On the monotonicity of attitudes

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Preamble

https://patrickdelliott.com/pdf/bochum2024.pdf

Collaborators

- This talk is based on ongoing joint with with Tanya Bondarenko (Harvard University).

- We have a manuscript *Monotonicity via mereology in the semantics of attitude reports* (Bondarenko & Elliott 2024), which you can find on lingbuzz (lingbuzz/008158).

Introduction

Overview

- Big question: what is the source of the monotonicity of attitude verbs (narrowly focusing on belief-reports, for the time being).
  - More narrowly, how to reconcile a non-monotonic, content-based semantics (Kratzer 2006, Moulton 2009, Elliott 2017, Bondarenko 2022) with, e.g., closure under entailment, and interaction with Negative Polarity Item (NPI)-licensing.

(1) Mitya believes [that it's raining heavily].
⇒ Mitya believes [that it's raining].

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

N.b. So-called neg-raising inference not crucially implicated.

(3) Mitya *is/isn't certain that Anton has ever snowboarded.

Overview ii

- Our answer: the source of the monotonicity of attitude verbs is a *systematic mapping between structured domains*.
  - Concretely, the mapping from attitudinal eventualities such as *believings* to the propositions that they have as their contents.
  - This mapping is sensitive to the part-whole structure of both eventualities (Bach 1986) and propositions.
  - To formalize this idea, we'll exploit mereological parthood (see, e.g., Champollion & Krifka 2016), and homomorphism-like principles inspired by Krifka (1998) on incrementality.
- Empirical payoff: an account of the NPI-licensing facts brought to light by Sharvit (2023); otherwise extremely difficult to account for if monotonicity is built directly into the semantics of attitude reports.

Roadmap

- A Whig history of clausal embedding, going directly from (Hintikka 1969) to (two incarnations) of Angelika Kratzer's content-based theory (Kratzer 2006).
    - Setting up two competing implementations of Kratzer's theory: subset semantics and equality semantics.
- Arguments for equality semantics - a non-monotonic semantics for attitude reports, and subsequent issues surrounding monotonicity.
- Reinstating monotonicity via conditions on mappings between domains with non-trivial part-whole structures.
- Yael Sharvit's recent observations concerning embedded declaratives and NPIs (Sharvit 2023); resolution via the mereological perspective.

From Hintikka to Kratzer

The Hintikkan view

- Attitude verbs like *believe* are classically analyzed as a kind of universal modal (Hintikka 1969).
  - Embedded declaratives denote propositions and function as arguments.

(4) $[\![\text{believe}]\!]^w = \lambda p_{\langle s,t\rangle} . \lambda x_e . \text{Dox}_w^x \subseteq \{ w' \mid p(w') = 1 \}$

(5) *Doxastic alternatives:*
For any individual $x \in D$, possible world $w \in W$,
$\text{Dox}_w^x = \{ w' \mid w'$ compatible with what x takes to be true in $w \}$

- Derived principles.
  - Closure under Entailment.
  - Closure under Conjunction.

Closure under entailment

(6) *Closure under entailment:*
For any sentences S, S', attitude-holder x,
if S entails S', then x believes S entails x believes S'.

- Why? If $\text{Dox}_w^x \subseteq p$, and $p \subseteq p'$ (i.e., proposition p semantically entails p'), then $\text{Dox}_w^x \subseteq p'$, by simple transitivity.

(7) Mitya believes that it's raining heavily.
⇒ Mitya believes that it's raining.

- Note: the problem of logical omniscience lurks (Stalnaker 1991, Yalcin 2018); we'll return to this at the very end of the talk, time-permitting.
  - For the time being, we'll assume that this principle is correct.

Closure under conjunction

(8) *Closure under conjunction:*
For any sentences S, S', attitude-holder x,
x believes S and x believes S' entails x believes [S and S'].

(9) Mitya believes that Jessica married an American,
and Mitya believes that Jessica married a philosopher.
$\Rightarrow$ Mitya believes that Jessica married an American philosopher.

- Why? If $\text{Dox}_w^x \subseteq p$, and $\text{Dox}_w^x \subseteq q$, then $\text{Dox}_w^x \subseteq (p \cap q)$ (since every world in Dox_w^x is a p-world and also a q-world).
- This one seems relatively uncontroversial.

Drawbacks

- Fails to capture event-related properties of attitude verbs (attitude verbs are verbs).

(10) Alice believed [that Santa Klaus was real] for a whole two weeks.

(11) Omer thinks about the Roman Empire at least once a day.

- Doesn't account for the full distribution of embedded declaratives; when composing with nouns, they pattern with modifiers rather than true arguments (Stowell 1981, Higgins 1973).

(12) a. Elis's belief [that Elin is in Tokyo].

b. Elis's belief is [that Elin is in Tokyo].

(13) a. The destruction of the city.

b. *The destruction is of the city.

Attitudinal eventualities

- Starting point: like other verbs (Davidson 1967), attitude verbs introduce eventualities (Kratzer 2006, Hacquard 2006).
  - Concretely, we'll assume neo-Davidsonian Logical Forms (Castañeda 1967), where sentences express existential claims about eventualities.
  - Thematic functions mediate eventualities and their participants (Parsons 1990).

(14) $[\![\text{believe}]\!] = \lambda e_v \,.\, \text{believe}(e)$

(15) $[\![\text{Mitya believes that } \ldots]\!]^w = 1$ iff

$\exists e \leq w[\textsc{Holder}(e) = \text{M} \wedge \text{believe}(e) \wedge \ldots]$

- Where do embedded declaratives fit into this picture?

Kratzer's insight

- Embedded declaratives can be modeled as predicates of individuals/eventualities with content (Kratzer 2022, 2013b,a, 2014, 2006) .
- I'll introduce two incarnations of this idea, which will later be pitted against each other (nomenclature from Bassi & Bondarenko 2020).
  - Subset semantics (Kratzer 2006).
  - Equality semantics (Moulton 2010, 2015, Elliott 2017, Bondarenko 2022).
- As we'll see, subset semantics is relatively close to the classical Hintikkan semantics, and inherits its advantages.
- Equality semantics does not resemble the classical Hintikkan semantics, and in fact fails to capture many of the basic inferences associated with, e.g., belief reports.

- Goals:
  - Capture the wider distribution of embedded declaratives (e.g., as nominal modifiers).
  - Preserve Hintikka's account of closure under entailment.

(16) Subset semantics for *that*-clauses (after Kratzer 2006):

$$[\![\text{that } S]\!] = \lambda x_\sigma \,.\, \textsc{Cont}(x) \subseteq \{\, w' \mid [\![S]\!]^{w'} = 1 \,\} \qquad \sigma \in \{\, e, v \,\}$$

- Cont is a partial function from individuals/eventualities to propositions (their *content*).
- Certain abstract entities like *facts* and *rumors* have content, but also attitudinal eventualities like *believings* (Hacquard 2006).

