Projection of non-spoken content: a composition-driven approach

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- Utterances aren’t just strings of spoken words. Hand gestures, facial expressions, voice modulations, etc. contribute to their meaning. I want to explain how they do that. So I work on **multi-modal** semantics.
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Today I’ll bring the two together by arguing for an interface-oriented approach to non-spoken content.
Posing the question

Much of the work in formal semantics and pragmatics of gesture and other non-spoken content has focused on PROJECTION (Ebert & Ebert 2014; Schlenker 2018a,b; Tieu et al. 2017, 2018; Esipova 2019).
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One type of projecting content is **LEXICAL PRESUPPOSITIONS**:

(1)  
   a. Jackie **stopped** smoking.  
   b. Jackie **didn’t stop** smoking.  
   c. **Did** Jackie **stop** smoking?  
   d. If Jackie **stopped** smoking, I’ll give you $10.  
      only (a): → Jackie no longer smokes.  
      (a)–(d): → Jackie used to smoke.

   **ONLY (a)**:  
   **DOESN’T PROJECT**

   **PROJECTS**
Posing the question

More instances of projection:

- a. her large dog
- b. her dog, a large animal
- c. her dog LARGE

..., we should get a bigger van.

Stephanie is bringing her dog.

Stephanie's dog is large.
More instances of projection:

(2) **Context:** *We are going on a group tour and want to rent a van. The speaker just learned that Stephanie might bring along her only dog.*

If Stephanie is bringing...

a. her **large** dog

b. her dog, **a large animal**

c. **her dog** LARGE

..., we should get a bigger van.

→ Stephanie is bringing her dog.

→ Stephanie’s dog is large.
Posing the question

Questions:

1. What is the exact classification of projecting content, and what determines which type of content projects in which way?
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2. How does non-spoken content (more generally, content that is not in the primary modality) fit into this classification?
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If you have a uniform, modality-neutral response to Question 1, Question 2 becomes trivial.
Posing the question

Questions:

1. What is the exact classification of projecting content, and what determines which type of content projects in which way?

2. How does non-spoken content (more generally, content that is not in the primary modality) fit into this classification?

If you have a uniform, modality-neutral response to Question 1, Question 2 becomes trivial.

But projection of non-spoken content is treated independently of projection of spoken content in the above cited literature, which relies heavily on whether a given piece of content co-occurs with something in the primary modality (most prominently, in Schlenker 2018b).
Composition-driven, modality-neutral approach to projection: for any piece of content that has its own node in the morphosyntax, how it projects is determined by how it composes in the syntax/semantics, regardless of its modality.
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(Compositional semantics: for each two expressions coming together in the syntax, we need to explain how their individual meanings combine to produce a more complex meaning.)
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(Compositional semantics: for each two expressions coming together in the syntax, we need to explain how their individual meanings combine to produce a more complex meaning.)

Two relevant composition strategies, (subsective) modifiers and supplements, with two associated projection patterns.
### Outline

1. **Introduction**
2. **Modifiers and supplements**
3. **Gestures**
4. **Facial expressions**
5. **Conclusion**
Modification as a composition strategy

A **SUBSECTIVE** MODIFIER composes with an expression $\alpha$ yielding an expression $\beta$ such that $\beta \Rightarrow \alpha$ (simplified).
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Modifiers of set-denoting expressions compose with sets and return subsets thereof.
Modification as a composition strategy

A \textbf{(SUBSECTIVE) MODIFIER} composes with an expression $\alpha$ yielding an expression $\beta$ such that $\beta \Rightarrow \alpha$ (simplified).

Modifiers of set-denoting expressions compose with sets and return subsets thereof.

E.g., \textit{blond} in (3) composes with the NP (Noun Phrase) \textit{stuntwoman} yielding a subset of stuntwomen.

(3) Zoe is a \textit{blond} stuntwoman.

$\{x \mid x \text{ is a stuntwoman and } x \text{ is blond}\}$

\[
\begin{array}{c}
\{x \mid x \text{ is blond}\} \\
\text{blond} \\
\{x \mid x \text{ is a stuntwoman}\} \\
\text{stuntwoman}
\end{array}
\]
Supplementation as a composition strategy

A SUPPLEMENT composes with an expression yielding propositional (i.e., sentence-like) content about it.
Supplementation as a composition strategy

A **SUPPLEMENT** composes with an expression yielding propositional (i.e., sentence-like) content about it.

