is a long pause in the middle, representing the helicopter hovering without movement somewhere between Boston and New York. (30)g is a control with an explicit modifier *WITH PAUSE* \_\_ \_\_, involving the lexical words *IF* and *PAUSE*, and an iconic representation of the 2-rotored hovering helicopter.

Inferential questions sought to assess the existence of presuppositional or cosuppositional inferences. Quantitative inferential questions were stated as in (31). Since the paradigm was presented in a single video, judgments pertaining to acceptability (reported in (30)) and inferential strength were contrastive as well as quantitative. Note that the question called *Meaning 2* tests an inference that one would expect to find with *CONTINUE* but not with the present paradigm; it can be taken to establish the baseline for an inference that is *not* expected to arise in this case.

- (31) Quantitatively assessed inferences for the paradigm in (30)  
 Does the sentence suggest that any of the following is the case? (1 = no inference; 7 = strongest inference)  
*Meaning 1*: the helicopter has 2 rotors  
*Meaning 2*: the helicopter has been on its way from Boston to NYC  
*Meaning 3*: the helicopter will go from Boston to NYC within the next hour  
*Meaning 4*: if the helicopter were to go from Boston to NYC within the next hour, it would  
 a. make a smooth detour  
 b. make an orthogonal detour  
 c. stop and hover on its way  
 (only pick the strongest inference among a, b, c)

A second paradigm was constructed in the same way as (30)-(31), but with the second line (*IF* \_\_\_\_, *2-EMAIL-1*) replaced with *MAYBE*, as shown in (32). Thus the meaning obtained for the baseline, modified from (30), was something like: 'Within the next hour, maybe our company's big helicopter will fly from Boston to New York'. This made it possible to investigate the projection of various inferences under *MAYBE*.

- (32) *Context*: our company has one helicopter and one airplane.  
 WITHIN 1-HOUR OUR COMPANY BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>b</sub> **MAYBE** a-\_\_\_\_-b.  
 'Within the next hour, maybe our company's big helicopter will \_\_\_\_ from Boston to New York.'  
 (ASL, [34, 3633](#); 3 judgments) Video: <http://bit.ly/2FvF6mJ>

Condition (ASL, <a href="#">34, 3633</a> ; 3 judgments)	Words (replacing ____ ) and acceptability	Translation
a. neutral path	<sup>7</sup> GO-helicopter-large_	fly
b. curved path	<sup>7</sup> GO-helicopter-large_∩_smooth	fly (with the assumption that this would involve a curved path)
c. at-issue control of curved path	<sup>5</sup> GO-helicopter-large_ WITH _∩_smooth	fly with a curved path
d. orthogonal detour	<sup>6,7</sup> GO-helicopter- large_ _no_acceleration	make an orthogonal detour on its way
e. at-issue control of orthogonal detour	<sup>5,3</sup> GO-helicopter-large_ _ _no_acceleration	fly with an orthogonal detour on its way
f. pause in the middle	<sup>7</sup> GO-helicopter-large__ __	pause to hover on its way
g. at-issue control of pause in the middle	<sup>6,7</sup> GO-helicopter-large__ WITH PAUSE __ __	fly with a pause to hover

Inferential results are given in (33) for embedding under *IF* and in (34) for embedding under *MAYBE*. As before we have boldfaced inferential strengths at or above 5, but now we can contrast those with control inferences triggered by at-issue modifiers.

(33) **Horizontal movement, *IF*: inferential results**

Target sentence / Inferences (ASL, <a href="#">34, 3637</a> ; 3 judgments)	Inference type	1. Helicopter has 2 rotors	2. Helicopter has been on its way from B to NYC	3. Helicopter will go from B to NYC	4. If the helicopter goes from B to NYC, ____ (= strongest conditional inference)
a. neutral path	at-issue + 2-rotored presupposition	<b>6.7</b>	2	1.7	1

<b>b. curved path</b>	<b>cosupposition</b> + 2-rotored presupposition	<b>7</b>	1	1.7 (smooth detour)	<b>5.3</b> (smooth detour)
<b>c. at-issue control of curved path</b>	<b>at-issue</b> + 2-rotored presupposition	<b>6.3</b>	1.3	3.3 (smooth detour)	2 (smooth detour)
<b>d. orthogonal detour</b>	<b>presupposition</b> + 2-rotored presupposition	<b>7</b>	1.7	<b>5</b> (orthogonal detour)	2 (orthogonal detour)
<b>e. at-issue control of orthogonal detour</b>	<b>at-issue?</b> + 2-rotored presupposition	<b>6.3</b>	1.7	3.7 (orthogonal detour)	2 (orthogonal detour)
<b>f. pause in the middle</b>	<b>presupposition</b> + 2-rotored presupposition	<b>6.7</b>	2.3	<b>5.7</b> (stop and hover)	2 (stop and hover)
<b>g. at-issue control of pause in the middle</b>	<b>at-issue</b> + 2-rotored presupposition	<b>6.3</b>	1.7	3.3 (stop and hover)	2 (stop and hover)

(34) **Horizontal movement, *MAYBE*: inferential results**

Target sentence / Inferences (ASL, 34, 3633; 3 judgments)	Inference type	1. Helicopter has 2 rotors	2. Helicopter has been on its way from B to NYC	3. Helicopter will go from B to NYC	4. If the helicopter goes from B to NYC, _____ (= strongest conditional inference)
<b>a. neutral path</b>	<b>at-issue</b> + 2-rotored presupposition	<b>7</b>	1	1.3	1
<b>b. curved path</b>	<b>cosupposition</b> + 2-rotored presupposition	<b>7</b>	1	1.7 (smooth detour)	<b>5.7</b> (smooth detour)
<b>c. at-issue control of curved path</b>	<b>at-issue</b> + 2-rotored presupposition	<b>6.7</b>	1.3	2 (smooth detour)	2.3 (smooth detour)
<b>d. orthogonal detour</b>	<b>at-issue?</b> + 2-rotored presupposition	<b>7</b>	1.7	3.7 (5, 2, 4) (orthogonal detour)	2 (orthogonal detour)
<b>e. at-issue control of orthogonal detour</b>	<b>at-issue?</b> + 2-rotored presupposition	<b>6.7</b>	1.3	3 (4, 3, 2) <sup>7</sup> (orthogonal detour)	2.3 (orthogonal detour)
<b>f. pause in the middle</b>	<b>presupposition</b> + 2-rotored presupposition	<b>7</b>	2	4.7 (stop and hover)	2 (stop and hover)
<b>g. at-issue control of pause in the middle</b>	<b>at-issue</b> + 2-rotored presupposition	<b>7</b>	1.3	3 (stop and hover)	2.3 (stop and hover)

Several conclusions can be drawn.

(i) In all conditions, we obtain in Column 1 a strong presuppositional inference that the helicopter has two rotors. This confirms results of earlier paradigms, but this particular presupposition does not come with an at-issue control (which would have involved an explicit modifier to the effect that the big helicopter had two rotors). At this point, then, we just replicate our earlier results.

(ii) In the b. sentences of both paradigms, we obtain a relatively strong cosupposition to the effect that, if the helicopter were to go from Boston to New York, it would have a curved path. Strikingly, this inference is quite a bit weaker in the at-issue control displayed in the c. sentences. This suggests that the cosuppositional inference is genuinely due to the path traced by the predicate classifier, rather than to common sense reasoning interacting with an at-issue contribution.

(iii) In (33), there is only a small difference between the d. sentence (orthogonal detour) and the e. sentence (at-issue control of orthogonal detour), and in (34) any difference is unclear and the judgments are unstable. Whereas in the paradigm of Section 3.2.1 a sudden orthogonal detour gave rise to the presupposition that the helicopter will fly from Boston to New York, the effect is lost with the new realization of the orthogonal detour, which is much larger than in the earlier case and involves no acceleration. This might be because the earlier realization was taken to involve some kind

<sup>7</sup> We provide the full scores although they don't display more than a 2-point difference; this is to facilitate comparison with the d. condition, 'orthogonal detour'.

of linguistic focus (M. Esipova's suggestion). But the contrast might be due to something else: in (30)d and (32)d, the orthogonal detour was very large, and might have been indicative of a planned detour as opposed to an unexpected one. In Appendix II, we investigate a paradigm with embedding under *MAYBE*, and an additional clause involving ellipsis (which is irrelevant for the present discussion, but is discussed for other reasons in Section 6). The unelided part of the 'orthogonal detour' condition as well as the corresponding control are very similar to our conditions with *MAYBE* in (32)d,e, but with one important difference: we asked the consultant to realize the orthogonal detour (in (76)f in Appendix II) as being smooth but smaller than (32)d. The corresponding inferential judgment displays a presuppositional inference that the helicopter will in fact make the trip (inferential strength of 6 for the target, of 2.3 for the at-issue control, Column 3a of (78)f,g).

(iv) Despite our failure to trigger a presupposition in the d. sentences in the present paradigm (although we did succeed in Appendix II), a completely different modification, involving hovering of the helicopter in the middle, does give rise to a presupposition that it will go from Boston to New York. Certainly no acceleration is involved in this case, since the helicopter represented as hovering involves *less* movement than the rest of the iconic representation.<sup>8</sup> The inferential effect can be seen in the f. sentences, especially under *IF*, where the inferential strength is of 5.7; the inferential strength is only of 4.7 under *MAYBE*. In both cases, the at-issue controls in the g. sentences give rise to weaker inferences to the same effect (3.7 under *IF*, 3 under *MAYBE*). The unelided part of similar sentences with embedding under *MAYBE* in (76)h,i in Appendix II yield the same conclusions (the presupposition that the helicopter will make the trip is endorsed with strength 5.7 for the target and for 2.7 for the at-issue control, as seen in Column 3a of (78)h,i).

#### 4.2 Vertical movement

We also studied a paradigm pertaining to the take-off of a normal helicopter (with modifications of the normal helicopter classifier predicate in (27)). Here too, we investigated embedding under *IF*, as shown in (35), and under *MAYBE*, as shown in (36).

- (35) *Context*: our company has one helicopter and one airplane.  
 WITHIN 5-MINUTES OUR COMPANY HELICOPTER *IF* \_\_\_\_\_, 2-EMAIL-1.  
 'If within the next five minutes our company's helicopter ..., e-mail me.'  
 (ASL, [34, 3647](#); 3 judgments)  
 Video: <sup>9</sup> <http://www.goo.gl/3DZNDM>

Condition (ASL, <a href="#">34, 3647</a> ; 3 judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. neutral take-off	<sup>7</sup> GO-helicopter-up__	takes off
b. curved path	<sup>7</sup> GO-helicopter-up_∩_smooth	takes off (with the assumption that this would involve a curved path)
c. at-issue control of curved path	<sup>6</sup> GO-helicopter-up__ WITH PATH _∩_smooth	takes off with a curved path
d. orthogonal detour	<sup>6.3</sup> GO-helicopter-up_ __ no_acceleration	takes off with a horizontal detour
e. at-issue control of orthogonal detour	<sup>5.7</sup> GO-helicopter-up__ WITH PATH  _ _no_acceleration	takes off with a horizontal detour
f. pause in the middle	<sup>6.7</sup> GO-helicopter-up__ _	pauses to hover after its take-off
g. at-issue control of orthogonal detour	<sup>6.7</sup> GO-helicopter-up__ WITH PAUSE __ _	takes off with a pause to hover

- (36) WITHIN 5-MINUTES OUR COMPANY HELICOPTER *MAYBE* \_\_\_\_\_ .  
 'Within the next five minutes, maybe our company's helicopter will ...!'

<sup>8</sup> One could argue that longer duration can be used to mark focus (e.g. Schlenker et al. 2016). Thus one could try to analyze this example as well as involving a kind of focus on the hovering part, which would make it necessary to study further 'focus-free' paradigms in the future.

<sup>9</sup> There was a false start for (35) (... *WITH PAUSE*...): the consultant aborts a sentence and immediately starts again.



(ASL, 34, 3643; 3 judgments)

Condition (ASL, 34, 3643; 3 judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. neutral take-off	<sup>7</sup> GO-helicopter-up__	take off
b. curved path	<sup>7</sup> GO-helicopter-up_∩_smooth	take off (with the assumption that this would involve a curved path)
c. at-issue control of curved path	<sup>6.3</sup> GO-helicopter-up__ WITH PATH _∩_smooth	take off with a curved path
d. orthogonal detour	<sup>7</sup> GO-helicopter-up__ __ no_acceleration	take off with a horizontal detour
e. at-issue control of orthogonal detour	<sup>5.7</sup> GO-helicopter-up__ WITH PATH __ __ no_acceleration	take off with a horizontal detour
f. pause in the middle	<sup>6.7</sup> GO-helicopter-up__ __	pause to hover after its take-off
g. at-issue control of orthogonal detour	<sup>7</sup> GO-helicopter-up__ WITH PAUSE __ __	take off with a pause to hover

Here too, inferential strength was assessed by way of quantitative questions, illustrated in (37). As before, the *Meaning 2* question tests an inference that one would expect to find with *CONTINUE* but not with the present paradigm (and thus it establishes the baseline for an inference that is not expected to arise).

(37) Quantitatively assessed inferences for the paradigm in (35)

Does the sentence suggest that any of the following is the case? (1 = no inference; 7 = strongest inference)

*Meaning 1:* the helicopter is currently on the ground

*Meaning 2:* the helicopter is currently taking off

*Meaning 3:* the helicopter will take off in the next 5 minutes

*Meaning 4:* if the helicopter were to take off within the next 5 minutes, it would

a. do so with a curved path

b. do so with an orthogonal horizontal detour

c. stop and hover on its way

(only pick the strongest inference among a, b, c)

Results for embedding under *IF* are displayed in (38) and those for embedding under *MAYBE* appear in (39).

(38) Vertical movement, *IF*: inferential results

Target sentence / Inferences (ASL, 34, 3647; 3 judgments)	Inference type	1. Helicopter is currently on the ground	2. Helicopter is currently taking off	3. Helicopter will take off in the next 5 minutes	4. If the helicopter takes off within 5 minutes ____ (= strongest conditional inference)
a. neutral path	at-issue + on ground presupposition	6.7	1	1.7	1
b. curved path	cosupposition + on ground presupposition	6.7	1	1.7 (curved path)	5.3 (curved path)
c. at-issue control of curved path	at-issue + on ground presupposition	6.3	1	3.3 (curved path)	2 (curved path)
d. orthogonal detour	presupposition? + on ground presupposition	6.7	1.3	4 (orthogonal horizontal detour)	2 (orthogonal horizontal detour)
e. at-issue control of orthogonal detour	at-issue? + on ground presupposition	6.3	1	3.3 (orthogonal horizontal detour)	2 (orthogonal horizontal detour)
f. pause in the middle	presupposition + on ground presupposition	6.7	1.3	4.7 (stop and hover)	2 (stop and hover)
g. at-issue control of pause in the middle	at-issue + on ground presupposition	6.3	1	3.3 (stop and hover)	2 (stop and hover)

(39) Vertical movement, *MAYBE*: inferential results

Target sentence / Inferences	Inference type	1. Helicopter is currently on the	2. Helicopter is currently taking	3. Helicopter will take off in the next 5	4. If the helicopter takes off within 5
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(ASL, 34, 3643; 3 judgments)		<b>ground</b>	<b>off</b>	<b>minutes</b>	<b>minutes ____ (= strongest conditional inference)</b>
<b>a. neutral path</b>	<b>at-issue</b> + on ground presupposition	<b>6.7</b>	1	1.7	1
<b>b. curved path</b>	<b>cosupposition</b> + on ground presupposition	<b>6.7</b>	1	2	<b>5.7 (curved path)</b>
<b>c. at-issue control of curved path</b>	<b>at-issue</b> + on ground presupposition	<b>6.3</b>	1	3	2.7 (curved path)
<b>d. orthogonal detour</b>	<b>presupposition?</b> + on ground presupposition	<b>6.7</b>	1.3	3.3 (5, 2, 3)	2.3 (orthogonal horizontal detour)
<b>e. at-issue control of orthogonal detour</b>	<b>at-issue?</b> + on ground presupposition	<b>6.3</b>	1	2.7	2.3 (orthogonal horizontal detour)
<b>f. pause in the middle</b>	<b>presupposition</b> + on ground presupposition	<b>6.3</b>	1.3	4	2 (stop and hover)
<b>g. at-issue control of pause in the middle</b>	<b>at-issue</b> + on ground presupposition	<b>6.7</b>	1	3.7	2.7 (stop and hover)

Conclusions are less sharp than for the horizontal paradigm, but they go in the same general direction. In addition, the '2-rotored presupposition' is now replaced with an 'on the ground' presupposition.

(i) In all conditions, we obtain the strong presuppositional inference that the helicopter is currently on the ground.

(ii) In the b. sentences (curved path), we obtain a relatively strong cosupposition to the effect that, if the helicopter were to take off, it would have a curved path. Strikingly, this inference is far weaker in the at-issue control in the target c. sentences.

(iii) As in the horizontal paradigm, and probably for the same reasons, there is little difference between sentences d. and e.: the orthogonal detour fails to trigger a presupposition. But here too, it is worth considering the data discussed for other purposes (involving ellipsis) in Appendix II: an unelided sentence extremely similar to (36)d, displayed in (79)f, triggered a relatively strong inference that the take-off will take place, as shown in (80)f (Column 3a, inferential strength of 4.7); the at-issue control in (79)g failed to yield this inference ((80)g, Column 3a, inferential strength of 2.7). Importantly, the sentence in (80)f was similar to (36)d in eschewing any abruptness in the detour, but the detour was smaller than in (36)d, which might have helped suggested that it was unexpected rather than planned.