Subset semantics ii

- The result is a straightforward, neo-Davidonian semantics for attitude reports:
  - The embedded declarative resolves to type $\langle v, t \rangle$ and may composes with the verb as a Davidsonian modifier.

(17) $[\![\text{Mitya believes that it's raining}]\!]^w = 1$ iff

$$\exists e \leq w \left[\begin{array}{l} \textsc{Holder}(e) = \text{Mitya} \wedge \text{believe}(e) \\ \\ \wedge\, \textsc{Cont}(e) \subseteq \{\, w' \mid \text{it's raining in } w' \,\} \end{array} \right]$$

- It's intuitive to imagine e to be the attitude holder's *total* belief state.
  - It's easy to see that subset semantics validates closure under entailment.
  - If $p \subseteq \textsc{Cont}(e)$, and $p' \subseteq p$, then $p' \subseteq \textsc{Cont}(e)$, by simple transitivity.

Subset semantics ii

- Content nouns and embedded declaratives receive a completely parallel treatment:
  - Content nouns like "rumor" are predicates of abstract, contentful individuals.
  - Embedded declaratives compose like ordinary, intersective modifiers; quantificational force comes from the determiner.

(18) $[\![\text{there's a rumor that it's raining}]\!]^{w} = 1$ iff

$\exists x \leq w[\text{rumor}(x) \wedge \textsc{Cont}(x) \subseteq \{ w' \mid \text{it's raining in } w' \}]$

Subset semantics iii

- Kratzer's approach in general (i) treats attitude verbs as ordinary verbs (ii) accounts of the syntactic distribution of embedded clauses, including as modifiers to content nouns, (iii) maintains closure under entailment.
    - What's not to like?
- In the next section we'll introduce *equality semantics*, a refinement which loses closure under entailment, rendering belief reports non-monotonic.
- Surprisingly, we'll see evidence from content nouns that this nevertheless must be correct.
- This will raise the obvious question of how to reconcile these facts with monotonicity.

Equality semantics

(19) Equality semantics for *that*-clauses
(after Moulton 2009, Elliott 2017, Bondarenko 2022, etc.):
$[\![\text{that } S]\!] = \lambda x_\sigma . \textsc{Cont}(x) = \{ w' \mid [\![S]\!]^{w'} = 1 \} \qquad \sigma \in \{ e, v \}$

(20) $[\![\text{Mitya believes that it's raining}]\!]^{w} = 1$ iff

$$\exists e \leq w \left[\begin{array}{l} \textsc{Holder}(e) = \text{M} \wedge \text{believe}(e) \\ \wedge \textsc{Cont}(e) = \{ w' \mid \text{it's raining in } w' \} \end{array} \right]$$

- Without saying anything more, note that closure under entailment is lost.
  - Mitya having a believing with content p doesn't have any bearing on Mitya having a believing with content q, irregardless of the semantic relationship between p and q.
- Surprisingly, there still are some pretty compelling arguments for equality rather than subset semantics.

Arguments for equality

- Main arguments discussed here:
  - Stacking (Moulton 2009, Elliott 2017).
  - Interaction with definiteness (Elliott 2017, 2020).
- There are some other arguments I won't discuss here, from clausal conjunction (Bassi & Bondarenko 2020), and interaction with certain content nouns (Bondarenko 2022).

(21) a. Neil whispered.

b. Neil whispered [that it's snowing].

c. * Neil whispered [that it's snowing] [that it's overcast].

- Equality but not subset semantics predicts triviality for (21c).

(22) p = *that it's snowing*; q = *that it's overcast*

a. Equality semantics:
$\exists e \leq w[\textsc{Theme}(e) = \mathrm{N} \wedge \mathrm{whisper}(e) \wedge \textsc{Cont}(e) = p \wedge \textsc{Cont}(e) = q]$

b. Subset semantics:
$\exists e \leq w[\textsc{Agent}(e) = \mathrm{N} \wedge \mathrm{whisper}(e) \wedge \textsc{Cont}(e) \subseteq p \wedge \textsc{Cont}(e) \subseteq q]$

Stacking ii

- The argument is especially forceful when we consider the contrast between ordinary restrictive relative clauses and embedded declaratives wrt stacking.

(23) a. Neil heard a rumor (that Mitya spread).

b. Neil heard a rumor [that Mitya spread] [that Anton later denied].

(24) a. Neil heard a rumor (that it's raining).

b. *Neil heard a rumor [that it's raining] [that it's snowing].

- Subset semantics incorrectly predicts that embedded declaratives should pattern with other intersective modifiers wrt stacking.

Interaction with definiteness

- Assumption: Fregean semantics for definite article (Heim & Kratzer 1998).

(25) $[\![\text{the}]\!] = \lambda P_{\langle e,t\rangle} : \exists!x[P(x) = 1]\,.\,\iota x[P(x) = 1]$

- Equality and subset semantics predict different presuppositions:

(26) the fact that it's raining

a. Presupp. (subset):
$\exists!x[\text{fact}(x) \wedge \textsc{Cont}(x) \subseteq \{\, w' \mid \text{it's raining in } w' \,\}]$

b. Presupp. (equality):
$\exists!x[\text{fact}(x) \wedge \textsc{Cont}(x) = \{\, w' \mid \text{it's raining in } w' \,\}]$

Interaction with definiteness ii

- Presupp. (equality): *there's a unique fact whose content is that it's raining*.
- Presupp. (subset): *there's a unique fact whose content entails that it's raining*.
    - Surprisingly, the presupposition predicted by subset semantics fails to be satisfied if the following abstract *facts* exist.

(27) a. $\textsc{Cont}(\mathbf{Fact}_r) = \{ w' \mid \text{it's raining in } w' \}$

b. $\textsc{Cont}(\mathbf{Fact}_{rh}) = \{ w' \mid \text{it's raining heavily in } w' \}$

- This predicts that "the fact that it's raining" isn't assertable if both facts exist.

Interaction with definiteness iii

- This is a bad prediction: according to subset semantics "the fact that it's raining", and "the fact that it's raining heavily" should necessarily refer to the *same fact*.

(28) [The fact that it's raining] doesn't bother me,
but [the fact that it's raining heavily] really does.

- According to equality semantics, (28) presupposes:
  - *There's a unique fact whose content is that it's raining.*
  - *There's a unique fact whose content is that it's raining heavily.*
- These presuppositions can easily be (jointly) satisfied.
- Subset semantics on the other hand 'collapses' "the fact that p" and "the fact that q" just in case there is an entailment relationship between p and q.

Interaction with definiteness iv

- Cf. the (expected) interaction between uniqueness presuppositions and ordinary intersective modifiers.

(29) #The student doesn't bother me, but the French student really does.

- Here, as expected, if the presupposition of "the student" is satisfied, then "the student" and "the French student" refer to the same student.

- More generally (this will play a role later):

(30) **Uniqueness collapse:**
If $[\![\text{the}\,\phi]\!]$ and $[\![\text{the}\ \psi]\!]$ are defined, and $[\![\psi]\!] \subseteq [\![\phi]\!]$, then $[\![\text{the}\ \phi]\!] = [\![\text{the}\ \psi]\!]$.

