Composing CPs:
evidence from disjunction and conjunction

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Clausal Embedding

General question: How do CPs combine with verbs to give the meanings of attitude reports, (1)?

(1) Maria thinks /knows /is upset [$_{CP}$ that Dina is dancing].

★ Does the complementizer (COMP) have a semantic contribution?

Semantics of belief attitudes

- **Hintikkan (1969)** semantics for attitude reports: $[\![\text{CP}]\!] = [\![\text{TP}]\!]$.

(2) $[\![_{\text{CP}}$ that Dina dances$]\!] = [\![_{\text{TP}}$ Dina dances$]\!] =$
$\{w : \text{Dina dances in } w\}$

- **Kratzer's approach** (Kratzer 2006; 2016, Moulton 2009; 2015, Bogal-Allbritten 2016; 2017, Elliott 2017): while the TP denotes a propopisition, syntactic material in the CP layer converts a proposition p into a predicate of entities with Content p.
  $\Rightarrow$ $[\![\text{CP}]\!]$ and $[\![\text{TP}]\!]$ are not equivalent.

- This talk argues for a particular implementation of the Kratzer's approach.

This talk

Empirical domain:

- We investigate the semantics of clausal embedding by looking at **CP disjunction** and **CP conjunction**, and comparing them to the corresponding TP disjunction and TP conjunction.

  (3) Bill got angry that Mary sang or that Dina danced.

  (4) Bill got angry that Mary sang and that Dina danced.

- Data drawn from four languages: Russian, Hebrew, Italian and English.

- This phenomenon in the literature: Bjorkman (2013) and Szabolcsi (2015; 2016).

This talk

Take-away points:

1. Complementizers have semantic contribution: $[\![\text{CP}]\!] \neq [\![\text{TP}]\!]$.
2. Novel empirical support for the claim (Moulton 2015, Elliott 2017) that the CP layer encodes a relation of **identity** between the embedded proposition and the content of the matrix predicate.
    - **Identity** is crucial: our reasoning serves as an argument against the weaker semantics of Kratzer (2006, 2016) on which the CP layer merely encodes a **subset** relation between contentful predicates and propositions.

The roadmap

1. **Part I. 2 problems** that stem from the ⟦CP⟧ = ⟦TP⟧ hypothesis:
   - ⟦CP ∨ CP⟧ ≠ ⟦TP ∨ TP⟧
   - ⟦CP ∧ CP⟧ ≠ ⟦TP ∧ TP⟧

2. **Part II. Proposal:** this follows from the semantics in (5)

   (5) $[\![\textsc{comp}]\!]^w = \lambda p_{st}.\lambda e_v.\textsc{cont}(e) = p$

   - the source of the Content function is ***the complementizer***;
   - the relation between the Content of e and the proposition is ***equality***.

3. **Part III.** tentative proposal about those speakers that appear to contradict our core analysis.

Part I:
2 problems for the $[\![\mathrm{CP}]\!] = [\![\mathrm{TP}]\!]$ hypothesis

CP/TP disjunction

(6) Bill knows that Masha sang or Dina danced (TP $\vee$)

(7) Bill knows that Masha sang or that Dina danced (CP $\vee$)

TP disjunction:

(8) Structure: **Subject knows [$_{CP}$ COMP [[$_{TP}$ p] ∨ [$_{TP}$ q]]]**

a. Bill knows [$_{CP}$ that [$_{TP}$ Mary sang] or [$_{TP}$ Dina danced]].

b. *Russian*

Vasja znaet [$_{CP}$ čto [$_{TP}$ Maša pela] ili [$_{TP}$ Dina tancevala]].
Vasja knows COMP Masha sang or Dina danced

c. *Hebrew*

Yosi yode'a [$_{CP}$ še [$_{TP}$ Maša šara] o [$_{TP}$ Dina rakda]].
Yosi knows COMP Masha sang or Dina danced

d. *Italian*

Giovanni sa [$_{CP}$ che [$_{TP}$ Maria ha cantato] o [$_{TP}$ Dina ha ballato]]
Giovanni knows COMP Maria have sang or Dina have danced

TP disjunction: *know* > *or*

(9) Bill knows that Mary sang or Dina danced.

- **Factivity of *know*:**
  it is presupposed that either Mary sang or Dina danced.
- **Ignorance inference of *or*:**
  is about which of the two embedded actions {Mary's singing, Dina's dancing} occurred.
- **Continuation with *but not both*** targets the embedded clause:

(10) Bill knows that Mary sang or Dina danced but not both.

a. ⇝ It's not the case that both Mary sang and Dina danced.

b. ?/# Bill doesn't know both facts.

