What embedded sentences do

The role of lexical semantics in clausal embedding

Tom Roberts

Utrecht University

EGG, 6 August 2025

In our last episode

Two main remaining plausible analyses of how responsive predicates can combine with both declaratives and interrogatives:

1. **q-to-p shifting**: Interrogative clauses can (in some way) receive a propositional interpretation
   - *Needs explaining*: why we have anti-rogative predicates, given the above mechanism being an option
2. **unified clause types**: interrogatives and declaratives both denote clauses of the same type
   - *Needs explaining*: why we have anti-rogative predicates, given the above mechanism being an option

Today: Some lexical inferences of CE predicates: what can they tell us about the responsive puzzle?

Is responsivity lexical?

Lexical semantics? In MY linguistics?

Weirdly, formal semanticists tend not to care much about lexical semantics, even though almost everyone else does.

Semantics Joke:

> *Normal person*: What is love?
>
> *Semanticist*: ⟦love⟧

Rather, formal semantics is most concerned with logical meanings and compositionality.

Clausal embedding is an interesting corner of this space:

- The compositional properties seem to be closely linked to conceptual/lexical semantic properties

Thinking, believing, and hoping whether

Inferences like (1), suggesting *think*/*hope*/etc. are **anti-rogative**, seem robust:

(1) *Veronica thinks/hopes/believes/fears whether the Earth is flat.

Or do they?

(2) a. I **fear whether** I'll have use of my arms/hands by age 55 or 60. (White 2021: ex. 25c))

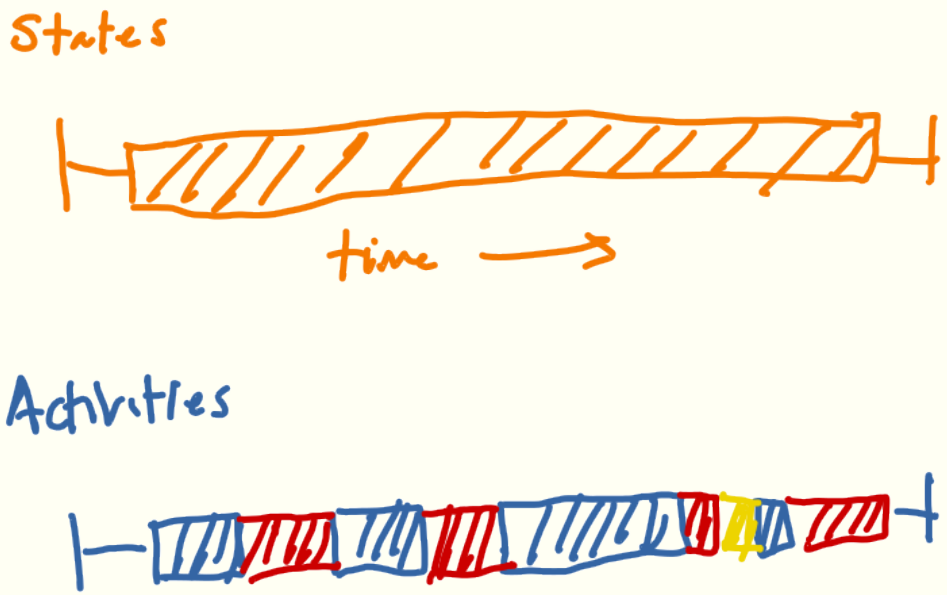
b. With no word from Rockstar Games, fans are left **hoping whether** the highly awaited trailer will release as it was once rumored or if the rumors were unfounded.

c. I'm **thinking whether** I should break up with my deadbeat boyfriend.

Aspect and clausal embedding

Özyıldız (2021): *Think* is not exactly anti-rogative; it can embed interrogatives when interpreted as an activity (as opposed to a state).