- The problem is that if $p \subseteq p'$:
  - $\{\, x \mid \textsc{Cont}(x) \subseteq p \,\} \subseteq \{\, x \mid \textsc{Cont}(x) \subseteq p' \,\}$
- The following however doesn't necessarily hold:
  - $\{\, x \mid \textsc{Cont}(x) = p \,\} \subseteq \{\, x \mid \textsc{Cont}(x) = p' \,\}$

Maximize presupposition

- An especially acute manifestation of this issue (from Elliott 2017).

(31) The fact (that it's raining).

(32) A fact (#that it's raining).

- surprising from the perspective of subset semantics; The problematic indefinite DP is predicted to assert that there is a fact whose content entails that it's raining, and in principle there could be many such facts.

Maximize presupposition ii

(33) Subset semantics:
$\exists x[\text{fact}(x) \wedge \textsc{Cont}(x) \subseteq \{ w' \mid \text{it's raining in } w' \}]$

(34) Equality semantics:
$\exists x[\text{fact}(x) \wedge \textsc{Cont}(x) = \{ w' \mid \text{it's raining in } w' \}]$

- Maximize Presupposition (Heim 1991): given two contextually equivalent alternatives, one must use the alternative with stronger presuppositions, if those presuppositions happen to be met (roughly).
- Equality semantics predicts that "a fact that *p*" is always an MP violation.

(35) { The | #A } moon shines brightly.

Reinstating monotonicity

- If we adopt equality semantics for belief reports, we lose closure under entailment, and thereby monotonicity.
- This seems like a heavy price to pay. No longer any principled account of the following data.

(36) Mitya believes it's raining heavily.
⇒ Mitya believes it's raining.

(37) Mitya doesn't believe [that Anton has ever snowboarded].

- I'll turn to this in the next section.

Monotonicity via mereology

The mereological structure of eventualities

- Mereology is the study of part-whole relationships in mathematics and logic, with broad applications in natural language semantics across domains such as plurality and aspect (Champollion & Krifka 2016).
- A mereology is simply a domain of entities, equipped with a *parthood* relation $\leq$, which satisfies the axiomatic principles below.

(38) Axioms of classical extensional mereology

a. **Reflexivity:** $\forall x, x \leq x$

b. **Transitivity:** $\forall x, y, z, (x \leq y \wedge y \leq z) \rightarrow x \leq z$

c. **Antisymmetry:** $\forall x, y (x \leq y \wedge y \leq x) \rightarrow x = y$

- We'll assume that *eventualities*, as well as other individuals, have a rich mereological structure (Bach 1986).

Mereological structure of *believings*

$$(39) \quad \exists e \leq w \left[\begin{array}{l} \textsc{Holder}(e) = \mathrm{M} \wedge \mathrm{believe}(e) \\ \\ \wedge\, \textsc{Cont}(e) = \{\, w' \mid \text{it's raining in } w' \,\} \end{array} \right]$$

- This LF should of course be compatible with Mitya simultaneously having distinct beliefs; Intuitively, Mitya's believing that it's raining is merely *part* of Mitya's believing.
- For a given rational agent x, we can posit an eventuality corresponding to x's *total beliefs*, which a witness the existential statement may be part of.
- We can assume then that *believings* have a rich mereological structure, but this doesn't accomplish much by itself. We must determine how parts of *believings* relate to informational content.

Sub-atomic quantification

- A clue: in English, so-called "sub-atomic" existential quantification over mereological parts expressed via "part of" or "partly" (Wągiel 2021).

(40) a. The flag is partly red.

b. Part of the flag is red.
⇒ *There is an x, s.t., x is a mereological part of the unique flag, and x is red.*

Sub-atomic quantification ii

- Same vocabulary used to quantify over mereological parts of abstract *contentful* entities, like *rumors* (Moltmann 2013, 2020).
  - The information conveyed by (i.e., the *content of*) the part seems to stand in a systematic relationship to the information conveyed by the whole.

(41) Context: *Mitya believes that Anton snowboarded on Friday.*

a. What Mitya believes is partly that Anton snowboarded.

b. Part of what Mitya believes is that Anton snowboarded.

(42) Context: *there's a rumor that Anton snowboarded on Friday.*

a. Part of the rumor is that Anton snowboarded.

b. The rumor is partly that Anton snowboarded.

A tangent: sub-atomic adverbial quantification

- "Partly" can also be used as an adverbial modifier with *belief*-reports, placing constraints on how the content of the believing relates to the embedded declarative.

(43) Context: *Mitya believes that Anton did something on Friday, but he isn't sure that Anton snowboarded.*
Mitya partly believes [that Anton snowboarded last Friday].

- The semantics for this particular construction turns out to introduce some unexpected additional complexity relating to the progressive paradox (Parsons 1989), so I'll put it to one side (but feel free to ask me about it).

(44) Mitya partly crossed the road.

Parthood for propositions

- OK, so what does it mean for a proposition to have "parts"?
  - The easiest way to implement this is via an informational notion of parthood; p is part of q if the information conveyed by q includes p (see Brown 2022 for a similar setup).

(45) **Parthood for propositions:**
$p \leq q$ iff p is semantically entailed by q (i.e., $p \sqsupseteq q$).

- This captures the intuition that, e.g., the proposition *that it's raining* is part of the proposition *that it's raining and it's cold*, and more generally predicts that the individual conjuncts are parts of conjunctive propositions.
- Less intuitive consequences: the proposition denoted by a sentence of the form "P or Q" will be part of the proposition denoted by P.

Parthood for propositions ii

- Pedantically: supersethood doesn't give rise to a classical mereology due to the bottom element (Champollion & Krifka 2016), but still qualifies as a partial ordering, and thus gives rise to a lattice.

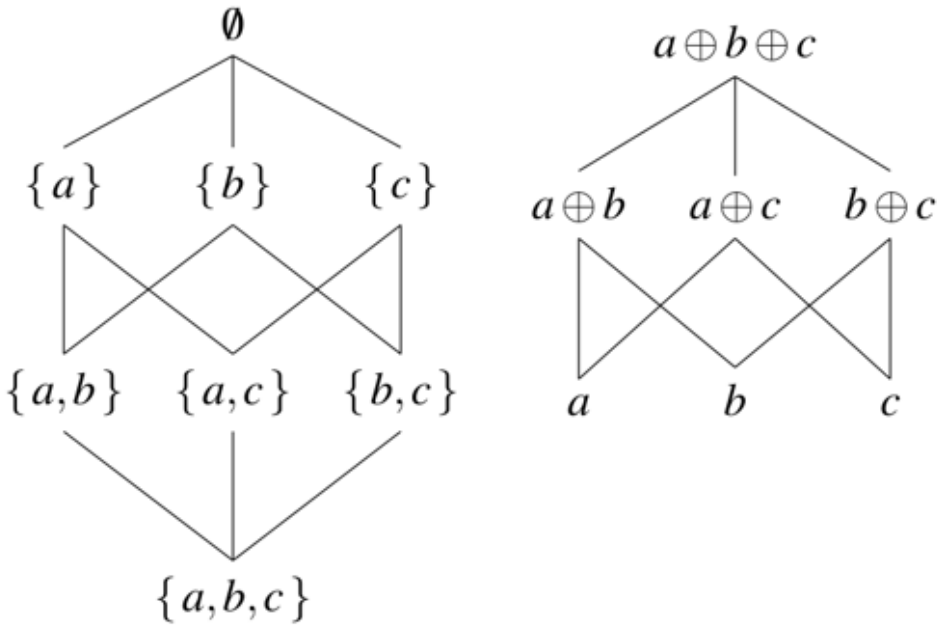

Figure 1 $\mathcal{P}(\{a,b,c\})$ as a superset lattice; $\oplus\{a,b,c\}$ as a mereology