(iv) A realization of the predicate classifier in which the helicopter pauses to hover during take-off gives rise to an inference that the take-off will take place, but it is weaker than in our horizontal paradigm and thus one should not jump to conclusions in this case.

### 4.3 Summary and outlook

#### 4.3.1 Main results

Having shown in Section 2 that in English co-speech gestures trigger cosuppositions, and that pro-speech gestures may trigger standard presuppositions, we suggested in Sections 3 and 4 that ASL classifier predicates may, depending on their realization, trigger standard presuppositions or cosuppositions.

We were careful in the present section to systematically compare iconically modified classifier predicates with at-issue controls involving explicit modifiers. The contrasts obtained make it unlikely that world knowledge alone was responsible for the observed inferences: the at-issue controls provided essentially the same overall information as the iconically modified targets, and thus world



knowledge should have interacted in the same way with that contribution as in the targets; still, presuppositions and cosuppositions were triggered in targets but not in controls.

#### 4.3.2 *The role of at-issue controls*

Still, there is only so much we can do in terms of controls, and we should mention that our controls come with their own pragmatic requirements. Since our results assess in part the *difference* between the targets and the at-issue controls, it is essential to understand these requirements in order to determine what role, if any, they play in the difference.

Importantly, a sentence of the form *The helicopter took off with movement X* comes with a pragmatic requirement that the modifier *with movement X* should not be semantically idle. This immediately explains why *The helicopter took off with an upward movement* is an odd thing to say: take-offs are *supposed* to involve an upward movement, hence the at-issue modifier doesn't add anything and is deviant. Thus it should not be the case that, relative to the relevant context, *the helicopter took off with movement X* should be equivalent to *the helicopter took off*.<sup>10</sup>

In the case at hand, our at-issue controls trigger a non-triviality inference that goes against the purported cosupposition. This is because the cosupposition *if the helicopter were to take off, this would involve movement X* leads to the prohibited equivalence: on the assumption that *take-off => take-off with movement X*, we immediately get the unwanted equivalence *take-off <=> take-off with movement X* (because the right-to-left direction of the equivalence is trivial). The pragmatic prohibition against such cases will on its own create part of the difference between our cosuppositional targets and these at-issue controls. This problem is unavoidable when one wishes to compare cosuppositional targets with modified expressions that have the same truth conditions. Still, it is reassuring that not just the *difference* between our targets and the controls is informative; the targets do give rise to fairly strong inferences on their own.<sup>11</sup>

Turning to the simple presuppositions of the form *the helicopter will in fact go from Boston to New York*, or *the helicopter will in fact take off*, our controls introduce small biases that go in the opposite direction, in the sense that they should make it *harder* for us to detect the desired differences. In this case, the non-triviality of the modifier does not go against the presupposition: one can for instance presuppose that the helicopter will take off while obeying the requirement that the manner of movement should be non-trivial. But there is another potential effect to keep in mind. It is conceivable that a sentence such as *the helicopter will take off with a pause in the middle* tends to be interpreted with focus on the modifier, which is final (both in ASL and in English), in which case the rest of the VP might be interpreted as 'given' - a phenomenon which, as mentioned above, sometimes gives rise to presupposition-like inferences, such as: *the helicopter will take off. Despite this potential effect, our presuppositional targets with pauses (or orthogonal detours, as in Appendix II) give rise to much stronger inferences than the at-issue controls with modifiers. This suggests that the desired effect might be robust.*<sup>12</sup>

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<sup>10</sup> According to Stalnaker 1978, an expression should not be trivial relative to (i.e. follow from) its local context. On the assumption that the local context of the modifier includes the semantic content of the verb it modifies, we obtain the condition that *The helicopter took off* should not be presupposed to entail *The helicopter took off with movement X*. Technically, this non-triviality requirement is an antipresupposition, as discussed for instance in Sauerland 2003, 2008; Percus 2006; Singh 2011; Schlenker 2012; Anvari 2018. For a derivation of the deviance of related cases in which a complex expression competes with structurally simpler alternatives, see Katzir 2007 and Katzir and Fox 2011.

<sup>11</sup> It is worth noting that the problem discussed in this section (to the effect that controls could be responsible for the desired) is pervasive in presupposition theory. For instance, in (14) above, we argued for the presuppositional behavior of the English verb *take off* by displaying a contrast between *Will the company's plane take off?* and *Will the company's plane be on the ground and then take off?* The traditional idea is that in the second sentence the underlined expression is at-issue and justifies the presupposition of *take off*, with the result that the entire conjunction is presuppositionless, hence should not give rise to a projection behavior. But the first conjunct comes with its own non-triviality requirement: it should not be presupposed that the plane is on the ground (this case immediately follows from conditions stated in Stalnaker 1978, see fn. 10). The contrast between the target and the at-issue control is thus due in part to this antipresupposition.

<sup>12</sup> See fn. 8 for some qualifications, however.

### 4.3.3 New questions

While these methodological issues should be kept in mind in future research, they should not obscure our main finding, which pertains to the existence of iconically triggered presuppositions and cosuppositions with ASL classifier predicates. Our results raise a question about pro-speech gestures in English: could they be modulated in comparable ways to ASL predicate classifiers so as to trigger not just standard presuppositions but also presuppositions? We give a positive answer in the next section.

## 5 Triggering cosuppositions with pro-speech gestures

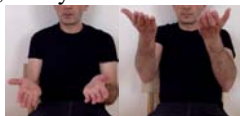
In order to show that pro-speech gestures can trigger cosuppositions, it would be particularly natural to explore constructions that are directly inspired by ASL classifier predicates, such as ones involving the path of a helicopter or a missile flying, or of a person walking. Our initial attempts suggested that the data might be overly subtle for an initial exploration, and thus we take a less direct route. First, in order to have gestural cases that are conceptually similar to the case of co-speech gestures modifying full words, we consider various gestural constructions in which one element, for instance a facial expression, modifies a pro-speech gesture, but is easily separable from it, and intuitively makes a less important contribution (e.g. because it is omissible whereas the pro-speech gesture isn't). As we will see, the less important expression typically triggers a cosupposition. Second, we extend the finding to cases in which it is an inseparable property of a gesture (the manner in which it is realized, rather than an add-on to it) that triggers a cosupposition; these cases will be close to the path modifications of our ASL classifier predicates.

To obtain judgments comparable to our ASL data, we conducted a detailed survey with three informants, all native speakers of American English (two from the United States, one from Canada). All are linguists and thus have considerable experience with acceptability and inferential judgments (as does our ASL consultant); two of them have worked on gestures, and none is a signer. We modeled our methods on those we used to elicit ASL data: acceptability as well as inferential judgments were recorded on a 7-point scale (with 7 = best for acceptability, and 7 = strongest inference for inferential strength). One important difference is that the author rather than the informants recorded the videos; this was to ensure that gesture modifications were realized in exactly the desired way. In order to mitigate any inadequacies of the author as a model (a different line of work), informants were encouraged to "repeat the sentences for [themselves] with the same gestures in order to get a feel for acceptability or inferential contrasts". Acceptability judgments suggest that videos were good enough to be assessed. Only averages will be discussed below, but raw data and informant comments can be found in the Supplementary Materials B.

### 5.1 Cosuppositions triggered by modifications of *LIFT*

Our first example contrasts three realizations of a lifting gesture, which we illustrate on the case of embedding in a question as in (40), which includes: a neutral lifting gesture, glossed as *LIFT* in (40)a; a manual lifting gesture realized with difficulty (trembling hands), glossed as *LIFT-difficult* in (40)b; and a manual lifting gesture realized with difficulty and co-occurring with a facial expression indicative of effort, glossed as *:-/ LIFT-difficult* in (40)c.<sup>13</sup> Finally, we have a gesture-free at-issue control, as in (40). As in most cases discussed in this section, acceptability was reasonably high in view of the non-standard nature of gestural examples, as shown in the acceptability scores in (40).

(40) This child, will you



- a. <sup>6</sup> *LIFT* ?  
 b. <sup>5.3</sup> *LIFT-difficult*?  
 c. <sup>6.3</sup> *:-/ LIFT-difficult*?

<sup>13</sup> The manual gesture need not be realized exactly in the same way in b. and in c.

d. <sup>5</sup> lift with difficulty?  
(video 01)

Our main focus was on the inferences triggered by these examples. We wished to determine whether, under embedding under yes-no questions, negation, *might* and *none*-type quantifiers, we obtained projection patterns characteristic of a presupposition/cosupposition of the form: *if x were to lift y, effort/difficulty would be involved*. The four embedding types are illustrated in (41) on the case of *LIFT*, but they were tested as well with all four conditions appearing in (40). For simplicity, only universal inferences were tested under *none*-type quantifiers.

(41) Conditions and inferences, illustrated with condition a. (= *LIFT*)

(i) Question: This child, will you *LIFT*? (video 01)

(ii) Negation: You son, I won't *LIFT*. (video 02)

(iii) Might: You son, I might *LIFT*. (video 03)

*Cosupposition tested in (i)-(iii):* if the speaker were to lift the child, effort/difficulty would be involved.

(iv) None: None of these children will I *LIFT*. (video 04)

*Cosupposition tested:* for each of these children, if the speaker were to lift him/her, effort/difficulty would be involved.

In (42), acceptability judgments appear under *Acc* while judgments of (cosuppositional) strength appear under *Cosup* and are boldfaced.

(42) Summary of acceptability and inferential results: *LIFT*

Target sentence / Conditions	(i) Question		(ii) Negation		(iii) Might		(iv) None	
Video	Video 01		Video 02		Video 03		Video 04	
	Acc	Cosup	Acc	Cosup	Acc	Cosup	Acc	Cosup
a. <i>LIFT</i>	6	<b>1</b>	5.67	<b>1</b>	6	<b>1</b>	5.67	<b>1</b>
b. <i>LIFT</i> -difficult	5.33	<b>4.67</b>	5.33	<b>5.33</b>	5.33	<b>5</b>	5.33	<b>5.67</b>
c. <i>:/ LIFT</i> -difficult	6.33	<b>6.67</b>	6.33	<b>6.67</b>	6.33	<b>6.67</b>	6	<b>5.33</b>
d. lift with difficulty	5	<b>1.33</b>	5.67	<b>1.33</b>	6.67	<b>2.5</b>	6.33	<b>1</b>

We obtain a rather strong projection of the conditional inference triggered by the facial expression combined with the manual modification obtained in *:/ LIFT*-difficult, illustrated in (40)c. This is relatively unsurprising: the optional facial expression plays the same kind of role relative to the pro-speech gesture *LIFT* as a co-speech gesture plays relative to a full word. What is particularly interesting for purposes of comparison with ASL predicate classifiers is that the manner modification of *LIFT* found in *LIFT*-difficult (illustrated in (40)b) triggers a cosupposition as well. Acceptability and inferential strength are weaker than in the case involving a facial expression (i.e. *:/ LIFT*-difficult), but the inferential results are still sharply different from the controls in (42)a,d.

We conclude that a gesture modification indicative of effort/difficulty might suffice to trigger a cosupposition, although the effect is strengthened in case it is accompanied with a facial expression with a related content.

## 5.2 Cosuppositions triggered by modifications of TAKE-OFF

Our second example followed the same logic, but involved a helicopter take-off, with a neutral pro-speech gesture as in (43)a, similar to the ascending rotating gesture illustrated in (15). In (43)b, the gesture was realized with a slow, irregular and difficult beginning, slowly accelerating. In (43)c, a neutral onomatopoeia, *ph*, was added to each cycle. In (43)d, an at-issue control with a 'like this' modifier was included, and *this* referred to the following gesture, realized silently as in (43)b.

(43) At 12:05, will out company's helicopter



- b. TAKE-OFF-difficult-accelerating?  
 c. TAKE-OFF-difficult-ph-accelerating?  
 d. take off like this TAKE-OFF-difficult-accelerating?  
 (video 05)

The various embeddings are illustrated in (44). Judgments of inferential strength pertain to a cosupposition (to the effect if the plane were to take off, it would initially accelerate slowly/with difficulty), but also to a standard presupposition, corresponding to the helicopter's initial position on the ground.

(44) Conditions and inferences, illustrated with condition a. (=TAKE-OFF)

- (i) Question: At 12:05, will our company's helicopter TAKE-OFF? (video 05)  
 (ii) Negation: At 12:05, our company's helicopter won't TAKE-OFF. (video 06)  
 (iii) Might: At 12:05, our company's helicopter might TAKE-OFF. (video 07)

Cosupposition tested in (i)-(iii): if the company's helicopter were to take off (at 12:05), it would initially accelerate slowly/with difficulty.

Presupposition tested in (i)-(iii): right before 12:05, the company's helicopter will be on the ground.

- (iv) None: At 12:05, none of our company's helicopters will TAKE-OFF. (video 08)

Cosupposition tested: for each of the company's helicopters, if it were to take off (at 12:05), it would initially accelerate slowly/with difficulty.

Presupposition tested: right before 12:05, each of the company's helicopters will be on the ground.

In **Error! Reference source not found.**, acceptability judgments appear under *Acc*, judgments of cosuppositional strength (pertaining to manner of movement) appear under *Cosup*, while judgments of presuppositional strength (pertaining to the helicopter's initial position) appear under *Presup*. Judgments of inferential strength are boldfaced.

(45) Summary of acceptability and inferential results: TAKE-OFF

Target sentence /Conditions	(i) Question			(ii) Negation			(iii) Might			(iv) None		
Video	Video 05			Video 06			Video 07			Video 08		
	Acc	Cosup	Presup	Acc	Cosup	Presup	Acc	Cosup	Presup	Acc	Cosup	Presup
a. TAKE-OFF	6	<b>1</b>	<b>6.33</b>	6	<b>1</b>	<b>5.33</b>	6.17	<b>1</b>	<b>6.33</b>	6	<b>1</b>	<b>4.33</b>
b. TAKE-OFF-difficult-accelerating	5.33	<b>5.33</b>	<b>6.33</b>	6	<b>5.67</b>	<b>5.33</b>	6.33	<b>5.5</b>	<b>6.33</b>	6	<b>6</b>	<b>4.33</b>
c. TAKE-OFF-difficult-ph-accelerating	4.67	<b>5.67</b>	<b>6.33</b>	5.67	<b>6</b>	<b>5.33</b>	6	<b>5.67</b>	<b>6.33</b>	6	<b>6</b>	<b>4.33</b>
d. take off like this	6.67	<b>1.33</b>	<b>6.33</b>	6.33	<b>1</b>	<b>6.33</b>	6.67	<b>2</b>	<b>6.33</b>	6.33	<b>1.67</b>	<b>5</b>

The presuppositional inference, to the effect that the helicopter(s) is/are initially on the ground, projects as expected in these various conditions; a weak universal projection is obtained under *none*. What is of interest is the cosupposition, to the effect that *if the helicopter were to take off, this would involve a slow/difficult initial acceleration*. It is fairly strongly obtained in (45)c, where the onomatopoeia might play the same kind of role as a co-speech gesture, but also in (45)b, where it seems to be entirely triggered by the manner in which the manual gesture is performed.

We conclude that in this case as well, a pro-speech gesture can trigger a cosupposition given the right realization of the manual component.<sup>14</sup>

<sup>14</sup> We do not discuss here an additional part of our gesture survey, which pertained to pro-speech music, in the form of a song (the first words of the French national anthem) replacing a verb, as illustrated in (i)a:

- (i) On Bastille Day, will your students  
 a. ♪ *Allons-enfants-de-la-patrie*?  
 b. ♪ *Allons-enfants-de-la-patrie*-unmusical?  
 c. ♪ *Allons-enfants-de-la-patrie*-HAND-ON-HEART?  
 d. sing the Marseillaise with HAND-ON-HEART [**this**] posture?

In (i)a, the French words *Allons enfants de la patrie* are literally sung as part of the sentence. In (i)b, they are sung in a reluctant and unmusical fashion. In (i)c, they are sung normally, but are accompanied by a patriotic

### 5.3 Pro-speech gestures vs. classifier predicates

Overall, the typology of inferences we have found with pro-speech gestures mirrors that obtained with ASL classifier predicates: in both cases, presuppositions and cosuppositions can be triggered. The next step would be to have much more minimal comparisons between classifier predicates and pro-speech gestures, for instance by investigating pro-speech gestures that resemble the path modifications we investigated in ASL.

The similarity we found between the inferential types triggered by classifier predicates and pro-speech gestures need not be surprising: in both cases, we are dealing with constructions that have a highly iconic component: this is obvious for pro-speech gestures; for classifier predicates, while the object shape may be lexical, the path certainly isn't, and is highly iconic in nature. These results suggest that iconic semantics can trigger standard presuppositions and cosuppositions.

## 6 Can iconic cosuppositions be disregarded under ellipsis?

### 6.1 The importance of ellipsis

Earlier literature noted that cosuppositions triggered by co-speech gestures can be ignored under ellipsis.<sup>15</sup> It was initially thought that this is because, in the course of ellipsis resolution, spoken words can be copied without the gestures that accompany them. On this view (henceforth the 'conservative hypothesis'), one would expect cosuppositions triggered by ASL classifier predicates to be less liberal because there is no clearly separable component responsible for the cosupposition – unlike a co-speech gesture, which can be neatly excised from the words it accompanies. The same expectation would naturally extend to the cosuppositions triggered by the pro-speech gestures *LIFT-difficult* and *TAKE-OFF-difficult-accelerating* in Section 5, since whatever is responsible for the cosupposition is hard to separate from the rest of the gesture.