CP disjunction:

(11) Structure: **Subject knows [$_{CP}$ COMP p] ∨ [$_{CP}$ COMP q]**

a. Bill knows [$_{CP}$ that Mary sang] or [$_{CP}$ that Dina danced].

b. *Russian*

Vasja znaet [$_{CP}$ čto Maša pela] ili [$_{CP}$ čto Dina tancevala].
Vasja knows COMP Masha sang or COMP Dina danced

c. *Hebrew*

Yosi yode'a [$_{CP}$ še Maša šara] o [$_{CP}$ še Dina rakda].
Yosi knows COMP Masha sang or COMP Dina danced

d. *Italian*

Giovanni sa [$_{CP}$ che Maria ha cantato] o [$_{CP}$ che Dina ha ballato]
Giovanni knows COMP Maria have sang or COMP Dina have danced

CP disjunction: *or > know*

(12) Bill knows that Mary sang or that Dina danced.

- **Factivity of *know*:**
  it is presupposed that Mary sang **and** that Dina danced.[1]
- **Ignorance inference of *or*** is about the Content of Bill's knowledge ⇒ infelicitous with 1st person attitude holder:

  (13) # I know that Masha sang or that Dina danced.

(14) Bill knows that Mary sang or that Dina danced but not both.

a. # It's not the case that both Mary sang and Dina danced.

b. ⇝ Bill doesn't know both facts.

[1] The presupposition is perhaps weaker when the disjuncts are mutually exclusive.

⟦CP ∨ CP⟧ ≠ ⟦TP ∨ TP⟧: *emotive factives*

CP disjunction: ✓*or* > *got.angry*; **got.angry* > *or*

(15) Structure: **Subject Verb$_{\text{EMOTIVE FACTIVE}}$ [$_{\text{CP}}$ COMP p] ∨ [$_{\text{CP}}$ COMP q]**

a. Bill got angry [$_{\text{CP}}$ that Mary sang] or [$_{\text{CP}}$ that Dina danced].

b. *Russian*

Vasja razozlilsja [$_{\text{CP}}$ čto Maša pela] ili [$_{\text{CP}}$ čto Dina tancevala].
Vasja got.angry COMP Masha sang or COMP Dina danced

c. *Hebrew*

Yosi hitacben [$_{\text{CP}}$ še Maša šara] o [$_{\text{CP}}$ še Dina rakda].
Yosi got.upset COMP Masha sang or COMP Dina danced

d. *Italian*

Giovanni si è stupito [$_{\text{CP}}$ che Maria abbia cantato] o [$_{\text{CP}}$ che Dina abbia ballato]
Giovanni REFL is surprised COMP Maria has.SUBJ sang or COMP Dina has.SUBJ danced

CP disjunction: ✓*or* > *got.angry*; **got.angry* > *or*

(16) Bill got angry [$_{CP}$ that Mary sang] or [$_{CP}$ that Dina danced].

a. ✓ **Ignorance about the cause of anger:**
Either Bill's anger is due to Mary singing, or it is due to Dina's dancing.

b. * **Ignorance about which action took place:**
Bill's anger is due to the fact that one of the two actions (Mary singing, Dina dancing) took place.

⟦CP ∨ CP⟧ ≠ ⟦TP ∨ TP⟧: emotive factives

TP disjunction: ✓*got.angry* > *or*

(17) Structure: **Subject Verb$_{\text{EMOTIVE FACTIVE}}$ [$_{\text{CP}}$ COMP [$_{\text{TP}}$ p] ∨ [$_{\text{TP}}$ q]]**

a. Bill got angry [$_{\text{CP}}$ that [$_{\text{TP}}$ Mary sang] or [$_{\text{TP}}$ Dina danced]].

b. *Russian*

Vasja razozlilsja [$_{\text{CP}}$ čto [$_{\text{TP}}$ Maša pela] ili [$_{\text{TP}}$ Dina tancevala]].
Vasja got.angry COMP Masha sang or Dina danced

c. *Hebrew*

Yosi hitacben [$_{\text{CP}}$ še [$_{\text{TP}}$ Maša šara] o [$_{\text{TP}}$ Dina rakda]].
Yosi got.upset COMP Masha sang or Dina danced

d. *Italian*

Giovanni si è stupito [$_{\text{CP}}$ che [$_{\text{TP}}$ Maria abbia cantato] o [$_{\text{TP}}$ Dina abbia ballato]]
Giovanni REFL is surprised COMP Maria has.SUBJ sang or Dina has.SUBJ danced

TP disjunction: ✓*got.angry* > *or*

(18) Bill got angry [$_{CP}$ that [$_{TP}$ Mary sang] or [$_{TP}$ Dina danced]].

a. ? **Ignorance about the cause of anger:**
Either Bill's anger is due to Mary singing, or it is due to Dina's dancing.[2]

b. ✓ **Ignorance about which action took place:** Bill's anger is due to the fact that one of the two actions (Mary singing, Dina dancing) took place.