Parthood for propositions: a concrete example

- Mitya and Neil are playing a game. The game can result in a tie, but only one person may win.
- The resulting possibilities are exhausted by w_m (Mitya is the winner), w_n (Neil is the winner), and $w_\varnothing$ (the game was a tie).

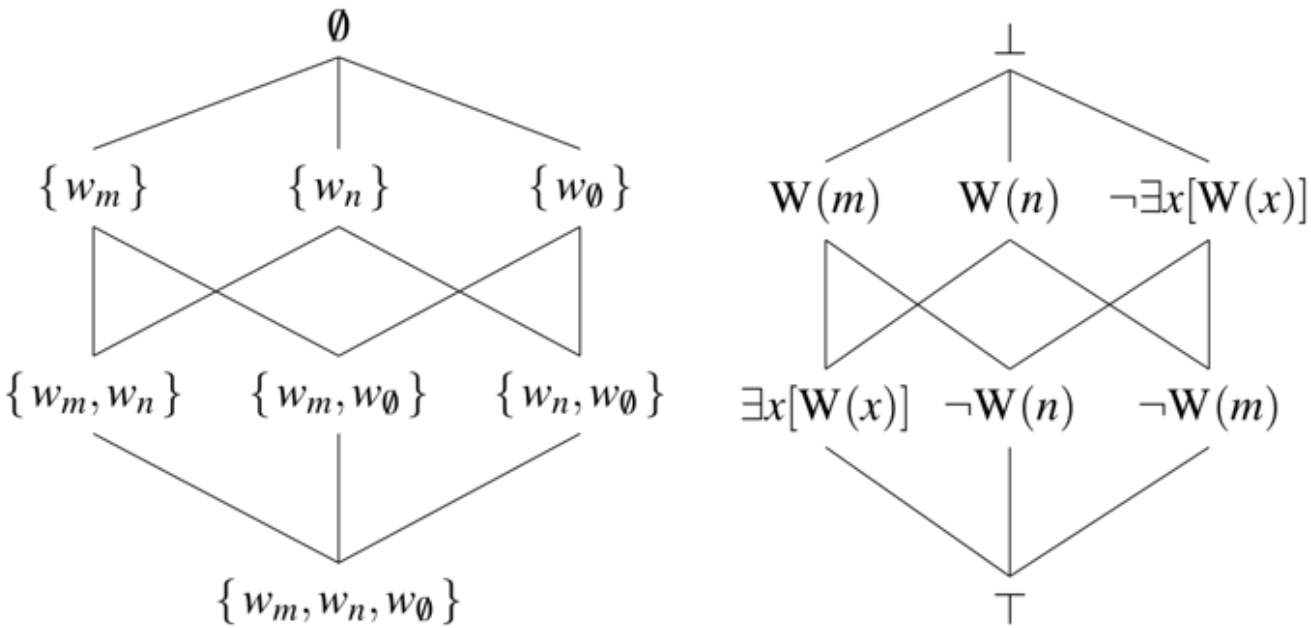

Figure 2 $W(m) :=$ *Mitya is the winner*; $W(n) :=$ *Neil is the winner*

Mapping to Subparts of the Inputs

- Let's say that Mitya holds a belief e with content p, and furthermore that p has proper parts (i.e., propositions it properly entails) q and r.
- This should necessitate the existence of a belief of Mitya's $e' < e$ with content q, and a belief of Mitya's $e'' < e$ with content r.
    - In other words, CONT preserves proper parthood. We formalize this as Mapping to Subparts of the Input (MSI).

(46) CONT satisfies MSI:

$p' < \text{CONT}(x) \rightarrow \exists x' < x[\text{CONT}(x') = p']$

$\forall x \in \text{Dom}(\text{CONT}), p' \in D_{st}$

- For arbitrary p, p', where $p' > p$ (so, $p' \supset p$), e.g.,
  - p' := it's raining
  - p := it's raining heavily

(47) Mitya believes p.

a. $\exists e \leq w[\textsc{Holder}(e) = \text{M} \wedge \text{believe}(e) \wedge \textsc{Cont}(e) = p]$

b. $p' < \textsc{Cont}(e)$

c. $\exists e' < e[\textsc{Cont}(e') = p']$ by MSI

d. $\therefore \exists e' \leq w[\textsc{Holder}(e') = \text{M} \wedge \text{believe}(e') \wedge \textsc{Cont}(e') = p']$

Reinstating monotonicity ii

- For arbitrary p, p', where $p' > p$ (so, $p' \supset p$), e.g.,
  - p' := it's raining
  - p := it's raining heavily

(48) Mitya doesn't believe p'.

a. $\neg\exists e' \leq w[\textsc{Holder}(e') = \text{M} \wedge \text{believe}(e') \wedge \textsc{Cont}(e') = p']$

b. $\exists e \leq w[\textsc{Holder}(e) = \text{M} \wedge \text{believe}(e) \wedge \textsc{Cont}(e) = p]$

c. By the reasoning on prev slides,
$\exists e' \leq w[\textsc{Holder}(e') = \text{M} \wedge \text{believe}(e') \wedge \textsc{Cont}(e') = p']$

d. $\therefore$ (48c) contradicts (48a).

Reinstating monotonicity iii

- I've shown that monotonicity - at least, closure under entailment - can be reinstated in a semantics that is based on equality of content.
- This allows one to maintain the advantages of equality semantics, without sacrificing monotonicity.
- Closure under entailment, as well as the basic NPI licensing facts can thereby be captured.
- In the next section, I'll go further and suggest that equality semantics + constraints on mappings has empirical advantages to subset semantics, by looking at a more intricate NPI-licensing paradigm.

Monotonicity and NPI licensing

Sharvit's puzzle i

- Sharvit (2023) observes that there's a contrast between ordinary restrictive relatives and embedded declaratives, wrt NPI licensing in singular definite descriptions.

(49) a. * Mitya believes the rumor [that anyone spread].

b. * Mitya doesn't believe the rumor [that anyone spread].

(50) a. * Mitya believes the rumor [that anyone was late].

b. Mitya doesn't believe the rumor [that anyone was late].

