

Attitudes and monotonicity

Tanya Bondarenko* Patrick Elliott†

November 2023 — PhLiP workshop

1. Introduction

- This talk is concerned with the question of **modeling monotonicity in attitude reports**: how should our semantics capture the entailments like in (1)?

- (1) a. Katya believes that Anton snowboarded last Friday.
 b. \rightsquigarrow Katya believes that Anton snowboarded.

- We will use Negative Polarity Items (NPIs) to probe this question.
- NPIs are sensitive to monotonicity¹: they are licensed in Strawson Downward-Entailing (SDE) environments, but not in Strawson Upward-Entailing (SUE) environments:

- (2) a. *Katya believes [that Anton has **ever** snowboarded].
 b. Katya doesn't believe [that Anton has **ever** snowboarded].

*Harvard University, tbondarenko@fas.harvard.edu

†Heinrich-Heine University Düsseldorf, patrick.d.elliott@gmail.com

¹Fauconnier 1975, 1979, Ladusaw 1979, 1980a,b, Hoeksema 1986, Kadmon & Landman 1993, von Stechow 1993

- A caution before we continue: *believe* typically licensed a NEG-raising inference, i.e., from *x doesn't believe that p* to *x believes that not p*. Non-NEG-raising doxastics show us that NEG-raising isn't necessary for licensing weak NPIs:

(3) Katya isn't certain [that Anton has **ever** snowboarded].

- Our empirical focus is the contrast discovered by Sharvit (2023): in negated belief reports, NPIs cannot be licensed in *relative* clauses modifying objects like *the rumor*, (4a), but they are licensed in *complement* clauses composing with such noun phrases, (4b).²

(4) **Sharvit's Puzzle**

- *Katya doesn't believe [the rumor [that Anton **ever** spread]].
- Katya doesn't believe [the rumor [that Anton has **ever** snowboarded]].

- Impossibility of the NPI in (4a) is expected:
The presupposition introduced by the singular definite description in (4a) makes the context SUE, and thus anti-licenses the NPI.

(5)

- Katya doesn't believe the rumor that Anton spread last Friday.
- There is a unique rumor that Anton spread.
- \leadsto Katya doesn't believe the rumor that Anton spread.

- But if singular definite descriptions create SUE environments and bleed NPI licensing, we should see that in (4b) as well, contra to the fact.

★ Questions:

- What explains the contrast between (4a) and (4b), and what does it tell us about how we need to model monotonicity in attitude reports?
- How do different theories of clausal embedding fare with respect to Sharvit's puzzle — can they account for these data equally well?

²The main contention of Sharvit 2023 is that this paradigm cannot be captured by (a particular rendering of) the Kratzerian approach to verbs like *believe*. One of our goals will ultimately be to argue against Sharvit by providing such a theory.

★ **This talk:**

- Certain approaches to clausal embedding make bad predictions (Sharvit 2023).
- Proposal: modelling monotonicity with the help of *incrementality* (Krifka 1998).
- Solving the puzzle: *Equality Semantics* of CP embedding (Moulton 2009, Elliott 2017, Bondarenko 2022) + *Incrementality*.
- **Implication:** attitude reports do not inherently involve universal quantification.

2. Semantics of Clausal Embedding

2.1. The Neo-Davidsonian Perspective & Attitude Reports

- Since Hintikka (1962, 1969), attitude verbs have been thought of as universal modals that establish a subset relationship between the doxastic set of the attitude holder and the embedded proposition:

$$(6) \quad \llbracket \text{believe} \rrbracket^w = \lambda p_{st} . \lambda x_e . \text{DOX}_w(x) \subseteq p$$

- (6) captures clause-embedding properties of the verb well, but ignores its event-related properties. Yet *believe* describes eventualities:

- (7)
- a. Alice believed in ghosts *for two weeks*.
 - b. When I saw this, I *suddenly/immediately/quickly* believed in ghosts.

- Instead, our starting point will be a Davidsonian treatment of attitude verbs — specifically, we adopt *Neo-Davidsonian* Logical Forms whereby arguments are introduced via *thematic functions*³ (Castañeda 1967). Then the Logical Form for (7a) might be something like in (8).

³The literature often treats thematic roles as relations, guaranteeing functionality via a distinct ‘thematic uniqueness’ postulate.

- (8) $\exists e[\text{Believe}(e) \wedge \text{HOLDER}(e) = \mathbf{Alice} \wedge \text{OBJ}(e) = \mathbf{Ghosts} \wedge \text{DUR}(e) = \mathbf{2weeks}]$
 “there is an event of believing whose experiencer is Alice, whose object is ghosts, and whose duration is 2 weeks”
- Once we make this move, we need to re-evaluate our analysis of clausal embedding: how does the verb combine with the CP in examples like (9a)?
 - What is the semantic contribution of *that*-clauses? Can we have a uniform semantics for the CPs in (9b), (9b) and (9c)?
- (9) a. Alice believes [that there are ghosts].
 b. The belief [that there are ghosts] is wrong.
 c. The belief was [that there are ghosts].
- **Kratzer’s insight:** clauses can be modeled as predicates of individuals/events (Kratzer 2006, 2013, 2016) .
 - In the following, we will argue against a particular implementation — *subset semantics* — and in favor of an alternative — *equality semantics*.

2.2. Subset Semantics

- We can marry event semantics with modal semantics by assuming that the modal base is determined by particulars—individuals and events (Kratzer 2013):
- (10) **The Modal Anchor Hypothesis**
 Modal domains are projected from particulars:
 events or individuals, the “modal anchors”.
- This idea has proven useful for treating modals of various kinds:
 - modal verbs (Hacquard 2006, 2010, Arregui 2010);
 - counterfactuals (Arregui 2007, 2009);
 - modal indefinites (Alonso-Ovalle & Menéndez-Benito 2018);

- mood (Kratzer 2016, Portner & Rubinstein 2020, Alonso-Ovalle, Menéndez-Benito & Rubinstein 2022);
- imperfective morphology (Arregui, Rivero & Salanova 2014).

- **Decomposing attitudes** (Kratzer 2006, 2013, 2016):

Certain particulars are associated with a unique *propositional content*. This can be retrieved via a partial function CONT , from eventualities/individuals to propositions.

- **Ontological assumption:**

The domain of individuals D_e includes familiar concrete objects, but also Davidsonian *eventualities*, and more abstract entities such as *ideas*, *stories*, and *dreams*.

(11) Elements in D_e :

- Mitya, Anton**
- the unique fact that the earth is round**
- Mitya’s dream (Oct 10 2023, 10:03-10:47) that Anton is skiing**
- Anton’s playing of the harp (Aug 3 2022, 14:05-14:32)**

- Embedded clauses are predicates of contentful particulars, and given their meanings, they can combine both with verbs, (28), and with nouns, (29), given the following ingredients.

(12) Verbs, like nouns, are just *predicates* (neo-Davidsonianism)

- $\llbracket \text{believe} \rrbracket^w = \lambda e . \text{Believe}_w(e)$
- $\llbracket \text{belief} \rrbracket^w = \lambda x . \text{Belief}_w(x)$

(13) An embedded clause denotation after Kratzer:

$$\llbracket \text{that there are ghosts} \rrbracket^w = \lambda x . \text{CONT}_w(x) \subseteq \{ w' \mid \text{there are ghosts in } w' \}$$

(14) Modifying the event argument of the verb (Elliott 2017):

$$\begin{aligned} & \llbracket \text{Alice believes that there are ghosts} \rrbracket^w \\ &= \exists e \left[\begin{array}{l} \text{Believe}_w(e) \wedge \text{HOLDER}_w(e) = \text{Alice} \\ \wedge \text{CONT}_w(e) \subseteq \{ w' \mid \text{there are ghosts in } w' \} \end{array} \right] \end{aligned}$$

- (15) Modifying the individual argument of the noun (Kratzer 2006, Moulton 2009):
 $\llbracket \text{the belief that there are ghosts} \rrbracket^w$
 $= \iota x [\text{Belief}_w(x) \wedge \text{CONT}_w(x) \subseteq \{w' \mid \text{there are ghosts in } w'\}]$
- **Virtue:** There is no need to postulate lexical ambiguity—treating clauses as predicates of contentful entities allows us to give a unified account of clauses that combine with verbs and clauses that combine with nouns.
 - Note that Kratzer’s proposal maintains Hintikka’s insight that attitude reports involve **modal semantics**: there is a subset relationship established between some set of worlds representing the modal base (*doxastic set, the set projected from a particular via CONT*) and the embedded proposition.
 - We will call Kratzer’s proposal *Subset Semantics*:
- (16) **Subset Semantics:**
 $\llbracket \text{that } p \rrbracket^w = \lambda x . \text{CONT}_w(x) \subseteq p$
- We choose to use this version of the modal analysis for Sharvit’s puzzle because the puzzle requires us to have a theory of how nouns compose with clauses, and Kratzer’s theory provides a straightforward way of doing that.

Some evidence in favor of decomposing attitudes

1. Harmonic attitudes

- (17) Ralph **advised** [that $\{\emptyset_{\text{Cont}}/\text{should}\}$ [Ortcut turn himself in]].
- The sentence in (17) seems intuitively true if Ortcut turns himself in all worlds that are compatible with the content of Ralph’s advice.
 - This is not expected if the verb itself is a source of displacement, as we would expect double quantification—first over the worlds compatible with Ralph’s advice, then, within those worlds, over worlds in the modal base of *should*.
 - But if displacement comes from embedded CPs, we can hypothesize that the null \emptyset_{Cont} is in complementary distribution with other modal elements like

should, and so in (17) there is only one modal—*should*.

2. Non-selected clauses

- Traditional analyses treat complement clauses as *semantic arguments*. This is at odds with the fact that they are in many cases optional.
- Embedded clauses that combine with nouns are never obligatory, (18); this seems to be a cross-linguistically stable generalization (Bondarenko 2022).

(18) Katya doesn't believe the rumor (that Anton has snowboarded).