We turn to data that might argue for a 'revisionist hypothesis' according to which presuppositions can quite generally be disregarded under ellipsis; this leaves open the possibility that co-speech gestures are particularly easy to disregard because they can be excised from the words they modify.

The behavior of cosuppositions under ellipsis matters for two reasons. First, it might offer an additional diagnosis to distinguish cosuppositions from standard presuppositions: the latter cannot normally be disregarded under ellipsis, and it would thus be interesting to find out that cosuppositions can be (as we will see in Section 9.2, this empirical has theoretical consequences).

Second, Aristodemo 2017 and Aristodemo and Santoro, to appear, argue that some signs in Italian Sign Language (LIS) trigger iconic cosuppositions, and suggest that this is because they include (co-sign) gestures in their realization. From the present perspective, the mere existence of cosuppositional inferences does not suffice to argue for the presence of gestures, as cosuppositions arise in a variety of iconic representations. Crucially, however, Aristodemo and Santoro argue that the cosuppositional contributions they investigate can be disregarded under ellipsis, which does in fact make them very similar to co-speech-induced cosuppositions. It is thus essential to determine whether iconic cosuppositions triggered by ASL classifier predicates and by pro-speech gestures can be disregarded under ellipsis. If they can be, cosupposition ignorance under ellipsis might be a broader phenomenon, and Aristodemo's data might be re-analyzed without positing that some LIS words

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posture, with the speaker's hand on his heart. (i)d is a control in which this position co-occurs with (and is the denotation of) *this posture*.

As can be seen in the Supplementary Materials B, (i)c and related embedding tests suggest that the posture triggers a cosupposition to the effect that *if the speaker's students were to sing the Marseillaise on Bastille Day, they would adopt a patriotic posture such as having one's hand on one's heart*. On the other hand, the unmusical rendering of the song in (i)b only triggers a much weaker cosupposition (to the effect that, if the relevant students were to sing, they would do so in a reluctant/unmusical fashion).

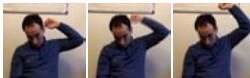
<sup>15</sup> Schlenker 2015 notes that the 'disappearing act' of co-speech gestures can be replicated in the 'focus dimension' under *only*. Here we solely discuss ellipsis, but *only* and other particles that associate with focus should be studied in the future. (Ellipsis is particularly important for the present discussion because it is used by Aristodemo 2017 to argue that some of her LIS constructions might involve incorporated gestures.)

contain gestures.

In the following subsections, we provide background on co-speech gestures under ellipsis and summarize Aristodemo's original findings.<sup>16</sup> We then present conflicting data: in ASL, cosuppositions are easily preserved under ellipsis, either because the revisionist hypothesis is wrong, or because there is an ambiguity and our contexts did not sufficiently promote the cosupposition-free reading; because the data are complex, and give rise to a null result, we only briefly summarize them in the main text and present them in greater detail in Appendix II. In English, we will discuss examples in which cosuppositions triggered by pro-speech gestures can be disregarded under ellipsis.

## 6.2 Co-speech gestures can be ignored under ellipsis

As noted in Schlenker 2015, to appear b, co-speech gestures can be disregarded under ellipsis, as is illustrated in (46)b. In this respect, co-speech gestures resemble height specifications of sign language loci, as studied by Schlenker et al. 2013 and Schlenker 2014. In the case of height specifications, one could claim that they are ignored under ellipsis because they are grammatical features inherited by way of agreement. This view is not plausible for co-speech gestures, which unlike features are not drawn from a closed inventory. Importantly, unlike co-speech gestures, pro-speech gestures cannot be ignored in the course of ellipsis resolution: in (46)a, the elided VP is preferably understood as *hanged*, hence the need for a specific covert word: *hanged* but not *punished*.

- (46) a. A traitor should be HANG\_ . A whistleblower shouldn't be.  
*Preferred interpretation:* whistleblowers shouldn't be hanged
- b. A traitor should be HANG\_  **punished**. A whistleblower shouldn't be.  
*Preferred interpretation:* whistleblowers shouldn't be punished  
 (Schlenker, to appear b)

A natural thought is that the disappearing act of co-speech gestures is due to their parasitic form, since one can recover a well-formed message by ignoring them. On this view, ellipsis can just copy the verbal part of the antecedent while disregarding the gesture.<sup>17</sup> As we will now see, recent data due to Aristodemo (2017) cast doubt on this theoretical direction, at least without significant additions.

## 6.3 Cosupposition in LIS maximal degree adjectives: Aristodemo's findings

Aristodemo 2017 notices that in LIS several lexical elements have an iconic component which (i) triggers presuppositions and (ii) can be disregarded under ellipsis. She bases her analysis on the behavior of the adjectives *FULL* and *BALD*, which mean 'completely full' and 'completely bald' respectively, and are illustrated in (47).

- (47) *FULL* and *BALD* in LIS (Aristodemo 2017)

a. *FULL*



b. *BALD*



Aristodemo's argument is in four steps, the first three of which are illustrated in (48).

- (48) a. GIANNI GLASS IX-3-poss FULL NOT.  
 'Gianni's glass is not full.'  
 => If Gianni's glass were full, it would be completely full.

<sup>16</sup> Aristodemo and Santoro (to appear) summarize Aristodemo's findings and provide further examples in which iconic material under Role Shift (a construction that has sometimes been treated as overt context shift, e.g. by Quer 2005, 2013 and Schlenker 2017b, c); here we only discuss the data from Aristodemo 2017.

<sup>17</sup> Similarly, one would need to posit that the 'focus dimension' under only is computed in a way that makes it possible to ignore gestures.

b. GLASS IX-1-POSS WINE FULL PIERO BELIEVE, MARIA IX-3 NOT.

(i) 'Piero believe that my glass is completely full of wine, Maria does not believe that my glass completely is full.'

(ii) 'Piero believe that my glass is completely full of wine, Maria does not believe that my glass is full.'

c. GLASS IX-1-POSS WINE FULL PIERO BELIEVE, MARIA GLASS IX-1-POSS WINE FULL BELIEVE NOT.

'Piero believe that my glass is completely full of wine Maria does not believe that Piero's glass is completely full of wine.'

(LIS, Aristodemo 2017)

First, a negative sentence such as (48)a with *FULL* gives rise – despite the negation – to the cosupposition-style inference that *if the glass were full, it would be completely full*. Second, the 'completely full' component is optionally disregarded under ellipsis: (48)b optionally gives rise to the inference in (ii), according to which Piero believes that the glass is completely full whereas Maria doesn't believe that it's full. Third, this option is precluded when the adjective *FULL* is repeated in the second clause, as in (48)c (now without ellipsis). The fourth step involves Italian: Aristodemo investigates a co-speech gesture, *COMPLETELY*, which triggers a cosupposition and can be disregarded under ellipsis: when it co-occurs with the adjective *pieno* ('full'), as in *COMPLETELY pieno*, the gesture triggers a cosupposition of the form *if x is full, it's completely full*. This is just what is expected in the case of co-speech gestures, but the similarity with the 'completely' component of the LIS sign *FULL* is striking.

Aristodemo 2017 attributes these effects to an iconic component of *FULL* and *BALD*: in both cases, the maximum degree is iconically represented. As Aristodemo writes, the sign *BALD* "starts close to the forehead and ends behind the head covering the entire area of the head"; while in the sign for *FULL*, "the dominant hand which articulates a flat handshapes looks like a top of a container".

Aristodemo 2017 concludes (very cautiously) that these signs might in effect contain an incorporated co-speech gesture, a conclusion further developed by Aristodemo and Santoro, to appear. But if so, the view that it is the parasitic nature of co-speech gestures that is responsible for their disappearing act under ellipsis is insufficient to account for these data: there are just no versions of the *FULL* and *BALD* signs that do not have the 'completely' component, and in that sense this component seems to be anything but optional and parasitic.

#### 6.4 *The behavior under ellipsis of cosuppositions triggered by ASL classifier predicates*

In Appendix II, we present detailed paradigms that seek to test whether the cosuppositions triggered by ASL classifier predicates in Section 4 can be disregarded under ellipsis. The judgments are unstable: among three judgment tasks, one gives rise to a positive answer, two to a negative answer. This can definitely *not* be taken to support the revisionist hypothesis according to which all cosuppositions (not just those triggered by co-speech gestures) can be disregarded under ellipsis. The results could point towards a refutation of the revisionist hypothesis, or towards a more refined version of it: it could be that there is a genuine ambiguity, in the sense that the cosupposition may either be preserved or ignored under ellipsis, but that a strong enough context must be provided to favor the cosupposition-free reading (this ambiguity theory might also explain why there is variation in the judgments).

#### 6.5 *The behavior under ellipsis of cosuppositions triggered by pro-speech gestures*

We turn to the behavior under ellipsis of cosuppositions triggered by pro-speech gestures. We base our discussion on the survey described in Section 5.

Our survey included cases in which a disgusted facial expression added to the pro-speech gesture *LIFT* triggers a cosupposition (= lifting would involve a disgusted expression) that can be disregarded under ellipsis.<sup>18</sup> This behavior need not be surprising: the pro-speech gesture cannot be

<sup>18</sup> The paradigm that appears in the Supplementary Materials B is summarized in (i):

removed without making the sentence ungrammatical, whereas the facial expression can. It thus plays the same kind of role as a co-speech gesture co-occurring with a normal word, and can thus be expected to display the same behavior, as is the case.

The more crucial cases for us pertain to the cosupposition-inducing pro-speech gestures in (49)b and (50)b. As before, *LIFT-difficult* is a manual modulation of *LIFT*, with trembling hands, indicative of difficulty; and *TAKE-OFF-difficult-accelerating* is a manual modulation of *TAKE-OFF* displaying a difficult initial acceleration.

(49) This [big]<sup>19</sup> adult , I won't \_\_\_\_\_ , but this small child, I will.

- a. LIFT
  - b. LIFT-difficult
  - c. lift like this LIFT-difficult
- (video 14)

(50) At 12:05, our company's old helicopter won't \_\_\_\_\_, but our company's new helicopter will.

- a. TAKE-OFF
  - b. TAKE-OFF-difficult-accelerating
  - c. take off like this TAKE-OFF-difficult-accelerating
- (video 15)

We will now see that (49)b triggers a cosupposition to the effect that *if the speaker were to lift the big adult, the movement would be slow/difficult*, but it can be disregarded under ellipsis. Things are less clear in (50)b: while a cosupposition is triggered by the antecedent clause to the effect that *if the company's old helicopter were to take off, it would initially accelerate slowly/with difficulty*, the inference is weakened, but doesn't fully disappear, in the elided clause. But this paradigm benefits from the presence of a normal presupposition, to the effect that the helicopter is initially on the ground. This makes it possible to compare the cosupposition with the presupposition; and under ellipsis, unlike the cosupposition, the presupposition is clearly preserved.

In greater detail, the inferential questions for the *LIFT* paradigm in (49) appear in (51), with the acceptability and inferential strength judgments in (52). The cosuppositional question is stated in conditional form for the antecedent, unelided clause, but as an unconditional statement for the elided clause. The reason for this differential treatment is that in the elided clause the cosupposition ought to be combined with the at-issue component: if it is the case that *I will lift this small child*, and *if I were to lift this small child, the movement would be slow/difficult*, then it follows that *I will lift this small child with a slow/difficult movement*. For this reason, it would be odd to test a conditionalized inference whose antecedent is trivially true,<sup>20</sup> the problem does not arise for the unelided cause, which is under negation.

(51) Inferential questions for the *LIFT* paradigm in (49)

- (i) Unelided cosupposition: If the speaker were to lift the big adult, the movement would be slow/difficult.

(i) Your son, I won't \_\_\_\_\_ , but your daughter, I will.

- a. LIFT
  - b. :( LIFT
  - c. lift with this kind of face :(
- (video 13)

The crucial condition is (i). It gives rise to the inference that *if the speaker were to lift the addressee's son, a disgusted expression would be involved*, but not that *the speaker will lift the addressee's daughter with a disgusted expression*.

<sup>19</sup> The survey contains 'fat' instead of 'big'.

<sup>20</sup> We could solve this problem by replacing *will* with *might* in (49) and (50): this would make the conditionalized inference entirely felicitous. But as we explain in greater detail in fn. 36 of Appendix II for an analogous case in ASL, embedding the elided clause in this way would cause problems of its own (because presuppositional inferences could fail to be drawn for two separate reasons: disappearance under ellipsis, or local accommodation).



(ii) Elided cosupposition: The speaker will lift the small child with a slow/difficult movement.

(52) Acceptability and inferential strength for the *LIFT* paradigm in (49)

Target sentence / Questions (video 14)	Acceptability	(i) Unelided cosupposition	(ii) Elided cosupposition
a. <i>LIFT</i>	6	1	1
b. <i>LIFT</i> -difficult	6	6	1.33
c. lift like this <i>LIFT</i> -difficult	5.33	2	6.67

The inferential strength results show that a cosupposition is derived in the unelided clause but not in the elided clause. In the latter respect, things are entirely different with the *like this* control in (49)c/(52)c, where (as expected) the elided clause inherits the modifier and gives rise to a strong endorsement of the corresponding inference.

The inferential questions for the *TAKE-OFF* paradigm in (50) appear in (53). They pertain not just to the cosuppositional inference of interest here, but also to the presupposition that the helicopter was initially on the ground. This makes it possible to compare the strength of these two inferences, especially under ellipsis.

(53) Inferential questions for the *TAKE-OFF* paradigm in (50)

(i) Unelided cosupposition: If the company's old helicopter were to take off (at 12:05), it would initially accelerate slowly/with difficulty.

(ii) Elided cosupposition: The company's new helicopter will take off (at 12:05) with a slow/ difficult initial acceleration.

(iii) Unelided presupposition: Right before 12:05, the company's old helicopter will be on the ground.

(iv) Elided presupposition: Right before 12:05, the company's new helicopter will be on the ground.

(54) Acceptability and inferential strength for the *LIFT* paradigm in (50)

Target sentence / Questions (video 15)	Acceptability	(i) Unelided cosupposition	(ii) Elided cosupposition	(iii) Unelided presupposition	(iv) Elided presupposition
a. <i>TAKE-OFF</i>	6.17	1	1	5.67	6.33
b. <i>TAKE-OFF</i> -difficult-accelerating	5.67	6	3.83 (scores: 2.5, 6, 3)	5.67	6.33
c. take off like this <i>TAKE-OFF</i> -difficult-accelerating	6.67	1	7	6.33	6.33 (scores: 7, 7, 5)

Two results are relevant for present purposes. First, the cosupposition triggered by the realization in (50)b (slow/difficult initial acceleration) has an intermediate status in the elided clause; the individual scores show that two informants largely disregard it, while the third informant preserves it. Second, the presupposition to the effect that the helicopter is initially on the ground is strongly preserved by all three informants in the elided clause.

We conclude that cosuppositions triggered by the manual gestures under investigation in this section can to some extent be disregarded under ellipsis; furthermore, they seem to pattern in this respect differently from the initial state ('on the ground') presupposition triggered by the *TAKE-OFF* gesture.

## 6.6 Summary and outlook

According to the revisionist hypothesis, cosuppositions triggered by iconic constructions in general (rather than just by co-speech gestures) can be ignored under ellipsis; according to the conservative hypothesis, only cosuppositions triggered by co-speech gestures can be disregarded in this way (for syntactic reasons). Our investigations of ASL did not provide evidence for the revisionist hypothesis, although it could be that the relevant reading exists but was not brought out by our contexts. For pro-speech gestures, on the other hand, we conclude that, given the right context, cosuppositions can to some extent be disregarded under ellipsis. The data will of course have to be investigated in much greater detail, both in ASL and in pro-speech gestures.

But if these results are confirmed, they might suggest an alternative explanation of Aristodemo's findings. The LIS signs for *FULL* and *BALD* might turn out to fall under a broader

generalization : (i) certain manner inferences, especially triggered by the iconic realization of signs or gestures (including pro-speech gestures), can give rise to cosuppositions; (ii) these can to some extent be disregarded under ellipsis. On this view, the behavior uncovered by Aristodemo does not argue that some LIS signs include incorporated gestures.

We also note that the revisionist hypothesis could be conceptualized differently. Ebert and Ebert 2014 argued that co-speech gestures trigger supplements, the kind of contribution made by appositive relative clauses (Potts 2005). It was observed in the literature that appositive relative clauses can be ignored under ellipsis, as in (55):

- (55) John sold a violin, which had once belonged to Nathan Milstein, to Itzhak Perlman, and Mary did too.  
(McCawley 1998)

As McCawley 1998 noted, the second sentence of (55) does not imply that the violin that Mary sold to Perlman had once belonged to Nathan Milstein. Assuming that ellipsis targets a constituent, McCawley concluded that appositives can be attached very high, outside the constituent which is the antecedent of the elided VP. By contrast, Potts 2005 posited that supplements are attached *in situ*, and argued instead that ellipsis resolution is a *semantic* operation which can disregard supplements (further argument that some non-at-issue material can be disregarded under ellipsis was provided in Potts et al. 2009: expressives, which are not thought to 'attach high', can be disregarded in a similar fashion under ellipsis<sup>21</sup>).