E.g., Potts 2005: *(who is) a stuntwoman* in (4) composes with the DP (Determiner Phrase) *Zoe* passing on the denotation of *Zoe* unchanged and contributing the proposition of a special type that *Zoe* is a stuntwoman.

(4) I invited Zoe, *(who is) a stuntwoman*.

\[
\text{Zoe (at-issue)}
\]

\[
\text{Zoe} \in \{x \mid x \text{ is a stuntwoman}\} \quad \text{(conventional implicature)}
\]

\[
\begin{align*}
\text{DP} & \quad \{x \mid x \text{ is a stuntwoman}\} \\
\text{Zoe} & \quad (\text{who is) a stuntwoman} \\
\text{Zoe} & \quad \text{(at-issue)}
\end{align*}
\]
Modifiers and supplements

Modifiers have the potential to **RESTRICT** the expressions they combine with, i.e., yield logically stronger expressions, but specific instances of modifiers don’t always realize this potential.
Projection of modifiers

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(5)  

\[
\begin{array}{l}
\beta \\
\gamma \\
\alpha \\
\end{array}
\]

Assuming \(\gamma\) is a subsective modifier (\(\beta \Rightarrow \alpha\)), \(\gamma\) is:

b. **RESTRICTING** iff \(\alpha \not\Rightarrow \beta\) and

c. **NON-RESTRICTING** iff \(\alpha \Rightarrow \beta\)
Modifiers have the potential to **RESTRICT** the expressions they combine with, i.e., yield logically stronger expressions, but specific instances of modifiers don’t always realize this potential.

(5) a. \[ \beta \wedge \gamma \quad \alpha \]

Assuming \( \gamma \) is a subsective modifier \( (\beta \Rightarrow \alpha) \), \( \gamma \) is:

b. **RESTRICTING** iff \( \alpha \not\Rightarrow \beta \) and

c. **NON-RESTRICTING** iff \( \alpha \Rightarrow \beta \)

E.g., *female* is restricting in (6a) and non-restricting in (6b).

(6) a. the **female** director of ‘Four Rooms’

b. the **female** director of ‘Mi Vida Loca’
Projection of modifiers

Non-restricting modifiers are truth-conditionally vacuous (Leffel 2014, examples adopted from there):

(7)  a. I will eliminate every harmful chemical.
    ↝ I will eliminate every chemical.

    b. I will eliminate every harmful carcinogen.
    → I will eliminate every carcinogen.
Non-restricting modifiers are truth-conditionally vacuous (Leffel 2014, examples adopted from there):

(7)  
   a. I will eliminate every harmful chemical.  
      \[\neg \exists x \text{ harmful} \rightarrow x \text{ chemical}.\]  
      \[\neg \exists x \text{ harmful} \rightarrow x \text{ chemical}.\]  
   b. I will eliminate every harmful carcinogen.  
      \[\rightarrow \exists x \text{ carcinogen}.\]

But that doesn’t mean we don’t interpret non-restricting modifiers at all; we still get the inference that the expression being modified entails the result of modification \( (\alpha \Rightarrow \beta) \), i.e. the NON-RESTRICTING MODIFIER INference.
Projection of modifiers

Non-restricting modifier inferences can’t be interpreted locally, i.e., they project **STRONGLY**—cf. existence inferences of definites:
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Non-restricting modifier inferences can’t be interpreted locally, i.e., they project **STRONGLY**—cf. existence inferences of definites:

(8) Context: *We are going on a group tour and want to rent a van. The speaker just learned that Stephanie might bring along her only dog.*
Projection of modifiers

Non-restricting modifier inferences can’t be interpreted locally, i.e., they project STRONGLY—cf. existence inferences of definites:

(8) Context: We are going on a group tour and want to rent a van. The speaker just learned that Stephanie might bring along her only dog.

a. If Stephanie’s bringing her large dog, we should get a bigger van.
   → Stephanie’s dog is large.
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a. If Stephanie’s bringing her *large* dog, we should get a bigger van.  
   → Stephanie’s dog is large.

b. Do you know how big Stephanie’s dog is? #’Cause if she’s bringing her *large* dog, we should get a bigger van.  
   \(\not\rightarrow\) Stephanie’s dog is large. 
   Intended: ‘...if (her dog is large and she’s bringing her large dog)....’
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Non-restricting modifier inferences can’t be interpreted locally, i.e., they project **STRONGLY**—cf. existence inferences of definites:

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   a. If Stephanie’s bringing her large dog, we should get a bigger van.
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      ↗ Stephanie’s dog is large.
      Intended: ‘...if (her dog is large and she’s bringing her large dog)...’