- While with some verbs embedded clauses are obligatory, with many they are not. For example, Russian has an intransitive verb *vyskazat'sja* 'say, make a statement', which can embed clauses, but doesn't have to:

(19) Maša vy-skazala-s', ([čto nam stoit priglasit' Petju]).
Masha PFV-say-INTR COMP we should invite Petya.ACC
'Masha made a statement (that we should invite Petya).'

- Furthermore, verbs that do not normally describe attitudinal or speech events (and so do not select for propositions) can combine with embedded CPs, e.g.:^a

(21) Ralph **seufzte**, dass er betrogen worden sei.
Ralph **sighed** that he betrayed been was.SUBJ
'Ralph sighed that he had been betrayed.' (Kratzer 2013: 29)

(22) Egor Egorovič dostal sklžanku s vinom, —vsego na dva stakančika,
Egor Egorovich got flask with wine only for two glasses
vzdoxnul, [čto bol'she ne dostat'].
sighed COMP more not get.INF
'Egor Egorovich took out the flask with wine—it only had two glasses (of wine), sighed that it's not possible to get more.' (from A.N. Tolstoy's "Russian character", via the Russian National Corpus: [<Link-to-source>](#))

- If the source of displacement is within the embedded clause, we can explain how such clausal embedding is possible.

3. Meaning from within

- There are attitude verbs whose meaning is dependent on the material inside of the embedded clause.
- Bogal-Allbritten (2016, 2017) observed that the verb *nízin* in Navajo (Na-Dené) can describe both thoughts and desires, depending on material inside of the complement that it selects:

(23) *nízin* as ‘think’
 Mary [naháłtin]
 Mary 3S.rain.IPFV
nízin
 3S.ATT.IPFV

‘Mary **thinks** it is raining.’
 (Bogal-Allbritten 2017: (2a))

(24) *nízin* as ‘wish’
 Alice [nisneez laanaa]
 Alice 1S.tall.IPFV wishful
nízin
 3S.ATT.IPFV

‘Alice **wishes** she (I) were tall.’
 (Bogal-Allbritten 2017: (2c))

- This suggests that the modal base (*doxastic* vs. *bouletic*) can be determined by the embedded clause.
- (Bondarenko 2022): languages like Buryat, Korean have overt morphology in the embedded clause that correlates with the presence of displacement.

★ **Upshot:** The source of displacement to some other worlds/situations in the semantics of attitude and speech reports comes from the embedded clause.

^aKratzer mentions the verbs in (20); a more complete list of English verbs that don’t select for propositions but can embed CPs can be found in (Levin 1993).

(20) **Some English non-attitude verbs taking embedded clauses:**
Babble, bark, bawl, bellow, bleat, boom, bray, burble, cackle, call, carol, chant, chaner, chirp, cluck, coo, croak, croon, crow, cry, drawl, drone, gabble, gibber, groan, growl, grumble, grunt, hiss, holler, howl...

2.3. Equality Semantics

- Decomposing attitude and speech reports does not commit us to the universal modal semantics of displacement. *Equality Semantics* is another option:

(25) **Equality Semantics**

$$\llbracket \text{that } p \rrbracket^w = \lambda x . \text{CONT}_w(x) = p$$

- On this view (Moulton 2009, 2015, Elliott 2016, 2017, 2020, Bassi & Bondarenko 2021, Bondarenko 2022), the set of worlds that CONT returns is *equated* with the embedded proposition.
- **N.B.:** This view does not imply that sentences describing attitude reports never contain universal modals, it only says that universal modals are not part of the semantics of the declarative complementizer.

(26) a. $\llbracket \text{believe} \rrbracket^w = \lambda e . \text{Believe}_w(e)$

b. $\llbracket \text{belief} \rrbracket^w = \lambda x . \text{Belief}_w(x)$

(27) $\llbracket \text{that there are ghosts} \rrbracket^w = \lambda x . \text{CONT}_w(x) = \{ w' \mid \text{there are ghosts in } w' \}$

- As with Kratzer’s subset semantics, CPs are predicates of contentful events and individuals, and can compose with both verbs and nouns via Predicate Modification (Elliott 2017):

(28) $\llbracket \text{Alice believes that there are ghosts} \rrbracket^w =$
 $\exists e [\text{believe}(e)_w \wedge \text{EXP}(e) = \text{Alice} \wedge \text{CONT}(e) = \{ w : \text{there are ghosts in } w \}].$

(29) $\llbracket \text{the belief that there are ghosts} \rrbracket^w =$
 $\iota x (\text{belief}(x)_w \wedge \text{CONT}(x) = \{ w : \text{there are ghosts in } w \})$

- In this approach, embedded clauses are treated on par with nominal arguments in neo-Davidsonian representations: they are linked to the verb via its event argument with the help of “thematic relations” (AGENT, THEME, EXP, CONT) that output the unique individual/proposition when provided with an event.⁴

⁴But note that there is a significant difference between the two: nominal arguments don’t themselves

2.3.1. Monotonicity in Subset Semantics vs. Equality Semantics

- An immediate drawback that one might notice is that Equality Semantics fails to capture entailment in cases like (1), repeated below as (30). Cf. (31) and (32).

- (30) a. Katya believes that Anton snowboarded last Friday.
 b. \rightsquigarrow Katya believes that Anton snowboarded.

- (31) *Subset Semantics*: \checkmark (30) captured
- a. $\llbracket \text{Katya believes that Anton snowboarded last Friday} \rrbracket^w =$
 $\exists e [\text{believe}(e)_w \wedge \text{EXP}(e)=\text{Katya}$
 $\wedge \text{CONT}(e) \subseteq \{w: \text{Anton snowboarded last Friday in } w\}].$
- b. $\llbracket \text{Katya believes that Anton snowboarded} \rrbracket^w =$
 $\exists e [\text{believe}(e)_w \wedge \text{EXP}(e)=\text{Katya}$
 $\wedge \text{CONT}(e) \subseteq \{w: \text{Anton snowboarded in } w\}].$

- (32) *Equality Semantics*: \times (30) not captured
- a. $\llbracket \text{Katya believes that Anton snowboarded last Friday} \rrbracket^w =$
 $\exists e [\text{believe}(e)_w \wedge \text{EXP}(e)=\text{Katya}$
 $\wedge \text{CONT}(e) = \{w: \text{Anton snowboarded last Friday in } w\}].$
- b. $\llbracket \text{Katya believes that Anton snowboarded} \rrbracket^w =$
 $\exists e [\text{believe}(e)_w \wedge \text{EXP}(e)=\text{Katya}$
 $\wedge \text{CONT}(e) = \{w: \text{Anton snowboarded in } w\}].$

- Subset Semantics captures the entailment in (30) in exactly the same way as Hintikka semantics did: if $\text{CONT}(e)$ is a subset of $\{w: \text{Anton snowboarded last Friday in } w\}$, then it's also a subset of any of its supersets, and hence it's a subset of $\{w: \text{Anton snowboarded in } w\}$.
- **Equality Semantics is inherently non-monotonic:** without additional assumptions, existence of an entity with content p does not tell us anything about existence of an entity of the same sort with content q , even if $p \subseteq q$.⁵

contribute the “thematic relation”, whereas embedded clauses do—their meanings are the source of the $\text{CONT}(\text{ENT})$ relation. This is the difference between arguments and modifiers on this view.

⁵It's worth noting that not all clause-embedding verbs are monotonic. For example, many emotive verbs are non-monotonic, and for them $V(+N) + p$ does not entail $V(+N) + q$ when $p \subseteq q$:

2.3.2. Motivation for Equality Semantics

- Equality Semantics can't capture simple entailments like in (30), why pursue it?
- **Motivations for Equality Semantics:**
 - impossibility of clause stacking (Moulton 2009);
 - impossibility of true CP conjunction (Bassi & Bondarenko 2021);
 - interaction with definiteness (Elliott 2017, 2020);
 - lack of entailment with noun-modifying CPs (Bondarenko 2021, 2022);
 - Russian Weak NPI subjunctives (Bondarenko 2022).

-
- (i) Ja ne udivilas' (zajavleniju,) čto kto-to polučil nagradu, no ja udivilas'
I NEG surprised (claim) COMP someone got award but I surprised
(zajavleniju,) čto Svuna polučila nagradu.
(claim) COMP Swuna got award
'I'm not surprised (by a claim) that someone got an award, but I am surprised (by a claim)
that Swuna got an award.'

So, in a sense, Equality Semantics generalizes “to the worst case”, assuming that attitude and speech reports are all underlyingly non-monotonic, whereas Subset Semantics takes the monotonic cases to be at the core of attitude and speech reports.

① Impossibility of clause stacking

- Embedded clauses, unlike relative clauses, cannot be stacked (Moulton 2009):

- (33) a. *The rumor that Fred was happy, that he was in Paris,
that he could see ghosts.
b. The rumor that Fred made, that Jill believed,
that Bill spread to his friends...
(Moulton 2009: 29)

- Once we start treating clauses as *predicates* that modify event and individual arguments, we need to explain why they, unlike other modifiers, cannot be stacked.
- Contradictory properties can't be ascribed to eventualities and individuals:

- (34) a. *Jones buttered the toast at 3pm at 1am.
cf. *I buttered the toast at 3pm on Sunday.*
b. *I met a girl with blue eyes with green eyes.
cf. *I met a girl with blue eyes with blonde hair.*

- Stacking embedded clauses results in contradictory meaning on Equality Semantics, but not on Subset Semantics:

- (35) *Equality Semantics: stacking leads to deviant meaning*

$$\llbracket \text{Katya believes [that there are no ghosts] [that Anton ate her toast]} \rrbracket^w =$$

$$\exists e [\text{believe}(e)_w \wedge \text{EXP}(e)=\text{Katya} \wedge \text{CONT}(e) = \{w: \text{there are no ghosts in } w\}$$

$$\wedge \text{CONT}(e) = \{w: \text{Anton ate Katya's toast in } w\}] = \mathbf{false} \text{ (for any } w)$$

- (36) *Subset Semantics: stacking does not lead to deviant meaning*

$$\llbracket \text{Katya believes [that there are no ghosts] [that Anton ate her toast]} \rrbracket^w =$$

$$\exists e [\text{believe}(e)_w \wedge \text{EXP}(e)=\text{Katya} \wedge \text{CONT}(e) \subseteq \{w: \text{there are no ghosts in } w\}$$

$$\wedge \text{CONT}(e) \subseteq \{w: \text{Anton ate Katya's toast in } w\}]$$

- The same set of worlds $\text{CONT}(e)$ cannot equal to different propositions, which makes any sentence with CP stacking always trivially false.⁶
- Subset Semantics does not result in a deviant meaning: the same set $\text{CONT}(e)$ can be a subset of two distinct propositions, so stacking should be possible.