- Singular definites more generally are thought to anti-license NPIs! (Lahiri 1998, Guerzoni & Sharvit 2007, Gajewski & Hsieh 2015, Crnič 2019).
  - The grammaticality of (50b) is surprising.

Sharvit's puzzle ii

- More general fact about (Strawson) downward-entailing environments:

(51) a. Every student who believes…
   i. …[the claim that Mary **ever** left] is easily fooled
   ii. *…[the claim that Mary **ever** spread] is easily fooled

b. Only John believes…
   i. …[the claim that Mary **ever** left].
   ii. *…[the claim that Mary **ever** spread].

c. Few believe…
   i. …[the claim that Mary **ever** left].
   ii. *…[the claim that Mary **ever** spread].

What's to come

- The narrative:
  - Subset semantics will fail to capture this contrast, since it will collapse embedded declaratives with other intersective modifiers.
  - Ultimately, the property of *uniqueness collapse* which we discussed earlier will predict that embedded declaratives in singular definites anti-license NPIs, just like restrictive relatives.
  - Our mereological approach will capture this contrast, with some natural extensions.
  - We'll need an additional constraint to govern how *believings* with a non-trivial part-whole structure relate to THEMEs with a non-trivial part-whole structure.

NPI licensing: background

- It's well known that NPIs are sensitive to the monotonicity of their local environment (Ladusaw 1979, Fauconnier 1975, 1978).
- We follow (von Fintel 1999) in assuming that monotonicity should be calculated in a way that takes presuppositions into account.
    - This is crucial for looking at NPIs in definite descriptions, which are presuppositional.

(52) **Strawson Entailment** ($\Rightarrow_s$):

$$p_\tau \Rightarrow_s q_\tau \text{ iff } \begin{cases} p = 0 \text{ or } q = 1 & \tau = t \\ \forall x \in \text{Dom(g)}, f(x) \Rightarrow_s \text{g}(x) & \tau = \langle \sigma_1, \sigma_2 \rangle \end{cases}$$

- p Strawson entails q iff, when p and q's presuppositions are satisfied, the truth of p guarantees the truth of q.
- This means, e.g.,:

(53) The French student sneezed. $\Rightarrow_S$ the student sneezed.

(54) The student sneezed. $\Rightarrow_S$ the French student sneezed.

Strawson Downward/Upward Entailingness

(55) Strawson Downward Entailing (SDE) (Crnič 2019):
A constituent S is SDE wrt a subconstituent X iff:
For all constituents X', s.t., $[\![X']\!] \Rightarrow_s [\![X]\!]$, $[\![S]\!] \Rightarrow_s [\![S[X / X']]\!]$

(56) Strawson Upward Entailing (SUE):
A constituent S is SUE wrt subconstituent X iff:
For all constituents X', s.t., $[\![X']\!] \Rightarrow_s [\![X]\!]$, $[\![S[X / X']]\!] \Rightarrow_s [\![S]\!]$

(57) [$_{S}$ Nadya met a [$_{NP}$ linguist]].

a. $[\![\text{syntactician}]\!] \Rightarrow_s [\![\text{linguist}]\!]$

b. $[\![\text{Nadya met a syntactician}]\!] \Rightarrow_s [\![\text{Nadya met a linguist}]\!]$

c. $[\![\text{Nadya met a linguist}]\!] \not\Rightarrow_s [\![\text{Nadya met a syntactician}]\!]$

(58) [$_{S}$ Nadya didn't meet a [$_{NP}$ linguist]].

a. $[\![\text{syntactician}]\!] \Rightarrow_s [\![\text{linguist}]\!]$

b. $[\![\text{Nadya didn't meet a syntactician}]\!] \not\Rightarrow_s$
$[\![\text{Nadya didn't meet a linguist}]\!]$

c. $[\![\text{Nadya didn't meet a linguist}]\!] \Rightarrow_s$
$[\![\text{Nadya didn't meet a syntactician}]\!]$

Licensing condition for weak NPIs

- See, e.g., (Lahiri 1998, Gajewski & Hsieh 2015, Guerzoni & Sharvit 2007).

(59) **Licensing condition for weak NPIs**

A sentence containing a weak NPI α is acceptable iff α is dominated by a constituent that is SDE and not SUE with respect to α's restrictor.

- The property of uniqueness collapse renders sentences with singular definites Strawson equivalent wrt NPI licensing.

(60) **Uniqueness collapse:**
If $[\![\text{the}\ \phi]\!]$ and $[\![\text{the}\ \psi]\!]$ are defined, and $[\![\psi]\!] \subseteq [\![\phi]\!]$, then $[\![\text{the}\ \phi]\!] = [\![\text{the}\ \psi]\!]$.

- The property of uniqueness collapse guarantees that the sentence *Nadya met the student who has written a book* Strawson-entails the sentence *Nadya met the student who has written a new book* AND vice versa.

(61) **Subset semantics: predictions**

a. Mitya doesn't believe the rumor that a syntactician was late.

b. Mitya doesn't believe the rumor that a linguist was late.

c. If the presupposition of (61a) is satisfied, then:
$\exists!x[\text{rumor}(x) \wedge \textsc{Cont}(x) \subseteq$
$\{ w' \mid \text{a syntactician was late in } w' \}]$

d. If the presupposition of (61a) is satisfied, then:
$\exists!x[\text{rumor}(x) \wedge \textsc{Cont}(x) \subseteq \{ w' \mid \text{a linguist was late in } w' \}]$

e. If both presuppositions are satisfied, then:
$[\![\text{the rumor that a syntactician was late}]\!]^w$
$= [\![\text{the rumor that a linguist was late}]\!]^w$

f. ∴ (61a) and (61b) are Strawson-equivalent.

Capturing Sharvit's puzzle: first steps

- Sharvit's puzzle involves sentences in which *believe* composes with a DP of the form *the rumor that p*.
- *Rumors* are Themes of *believings*.
- If we assume that rumors have non-trivial mereological structure too, then msi provides some guarantees:

(62) There's a rumor that *p*.

a. $\exists x[\text{rumor}(x) \wedge \textsc{Cont}(x) = p$

b. $p' < p$

c. $\therefore \exists x' < x[\textsc{Cont}(x') = p']$ By msi

- The non-trivial part-whole structure of propositions guarantees that a rumor with content *p* has, as a part, a *sub-rumor* with content p'.

Mapping to Subparts of the Output

- What constrains the relationship between *believings* and their Themes?
- The idea informally: if an eventuality e has a Theme, then for any subeventuality $e' < e$, there must be an x', which is part of Theme(e), and is e''s Theme.
    - Essentially, it requires that all subevents be mapped onto sub-Themes.

(63) Theme satisfies Mapping to Subparts of the Output (MSO):
$e' < e \rightarrow \exists x' < \text{Theme}(e)[\text{Theme}(e') = x']$
$\forall e \in \text{Dom}(\text{Theme}), e' \in D_v$

- This is directly inspired by Krifka's work on incrementality (Krifka 1998).