(9) Context: *We are going on a group tour and want to rent a van. The speaker just learned that Stephanie might bring along her pet.*
   Do you know what kind of pet Stephanie has? ?’Cause if she’s bringing her dog, we should get a bigger van.
   ↗ Stephanie has a dog.
   ≈ ‘...if (she has a dog and she’s bringing her dog)...’
Projection of modifiers

Non-restricting modifier inferences $=$ COSUPPOSITIONS, assertion-dependent inferences that project like lexical presuppositions (i.e., they need to be entailed by their local context).
Projection of modifiers

Non-restricting modifier inferences \(=\) **COSUPPOSITIONS**, assertion-dependent inferences that project like lexical presuppositions (i.e., they need to be entailed by their local context).

(10) a. \[ \beta \]
    \[ \gamma \quad \alpha \]

b. **COSUPPOSITION**: If \(\gamma\) is a non-restricting modifier, the local context \(c'\) of \(\beta\) has to assure that \(\alpha \Rightarrow \beta\).
Projection of modifiers

Non-restricting modifier inferences = COSUPPOSITIONS, assertion-dependent inferences that project like lexical presuppositions (i.e., they need to be entailed by their local context).

(10) a. \[ \beta \]
\[ \alpha \]
\[ \gamma \]

b. COSUPPOSITION: If \( \gamma \) is a non-restricting modifier, the local context \( c' \) of \( \beta \) has to assure that \( \alpha \Rightarrow \beta \).

Cosuppositions were proposed in Schlenker 2018a as inferences triggered by co-speech gestures across the board and extended to other types of content in Schlenker 2018b,c. By equating them with non-restricting modifier inferences, I both constrain and expand them.
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(11) a. If you invite Zoe, a stuntwoman, you should show her your muscle car.
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(11) a. If you invite Zoe, a stuntwoman, you should show her your muscle car.
   \[ \rightarrow \text{Zoe is a stuntwoman.} \]

b. Do you know if Zoe is a stuntwoman? #'Cause if you invite Zoe, a stuntwoman, you should show her your muscle car.
   \[ \not\rightarrow \text{Zoe is a stuntwoman.} \]
   Intended: ‘...if (Zoe is a stuntwoman and you invite her)...’

Many accounts for supplement projection (e.g., Potts 2005; AnderBois et al. 2013; Koev 2013)—I will not propose a new one here.
## Tally

<table>
<thead>
<tr>
<th><strong>Modifiers</strong></th>
<th><strong>Supplements</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Compose with $\alpha$, yielding $\beta$ such that $\beta \Rightarrow \alpha$</td>
<td>Compose with $\alpha$, return a proposition about $\alpha$</td>
</tr>
<tr>
<td>Can be restricting or not</td>
<td>Can never be restricting</td>
</tr>
<tr>
<td>Project when non-restricting, as cosuppositions</td>
<td>Always project, any existing analysis of supplement projection will do</td>
</tr>
</tbody>
</table>

**Examples:**
- adnominal adjectives
- restrictive relative clauses
- appositives
- sentence-level adverbs
Co-nominal gestures vs. adjectives and appositives: experiment

Acceptability judgement experiment:
Co-nominal gestures vs. adjectives and appositives: experiment

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- Participants: 122 (33 female, 89 male), recruited on Amazon MTurk.
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- Task: read contexts, watch videos of sentences uttered in those contexts, rate those sentences on a scale from ‘Totally unnatural’ to ‘Totally natural’ (mapped to 0–100).