② Impossibility of CP conjunction

- By the same logic, Equality Semantics but not Subset Semantics predicts that embedded CPs should not be conjoinable.

(37) *Equality Semantics: conjunction leads to deviant meaning*
 $*[[\text{K. believes} [[\text{that there are no ghosts}] \textbf{and} [\text{that Anton ate her toast}]]]]^w =$
 $\exists e [\text{believe}(e)_w \wedge \text{EXP}(e)=\text{Katya} \wedge \text{CONT}(e) = \{w: \text{there are no ghosts in } w\}$
 $\wedge \text{CONT}(e) = \{w: \text{Anton ate Katya's toast in } w\}] = \textbf{false} \text{ (for any } w\text{)}$

(38) *Subset Semantics: conjunction does not lead to deviant meaning*
 $*[[\text{K. believes} [[\text{that there are no ghosts}] \textbf{and} [\text{that Anton ate her toast}]]]]^w =$
 $\exists e [\text{believe}(e)_w \wedge \text{EXP}(e)=\text{Katya} \wedge \text{CONT}(e) \subseteq \{w: \text{there are no ghosts in } w\}$
 $\wedge \text{CONT}(e) \subseteq \{w: \text{Anton ate Katya's toast in } w\}]$

- (Bassi & Bondarenko 2021):
 Strings “CP and CP” always involve Conjunction Reduction; this is why cross-linguistically (English, Hebrew, Italian, Russian) such sentences have wide scope of conjunction (see also Bjorkman 2013, Szabolcsi 1997, 2016).

(39) *Context:* Yesterday Masha sang and Dina danced at the same time, and they produced so much noise that Bill couldn't handle it. Individually, these events were pleasant and didn't annoy Bill.

⁶A proviso: when the embedded clauses pick out *the same proposition*, the result is not contradictory, but stacking is nevertheless ruled out. We assume that sentences like (ia) are ruled out by some suitably articulated notion of redundancy. In any case, this seems to be paralleled by facts in other domains.

- (i) a. *I heard the rumor [Vincent doesn't have a spouse] [that Vincent isn't married].
 b. *I left [when Vincent's spouse arrived] [when the person that Vincent is married to arrived]

- (40) $\llbracket \text{CP and CP} \rrbracket$: *AND* > *angry*; $\llbracket \text{TP and TP} \rrbracket$: *angry* > *AND*.
 a. Bill got angry [_{CP} that [_{TP} Masha sang] and [_{TP} Dina danced]].
 b. Bill got angry [_{CP} that Masha sang] and [_{CP} that Dina danced].
- The context in (39) supports the narrow scope reading, and TP conjunction but not CP conjunction is good with it.
 - Similar point can be illustrated with verbs like *doubt*:
- (41) *Context*: Masha’s singing is quite likely, but Dina’s dancing is very unlikely. Thus, the combination of these two events is also very unlikely.
- (42) *Russian*: $\llbracket \text{CP and CP} \rrbracket$: *AND* > *angry*; $\llbracket \text{TP and TP} \rrbracket$: *angry* > *AND*.
 a. Ja somnevajus’, [_{CP} čto [_{TP} Maša pela] i [_{TP} Dina tancevala]].
 I doubt COMP Masha sang and Dina danced
 ‘I doubt that Masha sang and Dina danced.’
 b. Ja somnevajus’, [_{CP} čto Maša pela] i [_{CP} čto Dina tancevala].
 I doubt COMP Masha sang and COMP Dina danced
 ‘I doubt that Masha sang and that Dina danced.’
- This proposal makes a prediction that once we eliminate the possibility of Conjunction Reduction, true CP conjunction will be ungrammatical.
 - (Bondarenko 2022): we can test this prediction in Korean, and it is borne out.
 - Korean morphologically distinguishes conjunction that can occur in verbless coordinations, (43) (*kuliko*), from conjunction that cannot, (44) (*ko*).
- (43) Mary-ka [motun sakwa-lul] **kuliko** [motun panana-lul] mek-ess-ta.
 Mary-NOM every apple-ACC CONJ every banana-ACC eat-PST-DECL
 ‘Mary ate every apple and every banana.’
- (44) *Mary-ka [motun sakwa-lul]-**ko** [motun panana-lul] mek-ess-ta.
 Mary-NOM every apple-ACC-CONJ every banana-ACC eat-PST-DECL
 ‘Mary ate every apple and every banana.’

- Conjunction that is incompatible with Conjunction Reduction configuration cannot conjoin two embedded CPs—the result is ungrammatical, (45).

(45) *CP conjunction with -ko*

*Mina-ka [Swuna-ka nolayha-ess-ta-**nun**]-**ko** [Hani-ka
Mina-NOM Swuna-NOM sing-PST-DECL-ADN-CONJ Hani-NOM
chwumchwu-ess-ta-**nun**] cwucang-ul kiekha-n-ta
dance-PST-DECL-CONJ claim-ACC remember-PRS-DECL
'Mina remembers the claim that Swuna sang and that Hani danced.'

- Conjunction that is used in the Conjunction Reduction configuration can conjoin two embedded CPs, and this results in obligatory wide scope of conjunction:

(46) *CP conjunction with -kuliko*

[Swuna-ka nolayha-ss-ta-**nun**] **kuliko** [Mina-ka
Swuna-NOM sing-PST-DECL-ADN CONJ Hani-NOM
chwumchwu-ess-ta-**nun**] cwucang-i kiekha-n-ta
dance-PST-DECL-ADN claim-ACC exist-PST-DECL
'There was a claim that Swuna sang and that Mina danced.'
✓ AND > *angry*; ✗ *angry* > AND.

★ **Take-away:** Equality Semantics makes good predictions about CP stacking and CP conjunction, Subset Semantics does not.

③ Interaction with definiteness

- Consider the presupposition predicted by subset semantics for the following (assuming that definite descriptions presuppose existence and uniqueness):

(47) The fact that it's raining.
Presupposes: $\exists!x[\text{fact} \wedge \text{CONT}(x) \subseteq \{w \mid \text{it's raining in } w\}]$

- It's a fact (no pun intended) that an expression like (47) can be deployed in a context where, e.g., it's raining heavily.

(48) Context: *it's raining heavily*
 The fact that it's raining doesn't bother me.

- Why should this make us suspicious? Let's think again about exactly what constraints the presupposition in (47) places on the common ground:
 - *There's a unique fact whose content entails that it's raining*
- Importantly, both **fact**₁, and **fact**₂ are such facts:
 - $\text{CONT}(\mathbf{fact}_1) = \{ w \mid \text{it's raining in } w \}$
 - $\text{CONT}(\mathbf{fact}_2) = \{ w \mid \text{it's raining heavily in } w \}$
- For the presupposition in (47) to be satisfied, *fact*₁ and *fact*₂ can't both exist, as this violates uniqueness.
- This seems odd, but perhaps not fatal. Maybe, in a case like (48), we can say that either only **fact**₁ exists, or only **fact**₂ exists.⁷
- There is a serious problem with this view however. Consider the following:

(49) Context: *it's raining heavily*
 The **fact that it's raining** doesn't bother me,
 but **the fact that it's raining heavily** really does.

- The presupposition predicted by subset semantics predicts that *both definite descriptions must pick out the same fact* — **fact**₂ — since the content *it's raining heavily* entails both *that it's raining heavily*, and *that it's raining*.
- However! In (49), this would mean that we were ascribing contradictory properties to the self-same fact! Intuitively, a speaker uttering (49) is talking about *two different facts*.
- Note that equality semantics doesn't face this problem at all, and delivers intuitively plausible results. The facts picked out by (50a) and (50b) can quite happily co-exist.

⁷Nevertheless, this would require us to abandon the (eminently plausible) idea that there is an abstract *fact* entity corresponding to every true proposition in a given world.

- More generally, equality semantics is compatible with the view that every true proposition p corresponds to an abstract **fact** entity (which has p as its content).

- (50) a. The fact that it's raining.
 Presupposes: $\exists!x[\text{fact} \wedge \text{CONT}(x) = \{w \mid \text{it's raining in } w\}]$
 b. The fact that it's raining heavily.
 Presupposes: $\exists!x[\text{fact} \wedge \text{CONT}(x) = \{w \mid \text{it's raining heavily in } w\}]$

- Elliott (2017, 2020) provides another argument for equality semantics which also relies on the interaction between, facts, content, and definiteness.
- Elliott (2017) noticed the following paradigm — with *fact* specifically, whether or not a Noun Phrase can be constructed using an indefinite article seems to be conditioned on the absence of an embedded clause.

- (51) a. Josie mentioned the fact (that it's raining).
 b. Josie mentioned a fact (*that it's raining)
 cf. Josie mentioned a fact that everyone knows.
 cf. Josie mentioned a rumor that it's raining

- This is a rather curious paradigm, but it falls out from an intuitive understanding of facts and their contents, as well as an independently motivated constraint on the distribution of the indefinite article — just so long as we adopt equality semantics.
- The paradigm in (51) is highly reminiscent of paradigm noticed by Heim 1991:

- (52) a. The/*a weight of our tent is under 4lb.
 b. I interviewed the/*a biological father of the victim.

- Heim's explanation for the infelicity of the indefinite article in the examples above, is that using the indefinite article gives rise to an *obligatory* non-uniqueness inference, which gives rise to oddness in cases where uniqueness is contextually entailed.