- A property of *believe* that seems to be crucially implicated in Sharvit's puzzle is what we call the DP-to-CP entailment (Prior 1971, Vendler 1972, Ginzburg 1995, King 2002, Moltmann 2013, Uegaki 2016, Djarv 2019).

(64) DP-to-CP entailment:
$[\![x \text{ V } [_{\text{DP}} \text{ the NP CP}]]\!] \Rightarrow [\![x \text{ V CP}]\!]$

(65) Verbs exhibiting the DP-to-CP entailment

a. Katya *believes/denied/accepted/doubted/memorized/trusted/(dis)proved/validated/repeated* [the claim that Anton snowboarded].

b. ⇒ Katya *believes/denied/accepted/doubted/memorized/trusted/(dis)proved/validated/repeated* [that Anton snowboarded].

(66) Verbs not exhibiting the DP-to-CP entailment

a. Katya *knew/recognized/recalled/forgot/discovered/imagined/judged/regretted/praised/saw* [the claim that Anton snowboarded].

b. ⇏ Katya *knew/recognized/recalled/forgot/discovered/imagined/judged/regretted/praised/saw* [that Anton snowboarded].

(67) Theme-Event Content Matching (TECM):
TECM holds of $P \in D_{\langle v,t \rangle}$ iff:
$P(e) \rightarrow (\textsc{Cont}(e) = \textsc{Cont}(\textsc{Theme}(e)))$
$\forall e \in \text{Dom}(\textsc{Cont}) \cap \text{Dom}(\textsc{Theme})$

- Since TECM holds for believings, the content of a believing e is guaranteed to be identical to the content of e's THEME.
- This captures the following entailment.

(68) Mitya believes the rumor [that it's raining].
⇒ Mitya believes [that it's raining].

Ingredients (recap)

- A recap of the ingredients we'll need to account for Sharvit's puzzle.

(69) CONT satisfies MSI:

$p' < \textsc{Cont}(x) \rightarrow \exists x' < x[\textsc{Cont}(x') = p']$

$\forall x \in \text{Dom}(\textsc{Cont}), p' \in D_{st}$

(70) THEME satisfies MSO:

$e' < e \rightarrow \exists x' < \textsc{Theme}(e)[\textsc{Theme}(e') = x']$

$\forall e \in \text{Dom}(\textsc{Theme}), e' \in D_v$

(71) TECM:

TECM holds of $P \in D_{\langle v,t \rangle}$ iff:

$P(e) \rightarrow (\textsc{Cont}(e) = \textsc{Cont}(\textsc{Theme}(e)))$

$\forall e \in \text{Dom}(\textsc{Cont}) \cap \text{Dom}(\textsc{Theme})$

SUE and non-SDEness for positive cases

(72) a. Katya believes the rumor that *p*′.
(e.g., p’ = *Anton has snowboarded)*

b. Katya believes the rumor that *p*.
(e.g., p = Anton has snowboarded last Friday)

- Goals:
  - Show that (72b) Strawson-entails (72a).
  - Show that (72a) doesn’t Strawson-entail (72b).
- If we can demonstrate this, it will hold that this creates an environment that is SUE but not SDE.
- The basic proof strategy is completely parallel for the negative cases; see (Bondarenko & Elliott 2024) for details.

(73) a. *Assume (72b)'s presupposition is true:*
$\exists!r[\text{rumor}(r) \wedge \textsc{Cont}(r) = p]$

b. *Assume (72b) is true:*
$\exists e[\text{believe}(e) \wedge \textsc{Holder}(e) = \text{K} \wedge \textsc{Theme}(e) = r]$

c. *Assume (72a)'s presupposition is true:*
$\exists!r'[\text{rumor}(r') \wedge \textsc{Cont}(r') = p']$

d. $\textsc{Cont}(e) = p$ via TECM

e. $\exists e' < e[\textsc{Cont}(e') = p']$ via MSI, given $p' < p$

f. $\exists r'' < r[\text{rumor}(r'') \wedge \textsc{Theme}(e') = r'']$ via MSO

g. $\textsc{Cont}(r'') = p'$ via TECM

h. $r'' = r'$ via uniqueness

i. $\exists e'[\text{believe}(e') \wedge \textsc{Holder}(e') = \text{K} \wedge \textsc{Theme}(e') = r']$
generalization over e'

(74) a. (72a)'s presupposition is true:
$\exists!r'[\text{rumor}(r') \wedge \textsc{Cont}(r') = p']$

b. (72a) is true:
$\exists e' \leq w[\text{believe}(e') \wedge \textsc{Holder}(e') = \text{K} \wedge \textsc{Theme}(e') = r']$

c. (72b)'s presupposition is true:
$\exists!r[\text{rumor}(r) \wedge \textsc{Cont}(r) = p]$

d. $r \neq r'$ from functionality

e. $\textsc{Cont}(e') = p'$ via TECM

N.b.: no guarantee of a belief with content p!

Extensions and loose ends

Closure under Conjunction

- We still fail to derive closure under conjunction.

(75) a. Mitya believes that Jessica married an American,

b. ...and Mitya believes that Jessica married a philosopher.

c. ⇒ Mitya believes that Jessica married an American philosopher.

- (75a) and (75b) are still about distinct believing eventualities.
  - (75a) guarantees the existence of (sub-)believings corresponding to every proposition strictly weaker than *Jessica married an American*.
  - (75b) guarantees the existence of (sub-)believings corresponding to every proposition strictly weaker than *Jessica married a philosopher*.
  - MSI fails to guarantee the existence of believing with content *Jessica married an American philosopher*.

(76) **Summing contentful entities:**

$$\textsc{Cont}(x \oplus y) = \textsc{Cont}(x) \cap \textsc{Cont}(y) \qquad \forall x, y \in \text{Dom}(\textsc{Cont})$$

- Once we assume that an attitude holder's believings are closed under mereological summation, the existence of a believing with content p, and the existence of a believing with content q, guarantees the existence of a believing with content $p \cap q$

Summing contentful entities ii

(77) a. $\exists e \leq w[\textsc{Holder}(e) = \text{M} \wedge \text{believing}(e) \wedge \textsc{Cont}(e) = p]$

b. $\exists e' \leq w[\textsc{Holder}(e') = \text{M} \wedge \text{believing}(e') \wedge \textsc{Cont}(e') = q]$

c. $\textsc{Holder}(e \oplus e') = \text{M} \wedge \text{believing}(e \oplus e')$ by closure under summation

d. $\textsc{Cont}(e \oplus e') = \textsc{Cont}(e) \cap \textsc{Cont}(e') = p \cap q$ by (76)

e. $\therefore \exists e''[\textsc{Holder}(e'') = \text{M} \wedge \text{believe}(e'') \wedge \textsc{Cont}(e'') = p \cap q]$

- (Pasternak 2018a,b, Haslinger & Schmitt 20210).