[2]It is difficult to show precisely that this reading is absent, although intuitively the sentence does not convey ignorance about the cause of anger.

Conclusion: ⟦CP ∨ CP⟧ ≠ ⟦TP ∨ TP⟧

- ★ ⟦know [CP or CP]⟧ — * *know* > *or*, ✓ *or* > *know*
- ★ ⟦know [CP that [TP or TP]⟧ — ✓ *know* > *or*, */? *or* > *know*

- **Question**: are these distinctions derived from a distinct (syntactic) scope for CP, or from some piece of semantics?
- **Our analysis**: will derive the attested meaning of CP disjunction, and block the unattested one, while keeping the disjunction syntactically in its surface position.

CP/TP conjunction

(19) I got angry that Masha sang and Dina danced (TP ∧)

(20) I got angry that Masha sang and that Dina danced (CP ∧)

- The availability of the ATTITUDE > *and* reading for CP conjunction is subject to variation.
- Here we concentrate on the speakers that find ATTITUDE > *and* reading impossible. We return to the other speakers in part 3.
- We illustrate with examples from Russian.

TP Conjunction

- **Scenario:** I like when Masha sings, I like when Dina dances, but when both Masha sings and Dina dances, they produce so much noise that I can't handle it — I get very angry.

(21) Ja razozlilas', [$_{\text{CP}}$ čto [$_{\text{TP}}$ Maša pela] i [$_{\text{TP}}$ Dina tancevala]].
I got.angry COMP Masha sang and Dina danced
'I got angry that Masha sang and Dina danced.'

- $\Rightarrow angry > and$

TP Conjunction

- **Scenario:** I hate it when Masha sings. I hate it when Dina dances. Both of these things happened yesterday.

(22) Ja razozlilas', [$_{CP}$ čto [$_{TP}$ Maša pela] i [$_{TP}$ Dina tancevala]].
I got.angry COMP Masha sang and Dina danced
'I got angry that Masha sang and Dina danced.'

- ⇏ I got angry that Masha sang.
- ⇏ I got angry that Dina danced.

- It could have been only the combination of the events that made the speaker angry. (22) can be preceeded by *"I didn't get angry that Masha sang."*
- Tentatively ⇒ * *and* > *angry*

Conclusion: TP conjunction scopes below emotive factives

(23) **Structure:**
Subject $\text{Verb}_{\text{EMOTIVE.FACTIVE}}$ [$_{CP}$ COMP p] ∧ [$_{CP}$ COMP q]

★ ✓*angry* > *and*
★ * *and* > *angry*

CP Conjunction

- **Scenario:** I like when Masha sings, I like when Dina dances, but when both Masha sings and Dina dances, they produce so much noise that I can't handle it — I get very angry.

(24) *Russian*

Ja razozlilas', [[$_{CP}$ čto Maša pela] i [[$_{CP}$ čto Dina tancevala].
I got.angry COMP Masha sang and COMP Dina danced

'I got angry that Masha sang and that Dina danced.'

- $\Rightarrow$ * *angry* > *and*

CP Conjunction

- **Scenario:** I hate it when Masha sings. I hate it when Dina dances. Both of these things happened yesterday.

(25) *Russian*

Ja razozlilas', [[$_{CP}$ čto Maša pela] i [[$_{CP}$ čto Dina tancevala].
I got.angry COMP Masha sang and COMP Dina danced

'I got angry that Masha sang and that Dina danced.'

- $\Rightarrow \checkmark and > angry$

Conclusion: CP conjunction scopes above emotive factives

(26) **Structure:**
Subject $\text{Verb}_{\text{EMOTIVE.FACTIVE}}$ [$_{CP}$ COMP p] ∧ [$_{CP}$ COMP q]

★ * *angry* > *and*
★ ✓ *and* > *angry*

$[\![\text{CP} \wedge \text{CP}]\!] \neq [\![\text{TP} \wedge \text{TP}]\!]$

- This is not only a property of emotive factives.
- Many predicates in Russian and Hebrew that have negated existentials in their meanings exhibit the same difference between CP conjunction and TP conjunction:

  Russian *nevozmožno* 'impossible',

  Hebrew *lo yitaxen* 'impossible',

  Russian *somnevat'sja* 'doubt',

  Russian *ne dopuskat'* 'not.allow.for.the.possibility'.

- We tentatively think that all non-upward monotone attitude verbs show the same pattern.

⟦CP ∧ CP⟧ ≠ ⟦TP ∧ TP⟧: *impossible*

(27) *Russian*

Nevozmožno, [$_{CP}$ čto Maša pela] i [$_{CP}$ čto Dina
impossible COMP Masha sang and COMP Dina
tancevala].
danced.

'It's impossible that Masha sang and that Dina danced.'