- The constraint can be stated as follows (see Heim 1991 for a much more general formulation):

(53) In utterance situations where the presupposition of $[the\ \phi]\ \psi$ is already known to be satisfied, it is not permitted to utter $[the\ \phi]\ \psi$.

- How does equality (but not subset) semantics explain the paradigm in (51)?
 - *facts* are (abstract) entities, and there can be many such abstract entities, which readily explains the possibility of talking about *a fact*, or *a fact that everyone knows*.
 - According to equality semantics, when *fact* composes with an embedded clause p , it describes a property of *facts* whose content is p .
 - If we make the (very reasonable) assumption that facts are only individuated on the basis of their content, for any given (true) proposition p , there can only ever be a single *fact that p*.
 - This explains the infelicity of the indefinite article — once *fact* composes with an embedded clause, a unique satisfier is contextually entailed. This clashes with the constraint imposed by (53).
- In this particular case, *Josie mentioned a fact that it's raining* can't be asserted because the presupposition of *Josie mentioned the fact that it's raining* (there's a unique fact with content *that it's raining*) is already known to be satisfied.
- In subset semantics however, there can be many different *facts that p*. Let's see why:

(54) fact that it's raining
 $\lambda x . \text{Fact}(x) \wedge \text{CONT}(x) \subseteq \{ w' \mid \text{it's raining in } w' \}$

- Any fact whose content entails *that it's raining* will satisfy (54).
- There will always be many such true propositions corresponding to facts, so there is no expectation that “a fact that it's raining” should be deviant.

④ Lack of entailment with noun-modifying CPs

- Let us imagine that there is a complex claim, **claim**₃, has been made: this claim consists of two subclaims: “Swuna won an award” (**claim**₁) and “Swuna didn’t thank anyone” (**claim**₂), (55).

- (55)
- claim**₁: $\text{CONT}(\mathbf{claim}_1) = \{s': \text{Swuna won an award in } s'\}$
 - claim**₂: $\text{CONT}(\mathbf{claim}_2) = \{w': \text{Swuna didn't thank anyone in } w'\}$
 - claim**₃ = **claim**₁ \sqcup **claim**₂,
 $\text{CONT}(\mathbf{claim}_3) = \{w': \text{S. won the award and didn't thank anyone in } w'\}$

- We can think of the propositional content of this complex claim **claim**₃ as the conjunction of the propositional contents of the subclaims that it contains.
- Now in the context provided in (56), the sentences like (56a) and (56b) are judged false by native speakers of Korean and Russian.

- (56) **Context:** Someone claimed that Swuna won an award and that she didn’t thank anyone (= **claim**₃). Mina is not surprised by the claim that Swuna won an award (**claim**₁), but she is surprised by the claim (**claim**₂) that Swuna didn’t thank anyone when receiving it (Mina suspects that’s a lie).

- [FALSE] [Swuni-ka sang-ul pat-ess-ta-nun] cwucang-i
 Swuni-NOM award-ACC win-PST-DECL-ADN claim-NOM
 Mina-lul nollakey ha-yess-ta
 Mina-ACC be.surprise do-PST-DECL
 ‘A claim that Swuna won the award surprised Mina.’
- [FALSE] Zajavlenie, [čto Svuna polučila nagradu],
 claim COMP Swuna got award
 udivilo Minu.
 surprised Mina
 ‘A claim that Swuna got the award surprised Mina.’

- Equality Semantics predicts this, but the Subset Semantics doesn’t:

(57) Truth-conditions under Equality Semantics

$\llbracket A \text{ claim that Swuna won the award surprised Mina} \rrbracket^w = 1$ iff

$$\exists e[\text{surprise}_w(e) \wedge \text{THEME}(e)=\text{Mina} \wedge \exists x[\text{CAUSER}(e)=x \wedge \text{claim}(x)_w \\ \wedge \text{CONT}(x) = \{w': \text{Swuna got an award in } w'\}]]$$

(58) **Truth-conditions under Subset Semantics**

$$\llbracket A \text{ claim that Swuna won the award surprised Mina} \rrbracket^w = 1 \text{ iff} \\ \exists e[\text{surprise}_w(e) \wedge \text{THEME}(e)=\text{Mina} \wedge \exists x[\text{CAUSER}(e)=x \wedge \text{claim}(x)_w \\ \wedge \text{CONT}(x) \subseteq \{w': \text{Swuna got an award in } w'\}]]$$

- In the provided context, there is no claim with the content “*Swuna got an award*” that surprised Mina, and so Equality Semantics predicts the sentence to be false.
- But there is a claim that Mina found surprising whose content *entails* that Swuna got an award—this is **claim**₃. Existence of this claim is sufficient under Subset Semantics to predict the sentence to be true.⁸

⑤ **Russian Weak NPI Subjunctives**

- (Bondarenko 2022): Russian has subjunctive clauses that have distribution of weak NPIs—they are licensed only in SDE environments.
- But not all verbs and nouns can combine with weak NPI subjunctives.

⁸One possible objection to the argument sketched above is that it could be that (58) is the correct meaning, but it cannot be asserted in the context provided above because it would be uncooperative or uninformative to utter it. For example, maybe something should force us to speak about **claim**₁ instead of **claim**₃, as it is the **claim**₁ part of **claim**₃ that makes it surprising for Mina. I would like suggest that this is not the case: even if we modify the context to specify that the speaker is trying to conceal the cause of Mina’s surprise, the sentence remains false, (ia) (cf. the true sentence (ib), which includes an overt quantificational element *soglasno* ‘according to’).

- (i) **Context:** Everything is as in (56), but in addition imagine that the speaker is trying to conceal the real cause of Mina’s surprise—e.g., they don’t want others to know about Swuna’s lack of gratitude—without saying anything that is actually false.
- a. [FALSE] Zajavlenie, [čto Svuna polučila nagradu], udivilo Minu.
 claim COMP Swuna got award surprised Mina
 ‘A claim that Swuna got the award surprised Mina.’
- b. [TRUE] Zajavlenie, [soglasno kotoromu Svuna polučila nagradu], udivilo Minu.
 claim according which Swuna got award surprised Mina
 ‘A claim according to which Swuna got the award surprised Mina.’

- **Generalization (not bi-directional!):**

If a verb or a noun is incompatible with weak NPI subjunctives, it only combines with clauses that denote predicates of contentful individuals.

- For example, clauses that combine with *situacija* ‘situation’ describe some situation, their meanings, unlike meanings of clauses that combine with content nouns like *utverđenje* ‘claim’, do not introduce displacement.
- And ‘situation’, but not ‘claim’ can combine with weak NPI subjunctives:

(59) Mitja ne pomnit situaciji, /*utverđenija
 Mitya NEG remembers situation /claim
 [čto-by grabitel’ pytalsja proniknut’ na sklad].
 COMP-SUBJ robber tried to.get.in on warehouse
 ‘Mitya does not remember a situation/claim that the robber was trying to get into the warehouse.’

- If content-describing CPs introduce non-monotonicity, then impossibility of (59) is expected. If clauses have semantics of universal modals, (59) is puzzling.

3. Incorrect Predictions of Existing Theories

- So we have two theories of the semantics of clausal embedding, both of which:
 - equally successfully allow embedded CPs to combine with verbs and nouns;
 - make some good predictions
 (monotonicity for Subset Semantics,
 properties 1-5 from section 2.3.2 for Equality Semantics);
 - make some bad predictions
 (monotonicity for Equality Semantics,
 properties 1-5 from section 2.3.2 for Subset Semantics).

(60) **Subset Semantics**
 $\llbracket \text{that } p \rrbracket^w = \lambda x. \text{CONT}(x) \subseteq p.$

(61) **Equality Semantics**
 $\llbracket \text{that } p \rrbracket^w = \lambda x. \text{CONT}(x) = p.$

- Let us now get back to Sharvit’s puzzle, and see how the two theories fare.

(62) *NPIs within Complement Clauses*

- *Katya believes [the rumor [that Anton has ever snowboarded]].
- Katya doesn’t believe [the rumor [that Anton has ever snowboarded]].

(63) *NPIs within Relative Clauses*

- *Katya believes [the rumor [that Anton ever spread]].
- *Katya doesn’t believe [the rumor [that Anton ever spread]].

- Tables 1 summarizes the predictions of the two theories for complement and relative clauses, and the desired predictions.

	POS (63a)	NEG (63b)
Subset Semantics	✓ SUE, ✓ SDE *	✓ SUE, ✓ SDE *
Equality Semantics	✗ SUE, ✗ SDE *	✗ SUE, ✗ SDE *
Desideratum	✓ SUE, ✗ SDE *	✗ SUE, ✓ SDE OK

Table 1: Predictions of theories for complement clauses within definite DPs

- Let us first establish why the relative clauses are predicted to be ✓ *SUE*, ✓ *SDE*, and thus why (63a)–(63b) is an expected pattern (for any theory).
- We assume that the relevant property for licensing Weak NPIs like *ever* and *any* is *Strawson-Downward-Entailingness* (Fauconnier 1975, 1979, Ladusaw 1979, 1980a,b, Hoeksema 1986, Kadmon & Landman 1993, von Stechow 1993).

(64) **Strawson Entailment** (\Rightarrow_s)

(von Stechow 1999, here via Crnič 2019: p.2, (2))

- For any p, q of type t : $p \Rightarrow_s q$ iff $p = 0$ or $q = 1$.
- For any f, g of type $(\sigma\tau)$, $f \Rightarrow_s g$ iff for every x of type σ such that $g(x)$ is defined, $f(x) \Rightarrow_s g(x)$.