- States: continuous and homogeneous (like being tall or knowing French, etc.)
- Activities: continuous but non-homogeneous (like playing chess or walking the dog)



Aspect and *think*

(3) a. Glenn thought that it was raining. ✓state, ✓activity
b. Glenn thought what to make for the cocktail party.
*state, ✓activity
c. Glenn is thinking what to make for the cocktail party.
d. Glenn thinks what to make for the cocktail party.
(only has habitual/narrative reading)

⋆ Why is stative *think* allergic to embedded interrogatives? Does it illustrate a general pattern?

(4) a. ??Fans hope whether the highly awaited trailer will release.
b. Fans are hoping whether the highly awaited trailer will release.

Neg-raising and anti-rogativity

Neg-raising: A predicate *V* is neg-raising if *x doesn't V that p* gives rise to the inference *x V's that not-p*

(5) Chantal doesn't think/believe that Julienne is Canadian.
⇝ Chantal thinks/believes that Julienne is not Canadian.

Neg-raising predicates: *think*, *believe*, *feel*, *expect*, *want*, *seem*, *be likely*,...

(6) NEG-RAISING GENERALIZATION (Zuber 1982)
If a predicate is neg-raising, it is anti-rogative.

(7) a. *Chantal thinks/believes/expects/feels which person is Canadian.
b. *It seems/is likely which person is Canadian.

Deriving neg-raising

Neg-raising predicates associated with (weak) **excluded middle presupposition** (Bartsch 1973, Gajewski 2007)

(8) Chantal believes that Julienne is Canadian.
Presupposes: Chantal believes that Julienne is Canadian **or** she believes that Julienne **isn't** Canadian

In positive contexts, presupposition is redundant. But in negative contexts:

(9) Chantal doesn't believe that Julienne is Canadian.
Presupposes: Chantal believes that Julienne is Canadian **or** she believes that Julienne **isn't** Canadian

Strengthened conclusion: Chantal believes that Julienne isn't Canadian

The EM presupposition and the NR generalization

Theiler et al. (2018): The EM presupposition is responsible for the anti-rogativity of neg-raising predicates

- In their framework, the EM presupposition always reduces to equivalent to the at-issue component of *believe* when paired with a question
- Thus, the presupposed an at-issue contribution of an NR predicate in such contexts are identical
- this systematic redundancy manifests as unacceptability, i.e., incompatibility between neg-raisers and embedded interrogatives

However, not all anti-rogatives are NR predicates (e.g. *hope*, *fear*), so this cannot explain all anti-rogative restrictions

Factivity, Veridicality, & Responsivity

Factivity and responsivity

Two kinds of inferences: **factivity** and **veridicality**:

- Factives **presuppose** their declarative complements (*know*, *forget*, *be happy*,...)
- Veridicals **entail but do not presuppose** their declarative complements (*prove*, *be right*, *be true*,...)

(10) FACTIVITY/VERIDICALITY GENERALIZATION (from Egré 2008)
All veridicals (& factives) are responsive.

One-way generalization (*say*, *tell*, *matter*, etc. are responsive and non-veridical)

Diagnosing factivity vs. veridicality

Classic presupposition diagnostics: *know* is factive, *be correct* is not.

(11) a. She doesn't know that the body is missing.
b. Does she know that the body is missing?
c. If she knows that the body is missing, we will have to leave the country.

(12) a. She isn't correct that the body is missing.
b. Is she correct that the body is missing?
c. If she is correct that the body is missing, we will have to leave the country.

Caution: projection is a limited diagnostic.

(13) a. Ateş said that Tom knows that /s/ is a plosive, but in reality /s/ is a fricative.
b. ??Ateş thinks that Tom's sister is a professional wrestler, but Tom doesn't have a sister.

Presupposition as a lexical property

We could write factive/veridical inferences into lexical entries.

(14) a. $[\![\text{know}]\!] = \lambda p \lambda x : \underline{p = 1}.\textbf{know}(p)(x)$

b. $[\![\text{be correct}]\!] = \lambda p \lambda x.\textbf{believe}(p)(x) \wedge p = 1$

However, this yields no insight into the embedding behavior of such predicates.