(28) *Hebrew*

lo yitaxen [$_{CP}$ še Maša šara] ve [$_{CP}$ še Dina rakda].
not possible COMP Masha sang and COMP Dina danced.

'It's impossible that Masha sang and that Dina danced.'

- $\Rightarrow$ * *impossible* > *and*
- $\Rightarrow$ ✓ *and* > *impossible*

⟦CP ∧ CP⟧ ≠ ⟦TP ∧ TP⟧ *impossible*

(29) Nevozmožno, [$_{CP}$ čto [$_{TP}$ Maša pela] i [$_{TP}$ Dina tancevala]].
impossible COMP Masha sang and Dina danced.
'It's impossible that Masha sang and Dina danced.'

(30) lo yitaxen [$_{CP}$ še [$_{TP}$ Maša šara] i [$_{TP}$ Dina rakda]].
not possible COMP Masha sang and Dina danced.
'It's impossible that Masha sang and Dina danced.'

- $\Rightarrow \checkmark impossible > and$
- $\Rightarrow$ * $and > impossible$

⟦CP ∧ CP⟧ ≠ ⟦TP ∧ TP⟧: *Russian doubt*

(31) Ja somnevajus', [$_{CP}$ čto COMP Maša Masha pela] sang i and [$_{CP}$ čto COMP Dina Dina
I doubt
tancevala].
danced.
'I doubt that Masha sang and Dina danced.'

- ⇒ * *doubt > and*
- ⇒ ✓ *and > doubt*

(32) Ja somnevajus', [$_{CP}$ čto COMP [$_{TP}$ Maša Masha pela] sang i and [$_{TP}$ Dina Dina
I doubt
tancevala]].
danced.
'I doubt that Masha sang and Dina danced.'

- ⇒ ✓ *doubt > and*
- ⇒ * *and > doubt*

⟦CP ∧ CP⟧ ≠ ⟦TP ∧ TP⟧: *Russian not-allow-for-possibility*

(33) Ja ne dopuskaju, [$_{CP}$ čto Maša pela] i [$_{CP}$ čto
I NEG allow.for.the.possibility COMP Masha sang and COMP
Dina tancevala].
Dina danced.
'I don't allow for the possibility that Masha sang and that Dina danced.'

- ⇒ * *not.allow.for.the.possibility > and*
- ⇒ ✓ *and > not.allow.for.the.possibility*

(34) Ja ne dopuskaju, [$_{CP}$ čto [$_{TP}$ Maša pela] i
I NEG allow.for.the.possibility COMP Masha sang and
[$_{TP}$ Dina tancevala]].
Dina danced.
'I don't allow for the possibility that Masha sang and Dina danced.'

- ⇒ ✓ *not.allow.for.the.possibility > and*
- ⇒ * *and > not.allow.for.the.possibility*

- **Conclusion:** We need semantics of clausal embedding according to which CPs and TPs are never identical.[3]

- In particular:
  - ★ CP disjunction ≠ TP disjunction;
  - ★ CP conjunction ≠ TP conjunction.

[3] An alternative hypothesis could be that CP disjunction and TP disjunction are semantically equivalent, but CP disjunction must syntactically take scope in the matrix clause. The question that arises is: what could this follow from?

Part II:
Our proposal

Our proposal

- The Complementizer is meaningful; it encodes a relation between a proposition and a **contentful entity (event/state)** (Kratzer 2006,2016, Moulton 2015)
- That relation is **identity** (Elliott 2017; Moulton 2015)

- Equality semantics identifies the Content of the event with a proposition.

Our proposal

(35) a. $[\![[_{TP}\ \text{Mary sang}]\!] = \lambda w'_s.\text{sang}(\text{Mary})_{w'}$

b. $[\![\text{COMP}]\!]^w = \lambda p_{st}.\lambda e_v.\text{CONT}(e) = p$

c. $[\![\text{that Mary sang}]\!]^w = \lambda e_v.\text{CONT}(e) = \lambda w'.\text{sang}(\text{Mary})_{w'}$

- The complementizer takes a proposition p and returns a predicate of events such that their Content is p.
- E.g., the CP "that Mary sang" denotes predicate of events such that their Content is the proposition 'Mary sang'.

This predicts that CP disjunction ≠ TP disjunction:

(36) **CP disjunction:**

$[\![[_{CP}$ that Mary sang] or $[_{CP}$ that Dina danced$]\!]$ =

λe_v. [CONT(e) = λw'.sang(Mary)$_{w'}$] $\vee$
[CONT(e) = λw'.danced(Dina)$_{w'}$]

- either the Content of the attitude is "Mary sang" or the Content of the attitude is "Dina danced";
- ignorance is about which proposition constitutes the Content of the attitude.