- (65) **Strawson Downward-Entailing (SDE)** (from Crni 2019: p.4, (7))⁹
 A Constituent S is *Strawson Downward-Entailing* with respect to a subconstituent X iff for every X' such that $\llbracket X' \rrbracket \Rightarrow_s \llbracket X \rrbracket$, it holds that $\llbracket S \rrbracket \Rightarrow_s \llbracket S[X/X'] \rrbracket$ (where $S[X/X']$ is identical to S except that X' replaces X).
- (66) **Strawson Upward-Entailing (SUE)**
 A Constituent S is *Strawson Upward-Entailing* with respect to a subconstituent X iff for every X' such that $\llbracket X' \rrbracket \Rightarrow_s \llbracket X \rrbracket$, it holds that $\llbracket S[X/X'] \rrbracket \Rightarrow_s \llbracket S \rrbracket$ (where $S[X/X']$ is identical to S except that X' replaces X).
- (67) **Condition for licensing weak NPIs**
 A weak NPI is an indefinite that is acceptable only if it is dominated by a constituent that is Strawson Downward Entailing (SDE) and not Strawson Upward Entailing (SUE) with respect to its restrictor.
- Here is how this approach to NPIs explains the ungrammaticality of (63b): the presupposition of the definite determiner makes the sentence under negation a SUE environment, and thus the condition for licensing NPIs is not met.
- (68) Let $P = \text{Katya doesn't believe the rumor that Anton spread last Friday}$,
 $Q = \text{Katya doesn't believe the rumor that Anton spread}$.
- P is true: $\exists!x[\text{rumor}(x) \wedge \text{Anton spread } x \text{ last Friday}]$
 $\neg \exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge$
 $\text{Theme}(e) = (\iota x[\text{rumor}(x) \wedge \text{Anton spread } x \text{ last Friday}])]$
 - Q 's presupp. is true: $\exists!x[\text{rumor}(x) \wedge \text{Anton spread } x]$
 - Assume that Q is false, then the following is true:
 $\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge$
 $\text{Theme}(e) = (\iota x[\text{rumor}(x) \wedge \text{Anton spread } x])]$
 - We have arrived at a contradiction:
 Because *the rumor that Anton spread* and *the rumor that Anton spread last Friday* must be the same rumor, (68a) contradicts (68b).
 Hence, Q must be true, and $P \Rightarrow_s Q$.

⁹Crnič calls this property *Strawson Entailment-Reversing*, but here I keep the ‘downward entailing’ in the name, as we will not be looking at any contexts of reversal from a downward-entailing environment to an upward-entailing environment.

- Under the Subset Semantics, the same logic extends to complement clauses:

- (69) Let $P = \text{Katya doesn't believe the rumor that Anton snowboarded last Friday}$,
 $Q = \text{Katya doesn't believe the rumor that Anton snowboarded}$,
 $p = \{ w' \mid \text{Anton snowboarded last Friday in } w' \}$, $q = \{ w' \mid \text{Anton snowboarded in } w' \}$
- P is true: $\exists!x[\text{rumor}(x) \wedge \text{Cont}(x) \subseteq p]$
 $\neg\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge$
 $\text{Theme}(e) = (\iota x[\text{rumor}(x) \wedge \text{Cont}(x) \subseteq p])]$
 - Q 's presupp. is true: $\exists!x[\text{rumor}(x) \wedge \text{Cont}(x) \subseteq q]$
 - Assume that Q is false, then the following is true:
 $\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge$
 $\text{Theme}(e) = (\iota x[\text{rumor}(x) \wedge \text{Cont}(x) \subseteq q])]$
 - We have arrived at a contradiction:
Because *the rumor that Anton snowboarded last Friday* and *the rumor that Anton snowboarded* must be the same rumor, (70a) contradicts (70c).
Hence, Q must be true, and $\mathbf{P} \Rightarrow_s \mathbf{Q}$.

- **Note why this entailment holds:** it holds because if there is a unique individual whose content *entails* p , and p entails q , then that very same individual will be the individual whose content entails q . I.e., \mathbf{P} and \mathbf{Q} have the same assertion.
- Equality Semantics also makes bad predictions, but for the opposite reason: it predicts the environment to be neither SUE nor SDE. Let us illustrate the lack of SDE-ness with the sentence under negation.

- (70) Let $P = \text{Katya doesn't believe the rumor that Anton snowboarded}$,
 $Q = \text{Katya doesn't believe the rumor that Anton snowboarded last Friday}$,
 $p = \{ w' \mid \text{Anton snowboarded in } w' \}$, $q = \{ w' \mid \text{Anton snowboarded last Friday in } w' \}$
- P is true: $\exists!x[\text{rumor}(x) \wedge \text{Cont}(x) = p]$
 $\neg\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge$
 $\text{Theme}(e) = (\iota x[\text{rumor}(x) \wedge \text{Cont}(x) = p])]$
 - Q 's presupp. is true: $\exists!x[\text{rumor}(x) \wedge \text{Cont}(x) = q]$
 - This is compatible with Q being false:
 $\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge$

$$\text{Theme}(e) = (\iota x[\text{rumor}(x) \wedge \text{Cont}(x) = q])$$

(there is no connection between existence of an individual with content p and individual with content q)

- Since Equality Semantics doesn't account for monotonicity, *the rumor that Anton snowboarded* doesn't have to be the same entity as *the rumor that Anton snowboarded last Friday*. And so the truth of P and Q are completely independent.

★ Summing up:

- Both theories make bad predictions—they cannot capture the monotonicity of the environment that is empirically observed.
- Subset Semantics wrongly predicts that the context is both SUE and SDE.
- Equality Semantics wrongly predicts that the context is neither SUE nor SDE.

4. Monotonicity and Incrementality of Content

- Despite its inability to capture certain uncontroversial entailments, **equality semantics** has many advantages over subset semantics, as we outlined in §2.3.
- Our proposal: monotonicity can be grafted onto an equality semantics via a property that certain attitudinal eventualities may have: *incrementality of content* (by analogy with Krifka 1998).
- Importantly, our proposal imposes monotonicity via the verbal semantics, rather than directly building it into the meaning of the declarative complementizer. This means that the results outlined in §2.3 will be maintained.
- Finally, we'll show that a resolution to *Sharvit's puzzle* is achieved via *incrementality of content*.

4.1. Monotonicity via Mapping to Sub-Parts

- Our proposal will relate to the fact that contentful entities (including eventualities and individuals) have a *rich mereological structure*.

- (71) a. Part of what Tanya believes is that Anton can ski.
 b. Part of Tanya's belief is that Anton can ski.

- A natural question that arises: how does the part-whole structure of contentful entities relate to their *contents*.
- Here, borrowing ideas from Krifka's (1998) work on incrementality, we propose a very natural constraint, which applies to certain kinds of contentful entities such as *believings* and *beliefs*.
- The idea informally: *If there's a believing e with content p , and part of what p conveys is that q , then there's a part of e which conveys q .*
- In other words, let's say that it's true that "Tanya believes that Anton can ski, and Mitya can snowboard". Since *part of* the conjunctive proposition is that *Anton can ski*, then there's a sub-part of Tanya's belief which conveys this as its content.
- This corresponds directly to Krifka's 'Mapping-to-Sub-Events' property: here we generalize it as *Mapping-to-Sub-Parts*.

- (72) CONT exhibits Mapping-to-Sub-Parts
 relative to a property of contentful entities P ($MSS_{Cont}(P)$) iff:
 $(P(x) \wedge \text{CONT}(x) = p \wedge q \sqsubset p) \rightarrow \exists y[y \sqsubset x \wedge \text{CONT}(y) = q]$
 $\forall p, q \in D_{st}, \forall x \in \text{DOM}(\text{CONT})$

- Let's unpack the definition of $MSS_{Cont}(P)$:
- Given an x that is a P with content p :
 For any q that is a *proper part of* p , there's a proper part y of x with content q .
- Our contention: MSS_{Cont} holds for *believing*-eventualities, and more generally for any attitudes that exhibit monotonicity, as well as certain content nouns such as *belief*, *rumor*, *claim*, etc.

- There are various ways of implementing this compositionally, but for the purposes of this talk we'll assume meaning postulates like the following:

$$(73) \quad \text{MSS}_{Cont}(\text{Believing})$$

- Let's consider, informally, how this captures monotonicity for simple attitude-reports.

$$(74) \quad \text{Patrick believes that it's raining.}$$

$$\exists e \left[\begin{array}{l} \text{HOLDER}(e) = \mathbf{Patrick} \\ \wedge \text{Believing}(e) \wedge \text{CONT}(e) = \{ w' \mid \text{it's raining heavily in } w' \} \end{array} \right]$$

- In order for this existential statement to be true, it must have a *verifier*, let's call this eventuality \mathbf{b}_{rh}^P .

$$(75) \quad \text{CONT}(\mathbf{b}_{rh}^P) = \{ w' \mid \text{it's raining heavily in } w' \}$$

- Since *believing*-eventualities satisfy MSS_{Cont} , then for every proper part q of the proposition *it's raining heavily*, there must be a corresponding proper part of \mathbf{b}_{rh}^P with content q .
- Now, all that's left is for us to specify exactly what *parthood* means with respect to propositions.
- In order to hew as closely as possible to the predictions of a Hintikkan semantics, the notion of parthood we'll adopt here is simply based on classical entailment.¹⁰

$$(76) \quad \text{Parthood for propositions (entailment-based):}$$

$$\begin{array}{l} q \sqsubseteq p := q \supseteq p \\ (q \text{ is a part of } p \text{ iff } p \text{ entails } q) \end{array}$$

- It follows that if *believing* eventualities satisfy MSS_{Cont} , then it follows that, for every proposition q asymmetrically entailed by *it's raining heavily* there should be a corresponding proper sub-part of \mathbf{b}_{rh}^P with q as its content.

¹⁰It can easily be verified that the *superset* relation satisfies the requirements of a mereological parthood relation, namely, it's *reflexive*, *transitive*, and *anti-symmetric*.