Combining Potts's and Ebert's perspectives, one could analyze the behavior of our purported iconic cosuppositions under ellipsis in the following way: it was a mistake to treat these as a variety of cosuppositions in the first place; rather, they are varieties of supplements. While presuppositions cannot normally be disregarded under ellipsis, things are different with supplements, as shown in (55). The behavior of our purported cosuppositions doesn't show that cosuppositions have a special status under ellipsis (why should they if they are just a subvariety of presuppositions?), nor that they can be 'syntactically' removed (what would that mean for iconically realized paths?); rather, it is the expected behavior that supplements should have in such an environment.

The choice among these alternatives should of course interact with the broader debate about the existence and nature of cosuppositions and supplements (see Ebert and Ebert 2014 and Schlenker, to appear a for discussion).

## 7 Summary of the semantic generalizations

In this section, we summarize our main semantic generalizations, whose theoretical consequences for the Triggering Problem are discussed in the following sections. Our generalizations are of two types: some pertain to the triggering of standard presuppositions by iconic pro-speech gestures and ASL classifier predicates, others pertain to the triggering of cosuppositions by co-speech gestures, pro-speech gestures and ASL classifier predicates.

### 7.1 Generalizations about presuppositions

Instances of presupposition generation are summarized in (56), where we have pooled results from paradigms discussed in the text as well as in Appendix II, which (as discussed) occasionally contains clearer presuppositional data than the main text (independently from the issue of ellipsis, which is the focus of that appendix; Appendix I is summarized in the main text and thus its paradigms needn't be referenced independently). Cases of presupposition generation are of three (overlapping) types.

–The pro-speech gestures *TURN-WHEEL* (= (56)a) and *REMOVE-GLASSES* (= (56)b) as well as

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<sup>21</sup> Potts et al. 2009 contrast the case of the underlined expressive in (i)A, which can be ignored under ellipsis in (i)B, to the pronominal modifier in (ii)A, which cannot be ignored in a similar fashion in (ii)B.

- (i) A: I saw your  fucking  dog in the park.  
B: No, you didn't—you couldn't have. The poor thing passed away last week. (Potts et al. 2009)
- (ii) A: I saw a shaggy dog in the park.  
B: I did too. #The one I saw/It had no hair. (Potts et al. 2009)

the 2-rotored helicopter classifier (= (56)d) presuppose the presence in the relevant situation of a pre-existing object, namely the wheel, the glasses, or the 2-rotored helicopter.

–The pro-speech gestures *TAKE-OFF-ROTATING* (= (56)c) and (again) *REMOVE-GLASSES* (= (56)b) as well as the classifier predicate involving a take-off (= (56)e) are all change of state predicates, and they trigger a presupposition about the existence of the initial state, namely that the helicopter was on the ground, and that the glasses were on the relevant person's face.

–The modifications of a helicopter movement involving an orthogonal detour or a pause to hover are change of state predicates as well, but they do not presuppose the initial state; rather, they weakly presuppose that the relevant helicopter displacement will take place, and what is at issue is whether an orthogonal detour or a pause in the middle will take place.

For our ASL data, we wrote in (56) *presupposition* when the characteristic presuppositional inferences were endorsed with at least an average strength of 5 (out of 7) in all the propositional tests mentioned in the relevant tables (as mentioned above, quantificational tests are harder to analyze)<sup>22</sup>; we wrote *presupposition (?)* if this is the case for two propositional tests out of three. If tests sometimes came out positive and sometimes negative, we wrote *weak presupposition* (we added special notes when the score was very close to 4, such as 4.7).

#### (56) Summary of presuppositions triggered

Type	Possible source	Construction	Presupposition	Examples and comments
<b>a. pro-speech gesture</b>	pre-existing object	TURN-WHEEL	the agent is behind a wheel	(12), and experimental data in (18)
<b>b. pro-speech gesture</b>	pre-existing object + change of state presupposing the initial state	REMOVE-GLASSES	the agent has glasses on	(13), and experimental data in (18) <b>presupposition</b>
<b>c. pro-speech gesture</b>	change of state presupposing the initial state	TAKE-OFF-ROTATING	the helicopter is initially on the ground	(15) <b>presupposition</b>
<b>d. classifier predicate</b>	pre-existing object: 2-rotored representation	GO-helicopter-large_	the helicopter has 2 rotors	(26), (33), (34), (78) <b>presupposition</b>
<b>e. classifier predicate</b>	change of state presupposing the initial state: <i>take-off</i>	GO-helicopter-up__	the helicopter is initially on the ground	(29), (38), (39), (80) <b>presupposition</b>
<b>f. classifier predicate</b>	unexpected change from a trajectory: <i>abrupt orthogonal detour</i>	GO-helicopter-large_^^_abrupt GO-helicopter-up_^^_abrupt	the helicopter will fly from B to NYC / will take off	Horizontal: (26) Vertical: (29) <b>presupposition (?)</b>
<b>g. classifier predicate</b>	unexpected change from a trajectory: <i>non-abrupt orthogonal detour</i>	GO-helicopter-large_!__no_acceleration GO-helicopter-up_!__no_acceleration	the helicopter will fly from B to NYC / will take off	Horizontal: (33), (78) (but not (34)) Vertical: (80) [partially: 4.7 rating] (but not (38), (39)) <b>weak presupposition</b>
<b>h. classifier predicate</b>	unexpected change from a trajectory: <i>pause in the</i>	GO-helicopter-large__ __ GO-helicopter-up__ __	the helicopter will fly from B to NYC / will take off	Horizontal: (33), (34) [partially: 4.7 rating], (78) Vertical: (38)

<sup>22</sup> When referring to examples with ellipsis, we only considered the unelided part, since inferences pertaining to the elided part assess something more complicated, namely the interaction between ellipsis resolution and presupposition projection.

	<i>middle</i>			[partially:4.7 rating] (but not (39)), (80) <b>weak presupposition</b>
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## 7.2 Generalizations about cosuppositions

Turning to cosuppositions, they are of two main types.

–Co-speech gestures (= (57)a,b) and co-sign facial expressions (= (57)c) are external enrichments of regular words: they can be disregarded without affecting the grammaticality of the message.

–Cosuppositions triggered by classifier predicates and pro-speech gestures, by contrast, are not syntactically distinct from the rest of the iconic representation. Semantically, they provide information about manner modifications, involving how the relevant action takes place.

For ASL data, we adopted in (57) the same conventions as for the previous table in (56), writing *cosupposition* if the relevant conditionalized inference was endorsed in all propositional tests in the relevant tables with at least strength 5, and writing *cosupposition* (?) if this was the case for two propositional tests out of three.

### (57) Summary of the cosuppositions triggered

Type	Possible source	Construction	Nature of the cosupposition	Examples and comments
<b>a. co-speech gesture</b>	co-speech enrichment	UP help	helping => lifting	(5), (6)
<b>b. co-speech gesture</b>	co-speech enrichment	UPWARDS [use the stairs]	using the stairs => going up	experimental data in (10)
<b>c. co-sign facial expression</b>	co-sign enrichment	-[_[SPEND MONEY]	spending money => disgust	(11)
<b>d. classifier predicate</b>	curved path/smooth detour	GO-helicopter-large_∩_smooth GO-helicopter-up_∩_smooth (curved path)	going from B to NYC => curved path	Horizontal: (33), (34), (78) Vertical: (38), (39), (80)
<b>e. classifier predicate</b>	circling motion	GO-helicopter-up_circling (circling motion)	taking off => circling motion	(29)
<b>f. classifier predicate</b>	undulating motion	GO-helicopter-up_undulate_smooth (undulating motion)	taking off => undulating motion	(29)
<b>g. pro-speech gesture</b>	trembling motion of the hand	LIFT-difficult	lifting => effort/difficulty	(42)
<b>h. pro-speech gesture</b>	irregular, slowly accelerating motion	TAKE-OFF-difficult-accelerating	take off => slow/difficult initial acceleration	(45)

## 8 Consequences for presupposition theory

We turn to consequences of our results for presupposition theory. Standard analyses (e.g. Heim 1983, Schlenker 2009) focus on the Projection Problem and thus stipulate (in lexical entries) the presuppositions of elementary expressions. The existence of presuppositions triggered by iconic representations that one may see for the first time suggests that these theories would need to be supplemented with a productive triggering mechanism for the iconic case. This leaves open the possibility that a version of the same mechanism might be applied to the lexical case as well, which in turn might obviate the need (in some or all cases) for presuppositions that are hard-wired in lexical entries.

There have been several attempts to propose triggering mechanisms, notably those of Abusch 2002, 2010, Simons et al. 2010 and Abrusán 2011. We will briefly discuss the consequences of our data for these theories, especially the first and third (see Abrusán 2011, Section 2, for a detailed

critical review of various proposals, including those of Abusch and Simons et al.).

### 8.1 Three analyses of the Triggering Problem

Abusch 2002, 2010 starts from the observation that an expression that triggers a set of focus alternatives often comes with the presupposition that at least one of these alternatives is true. She proposes that some presupposition triggers are in fact elements that lexically introduce such alternatives, as illustrated in (58); the presupposition that the disjunction of the alternatives is true can then derive what might initially have appeared to be lexical presuppositions.

(58) Examples of lexical alternative sets in Abusch 2002

- a. stop: {*stop, continue*}
- b. win: {*win, lose*}
- c. be right: {*be right, be wrong*}
- d. know: {*know, be unaware*}

To illustrate, *John knows that p* (e.g. *John knows that it's raining*) generates (on the basis of (58)d, combined with the standard compositional mechanism of alternative generation in Rooth 1996) the alternative set {*John knows that p, John is unaware that p*}. In Abusch's analysis, neither member of the alternative set triggers a presupposition on its own: *John knows p* means something like *p and John believes p*; and similarly *John is unaware that p* means roughly: *p and it's not the case that John believes that p*. But the requirement that the disjunction of these alternatives should be true yields a presupposition that (*p and John believes that p*) or (*p and not John believes that p*), which simplifies to *p*, i.e. the desired presupposition. But as Abrusán 2011 notes, Abusch's theory replaces one kind of stipulation, pertaining to the presuppositions of lexical elements, with another, pertaining to their alternatives (a problem that Abusch 2010 discusses in some detail).

Simons et al. 2010, further developed in Beaver et al. 2017, propose a theory based on implicit or explicit 'Questions under Discussion' (QUD), sometimes evidenced by way of focus structure. Simplifying somewhat, the basic idea is that those implications of (embedded) clauses which fail to contextually entail an answer to the Question Under Discussion have the potential to project – and thus, in the cases of relevance here, to behave like presuppositions. To illustrate, consider (59):

- (59) *Context*: A nutritionist has been visiting first grade classrooms to talk to the children about healthy eating  
 Q: What most surprised you about the first graders?  
 A: They didn't know that you can eat raw vegetables. (Simons et al. 2010)

*They know that you can eat raw vegetables* is under negation and contextually entails that *you can eat vegetables*, but this proposition does not entail an answer to the Question under Discussion, and for this reason it projects. By contrast, in (60), *Bill know that Harry is dating Sally* entails that Harry is dating Sally, which answers the Question Under Discussion, and for this reason the entailment does not project.

- (60) Q: Is Harry dating Sally?  
 A: Bill doesn't know that he is. (Simons et al. 2010)

While appealing, this theory is hard to apply to our cases in the absence of explicit Questions under Discussion, which would require more elaborate contexts than we have. In addition, we should mention a general problem discussed by Abrusán (and by the authors themselves): "the theory as it stands predicts such shifts with much more ease than is actually observed". In (61)a,b, the entailments that the first graders failed the exam, or that John smoked before, should answer the Questions under Discussion and thus fail to project - but they do.

- (61) a. Q: What most surprised you about the first graders? A: They didn't know that they have failed the exam.  
 b. Q: What do you know about John? B: He still didn't quit smoking. (Abrusán 2011)

While Simons et al. 2010 notice the problem, they in effect give a lexicalist solution. In Abrusán's terms, this "gives up on predicting what projects from the meaning of utterances".

Focusing on the verbal case, Abrusán 2011 proposes instead that entailments that are not

about the event time of the verb get presupposed (this is motivated by considerations on attention, as only entailments that are about the event time are taken to be the main point of such constructions). In the case of change of state verbs, which will be of some importance below, Abrusán's theory works as in (62).

- (62) a. John stopped smoking at  $t_1$ .  
 b. Entailment 1: John does not smoke at  $t_1$   
 c. Entailment 2: John smoked at  $t_2$  (where  $t_2$  is some contextually given interval before  $t_1$ )

The simplified representation in (62)a, with event time  $t_1$ , comes with several entailments, two of which are stated in (62)b,c. Entailment 1 is about event time  $t_1$  and thus it does not get presupposed. By contrast, Entailment 2 is not about event time  $t_1$  and thus it gets presupposed.

In order to make the account predictive, Abrusán develops a theory of 'aboutness'. Its details do not bear on the rest of our discussion and thus we can rely on an intuitive understanding of that notion in what follows.<sup>23</sup>

## 8.2 Theoretical consequences of iconic presuppositions

Let us see how our data bear on these three theories.

### 8.2.1 Consequences for Abusch 2002, 2010

Abusch 2010 observes that her analysis can in principle account for any presupposition  $p$  triggered by a construction  $pp'$  (with at-issue entailment  $p'$  and presupposition  $p$ ) by stipulating an alternative set with meanings equivalent to  $\{p \text{ and } p', p \text{ and not } p'\}$ : their disjunction will immediately yield a presupposition  $p$ ; one may also use the alternative set  $\{p \text{ and } p', p\}$ , as its disjunction equally entails  $p$ . The question is whether such alternatives can be independently motivated or at least made plausible.

Let us start with gestural presuppositions pertaining to the presence of a pre-existing object, assuming that the alternatives are themselves gestural nature. Consider first *TURN-WHEEL* in (56)a. Abusch would need to posit that the gesture evokes a set of alternatives whose disjunction entails the presence of a wheel. This result could be achieved by positing a gesture that conveys the information that the relevant agent held a wheel but didn't turn it - call this *HOLD-WHEEL*. In this way, we could analyze  $x$  *TURN-WHEEL* as having the content:  $x$  has their hands on a wheel and turned it, while  $x$  *HOLD-WHEEL* comes with the content:  $x$  has their hands on a wheel and didn't turn it. It is clear that the disjunction ( $x$  *TURN-WHEEL* or  $x$  *HOLD-WHEEL*) yields the desired presupposition. One could obtain the same result with a weaker alternative, a gesture *HANDS-ON-WHEEL* to the effect that the relevant agent has hands on a wheel (irrespective of whether the agent turned the wheel or not). If  $x$  *HANDS-ON-WHEEL* has the content that  $x$  has their hands on a wheel, the disjunction ( $x$  *TURN-WHEEL* or  $x$  *HANDS-ON-WHEEL*) will again yield the desired result. On the other hand, positing an alternative set  $\{x$  *TURN-WHEEL*,  $x$  *TURN-BIG-WHEEL* $\}$  where  $x$  *TURN-BIG-WHEEL* means that  $x$  turns a large wheel would still yield the presupposition that  $x$  had their hands on a wheel, but also that  $x$  turned a wheel, which is too strong. And if instead the alternative set is  $\{x$  *TURN-WHEEL*,  $x$  *CROSSED-ARMS* $\}$  where  $x$  *CROSSED-ARMS* means that  $x$  has their arms crossed, we will lose the desired presupposition, since the disjunction of the

<sup>23</sup> Simplifying somewhat, the key condition is stated in (i) (Abrusán explicitly defines a version of the relevant notions for a first-order logic):

- (i) A sentence  $S$  is not about an object  $o$  just in case for every model  $M$ ,  
 $S$  is true in  $M$  if and only if for every model  $M'$  which is an  $o$ -variant of  $M$ ,  $S$  is true in  $M'$ .

A model  $M'$  is an  $o$ -variant of a model  $M$  just in case for every relation symbol  $R$ , the extension of  $R$  is made of the same tuples of objects in  $M'$  as in  $M$ , except possibly for those tuples that include object  $o$ .

alternatives fails to entail it. Thus Abusch's theory needs to provide some independent criterion to determine what the 'right' alternatives are - a gestural incarnation of the general problem noticed by Abrusán and Abusch.

The problem is particularly acute when we turn to the ASL 2-rotored classifier in (56)d. *GO-helicopter-large\_* would need to evoke a set of alternatives whose disjunction entails that the helicopter was 2-rotored - hence a set of classifier predicates with different actions (or inactions) on the part of a 2-rotored helicopter. But if instead we posit that *a-GO-helicopter-large\_-b* (connecting loci *a* for Boston and *b* New York) has an alternative set that just involves the unmarked helicopter classifier, hence  $\{a-GO-helicopter-large_-b, a-GO-helicopter_-b\}$ , we will lose the presupposition that the helicopter was 2-rotored, and we will get instead a presupposition that the helicopter went from Boston to New York. It is not obvious what should rule out this alternative set.

Similar issues are raised by change of state verbs presupposing the initial state, such as the pro-speech gesture or classifier predicate involving a take-off in (56)c and (56)e respectively. Abusch's theory can account for them if their alternatives involve a helicopter doing various things starting from the same initial state - including just staying put; but this would need to be derived.