(37) **TP disjunction:**

$[\![[_{CP}$ that $[_{TP}$ Mary sang] or $[_{TP}$ Dina danced$]]\!]$ =

λe_v. [CONT(e) = λw'.sang(Mary)$_{w'}$ $\vee$ danced(Dina)$_{w'}$]

- the Content of the attitude is the set of worlds where either Mary sang or Dina danced;
- ignorance is about whether Mary sang or Dina danced.

Our proposal

- When CP/TP disjunction combines with the attidue verb, (38), we get the truth conditions in (39) and (40 respectively.

(38) $[\![\text{know}]\!] = \lambda e.\ \text{know}(e)$

(39) $[\![\text{Bill knows } [_{CP} \text{ that Mary sang}] \text{ or } [_{CP} \text{ that Dina danced}]]\!] =$
1 iff $\exists e$ [know(e) & Exp(e) = Bill & [$\textsc{cont}(e) = \lambda w'.\text{sang}(\text{Mary})_{w'} \vee \textsc{cont}(e) = \lambda w'.\text{danced}(\text{Dina})_{w'}$]]

(40) $[\![\text{Bill knows that } [_{TP} \text{ Mary sang}] \text{ or } [_{TP} \text{ Dina danced}]]\!] =$
1 iff $\exists e$ [know(e) & Exp(e) = Bill &
$\textsc{cont}(e) = \lambda w'.\text{sang}(\text{Mary})_{w'} \vee \lambda w'.\text{danced}(\text{Dina})_{w'}$]

- The difference in factive inferences can be accounted for if the complementizer is the source of factivity (Kratzer 2006, a.o.): (39) will get two factive inferences, whereas (40) will get one.

This predicts that CP (unlike TP) conjunction is impossible:

(41) **CP Conjunction**

$[\![[_{CP}$ that Mary sang] and $[_{CP}$ that Dina danced$]\!]$ =

* λe_v. [CONT(e) = λw'.sang(Mary)$_{w'}$] $\wedge$
[CONT(e) = λw'.danced(Dina)$_{w'}$] $\quad$ ($\underline{= \emptyset}$)

- $\Rightarrow$ pathological: no event can have two different propositions as its unique Content.

(42) **TP conjunction:**

$[\![[_{CP}$ that $[_{TP}$ Mary sang] and $[_{TP}$ Dina danced$]]\!]$ =
λe_v. [CONT(e) = λw'.sang(Mary)$_{w'}$ $\wedge$ danced(Dina)$_{w'}$]

- $\Rightarrow$ coherent: set of events whose unique Content is a conjunctive proposition.

Our proposal

- **Question:** But how are strings 'Subject Vs COMP p and COMP q' then derived?
- **Answer:** Conjunction reduction or similar kind of ellipsis.

(43) [Bill is angry that Mary sang] and
[~~Bill is angry~~ that Dina danced]

- **Note:** Here we didn't show a concrete implementation for emotive factives, but we do so in appendix using the analysis in (Elliott 2017). But our proposal is compatible with different analyses of emotive factives, if they use our denotations for CPs.

Identity, not subset relation

- Note: it is important that COMP encodes the **identity** relation.
- Mere **subset** relation (Kratzer 2006,2016) would not do:

(44) $[\![\text{COMP}]\!] = \lambda p_{st}.\lambda e_v.\ \forall w'[w' \in \text{CONT}_{e,w} \rightarrow p(w')=1]$.
(Kratzer 2006)

  - COMP returns a predicate of events such that in all worlds compatible with their Content the TP proposition is true.)

- This does not predict that CP conjunction is pathological
- In fact, it predicts CP conjunction and TP conjunction to result in the same interpretation.

Identity, not subset relation

- This is so because conjoining two universals (=CP conjunction, (45)) is equivalent to one universal scoping over the conjunction (=C embedding TP conjunction, (46)).

(45) $[\![[_{CP}$ that Ann came] and $[_{CP}$ that Lucy came]$]\!]$ =
$\lambda x_e.\forall w'[w' \in \text{CONT}_{x,w} \rightarrow \text{Ann came}_{w'}] \wedge$
$\forall w'[w' \in \text{CONT}_{x,w} \rightarrow \text{Lucy came}_{w'}]$

(46) $[\![[_{CP}$ that $[_{TP}$ Ann came] and $[_{TP}$ that Lucy came]$]\!]$ =
$\lambda x_e.\forall w'[w' \in \text{CONT}_{x,w} \rightarrow \text{Ann came}_{w'} \wedge \text{Lucy came}_{w'}]$

- On a subset semantics, then, something else will have to block *angry* > *and* for CP conjunction.

Additional evidence from Russian: *a* 'but' conjunction

- Russian has a conjunction *a* 'but' seems to require two points of contrast between the propositions it conjoins: the subjects have to be different, and the VPs have to be different, (47).