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<th>Projecting</th>
<th>Restricting</th>
<th>Non-projecting</th>
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<tbody>
<tr>
<td>Adjective</td>
<td>4 4 4</td>
<td></td>
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<tr>
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Each participant saw 1 randomly selected item per condition and 2 additional check items.
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<td>4</td>
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<tr>
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Co-nominal gestures vs. adjectives and appositive: experiment

Typical trial:

Context: We are going on a group tour. Anna and Maria are responsible for renting a van. Maria just told Anna that Stephanie, who has two pets, a small cat and a large dog, is planning to bring along one of her pets. Anna, who has seen both Stephanie's pets before, says:

Given the context, how natural is the sentence in the video?

Totally unnatural

Drag the slider

Totally natural
Co-nominal gestures vs. adjectives and appositives: experiment

(12) Context: We are going on a group tour. Anna and Maria are responsible for renting a van. Maria just told Anna that...

a. PROJECTING NON-RESTRICTING ...Stephanie, who has two pets, a small cat and a large dog, is planning to bring along one of her pets. Anna, who has seen both Stephanie’s pets before, says: Do you know which one of Stephanie’s pets is coming with us? ’Cause if she’s bringing...

(i) her small cat
(ii) her cat, a small animal

(iii) [Gesture] her cat\textsubscript{SMALL}...

..., we’ll be fine, but if she’s bringing...

(i) her large dog
(ii) her dog, a large animal

(iii) [Gesture] her dog\textsubscript{LARGE}...

..., we should get a bigger van.
Co-nominal gestures vs. adjectives and appositives: experiment

(8) b.  **RESTRICTING** ...*Stephanie, who has two dogs, a small Pug and a large Great Dane, is planning to bring along one of her dogs. Anna, who has seen both Stephanie’s dogs before, says: Do you know which one of Stephanie’s dogs is coming with us? ‘Cause if she’s bringing...*

(i) her *small* dog  
(ii) her dog, a *small* animal  
(iii) her dog SM\text{ALL}...

..., we’ll be fine, but if she’s bringing...

(i) her *large* dog  
(ii) her dog, a *large* animal  
(iii) her dog L\text{ARGE}...

..., we should get a bigger van.
Co-nominal gestures vs. adjectives and appositives: experiment

(8) c. NON-PROJECTING NON-RESTRICTING ...Stephanie is planning to bring along her dog. Anna knows that Stephanie only has one dog, but has never seen it. She says:

Do you know how big Stephanie’s dog is? ’Cause if she’s bringing...

(i) her **small** dog

(ii) her dog, a **small** animal

(iii) her **dog**APPING

..., we’ll be fine, but if she’s bringing

(i) her **large** dog

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Co-nominal gestures vs. adjectives and appositives: experiment

Results:
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Fig. 1: % acceptability of the 3 interpretations for each content type. Error bars show standard error. Dots represent individual responses (with minor jitter added).
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Fig. 1: % acceptability of the 3 interpretations for each content type. Error bars show standard error. Dots represent individual responses (with minor jitter added).
Existing analyses of co-speech gestures

Ebert & Ebert 2014: co-speech gestures are supplements, akin to appositives.
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Ebert & Ebert 2014: co-speech gestures are supplements, akin to appositives.

Undergeneration problem: this analysis predicts that restricting interpretations of co-speech gestures should be completely unavailable.
Existing analyses of co-speech gestures

**Schlenker 2018a**: co-speech gestures trigger cosuppositions across the board.
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This analysis assumes modifier-like composition (i.e., essentially, conjunction) of co-speech gestures across the board.
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This analysis assumes modifier-like composition (i.e., essentially, conjunction) of co-speech gestures across the board.

This analysis yields good results for NP-level gestures. E.g., if LARGE composes with dog in Stephanie is bringing her dog_{LARGE}, we can get either a restricting or a projecting non-restricting interpretation.
Existing analyses of co-speech gestures

**Schlenker 2018a:** co-speech gestures trigger **cosuppositions** across the board.

This analysis assumes modifier-like composition (i.e., essentially, conjunction) of co-speech gestures across the board.

This analysis yields good results for NP-level gestures. E.g., if *LARGE* composes with *dog* in *Stephanie is bringing her dog*<sub>LARGE</sub>, we can get either a restricting or a projecting non-restricting interpretation.