The case of unexpected changes from a trajectory raises the same problems, but adds to them the contrast with versions that trigger cosuppositions. Take for instance the (abrupt or non-abrupt) orthogonal deviations with classifier predicates in (56)f,g. It is easy for Abusch's theory to posit that they raise as alternatives various other ways in which the same global movement (from Boston to New York, or during a take-off) could have been performed, in such a way that their disjunction will yield the presupposition that this global movement was in fact performed. But why wouldn't the same reasoning apply to the constructions in (57)d,e,f, involving a curved path, a circling motion, and an undulating motion? They yield cosuppositions to the effect that if the movement were to take place, it would involve a certain path or manner of motion, but not the presupposition that the movement does in fact take place. One could well posit that a movement involving a curved path raises as alternatives other global movements that don't have a curved path - which would yield the presupposition that global movement does in fact take place. One would thus need to posit that different alternatives are raised, but at this point the difference between this case and that of the orthogonal deviations must be stipulated.

### 8.2.2 Consequences for Simons et al. 2010

Turning to the analysis of Simons et al. 2010, we need to speculate on plausible Questions under Discussion in our paradigms. It makes good intuitive sense to posit that *TURN-WHEEL* and *REMOVE-GLASSES* in (56)a,b are used in contexts in which one is interested in whether the agent will turn the wheel or remove his/her glasses - in which case entailments about the presence of a wheel and of glasses would not answer the Question under Discussion and could thus project. With *TAKE-OFF-ROTATING*, one can posit that the Question Under Discussion is whether there will be a take-off. One can similarly argue that the entailment that *the helicopter is on the ground* does not answer the question and thus projects. But why couldn't one just as well note that *the helicopter will ascend* does not on its own answer the question (since a take-off requires ascent *from a ground position*), in which case this entailment too should project? The same issue is raised by the ASL take-off case in (56)e.

Turning to ASL *GO-helicopter-large\_* in (56)d, we need to postulate, plausibly enough, that the underlying question is whether a helicopter will go from Boston to New York, rather than whether a large helicopter will go from Boston to New York; this makes it possible for the entailment that the helicopter is large to project (because it fails to address the QUD). But what shall we say about (56)f,g,h, which involve orthogonal detours and a pause in the middle of the path? One might think that here too the underlying question is whether the global movement will be performed, but this would predict, incorrectly, that the fact that this global movement will take place is *not* presupposed; this is exactly the opposite from what we saw. To compound the problem, the analysis needs to explain why these cases are different from the cosupposition-inducing constructions in (57)d,e,f, which involve a curved path, a circling motion, and an undulating motion. More work is thus needed to derive these data from the Question under Discussion theory.

### 8.2.3 Consequences for Abrusán 2011

Abrusán's theory is in a good position to account for presuppositions pertaining to a pre-existing object and to an initial state. The key is that these entailments are not about the matrix event time, and thus Abrusán predicts that they should be presupposed. We schematically illustrate this reasoning in (63): given world knowledge, *x TURN-WHEEL at t<sub>1</sub>* entails that *x* was in front of a wheel right before *t<sub>1</sub>*, and that entailment is thus about some other time, call it *t<sub>2</sub>*. On Abrusán's theory, it should get presupposed. The same logic can be applied to the 2-rotored helicopter classifier predicate, since it certainly yields an entailment pertaining to the presence of a 2-rotored helicopter before the action took place.

- (63) a. *x TURN-WHEEL at t<sub>1</sub>*.  
 b. Entailment 1: *x* turned a wheel at *t<sub>1</sub>*  
 c. Entailment 2: *x* was in front of a wheel at *t<sub>2</sub>* (where *t<sub>2</sub>* is some contextually given interval right before *t<sub>1</sub>*)

Similar results are obtained with the pro-speech gesture and classifier predicate pertaining to a take-off, as in (56)c,e: (64)a,a' both entail that right before the event time the helicopter was on the ground. That entailment is not about the event time and thus it gets presupposed.

- (64) a. *x TAKE-OFF-ROTATING at t<sub>1</sub>*.  
 a'. *x GO-helicopter-up\_\_ at t<sub>1</sub>*.  
 b. Entailment 1: *x* moved up at *t<sub>1</sub>*  
 c. Entailment 2: *x* was on the ground at *t<sub>2</sub>* (where *t<sub>2</sub>* is some contextually given interval right before *t<sub>1</sub>*)

By contrast, it is not clear how Abrusán's theory should account for the (admittedly weaker) presuppositions obtained with unexpected changes from a trajectory displayed in (56)f,g,h. The difficulty is that the event depicted involves an entire movement that includes a pause in the middle or an orthogonal deviation. One possibility is that despite appearances the event time is really that of these subevents rather than of the entire development. But it's a bit unclear why this should be, since the iconic representation clearly provides information about an event that does not just include the pause or the deviation.<sup>24</sup> So the account is incomplete as things stand.

### 8.3 An alternative direction?

Let us turn to a further possibility, to be explored in future research. An old intuition in the literature on the Triggering Problem is that a presupposition is an entailment of an elementary<sup>25</sup> expression that is conceptualized as a 'precondition' for certain other entailments (e.g. Simons 2001, Thomason et al. 2006, Abusch 2010). As Abusch 2010 notes, however, an explicit and general definition of what a 'precondition' is has remained elusive. In addition, our examples involving a pause or an orthogonal deviation show that the 'pre' in 'precondition' cannot just be interpreted in temporal terms, since in this case what is (weakly) presupposed is that the global movement (from Boston to New York, or involving a take-off) will take place; thus the existence of an event that *follows* the pause or the deviation is presupposed.

Still, a more abstract implementation of this idea might capture the various cases we have discussed here. The three types of presuppositions mentioned in (56) have something in common: when one acquires information about the entire event, one plausibly analyzes certain informational parts as being more stable than others. More specifically, if we write as *pp'* the conjunction of the at-issue and of the presuppositional components, considered as simple entailments, we can apply the test in (65). It asks that one assume, relative to the assumptions of the context (i.e. relative to the Context

<sup>24</sup> One might want to test what the event time is by modifying the sentence so as to include a precise temporal modifier – for instance one meaning *at 5:05pm sharp* – and determining whether it unambiguously specifies the time of the subevent (the pause, or the deviation) rather than of the entire event. But it might well be that for independent reasons a modifier would be constrained to modify the at-issue component of the predicate, in which case a positive result (to the effect that the precise modifier provides information about the time of the pause, or of the deviation) would not be informative. We leave this question for future research.

<sup>25</sup> 'Elementary' is crucial: we want to predict a presupposition for the elementary expression *stopped* in *John stopped smoking*, but not for the complex conjunction in *John smoked and stopped*.



Set), that  $pp'$  holds true. Then it assesses the counterfactual stability of the entailment  $p$  by asking whether, on the counterfactual assumption that  $pp'$  had not been the case,  $p$  would still have held. As we will see, it is crucial that we apply this test with some non-monotonic analyses of counterfactuals, as in Stalnaker 1967 and Lewis 1973, among others.

(65) Stability of entailments (counterfactual test)

Assume that  $pp'$  holds (relative to the Context Set C). If (counterfactually)  $pp'$  had not been the case, would  $p$  still have been the case?

If  $\rightarrow$  represents the counterfactual conditional, this can be represented as:

C,  $pp' \models (\text{not } pp') \rightarrow p$ <sup>26</sup>

Yes: treat  $p$  as a presupposition.

No: do not treat  $p$  as a presupposition.

Let us apply this recipe to our three main cases.

(i) Consider first the presupposed pre-existence of an object, as in  $x$  *TURN-WHEEL* at  $t_1$  (= (56)a).

The intuition we wish to capture is that, on the assumption that  $x$  turned a wheel, if this had not been the case, the wheel would still have been in front of  $x$ . Here it is of course crucial that the counterfactual should not mean that if  $pp'$  had not been the case, it would *necessarily* have been the case that  $p$ , as this requirement would be far too strong. But the non-monotonic counterfactual explored in semantics by Stalnaker (1967), Lewis (1973) and others is far weaker: it only asks that we consider the *closest* worlds in which  $pp'$  fails to be the case, and determine whether in those worlds  $p$  still holds. The desirable answer - that the wheel would still have been in front of the agent - is intuitively plausible in this case.

(ii) The pre-existence of an initial state, as in  $x$  *TAKE-OFF-ROTATING* at  $t_1$  (in (56)c, in the related predicate classifier case in (56)e), works in a similar fashion. Assuming that a helicopter take-off happened, we can ask, counterfactually: had this event not take place, would the helicopter still have been initially on the ground? Here too the answer is plausibly positive, which is the result we desire.

(iii) The case of the unexpected changes of a trajectory is particularly interesting. As seen in (56)f,g,h, an orthogonal deviation and a pause to hover on a helicopter's trajectory are at-issue, but the fact that the global movement (upwards, or from Boston to New York) tends to get presupposed. Here too, our counterfactual test yields plausible results, especially if the modifications of the trajectory are viewed as unexpected, as in the abrupt orthogonal deviation from a path, which yielded some of the strongest results. Specifically, on the assumption that the helicopter went from Boston to New York with an abrupt orthogonal deviation, one would understand that the trip from Boston to New York was planned but that the deviation wasn't. Assuming that the trip took place with the deviation, we can reason counterfactually that if this big event hadn't taken place, this would likely have been because the deviation didn't occur, while the global displacement would still have happened. If the deviation is less abrupt and thus plausibly more planned, the effect might be expected to be weaker, which is compatible with our data. Finally, a pause to hover which is not particularly expected given the rest of the discourse might have the same status as the unexpected deviation.

(iv) It is also important to ask why the curved deviations and manner modifications of the movement seen in (57)d,e,f do not yield a presupposition that the displacement takes place (but rather a cosupposition - a case to which we turn below). Importantly, these modifications are plausibly viewed as being of a piece with the movement itself, and not particularly unexpected given the rest of the event. This might yield a very different result for the relevant counterfactual test. For instance, on the assumption that the helicopter moved along the curved path in (57)d, we can ask what would have happened, counterfactually, if the movement had not taken place in this way. Here the answer is less clear: maybe the movement would have taken place along some other path, but maybe the movement

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<sup>26</sup> This should be read as follows: in each world  $w$  that is in C and satisfies the (classical, non-presuppositional) meaning of  $pp'$ ,  $w$  makes true the counterfactual conditional  $(\text{not } pp') \rightarrow p$ .

would not have taken place at all because the curved path was the normal one taken by the helicopter, as nothing in its shape indicates that it involved an unexpected deviation. The same remark can be made about the manner of motion modifications involving a circling or an undulating motion in (57)e,f: without further information, a helicopter that moves in this way might be expected to do so with some regularity.

While we do not claim to have given a general solution to the Triggering Problem, we hope that these remarks will have suggested a further possible direction, to be explored in parallel with those developed by Abusch, Simons et al. and Abrusán, among others.

## 9 Consequences for cosupposition theory

We turn to the consequences of our findings for the analysis of cosuppositions. Initial work pertained to cosuppositions triggered by co-speech gestures, and took their conditionalized nature to be due to the parasitic nature of the gestures (Schlenker to appear a,b). The existence of cosuppositions that are triggered by classifier predicates and by pro-speech gestures casts doubt on this view, at least as a general theory of cosuppositions. We explore two theoretical directions. One, developed in Section 9.1, posits some commonalities among all cosuppositions discussed in this piece'. The other, developed in Section 9.2, treats cosuppositions triggered by classifier predicates and pro-speech gestures differently from those triggered by co-speech gestures

### 9.1 A unified theory?

#### 9.1.1 Iconic modulations as co-sign/co-gesture gestures?

The simplest way to unify all the cases we have discussed so far would be to treat modulations of classifier predicates and pro-speech gestures that trigger cosuppositions to be - well, co-sign and co-gesture gestures. As mentioned, Aristodemo 2017 does posit that some iconic components that are an obligatory component of LIS *FULL* are incorporated co-sign gestures. But since there is no sense in which these iconic components are add-ons to the sign, the sole motivation for this analysis lies in the conditionalized nature of the presuppositions triggered, and the fact that this component can be disregarded under ellipsis. We could extend Aristodemo's theory to the cosupposition-triggering iconic modulations we studied with ASL classifier predicates (in (57)d,e,f). This theory predicts that these elements could be disregarded under ellipsis, something that the data discussed in Appendix II do not show (possibly because the context was insufficient rich to invite the relevant reading).

However, for *LIFT-difficult* and *TAKE-OFF-difficult-accelerating*, this line of analysis is less convincing because the cosupposition-triggering part of the gesture is not easily separable from the rest of the gesture. The same problem carries over to the cosuppositions triggered by ASL predicate classifiers, as summarized in (57)d,e,f. It is difficult to treat these elements as co-sign or co-gesture (!) gestures: separability will not provide the desired criterion. We shall thus consider some alternative theoretical possibilities.

#### 9.1.2 A purely conceptual theory of cosuppositions?

Our Aristodemian theory sought to treat all cosuppositions as arising from co-speech and co-sign gestures. Going to the other extreme, we could seek a unified theory by positing that it is for purely conceptual reasons (due to their truth-conditional contribution) that all of these constructions (i.e. standard co-speech/sign gestures, some pro-speech gestures, some classifier predicates) trigger cosuppositions. On this view, there is nothing in the manner of production of co-speech/sign gestures (and in particular in their separability and parasitic character) that is responsible for their cosuppositional behavior.

We find this purely conceptual theory very implausible, for the following reason: in (66)a, the co-speech gesture *PUNCH* co-occurs with a VP (*act* or *do something*) that adds nothing to it: it is clear that if one punches, one acts/does something. Still, a clear cosupposition is triggered to the effect that acting or doing something in that situation would involve punching (the boss, presumably). No such inference is triggered in the pro-speech control in (66)b, which makes the same informational contribution as the co-speech gesture in (66)a, but without being a co-speech gesture. A purely

conceptual theory cannot capture this distinction.

(66) [Talking to one's close colleagues]

I am sure tomorrow our boss will once again hurl insults at us, and none of us will



a. PUNCH\_ **act** / [do something].



b. PUNCH\_.

(picture from Schlenker and Chemla 2017)

### 9.1.3 A more abstract unification?

We believe that a more abstract unification might be called for. In a nutshell, the idea is that, in all cases, a cosupposition  $p'$  is presented as an unimportant component of the meaning of an expression  $pp'$  (where as before the semantic meaning of  $pp'$  is just the conjunction of  $p$  and  $p'$ ). For this reason, the global context of the conversation should guarantee that, relative to its local context, it should make no difference whether the relevant word is evaluated with or without  $p'$ , as is stated in (67)a. This definition immediately derives the standard definition of cosuppositions as reviewed in Section 2.1, as shown in (67)b. Importantly, all co-speech gestures (discussed in this piece) are presented as unimportant because of their form, presumably because they are parasitic on the expressions they modify, as discussed in Schlenker to appear b. By contrast, only some entailments that are not triggered by co-speech gestures (i.e. in the case of classifier predicates and pro-speech gestures) are presented as unimportant: this crucially depends on their content and on the nature of the context. The dual source of cosuppositions is stated in (67)c.

(67) A unified theory of cosupposition generation

a. A cosupposition is triggered when an elementary expression  $pp'$  has an entailment  $p'$  which is presented as being unimportant, and for this reason the global Context Set  $C$  should guarantee that, relative to its local context  $c'$ ,  $pp'$  should be equivalent to  $p$ , i.e.

(i)  $c' \models pp' \Leftrightarrow p$ ,

b. (i) is equivalent to the standard definition of cosuppositions in (ii):

(ii)  $c' \models p' \Rightarrow p$

c. An entailment  $p'$  might be presented as unimportant for different reasons:

(i) for reasons of manner, in case  $p'$  is contributed by a co-speech or co-sign gesture (which is parasitic and thus should not make an essential contribution);

(ii) for conceptual reasons, in case  $p'$  is understood not to matter given the context of the conversation.

[d. Because cosuppositions are presented as unimportant, they can to some extent be disregarded under ellipsis resolution. (This does not preclude the possibility that co-speech/sign cosuppositions are more easily ignored for syntactic reasons.)]

Finally, it is worth noting that this analysis could very naturally be supplemented with the clause in (67)d, according to which all cosuppositions can to some extent be ignored under ellipsis because they are presented as unimportant. As we noted, this behavior seems to be displayed not just by co-speech gestures, but also by some cosuppositions triggered by pro-speech gestures; but as things stand, our ASL classifier predicate data do not bear this out, possibly for lack of a sufficiently strong context.

If this theory is on the right track, it might make it possible to re-analyze Aristodemo's cosuppositional data from a new perspective. These might not involve any co-sign gestures, but rather conceptual cosuppositions. Whether this is on the track remains to be seen, however.

## 9.2 A non-unified theory?

The unified theory of cosupposition outlined in (67) must still posit two sources of cosupposition generation, one based on considerations of manner (*how* an enrichment is contributed), and one based on conceptual considerations (as stated in (67)c). For this reason, one might ask whether a better theory couldn't be obtained by treating the 'conceptual' cosuppositions as being triggered by whatever mechanism is responsible for standard presupposition generation. Since cosuppositions are a special species of presuppositions, this possibility is in principle open; the question is whether more general algorithms will turn out (once they are stated precisely!) to derive 'conceptual' cosuppositions as a special case.