(47) a. Dina pela, a Masha tancevala.
Dina sang A Masha danced
'Dina sang, but Masha danced.'

b. *Dina pela, a Dina tancevala.
Dina sang A Dina danced

c. *Dina pela, a Masha pela.
Dina sang A Masha sang

d. Dina pela pesnju, a Masha pela častušku.
Dina sang song A Masha sang chastushka
'Dina sang a song, but Masha sang a chastushka.'[4]

[4]Chastushka is a Russian traditional humorous folk song with high beat frequency.

Additional evidence from Russian: *a* 'but' conjunction

The logic of this argument:[5]
When Conjunction Reduction structure is independently eliminated, we see that embedded CPs cannot be conjoined.

1. Under our proposal, strings of the form (48a) are derived from (48b) by Conjunction Reduction.

   (48) a. Subject Verb CP and CP

   b. Subject_k Verb_j CP and (Subject_k) Verb_j CP

2. This makes a prediction: if (48b) is not possible, (48a) should be ungrammatical as well.

3. We show that Russian *a* 'but', disallows (48b) due to the two subjects being the same. We show (48a) is ungrammatical with *a* 'but' too, as predicted.

[5] We are grateful to Masha Esipova for bringing *a* 'but' to our attention.

Additional evidence from Russian: *a* 'but' conjunction

- The requirement for the subjects of the two propositions to be different makes (49) an impossible structure for the *a* 'but' conjunction, (50).

(49) Subject$_k$ Verb$_j$ CP and (Subject$_k$) Verb$_j$ CP

(50) * **Lena** dumajet [$_{CP}$ čto Dina pela], a **Lena** dumajet, [$_{CP}$ čto
Lena thinks COMP Dina sang A Lena thinks COMP
Maša tancevala].
Masha danced
'Lena thinks that Dina sang, but she thinks that Masha danced.'

- Making the subjects of the two propositions different saves the structure:

(51) **Lena** dumajet [$_{CP}$ čto Dina pela], a **Petja** dumajet, [$_{CP}$ čto
Lena thinks COMP Dina sang A Petja thinks COMP
Maša tancevala].
Masha danced
'Lena thinks that Dina sang, and Petja thinks that Masha danced.'

Additional evidence from Russian: *a* 'but' conjunction

- Given that (52b) is an impossible structure for the *a* 'but', we predict that (52a) should be ungrammatical as well. This is borne out (53).

(52) a. Subject Verb CP and CP

b. Subject_k Verb_j CP and (Subject_k) Verb_j CP

(53) * Lena dumajet [$_{CP}$ čto Dina pela], a [$_{CP}$ čto Maša tancevala].
Lena thinks COMP Dina sang A COMP Masha danced
'Lena thinks that Dina sang, but that Masha danced.'

- Cf. (54), where embedded TP conjunction with *a* 'but' is grammatical.

(54) Lena dumajet [$_{CP}$ čto [$_{TP}$ Dina pela], a [$_{TP}$ Maša tancevala]].
Lena thinks COMP Dina sang A Masha danced
'Lena thinks that Dina sang, but Masha danced.'

Additional evidence from Russian: *a* 'but' conjunction

Our conclusions:

- *Subject Verb CP and CP* is not a possible string with *a* 'but' because it can be only derived by Conjunction Reduction, a structure which is independently ungrammatical with *a* 'but'.
- $\Rightarrow$ Declarative embedded CPs cannot be conjoined due to the fact that the resulting meaning would be ill-formed.

Alternative hypothesis:
a 'but' has a syntactic restriction against conjoining CPs.

- This ad-hoc restriction against CP conjunction with *a* 'but' will incorrectly predict (55) to be ungrammatical (on the assumption that unembedded questions are CPs).

(55) [$_{CP}$ Kto ušël domoj], a [$_{CP}$ kto ostalsja zdes']?
who went home A who remained here
'Who went home, and who remained here?'

Part III:
The speakers with a low-scope AND

Low scope AND with CP conjunction

- While judgments about CP disjunction were uniform across the speakers we consulted, we encountered variability in judgements with respect to CP conjunction:
  - Across different languages, there were speakers who accepted **the low scope of AND with CP conjunction.**

Low scope AND with CP conjunction

- We illustrate here with English:

(56) I doubt [that Mary came] and [that Dina came].

a. *and* > *doubt*:
I doubt that Mary came and I doubt that Dina came.

b. *doubt* > *and*:
I doubt that both Mary came and Dina came (without necessarily doubting each coming individually; e.g., Mary's coming is likely, but Dina's is unlikely because she avoids Mary)

(57) I don't doubt that Mary came, but I doubt that Mary came and that Dina came.

Low scope AND with CP conjunction

This raises a number of questions for our proposal:

1. Given that CP conjunction is semantically deviant, how do some speakers get the low scope of AND with CP conjunction?
2. Why are there no low scope OR readings with CP disjunction?[6]
3. What drives the cross-speaker variation?