**Overgeneration problem:** this analysis predicts unattested interpretations for DP-level gestures. E.g., if *LARGE* composes with *her dog* in *Stephanie is bringing her dog*<sub>LARGE</sub>, we predict that this sentence can be interpreted as ‘Stephanie is bringing her dog and a large object’ or ‘Stephanie is bringing her dog and her dog is large’.
Proposal: composition determines projection for gestures, too

Why do the supplemental and cosuppositional analyses fail? Because they want a uniform story for projection of co-speech gestures, regardless of where these gestures adjoin in the syntax. But this is not how spoken expressions work, so why should gestures?
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- composition determines projection both for spoken and gestural content;
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Proposal:

- composition determines projection **both for spoken and gestural content**;
- **no gesture-specific composition**, i.e., compositionally integrated gestures compose just like spoken content.
Proposal: composition determines projection for gestures, too

E.g., two construals for *Stephanie is bringing her dog_{LARGE}*: 
Proposal: composition determines projection for gestures, too

E.g., two construals for *Stephanie is bringing her dog*$_{LARGE}$:

- *LARGE* is a property (akin to *large*), adjoins to the NP *dog*, composes as a modifier, can be restricting or not, projects as a cosupposition if non-restricting (relative to the local context, *dog* $\Rightarrow$ *large*).
Proposal: composition determines projection for gestures, too

E.g., two construals for *Stephanie is bringing her dog*$_{\text{LARGE}}$:

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- **LARGE** is a **nominal** (akin to *a large object*), adjoins to the DP *her dog*, composes as a supplement, can’t be restricting, always projects.
Proposal: composition determines projection for gestures, too

E.g., two construals for *Stephanie is bringing her dog*_{LARGE}:

- *LARGE* is a **property** (akin to *large*), adjoins to the NP *dog*, composes as a modifier, can be restricting or not, projects as a cosupposition if non-restricting (relative to the local context, *dog* ⇒ *large*).

- *LARGE* is a **nominal** (akin to *a large object*), adjoins to the DP *her dog*, composes as a supplement, can’t be restricting, always projects.

No way to generate ‘Non-projecting non-restricting’ interpretations for gestures in this system.
Proposal: composition determines projection for gestures, too

E.g., two construals for *Stephanie is bringing her dog*$_{\text{LARGE}}$:

- *LARGE* is a **property** (akin to *large*), adjoins to the NP *dog*, composes as a modifier, can be restricting or not, projects as a cosupposition if non-restricting (relative to the local context, *dog* $\Rightarrow$ *large*).

- *LARGE* is a **nominal** (akin to *a large object*), adjoins to the DP *her dog*, composes as a supplement, can’t be restricting, always projects.

No way to generate ‘Non-projecting non-restricting’ interpretations for gestures in this system.

But why are restricting interpretations of gestures degraded?
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But why are restricting interpretations of gestures degraded?

- Following Schlenker’s original intuition, co-speech gestures prefer to be truth-conditionally vacuous due to their secondary modality nature.

- Thus, modifier gestures prefer to be non-restricting; this preference can be overridden (to a gradient and variable extent).
Schlenker’s (2018b) classification of “iconic enrichments”

<table>
<thead>
<tr>
<th>External enrichments (= syntactically eliminable)</th>
<th>Internal enrichments (= syntactically ineliminable)</th>
</tr>
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<tbody>
<tr>
<td>No separate time slot: Co-speech/co-sign gestures</td>
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<tr>
<td>punished</td>
<td>NEVER [SPEND MONEY]</td>
<td>Supplements</td>
</tr>
<tr>
<td>his son –</td>
<td></td>
<td>At-issue or not, depending on the case</td>
</tr>
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<td></td>
<td></td>
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<tr>
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<td></td>
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Schlenker predicts facial expressions co-occurring with primary modality expressions to trigger cosuppositions across the board. But such facial expressions do not behave uniformly wrt projection.
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| John punished his son. | John punished his son. | The talk was loooooong. | Your brother, I am going to |

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Facial expressions

I observe that **MIRATIVE** (i.e., expressing surprisal) facial expressions and spoken adverbs compose and project in a similar way.
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(13) a. Yesterday there was a party, and, ⟨surprisingly, impressively, *very, *extremely⟩, Mia got drunk.
   ✓ It is ⟨surprising, impressive⟩ that Mia got drunk.
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b. Yesterday there was a party, and Mia got ⟨surprisingly, impressively, very, extremely⟩ drunk.
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Facial expressions

Mirative facial expressions can have have both uses, too:
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(14) a. Yesterday there was a party, and Mia got drunk 😐.