Rather, we want some understanding of *what is special* about factive/veridical contexts.

Structural reflexes of factivity

Unlike non-factives, factives are **weak islands**:

(15) a. Who$_i$ do you think t_i ate the goulash?
b. *Who$_i$ do you remember t_i ate the goulash?

(16) a. Why$_i$ do you think [Marie ate the goulash t_i]?
b. *Why$_i$ do you remember [Marie ate the goulash t_i]?

Kastner (2015): Factive complements are covert definite DPs, not CPs; parallel to sentential subjects.

(17) a. [That he wore the same shirt twice] shocked me.
b. [His outfit] shocked me.

$\Rightarrow$ Weak islandhood follows
$\Rightarrow$ In this view, factivity underlyingly reflects syntactic differences between factive/non-factive verbs

Is factivity a property of complementizers?

Could factivity come from complementizers? Some factives have reduced acceptability with *that*-less declarative complements (Bolinger 1972 *et seq.*)

(18) a. Uma regrets/likes ??(that) it's raining.
b. Uma knows/is thrilled it's raining.
c. Uma thinks/believes it's raining.

BCS factive complementizers ***što*** vs non-factive ***da*** (also Bulgarian, Modern Greek, ...)

(19) a. Žalim **što** nije došao.
'I regret that he has not come.' (Krapova et al. 2024)
b. Vjerujem **da**/*što nije došao.
'I believe that he has not come.'

(20) a. Ivan se brine **da** je Marija bolesna.
'Ivan is worried that Marija is sick (but she might not be).'
b. Ivan se brine **što** je Marija bolesna.
'Ivan's worried about the fact that Marija is sick.'

Factivity alternations

Other languages offer evidence that other properties of complement clauses, correlate with factive inferences

Buryat *hanaxa* (Mongolic; Bondarenko 2020)

(21) **Clausal complement: non-factive *hanaxa***

Dugar [mi:sgə zagaha ədj-ə: gəžə] han-a:
Dugar cat.NOM fish eat-PST COMP think-PST
'Dugar thought a cat ate the fish.'

(22) **Nominal complement: factive *hanaxa***

Dugar [mi:sgəi-n zagaha ədj-ə:ʃ-i:jə-n'] han-a:
Dugar cat.GEN fish eat-PART-ACC-3 think-PST
'Dugar remembered a cat's eating the fish'

More factivity alternations

Korean focus-conditioned alternations (Jeong 2020):

(23) a. Sun-eun [Byul-i pati-e o-n-jul] an-da.
Sun-NOM Byul-NOM party-DAT come-PTCP-C att-DECL
'Sun knows that Byul came to the party.'

b. Sun-eun [Byul-i pati-e o-n-jul] an-da.
Sun-NOM Byul-NOM party-DAT come-PTCP-C att-DECL
'Sun thinks that Byul came to the party.'

Tonhauser (2016), Djärv & Bacovcin (2020): prosody (/focus) affects factivity inference, but can't fully eliminate it.

(24) a. Perhaps he noticed that SHE is a widow.
b. Perhaps he NOTICED that she is a widow.

Stronger inference that she is a widow in (b) compared to (a)

Connection to clausal embedding

In a world where declaratives/interrogatives are the same type, responsive predicates are the default

- We can rule out rogative + declarative if all rogatives have an ignorance presupposition
- We can rule out anti-rogative + interrogative if all anti-rogatives result in triviality with questions

Factives/veridicals, by their nature, lack ignorance presuppositions and are perfectly compatible with questions.

Perhaps factives are responsive because *they lack a reason not to be*?

⋆ This result can come through regardless of where we think factivity lives

Putting the pieces together

Encoding truth in predicates

Inferences like veridicality and factivity associated with particular lexical items can vanish in some contexts.