Let us discuss in turn the theories of presupposition generation sketched in Section 8.1. We write as  $pp'$  the iconic expression with at-issue contribution  $p'$  and cosupposition  $p' \Rightarrow p$ . For instance,  $x$  *GO-helicopter-large\_∩\_smooth* (in (57)d) is analyzed as having the at-issue contribution ( $= p'$ )  $x$  goes up, and the cosupposition ( $= p' \Rightarrow p$ ) *if  $x$  goes up,  $x$  has a circling motion*. Similarly,  $x$  *GO-helicopter-up\_circling* (in (57)e) is analyzed as having the at-issue contribution ( $= p'$ )  $x$  goes up, and the cosupposition ( $= p' \Rightarrow p$ ) *if  $x$  goes up,  $x$  has a circling motion*. As we will see, in most theories we have a chance of treating the cosupposition as a standard presupposition if we consider it to be a kind of inherent, pre-existing property of the relevant object – to the effect that the helicopter is one that tends to take off by way of a circling motion (not just in the described event but quite generally), or to go from Boston to New York by way of a curved path.

1. Abusch's theory could posit that  $pp'$  evokes a set of alternatives with meanings equivalent to  $\{(p' \Rightarrow p)$  and  $p'$ ,  $(p' \Rightarrow p)$  and not  $p'\}$  (simplifying to  $\{(p$  and  $p')$ , not  $p'\}$ ), or alternatively  $\{(p' \Rightarrow p)$  and  $p'$ ,  $p' \Rightarrow p\}$  (simplifying to  $\{(p$  and  $p')$ ,  $p' \Rightarrow p\}$ .<sup>27</sup> As we noted in Section 8.1, these are two technical possibilities that are always open Abusch's theory. In the standard case, we posit alternatives equivalent to  $\{p$  and  $p'$ ,  $p$  and not  $p'\}$ , or  $\{p$  and  $p'$ ,  $p\}$  in order to ensure that their disjunction derives the presupposition  $p$ . But given our notation, the cosuppositional presupposition is  $(p' \Rightarrow p)$ , hence the modification, with  $(p' \Rightarrow p)$  replacing  $p$ . The question is whether such sets of alternatives can be justified.

Any set that contains  $(p' \Rightarrow p)$  seems hopeless if the alternatives must be iconic, as the bare conditional  $(p' \Rightarrow p)$  seems very difficult to express iconically. The set  $\{(p' \Rightarrow p)$  and  $p'$ ,  $(p' \Rightarrow p)$  and not  $p'\}$  simplifies to  $\{(p$  and  $p')$ , not  $p'\}$  if we view  $\Rightarrow$  as a material implication. This yields the desired result, but it is a bit unclear how this set of alternatives could be justified. It is also hard to see how the same set of alternatives wouldn't be raised by the case of the path with an orthogonal detour or a pause in the middle, as in (56)f,g,h. Writing  $p$  for the orthogonal detour or the pause, and  $p'$  for the global displacement, this would give rise to a cosuppositional inference that if the displacement takes place, it involves an orthogonal detour or a pause – which is not at all what we want (the desired result is that the displacement will in fact take place).

Perhaps a more promising direction is to see  $\Rightarrow$  as a stronger conditional. On this view, the alternatives could be justified by assuming that  $p' \Rightarrow p$  is an inherent property of the relevant object; for instance, the helicopter might have a general tendency to fly in a circling motion, or to have a curved trajectory, hence: *usually, if the helicopter takes off ( $= p'$ ), it does so with a circling motion/a curved trajectory ( $= p$ )*. One could then posit that the unexpected deviations from a path fail to be conceptualized in terms of such inherent properties. In the case of the helicopter performing a take-off with a circling motion, Abusch could then posit that the alternatives have contents of the form:  $\{tends to circle and takes off, tends to circle and doesn't take off\}$ .<sup>28</sup> It remains to be seen whether such alternatives can be properly motivated.

2. Abrusán's theory could avail itself of the same general idea, and posit that the cosuppositional entailments are general properties of the object and/or of the situation rather than just of the event

<sup>27</sup> As is standard in work on cosuppositions (e.g. Schlenker, to appear a),  $\Rightarrow$  is taken to be material implication (an assumption we revisit below). For this reason  $(p' \Rightarrow p)$  trivially follows from not  $p'$ , with the result that the meaning of  $(p' \Rightarrow p)$  and not  $p'$  is just the meaning of not  $p'$ .

<sup>28</sup> This approximates the earlier alternative set  $\{(p' \Rightarrow p)$  and  $p'$ ,  $(p' \Rightarrow p)$  and not  $p'\}$ .

time; for this reason, these entailments are not about the event time and end up being presupposed. Thus *x GO-helicopter-up\_circling* could trigger the inference that the helicopter has a tendency to take off with a circling motion, or that the situation is one in which there is much wind, leading to the same consequence. This is plausible enough. Things are a bit less clear for *x GO-helicopter-large\_∩\_smooth*, but maybe one could posit that there was probably a pre-existing plan that the helicopter would fly with a curved path.

3. Things are more complex for Simons et al.'s Question under Discussion theory. It would need to posit that in our cosuppositional cases, the Question under Discussion does not bear on the relevant inherent property (e.g. the helicopter's tendency to take off with a circling motion, or with a curved path); this, in turn, could explain why the inherent property yields an entailment that is not at-issue and can project. Maybe one could argue that it is less natural to ask about such an inherent property than about temporary properties of the relevant objects; why this is so would need to be explained.

4. We can make use of the same idea if we view presuppositions as counterfactually 'stable' entailments, as we suggested in (65). Take the case of *x GO-helicopter-up\_circling*. On the assumption that helicopter *x* took off with a circling motion, we infer that this type of movement is an inherent property of *x*, and thus that if it hadn't taken off, it would still have had this property.<sup>29</sup> To extend this analysis to the case of *x GO-helicopter-large\_∩\_smooth*, we need to posit that, on the assumption that the helicopter took that path, it was pre-ordained, possibly as part of a regular plan, and thus that even if the helicopter hadn't made the trip from Boston to New York, the plan would have remained.

Thus Abusch, Abrusán and the 'stable entailment' theory can make use of similar ideas, with open questions at several junctures; things are less clear for Simons et al.' theory. But it is worth noting that treating cosuppositions triggered by predicate classifiers and pro-speech gestures as normal presuppositions leads one to expect that they should also display a standard behavior under ellipsis. This does not seem correct for pro-speech gestures – and as mentioned, the data for ASL classifier predicates are not entirely clear yet.

## 10 Conclusions

To conclude, we summarize our main findings, and list some questions for future research.

### 10.1 Main findings

Our first finding is that presuppositions (be they standard or cosuppositional in nature) can be triggered by iconic pro-speech gestures and classifier predicates, including ones whose precise shape may not have been encountered before. This highlights the need for a Triggering Algorithm. Iconic constructions offer a new tool to investigate its shape, for two reasons: they generate new meanings that require a productive rule, and they can be modified in minimal ways so as to provide fine-grained information about the precise shape of the algorithm (as shown by the contrast between different forms of deviations from a path).

Our second finding is that the presuppositions triggered by pro-speech gestures and classifier predicates are of two kinds: besides standard presuppositions that may have a counterpart in spoken words (such as the 'on the ground' presupposition of a pro-speech gesture or classifier predicate representing a take-off), they may trigger cosuppositions that resemble those triggered by co-speech/sign gestures. Under ellipsis, cosuppositions generated by pro-speech gestures might even display the same 'disappearing act' as cosuppositions generated by co-speech gestures. Whether this applies to ASL classifier predicates as well will require more work, as our data were not stable in this connection (possibly because our contexts were insufficiently rich to justify ignoring the relevant cosuppositions).

Our third finding pertained to the consequences of our data for analyses of the Triggering

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<sup>29</sup> Things are more complicated if we take the circling motion to be due to the situation rather than to the helicopter.

Problem. Abusch's and Abrusán's theories can naturally account for some but not necessarily all of our cases. Abusch's theory requires sets of lexical alternatives that sometimes seem *ad hoc*, especially when it comes to distinguishing presuppositions from cosuppositions. Abrusán's theory can very naturally account for the presuppositional status of entailments that pertain to pre-existing conditions (for instance the presence of a 2-rotored helicopter, or an initial state), but the case of presuppositions triggered by unexpected modifications of a trajectory is currently difficult to explain. Simons et al.'s could account for some of the data provided the 'right' Questions under Discussion were posited, but motivating such QUDs wasn't always easy. We sketched a fourth theoretical direction, according to which the most 'stable' entailments get presupposed, which might offer a unified account of our various presuppositional cases, but it has yet to be developed.

Our fourth finding is more tentative, and pertains to the triggering of cosuppositions. One theoretical direction seeks to unify pro-speech and classifier predicate cosuppositions with co-speech cosuppositions. This can be achieved by taking all cosuppositions to originate in entailments that are presented as being 'unimportant', either for reasons of manner (because they are contributed by syntactically parasitic enrichments) or for conceptual reasons (in the case of pro-speech and classifier predicate cosuppositions). An alternative theory treats cosuppositions triggered by pro-speech gestures and classifier predicates as standard presuppositions that happen to make reference to inherent properties of objects or situations. The behavior pro-speech and classifier predicate cosuppositions under ellipsis could potentially help decide among these two theoretical directions: the unified theory (but not its non-unified competitor) could posit that cosuppositions of all stripes can be disregarded under ellipsis because they are presented as unimportant. Pro-speech cosuppositions under ellipsis appear to bear this out, but in our data, classifier predicate cosuppositions do not show the same behavior – and are also unstable, hence the necessity of conducting more work.

## 10.2 Questions for future research

There are three main issues we leave for future research.

One pertains to data collection. We did our best to rely on diverse and transparent methods, based on experiments with naive subjects, detailed elicitation with an ASL consultant, and a survey with American informants. Improvements could be of several kinds: data could be collected from further consultants/informants in sign and spoken language; experiments could be conducted when necessary; and stimuli could be improved. Ideally, one would want to ensure that the very same iconic construction is evaluated in different conditions, which is hard to ascertain if each condition is recorded separately, as we did (the signer or gesturer may produce the target construction in slightly different ways, which in turn may have important inferential consequences). More sophisticated methods could be developed in the future by 'splicing' videos, i.e. by inserting the same video snippet in different contexts, in particular under different operators.<sup>30</sup>

The second issue concerns the behavior of presuppositions and cosuppositions under ellipsis. The results could be important to determine whether pro-speech and predicate classifier cosuppositions are part of the same 'natural class' as cosuppositions triggered by co-speech gestures. This general investigation should be extended to contexts involving *only*, since in many cases one can disregard in the 'focus dimension' under *only* whatever elements can be disregarded under ellipsis.

The third issue concerns the explanation of our results. While it is clear that they argue for the existence of triggering algorithms for standard presuppositions and for cosuppositions, there are many choice points in the definition of the algorithms in question. God is in the details: better and more precise algorithms should be constructed, and iconic presuppositions should help inform their shape.<sup>31</sup>

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<sup>30</sup> One further issue should be mentioned. We noted at several junctures that our target iconic constructions can be understood without prior exposure, but this conclusion would need to be motivated better in future research.

<sup>31</sup> Finally, as mentioned in Section 4.3.2, it should be kept in mind that, as in all studies of presuppositions, the inferential *contrasts* we obtain are due to the difference between the target constructions and the at-issue controls, which typically come with *anti*-presuppositions. This could pave the way for accounts based on general pragmatic reasoning: pragmatic enrichment might plausible in all cases (e.g. one raises the possibility that *pp'* because *p* is generally the case), but defeated in the controls (in case *p* is presented as non-trivial). We leave this issue for future research.

### Appendix I. Comparing lexical triggers and iconic triggers in ASL

We provide below some details about the paradigms discussed in Section 3. As in the main text, we boldface inferential strengths that are at or above 5.

#### □ *Going from Boston to New York: embedding under DOUBT, MAYBE, IF, and NONE*

We start with details about our paradigm involving horizontal movement of a helicopter from New York to Boston. We do not repeat the inferential questions, introduced in (24) and (25) in the text (see also the Supplementary materials, where all inferential questions are copied).

The inferential data for embedding under *DOUBT* in (68), under *MAYBE* in (69) and under *IF* in (70) all lead to the same general conclusions. First, the 2-rotored representation of the helicopter triggers a presupposition (in all cases), as does *CONTINUE* (to the effect that the helicopter has been on its way from Boston to New York). Contrary to our initial hypothesis, the 'swaying movement' condition does not trigger a cosupposition (or any presupposition besides the 2-rotored one). By contrast, the 'smooth detour' condition triggers a cosupposition to the effect that if the helicopter were to go from Boston to New York within the next hour, this would involve a smooth detour. Finally, the 'abrupt detour' condition triggers a presupposition that the helicopter will in fact go from Boston to New York within the next hour.

Data pertaining to embedding under *NONE* are harder to assess. First, we only have two judgments in this case. Second, several cases give rise to much variability. Still, *CONTINUE* does seem to trigger the expected presupposition, whether one uses existential projection or universal projection as a criterion. The same conclusion holds of the 'smooth detour' cosupposition. Using existential projection as a criterion, the 2-rotored presupposition emerges in some but not in all cases, and the presupposition that the helicopter will in fact go from Boston to New York in the next hour does emerge in the 'abrupt detour' condition.

#### (68) **DOUBT**

*Context:* our company has one helicopter and one airplane.

WITHIN 1-HOUR OUR COMPANY BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>b</sub> DOUBT \_\_\_\_ .

'I doubt that within an hour our company's big helicopter will ... from Boston to New York.' (ASL, [34, 3530](#); 3 judgments)

Condition (ASL, <a href="#">34, 3530</a> ; 3 judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. neutral path	<sup>6.3</sup> GO-helicopter-large_	fly
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-large_	continue to fly
c. swaying movement	<sup>5.7</sup> GO-helicopter-large_∧∧_	fly a swaying movement
d. smooth detour	<sup>7</sup> GO-helicopter-large_∩_smooth	fly (with the assumption that this would involve a smooth detour)
e. abrupt detour	<sup>6.7</sup> GO- helicopter-large_∧_abrupt	make an abrupt detour on its way

Target sentence / Inferences (ASL, <a href="#">34, 3530</a> ; 3 judgments)	Inference type	1. Helicopter has 2 rotors	2. Helicopter has been on its way from B to NYC within the next hour	3. Helicopter will go from B to NYC	4. If the helicopter goes from B to NYC within the next hour, ____ (= strongest conditional inference)
a. neutral path	2-rotored presupposition	5.7	2	1	1
b. CONTINUE	lexical presupposition [+ 2-rotored presupposition]	7	6.3	2	1
c. swaying movement	at-issue? cosupposition? [+ 2-rotored presupposition]	5.7	3.3	3.7	3.3 (2, 3, 5) (swaying-like motion)

<b>d. smooth detour</b>	<b>cosupposition</b> [+ 2-rotored presupposition]	<b>6.3</b>	1	1.3	<b>6</b> (smooth detour)
<b>e. abrupt detour</b>	<b>presupposition</b> [+ 2-rotored presupposition]	<b>6</b>	<u>4.7</u> (7, 4, 3)	<b>6.3</b>	1.3 (abrupt detour)

(69) **MAYBE**

*Context:* our company has one helicopter and one airplane.

WITHIN 1-HOUR OUR COMPANY BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>b</sub> MAYBE \_\_\_\_ .

'Within an hour, maybe our company's big helicopter will ... from Boston to New York.' (ASL [34, 3540](#);  
4 judgments)

<b>Condition</b> (ASL <a href="#">34, 3540</a> ; 4 judgments)	<b>Words (replacing ____ ) and acceptability</b>	<b>Translation (replacing ...)</b>
a. neutral path	<sup>7</sup> GO-helicopter-large_	fly
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-large_	continue to fly
c. swaying movement	<sup>6.3</sup> GO-helicopter-large_/\_\_\_	fly with a swaying movement
d. smooth detour	<sup>7</sup> GO-helicopter-large_∩_smooth	fly (with the assumption that this would involve a smooth detour)
e. abrupt detour	<sup>6.8</sup> GO- helicopter-large_∧_abrupt	make an abrupt detour on its way

<b>Target sentence / Inferences</b> (ASL <a href="#">34, 3540</a> ; 4 judgments)	<b>Inference type</b>	<b>1. Helicopter has 2 rotors</b>	<b>2. Helicopter has been on its way from B to NYC within the next hour</b>	<b>3. Helicopter will go from B to NYC</b>	<b>4. If the helicopter goes from B to NYC within the next hour, ____ (= strongest conditional inference)</b>
<b>a. neutral path</b>	<b>2-rotored presupposition</b>	<b>7</b>	2.3	1.8	1
<b>b. CONTINUE</b>	<b>lexical presupposition</b> [+ 2-rotored presupposition]	<b>6.8</b>	<b>6.5</b>	2	1
<b>c. swaying movement</b>	<b>at-issue? cosupposition?</b> [+ 2-rotored presupposition]	<b>7</b>	<u>2.8</u> (3, 6, 1, 1)	<u>3.5</u> (4, 6, 2, 2)	<u>3.8</u> (3, 2, 5, 5) (swaying-like motion)
<b>d. smooth detour</b>	<b>cosupposition</b> [+ 2-rotored presupposition]	<b>7</b>	1.3	1.8	<b>6</b> (smooth detour)
<b>e. abrupt detour</b>	<b>presupposition</b> [+ 2-rotored presupposition]	<b>7</b>	2.5	<b>5.5</b>	2 (abrupt detour)

(70) **IF**<sup>32</sup>

*Context:* our company has one helicopter and one airplane.