(78) Context: *Paul just got married, and his cousins Arnie and Beatrice, who have never met, just caught wind of it. Arnie suspects that Paul's husband is rich, and has no other relevant opinions. Beatrice thinks he's a New Yorker, and has no other relevant opinions.*
Paul's cousins think that he married a rich New Yorker.

(79) **Parthood for propositions:**
$p' \leq p$ iff p' is semantically entailed by p (i.e., $p' \supseteq p$).

(80) Context: *Mitya believes that Jessica married an American philosopher*.

a. What M. believes is partly that J. married an American.

b. #What M. believes is partly that J. married a linguist or a philosopher.

Refining parthood ii

- Informational parthood can be defined in terms of a stricter notion of entailment: *conjunctive parthood* (Fine 2017c,a,b).
- Here I'll give a minimal sketch in terms of *alternative semantics* (Hamblin 1973, Kratzer & Shimoyama 2002).
- Can also be formalized in truthmaker semantics (Fine 2017c, Moltmann 20200, Yablo 20140) and inquisitive semantics (Ciardelli, Groenendijk & Roelofsen 2019).

(81) **Alternative semantics**

a. $[\![\text{S}]\!] := \{ [\![\text{S}]\!] \}$

b. $[\![\text{S and S'}]\!] := \{ [\![\text{S and S'}]\!] \}$

c. $[\![\text{S or S'}]\!] := \{ [\![\text{S}]\!] , [\![\text{S'}]\!] \}$

d. $[\![\text{not S}]\!] := \{ W - \bigcup [\![\text{S}]\!] \}$

(82) **Classical entailment in alternative semantics:**

Q semantically entails Q' iff $\bigcup Q \subseteq \bigcup Q'$ $\quad \forall Q, Q' \subseteq \text{Pow}(W)$

(83) **Conjunctive parthood:**

Q' is a conjunctive part of Q iff

$\forall p \in Q, \exists p' \in Q', p \subseteq p'$ and $\forall p' \in Q', \exists p \in Q, p \subseteq p'$

$\forall Q, Q' \subseteq \text{Pow}(W)$

(84) $Q' :=$ [Jessica married a linguist or philosopher]

$= \{ \underbrace{[\![\text{J. married a linguist}]\!]}_{p_1}, \underbrace{[\![\text{J. married a philosopher}]\!]}_{p_2} \}$

$Q :=$ [Jessica married an American linguist]

$= \{ \underbrace{[\![\text{J. married an American linguist}]\!]}_{p_3} \}$

a. $p_3 \subseteq p_1$

b. $p_3 \not\subseteq p_2$

c. $\exists p' \in Q', p \in Q, p \not\subseteq p'$

d. $\therefore Q'$ is not a conjunctive part of Q

(85) **Parthood for propositions (alternative semantics):**

$Q' \leq Q$ iff Q' is a *conjunctive part* of Q.

Conclusion

Summing up

- We developed a new perspective on monotonicity, radically departing from the Hintikkan view that attitude verbs are universal modals.
- Instead, it arises as a consequence of how the part-whole structures of attitudinal eventualities is related to the part-whole structures of their contents.
- If this proposal is on the right track, then the Kratzerian approach to clausal embedding (Kratzer 2006), and in particular the implementation in terms of equality (Moulton 2009, Elliott 2017, Bondarenko 2022) seems like a very viable approach to the semantics of attitude reports and clausal embedding more generally.
- Next on the agenda: attitude verbs beyond *believe*.

Fin


Bach, Emmon. 1986. **The algebra of events.** *Linguistics and Philosophy* 9(1). 5–16. https://doi.org/10.1007/BF00627432. http://dx.doi.org/10.1007/BF00627432.


Bassi, Itai & Tanya Bondarenko. 2020. **Composing CPs: evidence from disjunction and conjunction.** Presentation given at SALT 30. https://osf.io/m9bge/ (14 September, 2020).


Bondarenko, Tanya & Patrick D. Elliott. 2024. **Monotonicity via mereology in the semantics of attitude reports.** Unpublished manuscript. Harvard/HHU. https://ling.auf.net/lingbuzz/008158.


Bondarenko, Tatiana Igorevna. 2022. ***Anatomy of an Attitude.*** Massachusetts Institute of Technology Thesis. https://dspace.mit.edu/handle/1721.1/147213 (11 February, 2024).


Brown, Campbell. 2022. **The Significance of Value Additivity.** *Erkenntnis* 87(6). 2547–2570. https://doi.org/10.1007/s10670-020-00315-3. https://doi.org/10.1007/s10670-020-00315-3 (14 February, 2024).


Castañeda, Hector-Neri. 1967. **Comments.** In Nicholas Resher (ed.), *The logic of decision and action*, 104–112. Pittsburgh: University of Pittsburgh Press.


Champollion, Lucas & Manfred Krifka. 2016. **Mereology.** In Maria Aloni & Paul Dekker (eds.), *The Cambridge handbook of formal semantics*.


Ciardelli, Ivano, J. A. G. Groenendijk & Floris Roelofsen. 2019. ***Inquisitive semantics.*** First edition (Oxford Linguistics 6). Oxford, United Kingdom: Oxford University Press. 1 p.


Crnič, Luka. 2019. **Any: Logic, likelihood, and context (Pt. 2).** *Language and Linguistics Compass* 13(11). e12353. https://doi.org/10.1111/lnc3.12353. https://onlinelibrary.wiley.com/doi/abs/10.1111/lnc3.12353 (5 April, 2024).


Davidson, Donald. 1967. **The logical form of action sentences.** In Nicholas Rescher (ed.), *The logic of decision and action*. University of Pittsburgh Press.


Djarv, Kajsa. 2019. **Factive And Assertive Attitude Reports.** *Publicly Accessible Penn Dissertations*. https://repository.upenn.edu/edissertations/3645.


Elliott, Patrick D. 2017. ***Elements of clausal embedding.*** UCL dissertation.

Elliott, Patrick D. 2020. **A Plea for equality: Remarks on Moltmann's semantics for clausal embedding.** *Theoretical Linguistics* 46(3-4). 241–251. https://doi.org/10.1515/tl-2020-0013. https://www.degruyter.com/view/journals/thli/46/3-4/article-p241.xml (13 December, 2020).

Fauconnier, Gilles. 1975. **Polarity and the Scale Principle.** *Chicago Linguistics Society* 11. 188–199.

Fauconnier, Gilles. 1978. **Implication Reversal in a Natural Language.** In F. Guenthner & S. J. Schmidt (eds.), *Formal Semantics and Pragmatics for Natural Languages*, 289–301. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-009-9775-2_10. http://link.springer.com/10.1007/978-94-009-9775-2_10 (5 April, 2024).


Fine, Kit. 2017a. **A Theory of Truthmaker Content I: Conjunction, Disjunction and Negation.** *Journal of Philosophical Logic* 46(6). 625–674. https://doi.org/10.1007/s10992-016-9413-y.