✓ It is {surprising, impressive} that Mia got drunk.?

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Facial expressions

Mirative facial expressions can have both uses, too:

(14) a. Yesterday there was a party,

[Image: Woman saying "O_O"

and Mia got drunk.]

✓ It is {surprising, impressive} that Mia got drunk.
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? Mia got drunk to a(n) {surprising, impressive, high} extent.

b. Yesterday, there was a party,

[Image: Woman saying "O_O"

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To side-step the concerns about iconic voice modulations, the two uses of $O\_O$ can be illustrated with a prosodically independent gesture instead of a spoken predicate *drunk*:
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Facial expressions

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(16) a. When, ⟨surprisingly, impressively⟩, a friend of mine gets drunk, I sometimes comment on that.

→ When a friend of mine gets drunk, this fact is ⟨surprising, impressive⟩.
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\[\rightarrow\text{When a friend of mine gets drunk, this fact is } \langle\text{surprising, impressive}\rangle.\]

b. \#When a friend of mine gets drunk, I usually don’t say anything, but when, \(\langle\text{surprisingly, impressively}\rangle\), a friend of mine gets drunk, I sometimes comment on that.

Intended: ‘When (a friend of mine gets drunk and I am \(\langle\text{surprised, impressed}\rangle\) by this fact)...’
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So do sentence-level mirative facial expressions:
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(17) a. When a friend of mine gets DRUNK\(^{O-0}\), I sometimes comment on that.
(under the sentence-level reading) \(\rightarrow\) When a friend of mine gets drunk, this fact is \{surprising, impressive\}. 
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So do sentence-level mirative facial expressions:

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b. ?When a friend of mine gets DRUNK, I don’t say anything, but when a friend of mine gets DRUNK^{O–O}, I sometimes comment on that.

✓ ‘...when a friend of mine gets very drunk...’

✗ ‘...when (a friend of mine gets drunk and I am \{surprised, impressed\} by this fact)...’
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(18) a. When a friend of mine gets drunk, I usually don’t say anything, but when a friend of mine gets \{surprisingly, very\} drunk, I sometimes comment on that.
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Facial expressions

Once again, how non-spoken content projects cannot be explained by its co-something status, contra Schlenker’s classification.
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Under the composition-driven approach to projection of non-spoken content, neither the differences between the two uses of $O\_O$ nor the parallels with the spoken adverbs are surprising.
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But why don’t degree modifier co-something facial expressions exhibit the preference to be truth-conditionally vacuous and thus non-restricting?
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But why don’t degree modifier co-something facial expressions exhibit the preference to be truth-conditionally vacuous and thus non-restricting?

Perhaps that’s due to them being degree modifiers. Cf. (adopted from Schlenker 2018b, (13)):

(19) If the talk is loooong, I’ll leave before the end.
    $\not\rightarrow$ If the talk is long, the speaker will leave before the end.
    $\rightarrow$ If the talk is very long, the speaker will leave before the end.
**Updated tally**

<table>
<thead>
<tr>
<th>Modifiers</th>
<th>Supplements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compose with $\alpha$, yielding $\beta$ such that $\beta \Rightarrow \alpha$</td>
<td>Compose with $\alpha$, return a proposition about $\alpha$</td>
</tr>
<tr>
<td>Can be restricting or not</td>
<td>Can never be restricting</td>
</tr>
<tr>
<td>Project when non-restricting, as cosuppositions</td>
<td>Always project, any existing analysis of supplement projection will do</td>
</tr>
</tbody>
</table>

**Examples:**
- adnominal adjectives
- restrictive relative clauses
- NP-level gestures
- degree modifier facial expressions
- *phi*-features on pronouns
- height specifications on gestures

- appositive
- sentence-level adverbs
- DP-level gestures
- sentence-level facial expressions
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- The “co-something” status does not determine the choice of projection strategy for non-spoken content. The way this content composes does, just like for spoken content.
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- The “co-something” status might make a given piece of content preferably truth-conditionally vacuous, but this preference can be overridden by other considerations.

Broad programmatic point: if we want to approach gestures (and other types of non-spoken content) as linguistic objects, we should do so at all levels of representation.
Acknowledgements

I thank my dissertation committee:

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Stephanie Harves  Philippe Schlenker

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Anna Alsop

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