WITHIN 1-HOUR OUR COMPANY BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>b</sub> IF \_\_\_\_, 2-E-MAIL-1 .

'If within an hour our company's big helicopter ... from Boston to New York, e-mail me.' (ASL, [34, 3518](#)  
3 judgments)

<b>Condition</b> (ASL, <a href="#">34, 3518</a> ; 3 judgments)	<b>Words (replacing ____ ) and acceptability</b>	<b>Translation (replacing ...)</b>
a. neutral path	<sup>7</sup> GO-helicopter-large_	flies
b. CONTINUE	<sup>6.7</sup> CONTINUE GO-helicopter-large_	continues to fly
c. swaying movement	<sup>6.3</sup> GO-helicopter-large_/\_\_\_	flies with a swaying movement
d. smooth detour	<sup>7</sup> GO-helicopter-large_∩_smooth	flies (with the assumption that this

<sup>32</sup> As shown in the Supplementary Materials, initial judgments did not ask for quantitative inferential judgments; for uniformity with the other paradigms discussed in this piece, only the judgment tasks that included quantitative inferential questions are taken into account here.



		would involve a smooth detour)
e. abrupt detour	<sup>6,7</sup> GO- helicopter- large_∧_abrupt	makes an abrupt detour on its way

Target sentence / Inferences (ASL, 34, 3518; 3 judgments)	Inference type	1. Helicopter has 2 rotors	2. Helicopter has been on its way from B to NYC within the next hour	3. Helicopter will go from B to NYC	4. If the helicopter goes from B to NYC within the next hour, ____ (= strongest conditional inference)
a. neutral path	2-rotored presupposition	6	2	2	1
b. CONTINUE	lexical presupposition [+ 2-rotored presupposition]	5.7	6.3	2	1
c. swaying movement	at-issue? cosupposition? [+ 2-rotored presupposition]	6	2	2.3	4.7 (swaying-like motion)
d. smooth detour	cosupposition [+ 2-rotored presupposition]	6.3	1.7	1.7	6 (smooth detour)
e. abrupt detour	presupposition [+ 2-rotored presupposition]	6.7	2.7	5.7	2 (abrupt detour)

## (71) NONE

Context: our company has four helicopters and one airplane.

WITHIN 1-HOUR OUR COMPANY 4 BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>b</sub> NONE IX-arc<sup>33</sup>

\_\_\_\_\_  
'Within the next hour our, none of our company's 4 big helicopters will ... from Boston to New York.'  
(ASL, 34, 3552; 2 judgments)

Condition (ASL, 34, 3552; 2 judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. neutral path	<sup>6,5</sup> GO-helicopter-large_	fly
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-large_	continue to fly
c. swaying movement	<sup>6,5</sup> GO-helicopter-large_∧∧_	fly with a swaying movement
d. smooth detour	<sup>7</sup> GO-helicopter-large_∩_smooth	fly (with the assumption that this would involve a smooth detour)
e. abrupt detour	<sup>7</sup> GO- helicopter-large_∧_abrupt	makes an abrupt detour on their way

Target sentence / Inferences (ASL, 34, 3552; 2 judgments)	Inference type	1. __helicopter has 2 rotors		2. __ helicopter has been on its way from B to NYC within the next hour		3. __ helicopter will go from B to NYC		4. For__ helicopter, if it goes from B to NYC within the next hour, ____ (= strongest conditional inference)	
		Each	At least one	Each	At least one	Each	At least one	each	at least one
a. neutral path	2-rotored presupposition	3.5	4	1	1	1	1	1	1
b. CONTINUE	lexical presupposition [+ 2-rotored presupposition]	4.5	5.5	5	6.5	1	1	1	1
c. swaying movement	at-issue? cosupposition? [+ 2-rotored presupposition]	4.5	5	2.5	3	<u>3</u> (1, 5)	<u>3.5</u> (1, 6)	<u>3</u> (5, 1)	<u>3.5</u> (6, 1) (swaying-like motion)
d. smooth detour	cosupposition [+ 2-rotored]	5	5.5	1	1	1	1	6.5	6.5

<sup>33</sup> IX-arc appears to be signed in a neutral position, so no locus is assigned to it.

	presupposition]								(smooth detour)
<b>e. abrupt detour</b>	<b>presupposition</b> [+ 2-rotored presupposition]	5.5	5.5	2.5	3.5	4	5.5	1	1 (abrupt detour)

□ *Taking off: embedding under DOUBT, MAYBE, IF, and NONE*

Under *DOUBT* and *MAYBE*, we obtain the expected pattern of projection: *CONTINUE* triggers a lexical presupposition (to the effect that the helicopter is currently taking off); all constructions except *CONTINUE* trigger a presupposition that the helicopter is currently on the ground (the presupposition triggered by *CONTINUE* is nearly incompatible with it: if the helicopter continues to take off, it is probably not on the ground any more). The 'circling motion' and 'undulating motion' conditions trigger a cosupposition, to the effect that if the helicopter were to take off in the next five minutes, this would involve a circular/undulating motion. Finally, the 'abrupt detour' condition triggers a presupposition to the effect that the helicopter will in fact take off in the next five minutes.

For reasons we do not understand, the iconic cosuppositions involving a circling motion and an undulating motion are weakened under *IF*, as is the presupposition that the helicopter will in fact take off in the 'abrupt detour' condition. And under *NONE* (where we only have two judgments, and quite a bit of variation), only the presupposition triggered by *CONTINUE* and the cosuppositions involving a circular/undulating motion give rise to reasonably strong inferences.

## (72) DOUBT

*Context:* our company has one helicopter and one airplane.

WITHIN 5-MINUTES OUR COMPANY HELICOPTER DOUBT \_\_\_\_\_ .

'I doubt that within the next five minutes our company's helicopter will ...!' (ASL, [34, 3562](#); 2 judgments)

Condition (ASL, <a href="#">34, 3562</a> ; 2 judgments)	Words (replacing _____) and acceptability	Translation (replacing ...)
a. neutral path	<sup>7</sup> GO-helicopter-up_	take off
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-up_	continue to take off
c. circling motion	<sup>7</sup> GO-helicopter-up_circling	take off (with the assumption that this would involve a circular motion)
d. undulating motion	<sup>6.5</sup> GO-helicopter-up_undulate_smooth	take off with an undulating motion
e. abrupt detour	<sup>7</sup> GO-helicopter-up_∧_abrupt	make an abrupt detour during take off

Target sentence / Inferences (ASL, <a href="#">34, 3562</a> ; 2 judgments)	Inference type	1. Helicopter is currently on the ground	2. Helicopter is currently taking off	3. Helicopter will take off in the next 5 minutes	4. If the helicopter takes off in the next five minutes, _____ (= strongest conditional inference)
<b>a. neutral path</b>	on ground presupposition	6.5	1	2	1
<b>b. CONTINUE</b>	lexical presupposition [+ on ground presupposition]	2	6	2	1
<b>c. circling motion</b>	cosupposition [+ on ground presupposition]	5	1	2	5 (circular motion)
<b>d. undulating motion</b>	cosupposition [+ on ground presupposition]	5	1.5	2	5.5 (undulating motion)
<b>e. abrupt detour</b>	presupposition [+ on ground presupposition]	4.5	2.5	5	2.5 (abrupt horizontal displacement)

(73) **MAYBE**

*Context:* our company has one helicopter and one airplane.

WITHIN 5-MINUTES OUR COMPANY HELICOPTER MAYBE \_\_\_\_ .

'Within the next five minutes, maybe our company's helicopter will ...' (ASL, [34, 3556](#); 3 judgments)

Condition (ASL, <a href="#">34, 3556</a> ; 3 judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. neutral path	<sup>7</sup> GO-helicopter-up_	take off
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-up_	continue to take off
c. circling motion	<sup>7</sup> GO-helicopter-up_circling	take off (with the assumption that this would involve a circular motion)
d. undulating motion	<sup>7</sup> GO-helicopter-up_undulate_smooth	take off with an undulating motion
e. abrupt detour	<sup>6,7</sup> GO-helicopter-up_∧_abrupt	make an abrupt detour during take off

Target sentence / Inferences (ASL, <a href="#">34, 3556</a> ; 3 judgments)	Inference type	1. Helicopter is currently on the ground	2. Helicopter is currently taking off	3. Helicopter will take off in the next 5 minutes	4. If the helicopter takes off in the next five minutes, ____ (= strongest conditional inference)
a. neutral path	on ground presupposition	6.3	1.3	2.3	1
b. CONTINUE	lexical presupposition [+ on ground presupposition]	2	6	3	1
c. circling motion	cosupposition [+ on ground presupposition]	5.7	1.3	2.3	5.7
d. undulating motion	cosupposition [+ on ground presupposition]	5.7	1.3	2.7	5.3
e. abrupt detour	presupposition [+ on ground presupposition]	5.7	1.7	5	2 <sup>34</sup>

(74) **IF**

*Context:* our company has one helicopter and one airplane.

WITHIN 5-MINUTES OUR COMPANY HELICOPTER IF \_\_\_\_ , 2-CALL-1.

'If within the next five minutes our company's helicopter ..., call me.' (ASL, [34, 3568](#); 3 judgments)

Condition (ASL, judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. neutral path	<sup>7</sup> GO-helicopter-up_	takes off
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-up_	continues to take off
c. circling motion	<sup>7</sup> GO-helicopter-up_circling	takes off (with the assumption that this would involve a circular motion)
d. undulating motion	<sup>7</sup> GO-helicopter-up_undulate_smooth	takes off with an undulating motion
e. abrupt detour	<sup>7</sup> GO-helicopter-up_∧_abrupt	takes off with an abrupt detour

Target sentence / Inferences	Inference type	1. Helicopter is currently on the	2. Helicopter is currently taking	3. Helicopter will take off in the next	4. If the helicopter takes off in the next five

<sup>34</sup> As seen in the Supplementary Materials, in judgment [JL 17.10.22] the consultant picked option '(d)', which was not offered; we believe he meant the last option offered, i.e. (c), which is also the option he picked in other judgment tasks for the same sentence. The inference strength is extremely low and thus this point is immaterial to the present discussion.

(ASL, 34, 3568; 3 judgments)		<b>ground</b>	<b>off</b>	<b>5 minutes</b>	<b>minutes, ____ (= strongest conditional inference)</b>
<b>a. neutral path</b>	<b>on ground presupposition</b>	<b>6.3</b>	1.7	2	1
<b>b. CONTINUE</b>	<b>lexical presupposition</b> [+ on ground presupposition]	2.3	<b>5.3</b>	2	1
<b>c. circling motion</b>	<b>cosupposition? at-issue?</b> [+ on ground presupposition]	<b>5.7</b>	1.7	2	4.3 (circular motion)
<b>d. undulating motion</b>	<b>cosupposition?at-issue?</b> [+ on ground presupposition]	<b>6</b>	1.7	2	4.7 (undulating motion)
<b>e. abrupt detour</b>	<b>presupposition? at-issue?</b> [+ on ground presupposition]	<b>6</b>	2	4	1.7 (abrupt horizontal displacement)

(75) **NONE**

*Context:* our company has four helicopters and one airplane.

WITHIN 5-MINUTES OUR COMPANY 4 HELICOPTER NONE IX-arc \_\_\_\_.

'Within the next five minutes, none of our company's 4 helicopters will ...' (ASL, 34, 3570; 2 judgments)

<b>Condition</b> (ASL 34, 3570; 2 judgments)	<b>Words (replacing ____ ) and acceptability</b>	<b>Translation (replacing ...)</b>
a. neutral path	<sup>7</sup> GO-helicopter-up_	takes off
b. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-up_	continues to take off
c. circling motion	<sup>6.5</sup> GO-helicopter-up_circling	takes off (with the assumption that this would involve a circular motion)
d. undulating motion	<sup>6.5</sup> GO-helicopter-up_undulate_smooth	takes off with an undulating motion
e. abrupt detour	<sup>6</sup> GO-helicopter-up_ ^ _ abrupt	takes off with an abrupt detour

<b>Target sentence / Inferences</b> (ASL, 34, 3570; 2 judgments)	<b>Inference type</b>	<b>1. __ helicopter is currently on the ground</b>		<b>2. __ helicopter is currently taking off</b>		<b>3. __ helicopter will take off in the next 5 minutes</b>		<b>4. For __ helicopter, if it takes off in the next five minutes, ____ (= strongest conditional inference)</b>	
		<b>Each</b>	<b>At least one</b>	<b>Each</b>	<b>At least one</b>	<b>Each</b>	<b>At least one</b>	<b>each</b>	<b>at least one</b>
<b>a. neutral path</b>	<b>on ground presupposition</b>	<u>3</u> (1, 5)	<u>3.5</u> (2, 5)	1	1	1	1	1	1
<b>b. CONTINUE</b>	<b>lexical presupposition</b> [+ on ground presupposition]	1.5	2	4.5	<b>6</b>	1	1	1	1
<b>c. circling motion</b>	<b>cosupposition? at-issue?</b> [+ on ground presupposition]	<u>3</u> (1, 5)	<u>3.5</u> (2, 5)	1	1	1.5	1.5	<b>5</b>	<b>6</b> (circular motion)
<b>d. undulating motion</b>	<b>cosupposition?at-issue?</b> [+ on ground presupposition]	<u>3</u> (1, 5)	<u>3.5</u> (2, 5)	1	1	2	2	4.5	<b>5.5</b> (undulating motion)
<b>e. abrupt</b>	<b>presupposition?</b>	<u>3.5</u>	5	1.5	1.5	3	4.5	1 <sup>35</sup>	1

<sup>35</sup> As seen in the Supplementary Materials, in judgment [JL 17.10.21] our consultant picked option '(d)', which was not offered, for sentence e. He may have meant '(c)', which was the last option offered, and the one he

<b>detour</b>	<b>at-issue?</b> [+ on ground presupposition]	(2,5)							(abrupt horizontal displacement)
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picked in other judgments for the same sentence. In any event, the inference strength is extremely weak and this has not import.

**Appendix II. The behavior under ellipsis of cosuppositions triggered by ASL classifier predicates**

In this Appendix, we seek to determine whether our ASL consultant can ignore iconic cosuppositions of classifier predicates under ellipsis. According to the 'revisionist hypothesis' mentioned in Section 6, this should be possible. Our results do not bear this out: in an initial judgment task, our consultant disregarded cosuppositions under ellipsis; in two further judgment tasks, he didn't. We discuss possible reasons for this.

In order to assess the behavior of cosuppositions under ellipsis, we focus on a version of our earlier paradigms involving embedding under *MAYBE* with an elided clause. Because the elided clause included an overt *WILL* but no VP, it is plausible that this is an instance of VP-ellipsis.

□ *Horizontal movement with ellipsis*

Our horizontal paradigm is illustrated in (76) and included a condition with *CONTINUE* in order to assess the behavior of a standard presupposition trigger.

- (76) *Context*: the signer's company has one helicopter and the the addressee's company also has one helicopter.  
 WITHIN 1-HOUR POSS-1 COMPANY BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>b</sub> **MAYBE** WILL a-\_\_\_\_-b . POSS-2 COMPANY HELICOPTER DEFINITELY WILL.  
 'Within the next hour, maybe my company's big helicopter will ... from Boston to New York. Your company's helicopter definitely will.' (ASL [34, 3693](#); 3 judgments)

Condition (ASL <a href="#">34, 3693</a> ; 3 judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. CONTINUE	<sup>7</sup> CONTINUE GO-helicopter-large_	continue to fly
b. swaying movement	<sup>7</sup> GO-helicopter-large_ ^^^_ very_light	fly (with the assumption that this would be with a swaying motion)
c. at-issue control of swaying movement	<sup>6,7</sup> GO-helicopter-large_ WITH MOVEMENT_ ^^^_ very_light	fly with a swaying motion
d. curved path	<sup>7</sup> GO-helicopter-large_ ∩_ smooth	fly (with the assumption that this would be with a curved path)
e. at-issue control of curved path	<sup>6,7</sup> GO-helicopter-large_ WITH PATH_ ∩_ smooth	fly with a curved path
f. orthogonal detour	<sup>6,7</sup> GO-helicopter-large_  _ no_acceleration_smaller	make a detour on its way
g. at-issue control of orthogonal detour	<sup>6,3</sup> GO-helicopter-large_ WITH PATH_  _ no_acceleration_smaller	fly with a detour
h. pause in the middle	<sup>7</sup> GO-helicopter-large- _ _	make a pause to hover on its way
i. at-issue control of pause	<sup>7</sup> GO-helicopter-large_ WITH PAUSE_ _ _	fly with a pause to hover on its way

As in our earlier paradigms, the strength of relevant inferences was assessed in a quantitative fashion by way of the questions in (77).