[6]We put aside cases which could be analyzed with decomposition and intermediate attachment of CP disjunction, e.g., *doubt* = *not think*. See Szabolcsi (2015, 2016) for discussion.

Low scope AND with CP conjunction

- At this point, we do not have a handle of what drives the cross-speaker variation, so we can't develop a real account.
- However, we can be fairly certain that the source of the variability cannot be that some speakers treat the CP layer as semantically vacuous and therefore treat CP meaning as inheritng the meaning of the TP.
  - This is because the CP **dis**junction data, which was robust for all speakers we consulted: CP- and TP-disjunction are not equivalent.

Low scope AND with CP conjunction

- We will sketch a possible direction to the low-scope AND with CP conjunction...:
  - which keeps meanings of CPs and attitude verbs the same as before;
  - which makes use of a non-Boolean *and* (and thus explains why there is no low scope OR with disjunction);
  - which makes use of Elliott (2017)'s proposal that an individual's belief states form a Boolean algebra.

Low scope AND with CP conjunction

- Here is the entry of a non-Boolean AND that we will need:

(58) $[\![\text{and}_{\text{NON-BOOL}}]\!] =$
$\lambda P_{vt}.\lambda Q_{vt}.\lambda e_v.\ \exists e_1,e_2,\ [e_1 \oplus e_2 = e \wedge P(e_1) = 1 \wedge Q(e_2) = 1]$

  - It takes two predicates of events P and Q
  - and returns a predicate of events e which are a sum of two subevents e_1 and e_2
  - such that the first predicate argument P is true of e_1 and the second predicate argument Q is true of e_2.

Low scope AND with CP conjunction

(59) $[\![\text{and}_{\text{NON-BOOL}}]\!] =$
$\lambda P_{vt}.\lambda Q_{vt}.\lambda e_v.\ \exists e_1,e_2,\ [e_1 \oplus e_2 = e \wedge P(e_1) = 1 \wedge Q(e_2) = 1]$

- A similar AND might be needed in the nominal domain:

(60) Every woman and man who came in together are smiling and frowning respectively. (Fox & Johnson 2016: 6)

(61) that mutually incompatible man and woman (≠ that mutually incompatible man and mutually incompatible woman) (Champollion 2015: 7)

- NPs in (60)-(61) denote predicates which hold of pluralities that are the sum of two singulars: one a man and the other a woman.

Low scope AND with CP conjunction

- With the meaning of AND in (62) and the meanings of CPs in (63)-(64), we get (65) as the meaning for the (non-Boolean) CP conjunction:

(62) $[\![\text{and}_{\text{NON-BOOL}}]\!] =$
$\lambda P_{vt}.\lambda Q_{vt}.\lambda e_v.\ \exists e_1,e_2,\ [e_1 \oplus e_2 = e \wedge P(e_1) = 1 \wedge Q(e_2) = 1]$

(63) $[\![\text{that Mary came}]\!] = \lambda e_1.\ \text{Content}(e_1) = \lambda w.\ \text{Mary came in w.}$

(64) $[\![\text{that Dina came}]\!] = \lambda e_2.\ \text{Content}(e_2) = \lambda w.\ \text{Dina came in w.}$

(65) $[\![\text{that Mary came and}_{\text{NON-BOOL}}\ \text{that Dina came}]\!] =$
$\lambda e_v.\ \exists e_1,e_2,\ [e_1 \oplus e_2 = e \wedge \text{Content}(e_1) = \lambda w.\ \text{Dina came in w.}$
$\wedge\ \text{Content}(e_2) = \lambda w.\ \text{Mary came in w.}]$

Low scope AND with CP conjunction

Elliott 2017:

- An individual is the experiencer of a plurality of belief states.
- An individual's belief states form a boolean algebra which is closed under boolean meet.
- ***Content* is a homomorphism** from the boolean algebra of belief states of an individual to the boolean algebra of propositions:

(66) If $\text{Content}(e_1) = p$ and $\text{Content}(e_2) = q$,
then $\text{Content}(e_1 \oplus e_2) = p \wedge q$.

Low scope AND with CP conjunction

(67) If Content(e_1) = p and Content(e_2) = q,
then Content($e_1 \oplus e_2$) = $p \wedge q$.

- Given (67), CP conjunction with non-Boolean AND in (68) in fact denotes a predicate of events whose Content is $p \wedge q$.

(68) $[\![$that Mary came and$_{\text{NON-BOOL}}$ that Dina came$]\!]$ =
λe_v. $\exists e_1, e_2$, [$e_1 \oplus e_2 = e \wedge$ Content(e_1) = λw. Dina came in w.
$\wedge$ Content(e_2) = λw. Mary came in w.]