- This guarantees the existence of, e.g., the following sub-believings of Patrick:¹¹

$$(77) \quad \begin{aligned} \text{a. } & \text{CONT}(\mathbf{b}_r^P) = \{ w \mid \text{it's raining in } w \} \\ \text{b. } & \text{CONT}(\mathbf{b}_{rs}^P) = \{ w \mid \text{it's raining or snowing in } w \} \\ \text{c. } & \text{CONT}(\mathbf{b}_\top^P) = \{ w \mid \text{it's raining or not raining in } w \} \end{aligned}$$

- Each of these sub-believings verifies a corresponding belief-report, where the content of Patrick's belief is entailed by *it's raining heavily*, e.g., (77a) verifies:

$$(78) \quad \begin{aligned} & \text{Patrick believes it's raining.} \\ & \exists e \left[\text{HOLDER}(e) = \mathbf{Patrick} \right. \\ & \quad \left. \wedge \text{Believing}(e) \wedge \text{CONT}(e) = \{ w \mid \text{it's raining in } w \} \right] \end{aligned}$$

- It's easy to see that imposing MSS_{Cont} renders *believe* monotonic, since for any *believing* eventuality with content p , there's guaranteed to be a sub-*believing* with content q , where p classically-entails q .
- The corollary is that a *negated* belief-report creates a downward-entailing environment, thus accounting for NPIs. This should be straightforward to see:

$$(79) \quad \begin{aligned} & \text{Patrick doesn't believe that it's raining.} \\ & \neg \exists e \left[\text{HOLDER}(e) = \mathbf{Patrick} \right. \\ & \quad \left. \wedge \text{Believing}(e) \wedge \text{CONT}(e) = \{ w \mid \text{it's raining in } w \} \right] \end{aligned}$$

- The existence of a verifier for *Patrick believes that it's raining heavily* would falsify (79), since thanks to the guarantees imposed by MSE_{Cont} it would entail the existence of a verifier for Patrick believes that it's raining.
- As well as responding to one of the main objections to equality semantics, this handily accounts for the possibility of NPIs in negated belief-reports:

$$(80) \quad \text{Mitya doesn't believe that Anton has ever snowboarded.}$$

¹¹We importantly assume that every part of a *believing-of-Patrick* eventuality is also a *believing-of-Patrick* eventuality.

- However, without saying more, this still doesn't allow us to resolve Sharvit's puzzle; Sharvit's puzzle involves verbs like *believe* composing with an *internal argument*. Cases like:

(81) Patrick believes the claim that it's raining.

- A neo-Davidsonian Logical Form is under-informative with respect to how the content of the internal argument relates to the content of the attitudinal eventuality.

4.2. Resolving Sharvit's puzzle: Mapping to Sub-Objects

- We've resolved the monotonicity problem for equality semantics, but we still need an additional step in order to resolve Sharvit's puzzle.
- We need to adopt one more, independently motivated principle from Krifka 1998 in order to constrain how the part-whole structure of certain eventualities relates to the part-whole structure of their internal arguments: namely, *Mapping-to-Sub-Objects* (MSO).

(82) THEME exhibits MSO with respect to a predicate of eventualities P (MSO_{Th}),
iff:

$$(P(e) \wedge \text{THEME}(e) = x \wedge e' < e) \rightarrow \exists y[y < x \wedge \text{THEME}(e') = y]$$

$$\forall e \in \text{DOM}(\text{THEME}), \forall x \in D$$

- We'll also need to assume a principle which we call *Content-Theme Matching* for certain predicates such as *believe*:

(83) A predicate of contentful eventualities P exhibits *Content-Theme-Matching*
iff:

$$P(e) \rightarrow \text{CONT}(e) = \text{CONT}(\text{THEME}(e))$$

$$\forall e \in \text{DOM}(\text{CONT}), \text{DOM}(\text{THEME})$$

4.3. Sketch of Strawson UE

- In tandem, these two principles derive Strawson-entailment from x *believes the rumor that* q , to x *believes the rumor that* p , where q is logically stronger than p .
- First, if the presuppositions of x believes the rumor that p are defined, then:

$$(84) \quad \exists!x[\text{rumor}(x) \wedge \text{CONT}(x) = p]$$

- If x believes the rumor that q is true, then from CTM, we can establish that x believes that q , since any verifier of x believes the rumor that q will also verify x believes that q .

$$(85) \quad \exists e[\text{Believe}(e) \wedge \text{HOLDER}(e) = x \wedge \text{CONT}(e) = q]$$

- From mapping to sub-parts, we can infer the existence of a verifier $e' < e$ for x believes the rumor that p :

$$(86) \quad \exists e'[\text{Believe}(e') \wedge \text{HOLDER}(e') = x \wedge \text{CONT}(e') = p]$$

- Now, given the existence of e' , we can infer via mapping to sub-parts a theme of e' y , which is part of the theme of e .
- Since the content of e' is p , then via content-theme matching the content of y must also be p .

4.4. Sketch of Strawson DE

- Assume the following:
 - $S_p = x$ doesn't believe the rumor that p
 - $S_q = x$ doesn't believe the rumor that q
 - $q \subseteq p$

- If the presuppositions hold, then there's *a unique rumor with content p*, and *a unique rumor with content q*
- The first sentence is such that there's no believing event with Theme *rumor that p*, and content *p*.
- Let's assume that the second sentence is true, and see how this leads to a contradiction.
- If the second sentence is true, then via the logic in the previous section, we can infer that *x* believes the content that *p*.

The following section ultimately needs to be replaced

4.5. Resolving Sharvit's puzzle: Content-Theme Matching

- We've resolved the monotonicity problem for equality semantics, but we still need an additional step in order to resolve Sharvit's puzzle.
- Certain verbs, such as *believe* license what we call *Theme-to-Content* entailments (Uegaki 2016).

(87) Patrick believes the claim that it's raining.
 \Rightarrow Patrick believes that it's raining.

- In Neo-Davidsonian event semantics, it's standard to assume that argument composition is mediated by thematic functions; we shall assume that arguments like *the claim* are no exception.
- This means that (87) has the following Logical Form:

$$(88) \quad \exists e \left[\begin{array}{l} \text{HOLDER}(e) = \mathbf{Patrick} \wedge \text{Believe}(e) \\ \wedge \text{THEME}(e) = \iota x [\text{Claim}(x) \wedge \text{CONT}(x) = \{ w \mid \text{it's raining in } w \}] \end{array} \right]$$

- The most straightforward way of capturing the entailment we're interested in is to posit that certain eventualities inherit the content of their internal arguments. A property we call *Content-Theme-Matching*.
- There are various different ways of implementing *Content-Theme Matching*. We simply assume the following definition for THEME_{Cont} :

$$(89) \quad \text{THEME}_{Cont}(x) := \lambda e. \text{CONT}(e) = \text{CONT}(x)$$

- The entailment in (87) immediately follows from the neo-Davidsonian Logical Form, as shown below:

$$(90) \quad \exists e \left[\begin{array}{l} \text{HOLDER}(e) = \mathbf{Patrick} \wedge \text{Believe}(e) \\ \wedge \text{THEME}_{Cont}(e) = \iota x [\text{Claim}(x) \wedge \text{CONT}(x) = \{w \mid \text{it's raining in } w\}] \end{array} \right]$$

(91) Expand definition:

$$\exists e \left[\begin{array}{l} \text{HOLDER}(e) = \mathbf{Patrick} \wedge \text{Believe}(e) \\ \wedge \text{CONT}(e) = \text{CONT}(\iota x [\text{Claim}(x) \wedge \text{CONT}(x) = \{w \mid \text{it's raining in } w\}]) \end{array} \right]$$

$$(92) \quad \begin{array}{l} \text{If } \exists! x [\text{Claim}(x) \wedge \text{CONT}(x) = \{w \mid \text{it's raining in } w\}], \\ \text{then } \exists e \left[\begin{array}{l} \text{Believe}(e) \wedge \text{HOLDER}(e) = \mathbf{Patrick} \\ \wedge \text{CONT}(e) = \{w \mid \text{it's raining in } w\} \end{array} \right] \end{array}$$

- Note that an immediate (desirable) consequence of *Content-Theme Matching* is that it blocks stacking of contentful NP arguments and embedded clauses; these are predicted to be trivial, just like stacking of embedded clauses:

$$(93) \quad * \text{Patrick believes [the claim that it's raining] [that it's snowing].}$$

- We're now in a position to outline our account of Sharvit's puzzle. Recall that, according to equality semantics, the environment created by *the rumor that p* was neither SUE nor SDE.
- Here, we'll demonstrate that the *Mapping-to-Sub-Events* and *Content-Theme-Matching* reinstates SDEness without introducing SUEness.
- Let's start with the following notational conveniences:

- $P = \text{Katya doesn't believe the rumor that Anton snowboarded,}$
- $Q = \text{Katya doesn't believe the rumor that Anton snowboarded last Friday,}$
- $p = \{ w \mid \text{Anton snowboarded in } w \}$
- $q = \{ w \mid \text{Anton snowboarded last Friday in } w \}$
- The goal is to show that if (i) P is true, and (ii) the presuppositions of Q are true, then Q is guaranteed to be true, thus showing that SDEness has been reinstated.
- We'll do so by showing that if P is true, and the presuppositions of Q are true, assuming that Q is false results in a contradiction.
- Firstly, if P is true, we can take for granted that there is a unique *rumor* with content p , and that there is no believing of Katya's with this rumor as its theme.

$$(94) \quad \neg \exists e \left[\begin{array}{l} \text{belief}(e) \wedge \text{HOLDER}(e) = \mathbf{Katya} \\ \wedge \text{THEME}_{\text{Cont}}(e) = \iota x [\text{Rumor}(x) \wedge \text{CONT}(x) = p] \end{array} \right]$$

- This entails that there is no believing of Katya's with p as its content, by *Content-Theme-Matching*.

$$(95) \quad \neg \exists e [\text{Belief}(e) \wedge \text{HOLDER}(e) = \mathbf{Katya} \wedge \text{CONT}(e) = p]$$

- From *Mapping-to-Sub-Events* and (95), we can further conclude that there is no believing of Katya's with content q , since q is a 'part-of' p according to the entailment-based notion:

$$(96) \quad \neg \exists e [\text{Belief}(e) \wedge \text{HOLDER}(e) = \mathbf{Katya} \wedge \text{CONT}(e) = q]$$

- If we now take for granted that Q 's presupposition is true, then there's a unique rumor \mathbf{Rumor}_q with content q .
- Now, if Q were *false*, this would lead to a contradiction, since if there is a believing of Katya's with \mathbf{Rumor}_q as its theme, then it would follow from *Content-Theme-Matching* that Katya believes q , which contradicts (96)!
- **Pay-off:** SDEness has been reinstated.