Fine, Kit. 2017b. **A Theory of Truthmaker Content II: Subject-matter, Common Content, Remainder and Ground.** *Journal of Philosophical Logic* 46(6). 675–702. https://doi.org/10.1007/s10992-016-9419-5.


Fine, Kit. 2017c. **Truthmaker Semantics.** In *A Companion to the Philosophy of Language*, 556–577. John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118972090.ch22.


Gajewski, Jon & I-Ta Chris Hsieh. 2015. **Comments on Negative Polarity Items in definite descriptions.** In *The Art and Craft of Semantics: A Festschrift for Irene Heim*, vol. 1, 2 vols. Massachusetts Institute of Technology: MITWPL.


Ginzburg, Jonathan. 1995. **Resolving Questions, II.** *Linguistics and Philosophy* 18(6). 567–609. https://www.jstor.org/stable/25001607 (5 April, 2024).


Guerzoni, Elena & Yael Sharvit. 2007. **A question of strength: on NPIs in interrogative clauses.** *Linguistics and Philosophy* 30(3). 361–391. https://doi.org/10.1007/s10988-007-9014-x. https://doi.org/10.1007/s10988-007-9014-x (5 April, 2024).

Hacquard, Valentine. 2006. ***Aspects of modality.*** Massachussetts Institute of Technology dissertation. http://dspace.mit.edu/handle/1721.1/37421.

Hamblin, Charles L. 1973. **Questions in montague english.** *Foundations of Language* 10(1). 41–53.

Haslinger, Nina & Viola Schmitt. 2021. **Counterfactual attitude contents and the semantics of plurals in belief contexts.** *Proceedings of Sinn und Bedeutung* 25. 394–411. https://doi.org/10.18148/sub/2021.v25i0.944. https://ojs.ub.uni-konstanz.de/sub/index.php/sub/article/view/944 (23 February, 2024).


Heim, Irene. 1991. **Artikel und definitheit.** In Armin von Stechow & Dieter Wunderlich (eds.), *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung*, 487–535. de Gruyter Mouton.


Heim, Irene & Angelika Kratzer. 1998. ***Semantics in generative grammar.*** (Blackwell Textbooks in Linguistics 13). Malden, MA: Blackwell. 324 pp.


Higgins, Francis Robert. 1973. ***The pseudo-cleft construction in English.*** Massachussetts Institute of Technology dissertation.


Hintikka, Jaakko. 1969. **Semantics for propositional attitudes.** In J. W. Davis, D. J. Hockney & W. K. Wilson (eds.), *Philosophical logic* (Synthese Library 20), 21–45. Springer Netherlands.


King, Jeffrey C. 2002. **Designating propositions.** *Philosophical Review* 111(3). 341–371.

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. 2013a. **Modality and the semantics of embedding.** Talk given at the Amsterdam Colloquium. http://blogs.umass.edu/kratzer/files/2014/01/Kratzer-Semantics-of-Embedding.pdf.

Kratzer, Angelika. 2013b. **Modality for the 21st century.** https://mediaserver.unige.ch/play/80082.

Kratzer, Angelika. 2014. **The semantics of embedding and the syntax of the left periphery.** Talk given at the 2014 Annual Meeting of the Linguistics Association of Great Britain.

Kratzer, Angelika. 2022. **The John Locke Lectures 2022.** https://tinyurl.com/kratzer-john-locke.

Kratzer, Angelika & Junko Shimoyama. 2002. **Indeterminate Pronouns: The View from Japanese.** 1–25. https://works.bepress.com/angelika_kratzer/12/ (10 June, 2021).

Krifka, Manfred. 1998. **The Origins of Telicity.** In Susan Rothstein (ed.). Red. by Gennaro Chierchia, Pauline Jacobson & Francis J. Pelletier, *Events and Grammar*, vol. 70, 197–235. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-011-3969-4_9. http://link.springer.com/10.1007/978-94-011-3969-4_9 (4 November, 2023).

Ladusaw, William. 1979. ***Polarity sensitivity as inherent scope relations.*** University of Texas at Austin dissertation.


Lahiri, Utpal. 1998. **Focus and Negative Polarity in Hindi.** *Natural Language Semantics* 6(1). 57–123. https://doi.org/10.1023/A:1008211808250. https://doi.org/10.1023/A:1008211808250 (12 February, 2024).


Moltmann, Friederike. 2013. ***Abstract objects and the semantics of natural language.*** Oxford University Press. http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199608744.001.0001/acprof-9780199608744.

Moltmann, Friederike. 2020. **Truthmaker semantics for natural language: Attitude verbs, modals, and intensional transitive verbs.** *Theoretical Linguistics* 46(3-4). 159–200. https://doi.org/10.1515/tl-2020-0010. https://www.degruyter.com/document/doi/10.1515/tl-2020-0010/html (7 May, 2024).

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. 2010. **Clausal complements and the wager-class.** In *NELS 38: Proceedings of the 38th annual meeting of the north east linguistic society*, 492. CreateSpace Independent Publishing Platform.

Moulton, Keir. 2015. **CPs: Copies and compositionality.** *Linguistic Inquiry* 46(2). 305–342. https://muse.jhu.edu/journals/linguistic_inquiry/v046/46.2.moulton.html.

Parsons, Terence. 1989. **The progressive in English: Events, states and processes.** *Linguistics and Philosophy* 12(2). 213–241. https://doi.org/10.1007/BF00627660. http://link.springer.com/10.1007/BF00627660 (14 November, 2023).

Parsons, Terence. 1990. ***Events in the semantics of English: A study in subatomic semantics.*** The MIT Press.

Pasternak, Robert. 2018a. ***The mereology of attitudes.*** Stony Brook dissertation.


Pasternak, Robert. 2018b. **Thinking alone and thinking together.** *Semantics and Linguistic Theory* 28(0). 546–565. https://doi.org/10.3765/salt.v28i0.4435. https://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/28.546 (6 October, 2020).


Prior, Arthur N. 1971. ***Objects of thought.*** Oxford, Clarendon Press.


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 (7 October, 2020).


Stowell, Timothy. 1981. ***Origins of phrase structure.*** Massachussetts Institute of Technology dissertation.


Uegaki, Wataru. 2016. **Content Nouns and the Semantics of Question-Embedding.** *Journal of Semantics* 33(4). 623–660. https://doi.org/10.1093/jos/ffv009. https://doi.org/10.1093/jos/ffv009 (30 December, 2020).


Vendler, Zeno. 1972. ***Res cogitans: an essay in rational psychology.*** (Contemporary Philosophy). Ithaca, NY: Cornell University Press.


von Fintel, Kai. 1999. **NPI licensing, Strawson entailment, and context dependency.** *Journal of Semantics* (16). 97–148.


Wągiel, Marcin. 2021. ***Subatomic quantification.*** Language Science Press. https://doi.org/10.5281/zenodo.5106382. https://langsci-press.org/catalog/book/317 (19 February, 2024).


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. https://doi.org/10.1111/phpr.12330. http://onlinelibrary.wiley.com/doi/abs/10.1111/phpr.12330 (7 October, 2020).