= λe_v. Content(e) = λw. Mary came in w and Dina came in w.

- Thus, this way we are getting the low scope AND.

Low scope AND with CP conjunction

If *doubt* = *not think*, we get the following:

(69) I doubt [that Mary came] and [that Dina came].
$\neg\exists$e [think(e) $\wedge$ Exp(e)= Speaker $\wedge$ $\exists e_1,e_2$, [$e_1 \oplus e_2$ = e $\wedge$ Content(e_1) = λw. Dina came in w. $\wedge$ Content(e_2) = λw. Mary came in w.]]

= $\neg\exists$e [think(e) $\wedge$ Exp(e)= Speaker $\wedge$ Content(e) = λw. Mary came in w and Dina came in w]].

- This is equivalent to TP conjunction *I doubt that Mary came and Dina came*.

Summary

- CP disjunction doesn't have a meaning it is expected to have if it were equivalent to a disjunction of propositions under a matrix attitude.
- This fact is also true for TP/CP **con**junction for some speakers.
- We've derived this using the idea (based on Kratzer, Elliott) that the CP layer contributes a relation of identity between the proposition and the content of an attitude state.
- We've sketched a way to derive low scope AND with CP conjunction (which is present for some speakers) using non-Boolean AND and Elliott's (2017) idea that the plurality of belief states forms a Boolean algebra.

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Appendix: *emotive factives*

- If an emotive factive falls into the category of predicates with which CPs denote *subject matter* (Hartman 2012), then we do not have to make any additional assumptions (see Elliott 2017).
- But there is a potentially more difficult case: a case when a CP combining with an emotive factive denotes *a cause*.
- We follow Elliott (2017) in treating such CPs as specifying the Content of the causing event, which is introduced in syntax by a special functional projection CAUSE:

(70) ⟦Bill is angry that Mary sang⟧ =
∃e,e' [angry(e) ∧ Exp(e) = Bill ∧ Cause(e) = e' ∧ Exp(e') = Exp(e) ∧ Content(e') = λw. Mary sang in w].

Appendix: *emotive factives*

- Disjunction of CPs (71), unlike disjunction of TPs (72), will then convey ignorance about the Content of the cause of Bill's anger.

(71) ⟦Bill is angry that Mary sang or that Dina danced⟧ =
∃e,e' [angry(e) ∧ Exp(e) = Bill ∧ Cause(e) = e' ∧ Exp(e') =
Exp(e) ∧ **[Content(e') = λw. Mary sang in w ∨**
Content(e') = λw. Dina danced in w]

(72) ⟦Bill is angry that Mary sang or Dina danced⟧ =
∃e,e' [angry(e) ∧ Exp(e) = Bill ∧ Cause(e) = e' ∧ Exp(e') =
Exp(e) ∧ **[Content(e') = λw. Mary sang in w ∨**
Dina danced in w]

Appendix: *emotive factives*

- Conjunction of CPs (75) will create an ill-formed meaning.

(73) * ⟦Bill is angry that Mary sang and that Dina danced⟧ =
∃e,e' [angry(e) ∧ Exp(e) = Bill ∧ Cause(e) = e' ∧ Exp(e') =
Exp(e) ∧ **[Content(e') = λw. Mary sang in w ∧**
Content(e') = λw. Dina danced in w]

- This is not the case for TP conjunction:

(74) ⟦Bill is angry that Mary sang and that Dina danced⟧ =
∃e,e' [angry(e) ∧ Exp(e) = Bill ∧ Cause(e) = e' ∧ Exp(e') =
Exp(e) ∧ **[Content(e') = λw. Mary sang in w ∧**
Dina danced in w]

Appendix: *emotive factives*

- Finally, low scope AND with CP conjunction can be achieved in the same way as with *doubt*, if we make an assumption that causing events of emotive factives form a boolean algebra.

(75) $[\![$Bill is angry that Mary sang and$_{\text{NON-BOOL}}$ that Dina danced$]\!]$ =
$\exists e,e'$ [angry(e) $\wedge$ Exp(e) = Bill $\wedge$ Cause(e) = e' $\wedge$ Exp(e') = Exp(e) $\wedge$ $\exists e_1,e_2$, [$e_1 \oplus e_2$ = e' $\wedge$ Content(e_1) = λw. Dina danced in w $\wedge$ Content(e_2) = λw. Mary sang in w]

= $\exists e,e'$ [angry(e) $\wedge$ Exp(e) = Bill $\wedge$ Cause(e) = e' $\wedge$ Exp(e') = Exp(e) $\wedge$ Content(e') = λw. Mary sang $\wedge$ Dina danced in w.

- This might be easier to accept if only *facts* can be causers of emotive states: if x is a fact with Content p, and y is a fact with Content q, then x $\oplus$ y would be a fact with Content p $\wedge$ q.