- It's easy to see that SUEness hasn't been accidentally re-introduced. Again, consider the following:
 - $P = \text{Katya doesn't believe the rumor that Anton snowboarded,}$
 - $Q = \text{Katya doesn't believe the rumor that Anton snowboarded last Friday,}$
 - $p = \{ w \mid \text{Anton snowboarded in } w \}$
 - $q = \{ w \mid \text{Anton snowboarded last Friday in } w \}$
- Our goal is to show that taking Q and the presuppositions of P for granted doesn't guarantee the truth of P .
- Briefly, if Q is true, then from *Content-Theme-Matching*, we can conclude that Katya doesn't believe that Anton snowboarded last Friday.
- *Mapping-to-Sub-Events* is however compatible with Katya believing that Anton snowboarded.
- Therefore, P could still be false; there may well be a rumor that Anton snowboarded that Katya believes; this doesn't conflict with our evidence regarding Katya's beliefs.
- Importantly, neither *Content-Theme-Matching* nor *Mapping-to-Subevents* helps subset semantics.

Do we need to show this in detail?

4.6. Addendum I: Beyond *Believe*

- There were two crucial ingredients underlying our account:
 1. *Mapping-to-Sub-Events*.
 2. *Content-Theme-Matching*.
- We conjectured that *believing* eventualities satisfy both of these properties.

- What predictions do we make beyond *believe*? We can diagnose whether or not an attitudinal predicate *P* satisfies *Mapping-to-Sub-Events* on the basis of its monotonicity. In essence, *Mapping-to-Sub-Events* is just a way of imposing monotonicity.
- For an attitudinal predicate *V* that satisfy *Mapping-to-Sub-Events*, we make some subtle predictions regarding whether or not an NPI is licensed in the environment *x doesn't V the rumor that [...]*.
- Concretely, for those predicates that allow an internal NP argument, this should depend on the property of *Content-Theme-Matching*.
- Uegaki (2016) provides the following list of predicates which satisfy *Content-Theme-Matching*.¹²
- All of these predicates also seem to be monotonic, and can further be sub-divided into *upward entailing* (97), and *downward entailing* (98).
 - *believe, accept, trust*.¹³
 - *deny, disprove*.

- (97)
- John **accepts** that it's raining heavily,
#but he doesn't accept that it's raining.
 - John **trusts** that it's raining heavily,
#but he doesn't trust that it's raining.
 - John **validated** that it's raining heavily,
but he didn't validate that it's raining.

¹²Pending further investigation, it seems to us that some predicates variably satisfy *Content-Theme-Matching*, depending on properties of the internal argument. Take, for example, *confirm*:

- (i)
- Anton confirmed the rumor that Mitya is sick.
⇒ Anton confirmed the rumor that Mitya is sick.
 - Anton confirmed the lie that Mitya is sick.
≠ Anton confirmed that Mitya is sick.

¹³Uegaki includes *validate* in this list, but we removed it, since it's not clear to us what it means to, e.g., *validate a rumor*.

- (98) a. John **denies** that it's raining,
 #but he doesn't deny that it's raining heavily.
 b. John **disproved** that it's raining,
 #but he didn't disprove that it's raining heavily.
- On this basis, we immediately make the following (we think, correct) predictions:
- (99) a. Mitya doesn't **accept/trust** the rumor that Anton has ever been skiing.
 b. Mitya **denies/disproved** the rumor that Anton has ever been skiing.

4.7. Addendum II: Content and conjunctive parthood

- The notion of parthood we adopted for propositions, repeated below, is based on *classical entailment*:
- (100) Parthood for propositions (entailment-based):

$$q \sqsubseteq p := q \supseteq p$$
 (q is a part of p iff p entails q)
- Although orthogonal to our main point, we're interested in the extent to which (100) is really adequate.
 - By design, it inherits the problem of logical omniscience (Stalnaker 1991, etc.) from the Hintikka semantics for attitude reports.
 - We can see manifestations of this problem when we explicitly query the mereological part-whole structure of the content of *believing* eventualities.
 - An entailment-based view of parthood for propositions correctly predicts that (101a) and (101b) should be true in the context provided, but it also erroneously predicts that (101c) should be true.
- (101) Context: *Mitya is planning a bank robbery. Mitya believes that there are 5 security cameras, and that there are 3 security guards.*
- a. Part of what Mitya believes is that there are 5 security cameras.
 b. Part of what Mitya believes is that there are security cameras.

c. #Part of what Mitya believes is that either there are security cameras, or there are no security guards.

- This problem is mirrored by the familiar problem of logical omniscience in belief reports, specifically disjunction introduction:

(102) Mitya believes that there are 5 security cameras.

? \Rightarrow Mitya believes that there are 5 security cameras or no security guards.

- This general issue can be localized in the notion of parthood (and concomitantly the notion of content), that we adopt.
- It's of course widely appreciated that the putative entailment in (102) is extremely difficult to block, assuming a classical notion of content and entailment (but see, e.g., Yalcin 2018 that maintains a classical notion of content).
- One salient possibility is to shift to a richer notion of content in which a notion of *conjunctive parthood* can be stated, such as truthmaker semantics (Yablo 2014, Fine 2017c,a,b). Essentially, we'd like p to count as *part of* $p \wedge q$, without $p \vee q$ counting as part of p .
- Here, we'll sketch how Kit Fine does it, purely as a proof of concept.
- Fine's truthmaker semantics is *state-based* — a sentence ϕ is verified/falsified by a *state*, which can be thought of as a situations with just enough information to make ϕ true/false.
- Sentences can thereby be associated with sets of verifiers/falsifiers. The state-space itself has a mereological part-whole structure, and is closed under mereological fusion \sqcup .
- The propositional fragment is quite straightforward; the semantics is fundamentally bilateral, so each sentence is mapped to a set of verifiers by $\llbracket \cdot \rrbracket^+$, and a set of falsifiers by $\llbracket \cdot \rrbracket^-$.

(103) Atomic sentences

- a. $\llbracket p \rrbracket^+ = I^+(p)$
- b. $\llbracket p \rrbracket^- = I^-(p)$

(104) Negated sentences

- a. $\llbracket \neg \phi \rrbracket^+ = \llbracket \phi \rrbracket^-$
- b. $\llbracket \neg \phi \rrbracket^- = \llbracket \phi \rrbracket^+$

- For our purposes, the definitions for verifiers of complex sentences are worth paying attention to:
 - The verifiers of a conjunctive sentence are the *pointwise fusion* of the verifiers of each conjunct.
 - The verifiers of a disjunctive sentence are simply the union of the verifiers of each disjunct.
 - We provide the falsifier clauses for completeness, although they won't be directly relevant to the following discussion.

(105) Conjunctive sentences

- a. $\llbracket \phi \wedge \psi \rrbracket^+ = \{ t \sqcup u \mid t \in \llbracket \phi \rrbracket^+, u \in \llbracket \psi \rrbracket^+ \}$
- b. $\llbracket \phi \wedge \psi \rrbracket^- = \llbracket \phi \rrbracket^- \cup \llbracket \psi \rrbracket^-$

(106) Disjunctive sentences

- a. $\llbracket \phi \vee \psi \rrbracket^+ = \llbracket \phi \rrbracket^+ \cup \llbracket \psi \rrbracket^+$
- b. $\llbracket \phi \vee \psi \rrbracket^- = \{ t \sqcup u \mid t \in \llbracket \phi \rrbracket^-, u \in \llbracket \psi \rrbracket^- \}$

- Fine goes on to define a notion of *conjunctive parthood*, which we'll exploit for a revised notion of parthood for content:

(107) **Conjunctive parthood:** given two sentences ϕ, ψ , ψ is a conjunctive part of ϕ iff:

- a. $\forall s' \in \llbracket \psi \rrbracket^+, \exists s \in \llbracket \phi \rrbracket^+ [s' \sqsubseteq s]$
- b. $\forall s \in \llbracket \phi \rrbracket^+, \exists s' \in \llbracket \psi \rrbracket^+ [s' \sqsubseteq s]$

- It follows from this definition that p is a conjunctive part of $p \wedge q$, but $p \vee q$ is *not* a conjunctive part of p .
- Let's see how this works:
 - $\llbracket \text{it's raining} \rrbracket^+ = \{ r_1, r_2 \}$

$$- \llbracket \text{it's cold} \rrbracket^+ = \{ c_1, c_2 \}$$

$$(108) \quad \llbracket \text{it's raining and cold} \rrbracket^+ = \{ r_1 \sqcup c_1, r_1 \sqcup c_2, r_2 \sqcup c_1, r_2 \sqcup c_2 \}$$

$$(109) \quad \llbracket \text{it's raining or cold} \rrbracket^+ = \{ r_1, r_2, c_1, c_2 \}$$

- It follows that *it's raining* is a conjunctive part of *it's raining and cold*, since for every verifier r of *it's raining*, we can find a verifier s for *it's raining and cold*, such that $r \sqsubseteq s$, and for every verifier s of *it's raining and cold*, we can find a verifier r or *it's raining*, such that $r \sqsubseteq s$.
- It's easy to see that *it's raining or cold* is **not** a conjunctive part of *it's raining*, since there's a verifier of *it's raining or cold* — e.g., c_1 — that is not part of a verifier of *it's raining*.
- Combining truth-maker semantics with a neo-Davidsonian semantics for attitudes of course requires some care, but as a first step we can think of CONT as a function from an eventuality/individual to a set of states.
- Embedded clauses might have the following semantics; *that* p denotes a predicate of individuals that have as their content the set of states that verify p .

$$(110) \quad \llbracket \text{that it's raining} \rrbracket = \lambda x. \text{CONT}(x) = \llbracket \text{it's raining} \rrbracket^+$$

- Finally, we replace our notion of parthood for propositions for *conjunctive parthood*.