True: normally veridical, but veridicality goes away with external argument

(25) a. It is true that she would be betrayed.

b. It is true to Miriam that she would be betrayed.
⇝I think that Miriam is wrong.

Irish *fíor*: No implication of falsity whether or not external argument is present (Jim McCloskey, p.c.)

(26) a. Is fíor go bhfuil an fharraige fealltach.
PRES true C is the sea treacherous
'It is true that the sea is treacherous.'

b. B' fhíor dó go ndéanfaí feall orthu.
PAST true to-him C do.COND-IMPERS treachery on-them
'He was right that they would be betrayed.'
(Lit. 'It was true to him that they would be betrayed.')

Selectional properties

If lexical properties which are associated with clause-embedding profiles can disappear...

...can restrictions on clausal-embedding, too?

(27) a. Nora is certain that today is Tuesday.
b. *Nora is certain whether today is Tuesday.

(28) a. Nora isn't certain that today is Tuesday.
b. ✓Nora isn't certain whether today is Tuesday. (Mayr 2017, 2018)

Introducing *can't believe* (Roberts 2019, 2021)

(29) a. It's not butter.
b. She can't believe it's not butter. ✓entails (29a)

(30) a. She believes it's not butter. ✗entails (29a)
b. She can believe it's not butter. ✗entails (29a)
c. She doesn't believe it's not butter. % entails (29a)

(31) I *(can't) believe [what that spread is made out of/why you would do such a thing].

Can't believe is not purely idiomatic

(32)
a. It's **unbelievable** who's lecturing us about fake news.
b. My appetite fled as I sat rigidly in my seat, **unable to believe** who was next to me.
c. Everyone who was present that night was **incapable of believing** why UEFA allocated this stadium for a European Cup final.

BUT:

(33)
a. ??It's **not possible to believe** who's lecturing us about fake news.
b. ??It's **not believable** who's lecturing us about fake news.

Can't believe across languages

Strikingly, factive *can't believe* has similar counterparts in many other languages

(34) a. *I believe who won the race.
b. I can't believe who won the race. *English*

(35) a. *Ik geloof wie de race gewonnen heeft.
b. Ik kan niet geloven wie de race gewonnen heeft. *Dutch*

(36) a. *Ma usun, kes võidujooksu võitis.
b. Ma ei suuda uskuda, kes võidujooksu võitis. *Estonian*

→ We can 'alter' the compatibility of some verbs with a clause type by putting other stuff in front of it

Two questions

But which verbs? And which stuff?

(37) a. I can't think that Francesca won the race.
~~⊬~~ Francesca won the race
b. I can't think who won the race.
Paraphrase: I can't remember who won the race.
c. She (won't/can't/*mustn't/*may not) believe who won the race.

Some languages: only negation is necessary

(38) **Malay** (Michaelis 2001: 1043)

Saya tak percaya siapa yang bercakap.
I not believe who RM spoke.up
'I don't believe who spoke up!'

(39) **Setswana** (Michaelis 2001: 1043)

Ga ke dumele se re se boneng.
NEG I believe RP we OM found
'I don't believe what we found!'

Making sense of *can't believe*

Roberts (2019, 2021) assumes Theiler et al.'s treatment of neg-raising verbs, including *believe*

⇒ *believe* + *q* normally results in systematic triviality & therefore unacceptability

But, under the right combination of operators, this triviality can disappear

(40) She can't believe it's not butter.
She lacks the ability to believe it's not butter and also maintain a consistent belief state/believe very good evidence

(41) She can't believe who won the election. She lacks the ability to believe the true answer to the question 'who won the election' and also maintain a consistent belief state/believe very good evidence

Wrapping up

Two kinds of lexically-associated inferences: **neg raising** and **factivity/veridicality**

- neg-raising $\rightarrow$ anti-rogative
- factive/veridical $\rightarrow$ responsive

Several ways to connect these inferences to embedding patterns semantically

Division of labor between attitude predicate and embedded clause in generating these inferences: still debated

We need your cross-linguistic help!