- (77) Quantitatively assessed inferences for the paradigm in (76)  
 Does the sentence suggest that any of the following is the case? (1 = no inference; 7 = strongest inference).  
**Answer separately for a. the signer's company's helicopter b. the addressee's company's helicopter.**  
*Meaning 1*: the helicopter has 2 rotors  
*Meaning 2*: the helicopter has been on its way from Boston to NYC  
*Meaning 3*: the helicopter will go from Boston to NYC within the next hour  
  
*Meaning 4a: About the signer's company's helicopter:*  
if the helicopter were to go from Boston to NYC within the next hour, it would  
 a. have a swaying-like motion  
 b. have a curved path

- c. make an orthogonal detour
  - d. stop and hover on its way
- (only pick the strongest inference among a, b, c, d)

**Meaning 4b: About the addressee's company's helicopter:**

within the next hour, the helicopter will

- a. have a swaying-like motion
  - b. have a curved path
  - c. make an orthogonal detour
  - d. stop and hover on its way
- (only pick the strongest inference among a, b, c, d)

The consultant was asked to provide separate answers to questions about the signer's company's helicopter, and about the addressee's company's helicopter; this was crucial to assess differences between the antecedent clause and the elided clause. As a result, inferential questions systematically came in two versions (labelled a. and b. for the signer and addressee respectively). The antecedent was embedded under *MAYBE* so as to assess the difference between at-issue, presuppositional and cosuppositional inferences. Our goal was to see which of these inferences survived under ellipsis, and for this reason the elided clause was not embedded under *MAYBE*, in order to obtain sharper inferences, not involving modal reasoning.<sup>36</sup> This required a modulation of the fourth question: under *MAYBE*, it makes sense to test cosuppositional inferences in a conditional fashion (e.g. 'if the company's helicopter were to go from Boston to New York, would it have a swaying-like motion'), but without *MAYBE*, the relevant inference becomes unconditional (e.g. 'the company's helicopter will go from Boston to New York with a swaying-like motion'). This explains why there are two separate columns for question 4a and question 4b in the table in (78).

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<sup>36</sup> To see why we made this decision, consider the condition in (76)b, involving a swaying movement. On the basis of the inferences triggered by the antecedent clause (about the signer's company's helicopter), we can determine that the 'swaying movement' inference is a cosupposition. The question is whether it is preserved under ellipsis. If the elided clause included *MAYBE*, there would be two potential reasons why this inference could fail to arise: (i) because it just isn't preserved under ellipsis; (ii) because it gives rise to local accommodation (and is thus treated as part of the at-issue component) in the scope of *MAYBE* within the elided clause. Possibility (ii) is a significant worry because cosuppositions are often taken to be weak presuppositions (which means that they are easily turned into part of the at-issue component). It is to avoid this attenuation of the effects that we did not include *MAYBE* the clause with the elided VP: whether there is local accommodation or not, the 'swaying' inference should show up if it is preserved under ellipsis. (With more fine-grained data, one could include *MAYBE* in the elided clause and assess the *difference* between the strength of the cosuppositional inference in the elided clause and in the antecedent, with the assumption that local accommodation should target both conditions in comparable ways.)

(78) Horizontal, *MAYBE*, with ellipsis added: inferential results for the paradigm in (76)

Target sentence / Inferences (ASL 34, 3693; 3 judgments)	Inference type	1. Helicopter has 2 rotors		2. Helicopter has been on its way from B to NYC		3. Helicopter will go from B to NYC		4a. If the signer's company's helicopter goes from B to NYC, _____ (= strongest conditional inference)	4b. The addressee's company's helicopter will _____ (= strongest inference)
		a. Signer	b. Addressee	a. Signer	b. Addressee	a. Signer	b. Addressee	a. Signer	b. Addressee
<b>a. CONTINUE</b>	lexical presupposition [+ 2-rotored presupposition]	6.3	2.7	7	6.7	2	6.7	1	1
<b>b. swaying movement</b>	cosupposition [+ 2-rotored presupposition]	6.7	2.3	1.7	2.3	2.7	7	5 (swaying)	6 (4, 7, 7) (swaying)
<b>c. at-issue control of swaying movement</b>	at-issue [+ 2-rotored presupposition]	6.7	2.7	1	1.7	2.7 (3, 4, 1)	7	3 (swaying)	7 (swaying)
<b>d. curved path</b>	cosupposition [+ 2-rotored presupposition]	7	3.3	1.3	2	2	7	6 (curved)	6.3 Note: (5, 7, 7) (curved)
<b>e. at-issue control of curved path</b>	at-issue [+ 2-rotored presupposition]	6	2.3	1	1.7	3.3 (5, 3, 2)	7	3.3 (curved)	7 (curved)
<b>f. orthogonal detour</b>	presupposition [+ 2-rotored presupposition]	7	2.7	2	2	6	7	2 (orthogonal detour)	7 (orthogonal detour)
<b>g. at-issue control of orthogonal detour</b>	at-issue [+ 2-rotored presupposition]	6.3	2.3	1	1.7	2.3	7	3 (orthogonal detour)	7 (orthogonal detour)
<b>h. pause in the middle</b>	presupposition [+ 2-rotored presupposition]	6.3	2.3	1.7	2	5.7	7	2 (stop and hover)	7 (stop and hover)
<b>i. at-issue control of pause</b>	at-issue [+ 2-rotored presupposition]	6.7	2.7	1	1.7	2.7	7	3.7 (stop and hover)	7 (stop and hover)

Several conclusions can be drawn.

(i) The initial sentence with *MAYBE* (and without ellipsis) allows us to assess whether we managed to trigger the inferences we wanted. We did: the results strengthen the conclusions reached in the main text:

–In Column 4a, cosuppositions are obtained in the target sentences in the 'swaying movement' and 'curved path' conditions in b. and d. (= if the helicopter were to go from Boston to New York within the next hour, this would involve a swaying movement/a curved path), but not in the corresponding at-issue controls in c. and e.

–In Column 3a, presuppositions are obtained in the target sentences in the 'orthogonal detour' and 'pause in the middle' conditions in f. (= the helicopter will go from Boston to New York within the next hour), but not in the corresponding at-issue controls in g. and i.

(ii) The at-issue controls behave as expected, both under *MAYBE* and in the elided clause: they clearly must be copied under ellipsis.



(iii) The presupposition triggered by *CONTINUE* is as expected in the sentence with *MAYBE*. It is not preserved in the elided clause, and the reason might be quite simple: *DEFINITELY WILL* is missing a Verb Phrase, which can be resolved *CONTINUE GO-helicopter-large\_\_* or just as *GO-helicopter-large\_\_*. The inferential data suggest that the latter option is strongly preferred in this case.

(iv) Crucially, Column 4b suggests that cosuppositional inferences *are* inherited under ellipsis, since inferential scores are high for sentence b. and sentence d.

Thus the main conclusion is that the revisionist hypothesis according to which cosuppositions can be ignored under ellipsis is not at all confirmed. Two remarks must be made, however. First, judgments varied: the first judgment obtained (after right after the video was made) suggests that the cosupposition can to some extent be ignored. The latter two judgments disconfirm this. Second, nothing in the context really encouraged a reading without the cosupposition in the elided sentence. Thus it is conceivable that with a more inviting context the effect found in the first set of judgments could re-emerge - but we do not know this.

(v) By contrast, and perhaps surprisingly, the '2-rotored' presupposition triggered by the two-handed nature of the classifier is easily ignored under ellipsis. We come back to this point at the end of this Appendix.

#### □ *Vertical movement with ellipsis*

We turn to a paradigm with vertical movement depicting a helicopter take off, with the paradigm in (79).

- (79) *Context:* the signer's company has one helicopter and the the addressee's company also has one helicopter.  
 WITHIN 5-MINUTES POSS-1 COMPANY HELICOPTER **MAYBE** WILL \_\_\_\_ .  
 POSS-2 COMPANY HELICOPTER **DEFINITELY** WILL.  
 'Within the next five minutes, maybe my company's helicopter will ... . Your company's helicopter definitely will.' (ASL [34, 3697](#); 3 judgments)

Condition (ASL <a href="#">34, 3697</a> ; 3 judgments)	Words (replacing ____ ) and acceptability	Translation (replacing ...)
a. neutral take-off	<sup>7</sup> GO-helicopter-up__	take off
b. swaying movement	<sup>7</sup> GO-helicopter-up__∧∧__light	take off (with the assumption that this would be with a swaying motion)
c. at-issue control of swaying movement	<sup>7</sup> GO-helicopter-up__ WITH MOVEMENT _∧∧__light	take off with a swaying motion
d. curved path	<sup>7</sup> GO-helicopter-up_∩_smooth	take off (with the assumption that this would be with a curved path)
e. at-issue control of curved path	<sup>6,7</sup> GO-helicopter-up__ WITH PATH _∩_smooth	take off with a curved path
f. orthogonal detour	<sup>7</sup> GO-helicopter-large_!__ no_acceleration_smaller	make a detour during take off
g. at-issue control of orthogonal detour	<sup>6,7</sup> GO-helicopter-up__ WITH PATH _!__ no_acceleration_smaller	take off with a detour
h. pause in the middle	<sup>7</sup> GO-helicopter-up__ _	make a pause to hover during take off
i. at-issue control of pause	<sup>6,7</sup> GO-helicopter-up__ WITH PAUSE __ _	take off with a pause to hover

We provide judgments of inferential strength in (80). Because the helicopter predicate classifier is now a standard one, the '2-rotored' inference from the preceding paradigm is replaced with one to the effect that the helicopter is currently on the ground (Column 1). By parallelism with

the preceding paradigm, we preserved the inference that would have been triggered by *CONTINUE* ('the helicopter continues to take off'), namely that the helicopter is currently taking off (Column 2); since it is not triggered by anything, it should be at floor. Column 3 tests the existence of a presupposition to the effect that the helicopter will take off within the next 5 minutes. Finally, Columns 4a and 4b test two versions (depending on the presence or absence of *MAYBE*) of a cosuppositional inference to the effect that if the helicopter were to take off, it would have a swaying-like motion, or have a curved path, or make an orthogonal detour, or hover on its way (the consultant was to pick the strongest inference and assess its strength).

(80) Vertical, *MAYBE*, with ellipsis added: inferential results for the paradigm in (79)

Target sentence / Inferences (ASL 34, 3697; 3 judgments)	Inference type	1. Helicopter is currently on the ground		2. Helicopter is currently taking off		3. Helicopter will go take off		4a. If the signer's company's helicopter goes from B to NYC, _____ (= strongest conditional inference)	4b. The addressee's company's helicopter will _____ (= strongest inference)
		a. Signer	b. Addressee	a. Signer	b. Addressee	a. Signer	b. Addressee		
<b>a. neutral take-off</b>	'on the ground' presupposition	6	6.3	1	1.3	2	7	1	1
<b>b. swaying movement</b>	cosupposition + 'on the ground' presupposition	5.7	6.3	1.3	1.7	2	7	6 (swaying)	6 (4, 7, 7) (swaying)
<b>c. at-issue control of swaying movement</b>	at-issue + 'on the ground' presupposition	6.3	6.7	1.3	1.7	2.7	7	3 (swaying)	7 (swaying)
<b>d. curved path</b>	cosupposition + 'on the ground' presupposition	6.3	6.7	1	1.3	2	7	6.7 (curved)	5.7 (3, 7, 7) (curved)
<b>e. at-issue control of curved path</b>	at-issue + 'on the ground' presupposition	5.7	6.7	1	1.3	2.7	7	3.7 (curved)	7 (curved)
<b>f. orthogonal detour</b>	presupposition? + 'on the ground' presupposition	5.7	6.3	1.3	1.7	4.7	7	2.7 (orthogonal detour)	7 (orthogonal detour)
<b>g. at-issue control of orthogonal detour</b>	at-issue + 'on the ground' presupposition	6	6.7	1	1.3	2.7	7	3.3 (orthogonal detour)	7 (orthogonal detour)
<b>h. pause in the middle</b>	presupposition? + 'on the ground' presupposition	5.3	6.3	1.3	1.7	5	7	2.3 (pause and hover)	7 (pause and hover)
<b>i. at-issue control of pause</b>	at-issue + 'on the ground' presupposition	5.7	6.3	1	1.3	2.7	7	3.7 (pause and hover)	7 (pause and hover)

On the basis of these inferential judgments, a slightly weakened version of the main conclusions from the preceding paradigm can be drawn.

(i) The initial sentence with *MAYBE* (and without ellipsis) allows us once again to assess whether we managed to trigger the inferences we wanted. We did, although in slightly weaker from than in the horizontal paradigm (in (76)) for iconic presuppositions.

–In Column 4a, cosuppositions are obtained in the target sentences in the 'swaying movement' and 'curved path' conditions in b. and d. (= if the helicopter were to take off in the next five minutes, this

would involve a swaying movement/a curved path), but not in the corresponding at-issue controls in c. and e.

–In Column 3a, weak presuppositions are obtained in the target sentences in the 'orthogonal detour' and 'pause in the middle' conditions in f. (= the helicopter will go from Boston to New York within the next hour, with endorsements rates of 4.7 and 5 respectively), but not in the corresponding at-issue controls in g. and i. (with endorsements rates of 2.7 and 2.7 respectively).

(ii) Here too, the at-issue controls behave as expected, both under *MAYBE* and in the elided clause: they clearly must be copied under ellipsis.

(iii) The presupposition that the first helicopter is currently on the ground is triggered as expected under *MAYBE*, and it is (rather unsurprisingly) preserved under ellipsis.

(iv) Crucially, Column 4b suggests that cosuppositional inferences *are* inherited under ellipsis, since inferential scores are high for sentence b. and sentence d. The same remarks hold as in the preceding horizontal paradigm: the revisionist hypothesis according to which cosuppositions can be ignored under ellipsis is not at all confirmed. But here too, judgments varied: the first judgment obtained suggests that the cosupposition can to some extent be ignored, the last two judgments disconfirm this. And one would need to determine whether a more inviting context could lead one to ignore the cosupposition under ellipsis.

#### □ *The '2-rotored' inference under ellipsis*

We noted above the surprising fact that the '2-rotored' inference can easily be disregarded under ellipsis. We do not know why this is: since it has the hallmarks of a presupposition rather than of a cosupposition, even the revisionist hypothesis (according to which cosuppositions can be ignored under ellipsis) couldn't immediately explain this.

Still, it is important to test whether in other cases, the object-related information provided by the predicate classifier shape (as opposed to the path traced by the classifier) can be ignored under ellipsis. While judgments were not entirely stable, they suggest that ignorance of object shape under ellipsis is possible, as shown by the paradigm in (81).

- (81) Helicopter - plane  
 YESTERDAY POSS-1 COMPANY BIG HELICOPTER BOSTON<sub>a</sub> NEW-YORK<sub>a</sub> \_\_\_\_\_. POSS-1  
 COMPANY PLANE SAME ....  
 'Yesterday my company's big helicopter flew from Boston to New York. Your company's plane did too.'  
 a. <sup>6.3</sup> \_\_\_ = a-GO-helicopter-b      ... = Ø  
 b. <sup>2</sup> \_\_\_ = a-GO-helicopter-b      ... = a-GO-helicopter-b  
 c. <sup>7</sup> \_\_\_ = a-GO-helicopter-b      ... = a-GO-plane-b  
 d. <sup>5.7</sup> \_\_\_ = a-GO-helicopter-large-b      ... = Ø (4, 6,7)  
 e. <sup>2.7</sup> \_\_\_ = a-GO-helicopter-large-b      ... = a-GO-helicopter-large-b  
 f. <sup>6.7</sup> \_\_\_ = a-GO-helicopter-large-b      ... = a-GO-plane-b  
 (ASL, [34.3502](#); 3 judgments)

The predicate classifier used in the antecedent clause corresponds to a normal helicopter (in (81)a-c) or to a 2-rotored helicopter (in (81)d-f). In all cases, the shape of this predicate classifier is inappropriate to represent the movement of an airplane, as is seen in the unelided controls (81)b and (81)e, which are very degraded: an airplane predicate classifier must be used instead, as seen in (81)c and (81)f. The crucial conditions are those with ellipsis in (81)a and (81)c: they are relatively acceptable. We leave it for future research to determine why this 2-rotored component can be disregarded in this way.<sup>37</sup>

<sup>37</sup> The following general directions could be explored.

(i) There could be a kind of agreement relation between the noun *HELICOPTER* and the predicate classifier. But this explain (81)d, where there is a mismatch between the noun *HELICOPTER* (which is neutral) and the predicate classifier, which is 2-rotored.

### *Supplementary Materials. Raw data*

#### **Supplementary Materials A**

Link to the raw ASL data:

<https://drive.google.com/file/d/15WB8niSJYrK1tFkWS5StqzLtBisNpYWe>

#### **Supplementary Materials B**

Link to the raw data of the survey (3 native informants) on inferences triggered by pro-speech gestures:

<https://drive.google.com/file/d/126zMfnDk8GEJmXZHHXnBMBfggtfmz68P>

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(ii) Another possibility is that, for our consultant at least, ellipsis is very liberal and allows for any material that is redundant to be disregarded under ellipsis. This proposal was made for ASL in Schlenker 2014 and Schlenker, to appear f.

(iii) Yet another possibility is that the inference about object shape is in fact a cosupposition, but that it gets strengthened due to world knowledge. The idea would be as follows: suppose we obtain an inference to the effect that *if the helicopter flies, it will have two rotors*. The only plausible way to justify this condition is to assume that the helicopter has two rotors, whether it flies or not. But this analysis only helps if classifier predicates cosuppositions can in fact be ignored under ellipsis, which isn't clear for our ASL consultant.

(iv) Finally, we find it plausible that the helicopter path is really decomposed (whether syntactically or just conceptually) as being made of two parts: one corresponds to the object shape, and the other to the path. Under this decompositional view, it is relatively unsurprising that one can to some extent recover the path without the object shape under ellipsis.

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