(111) Conjunctive parthood for state-based content:

$$Q \sqsubseteq_{\text{Conj}} P \iff \forall s' \in Q, \exists s \in P [s' \sqsubseteq s] \\ \forall s \in P, \exists s' \in Q [s' \sqsubseteq s]$$

- By exploiting *Mapping-to-Sub-Events*, we can now account for the fact that x *believes that* $p \wedge q$ entails that x *believes that* p , but x *believes that* p doesn't entail that x *believes that* $p \vee q$.
- We leave a more thorough exploration of conjunctive parthood in the domain of content to future work.

5. Conclusion

still todo

References

- Alonso-Ovalle, Luis & Paula Menéndez-Benito. 2018. Projecting possibilities in the nominal domain: spanish uno cualquiera. *Journal of Semantics* 35(1). 1–41.
- Alonso-Ovalle, Luis, Paula Menéndez-Benito & Aynat Rubinstein. 2022. Vent-dependent Modal Projection: The Case of Spanish Subjunctive Relative Clauses. In Özge Bakay et al. (eds.), *North East Linguistics Society (NELS) 52*, 15–28. Amherst: GLSA.
- Arregui, Ana. 2007. When aspect matters: the case of would-conditionals. *Natural Language Semantics* 15. 221–264.
- Arregui, Ana. 2009. On similarity in counterfactuals. *Linguistics and Philosophy* 32. 245–278.
- Arregui, Ana. 2010. Detaching if-clauses from should. *Natural Language Semantics* 18. 241–293.
- Arregui, Ana, María Luisa Rivero & Andrés Salanova. 2014. Cross-linguistic variation in imperfectivity. *Natural Language & Linguistic Theory* 32. 307–362.
- Bassi, Itai & Tatiana Bondarenko. 2021. Composing CPs: Evidence from disjunction and conjunction. In *Semantics and Linguistic Theory*, vol. 30, 583–602.
- Bjorkman, Bronwyn. 2013. A syntactic answer to a pragmatic puzzle: The case of asymmetric *and*. In Raffaella Folli, Christina Sevdali & Robert Truswell (eds.), *Syntax and its Limits*. Oxford University Press.
- Bogal-Allbritten, Elizabeth. 2016. *Building meaning in Navajo*. University of Massachusetts Amherst dissertation.
- Bogal-Allbritten, Elizabeth. 2017. Basic pieces, complex meanings: Building attitudes in Navajo and beyond. Invited talk at the Workshop on polysemy and coercion of clause embedding predicates. In 39th Annual Meeting of DFfS. Saarbrücken, Germany.
- Bondarenko, Tatiana. 2021. The dual life of embedded CPs: Evidence from Russian to-clauses. In *Semantics and Linguistic Theory* 31.

- Bondarenko, Tatiana. 2022. *Anatomy of an attitude*. Cambridge, MA: Massachusetts Institute of Technology dissertation.
- Castañeda, Hector-Neri. 1967. Comments on Donald Davidson’s “The logical form of action sentences”. In Nicholas Resher (ed.), *The logic of decision and action*, 104–112. Pittsburgh, PA: University of Pittsburgh Press.
- Crni, Luka. 2019. *Any*: logic, likelihood, and context (Pt. 1 & 2). *Language and Linguistics Compass* 13(11). e12354, e12353.
- Elliott, Patrick D. 2016. Explaining DPs vs. CPs without syntax. In *Chicago Linguistic Society (CLS)*, vol. 52, 171–185.
- Elliott, Patrick D. 2017. *Elements of clausal embedding*. UCL dissertation.
- Elliott, Patrick D. 2020. A Plea for equality: Remarks on Moltmanns semantics for clausal embedding. *Theoretical Linguistics* 46(3-4). 241–251.
- Fauconnier, Gilles. 1975. Polarity and the scale principle. In *The Chicago Linguistics Society II*, 188–199.
- Fauconnier, Gilles. 1979. Implication reversal in a natural language. In Franz Guenther & Siegfried J. Schmidt (eds.), *Formal Semantics and Pragmatics for Natural Languages*, 289–302. Reidel, Dordrecht.
- Fine, Kit. 2017a. A Theory of Truthmaker Content I: Conjunction, disjunction and negation. *Journal of Philosophical Logic* 46(6). 625–674.
- Fine, Kit. 2017b. A Theory of Truthmaker Content II: Subject-matter, common content, remainder and ground. *Journal of Philosophical Logic* 46(6). 675–702.
- Fine, Kit. 2017c. Truthmaker Semantics. *A Companion to the Philosophy of Language* 2. 556–577.
- von Fintel, Kai. 1993. Exceptive Constructions. *Natural Language Semantics* 1(2). 123–148.
- von Fintel, Kai. 1999. NPI licensing, Strawson entailment, and Context dependency. *Journal of semantics* 16(2). 97–148.
- Hacquard, Valentine. 2006. *Aspects of modality*. Massachusetts Institute of Technology dissertation.
- Hacquard, Valentine. 2010. On the event relativity of modal auxiliaries. *Natural Language Semantics* 18(1). 79–114.
- Heim, Irene. 1991. Artikel und Definitheit. In Arnim von Stechow & Dieter Wunderlich (eds.), *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung*, 487–535. Berlin: de Gruyter.

- Hintikka, Jaakko. 1962. *Knowledge and Belief: An introduction to the logic of the two notions*. Cornell University Press.
- Hintikka, Jaakko. 1969. Semantics for Propositional Attitudes. In *Models for Modalities*, 87–111. Springer.
- Hoeksema, Jack. 1986. Monotonicity Phenomena in Natural Language. *Linguistic Analysis* (16). 25–40.
- Kadmon, Nirit & Fred Landman. 1993. *Any*. *Linguistics and Philosophy* 16(4). 353–422.
- Kratzer, Angelika. 2006. Decomposing attitude verbs. Handout from a talk in honor of Anita Mittwoch on her 80th birthday. The Hebrew University of Jerusalem. <http://semanticsarchive.net/Archive/DcwY2JkM/attitude-verbs2006.pdf>.
- Kratzer, Angelika. 2013. Modality and the semantics of embedding. Talk given at the Amsterdam Colloquium.
- Kratzer, Angelika. 2016. Evidential moods in Attitude and Speech reports. Talk given at the 1st Syncart Workshop.
- Krifka, Manfred. 1998. The Origins of Telicity. In Susan Rothstein (ed.), *Events and Grammar*, 197–235. Springer.
- Ladusaw, William. 1979. *Polarity Sensitivity as Inherent Scope Relations*. The University of Texas at Austin dissertation.
- Ladusaw, William. 1980a. Affective *or*, factive verbs, and negative-polarity items. In *The Chicago Linguistic Society (CLS) 16*, 170–184.
- Ladusaw, William. 1980b. On the notion “affective” in the analysis of negative polarity items. *Journal of Linguistic Research* (1). 1–23.
- Levin, Beth. 1993. *English Verb Classes and Alternations: A preliminary investigation*. University of Chicago press.
- Moulton, Keir. 2009. *Natural selection and the syntax of clausal complementation*. University of Massachusetts - Amherst dissertation. http://scholarworks.umass.edu/open_access_dissertations/99.
- Moulton, Keir. 2015. CPs: Copies and Compositionality. *Linguistic Inquiry* 46(2). 305–342.
- Portner, Paul & Aynat Rubinstein. 2020. Desire, belief, and semantic composition: variation in mood selection with desire predicates. *Natural Language Semantics* 28(4). 343–393.
- Sharvit, Yael. 2023. Standard and non-standard theories of attitudes and NPIs.

- Stalnaker, Robert. 1991. The Problem of Logical Omniscience, I. *Synthese* 89(3). 425–440. <http://www.jstor.org/stable/20116982>.
- Szabolcsi, Anna. 1997. Quantifiers in Pair-List Readings. In *Ways of Scope Taking*, 311–347. Springer.
- Szabolcsi, Anna. 2016. Direct vs. indirect disjunction of *wh*-complements, as diagnosed by subordinating complementizers. Manuscript, New York University.
- Uegaki, Wataru. 2016. Content Nouns and the Semantics of Question-Embedding. *Journal of Semantics* 33(4). 623–660.
- Yablo, Stephen. 2014. *Aboutness* (Carl g. Hempel Lecture Series). Princeton: Princeton University Press. 221 pp.
- Yalcin, Seth. 2018. Belief as question-sensitive. *Philosophy and Phenomenological Research* 97(1). 23–47.

A. Comparison with Sharvit 2023

- Sharvit’s claim: a Kratzerian theory of clausal embedding is incompatible with a monotonicity-based account of NPI licensing.
- Sharvit’s rendering of a Kratzerian theory (“Hypothesis II” in Sharvit 2023):
- N.b., Sharvit is assuming that *CONT*, where defined, is a function from an eventuality to a partial proposition.
- Sharvit’s rendering of a Kratzerian entry for *believe* comes with a number of presuppositions:
 - The attitude holder’s *total beliefs* entail the presuppositions of the believing’s content.
 - *e* is a believing event iff the attitude holder’s total beliefs entail the believing’s content.
 - If *e* has a theme, then the content of the believing is the content of the theme.

$$\begin{aligned}
(112) \quad \mathbf{believe}^K &= \lambda e : Dox_{\text{HOLDER}(x)} \subseteq \{ w \mid w \in \text{DOM}(\text{CONT}(e)) \} \\
&\quad \text{Believing}(e) \iff Dox_{\text{HOLDER}(x)} \subseteq \text{CONT}(e) \\
&\quad \wedge (e \in \text{DOM}(\text{THEME}) \rightarrow \text{CONT}(e) = \text{CONT}(\text{THEME}(e))) \\
&\quad . \text{Believing}(e)
\end{aligned}$$

- (113) Ted doesn't believe the claim that it was raining. $\not\Rightarrow_s$
Ted doesn't believe the claim that it was raining heavily.

Still need to do this! (Christ it's getting long)