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**Overview:** In this talk, we propose that *monotonicity* of attitude reports is best modelled with the notion of *incrementality* (Krifka 1998). We adopt a version of the Kratzer (2006)'s approach to clausal embedding that rejects the idea that attitude reports involve universal quantification (Moulton 2009, Elliott 2017, Bondarenko 2022). We show that once it is supplemented with the idea that monotonic attitudes have incremental propositional content, we not only fix the bad predictions of this approach about entailment, but also solve a puzzle about NPI licensing (Sharvit 2023) that other approaches cannot account for.

**Sharvit's puzzle:** Our empirical focus is the paradigm in (1) discovered by Sharvit (2023): in negated belief reports, there is a contrast between an NPI in a *relative* clause modifying the object *rumor*, (1a), on the one hand, and NPIs in *complement* clauses composing with *rumor*, (1b), and with *believe*, (1c), on the other hand. These facts hold for both neg-raising and non-neg-raising interpretations.

(1)  a. *Katya doesn't believe [the rumor [that Anton ever spread]].
     b. Katya doesn't believe [the rumor [that Anton has ever snowboarded]].
     c. Katya doesn't believe [that Anton has ever snowboarded].

Then the contrast between (1a) and (1c) is expected under the view that NPIs must occur in environments that are Strawson Downward Entailing (SDE), but not Strawson Upward Entailing (SUE): the singular definite description in (1a) makes the context SUE, and thus anti-licenses the NPI. But the acceptability of (1b) is surprising: the NPI should be anti-licensed by the singular definite description here too, but it is not.

**Question:** How do we model monotonicity in attitude reports in a way that derives NPI licensing facts?

**Semantics of clausal embedding:** Kratzer (2006) proposed that embedded CPs are *predicates of contentful entities* (*rumors, ideas,* etc.): a clause introducing a proposition $p$ is true of an entity $x$ whose content is a *subset* of $p$. Moulton (2009), Elliott (2017), Bondarenko (2022) argued for a different view of displacement: the content of $x$ should be *equated* with $p$. Here is the meaning of (1b) under these approaches:

(2) *Subset Semantics:* $\neg\text{Believe}(k)(\iota x[\text{rumor}(x) \wedge \text{Cont}(x) \subseteq \{w' \mid \text{Anton snowboarded in } w'\}])$

(3) *Equality Semantics:* $\neg\text{Believe}(k)(\iota x[\text{rumor}(x) \wedge \text{Cont}(x) = \{w' \mid \text{Anton snowboarded in } w'\}])$

As it stands, the equality semantics faces a serious issue: it renders all attitude reports non-monotonic. Let us illustrate this with (1c). Adopting Elliott (2017)'s proposal that when clauses combine with verbs, they provide content of the event argument, (1c) receives denotations in (4) and (5) under the two approaches.

(4) *Subset Semantics:* $\neg\exists e[\text{Holder}(e)=\text{K.}\wedge\text{belief}(e)\wedge\text{Cont}(e) \subseteq \{w' \mid \text{Anton snowboarded in } w'\}]$

(5) *Equality Semantics:* $\neg\exists e[\text{Holder}(e)=\text{K.}\wedge\text{belief}(e)\wedge\text{Cont}(e) = \{w' \mid \text{Anton snowboarded in } w'\}]$

Subset semantics correctly predicts the entailment that if *Katya doesn't believe that Anton snowboarded*, then *she doesn't believe that Anton snowboarded last Friday*: if there is no event whose content is a subset of the set of worlds in which Anton snowboarded, then there is no event whose content is a subset of the set of worlds in which Anton snowboarded last Friday. Equality semantics fails to predict such entailment: absence of a belief whose content is *Anton snowboarded* does not allow us to infer anything about the existence of a belief whose content is *Anton snowboarded last Friday*. This is a significant shortcoming, which Kratzer's semantics and other approaches based on universal quantification (Hintikka 1969) lack.

**Incorrect predictions of existing theories:** Both subset semantics and equality semantics cannot account for the contrast between (1a) and (1b). Equality semantics fails because it generally fails to model monotonicity, and so (1b) is incorrectly predicted to not be SDE. Subset semantics fails because it incorrectly predicts (1b) to be SUE. If *Katya doesn't believe the rumor that Anton snowboarded last Friday*, then there must be a unique rumor $r_1$ whose content is a subset of *Anton snowboarded last Friday*. Any rumor whose content is a subset of *Anton snowboarded last Friday* is also a rumor whose content is a subset of *Anton snowboarded*, and so our unique rumor $r_1$ satisfies the description *rumor that Anton snowboarded*, and it then follows that *Katya doesn't believe the rumor that Anton snowboarded*.

| | Positive version of (1b) | Negative Sentence (1b) | Grammaticality of (1b) |
|---|---|---|---|
| Subset Semantics | ✓ SUE, ✓ SDE | ✓ SUE, ✓ SDE | * |
| Equality Semantics | ✗ SUE, ✗ SDE | ✗ SUE, ✗ SDE | * |
| Desideratum | ✓ SUE, ✗ SDE | ✗ SUE, ✓ SDE | OK |

Table 1: Predictions of theories for sentences like (1b) and their positive counterparts

**PROPOSAL:** We propose that monotonicity of attitude reports should be modelled in terms of an independently needed notion of *incrementality* (Krifka 1998). Once equality semantics is supplemented with such an account, and we recognise special properties of certain THEME arguments, Sharvit's puzzle is solved.

**1. Monotonicity as Incrementality of Content.** Krifka (1998) proposed that the $\theta$-role of objects of verbs like *eat*, i.e. the role of an *incremental theme*, satisfies the property of *Mapping to Subevents* (MSE): if there is an event of eating of the apple, then for each subpart of this apple there is some subevent of the eating event that it is the Theme of. We propose that not only relations that hold between events and individuals can be incremental: *Cont*, a relation that holds between an event and a proposition, can be incremental too, (7).

(6)  $\theta$ *shows Mapping to Subevents (MSE)*, iff:
$$\forall x, y \in D_e, \forall e \in D_v[\theta(e)=x \wedge y \sqsubset x \rightarrow \exists e'[e' \sqsubset e \wedge \theta(e')=y]]$$

(7)  *Cont shows Mapping to Subevents (MSE)*, iff:
$$\forall p, q \in D_{st} \forall e \in D_v[Cont(e)=q \wedge p \sqsubset q \rightarrow \exists e'[e' \sqsubset e \wedge Cont(e')=p]]$$

(8)  *Parthood for Propositions:* $\forall p, q \in D_{st}[p \sqsubset q \iff p \supset q]$

Assuming that for propositions, parthood is the (strict) superset relation, (8), we can now capture monotonicity of *believe* under equality semantics: since $\{w' | \text{Anton snowboarded in } w'\} \supset \{w' | \text{Anton snowboarded last Friday in } w'\}$, if Katya has a belief $e_1$ that Anton snowboarded last Friday, then because *believe*'s content is incremental and MSE holds, (7), she must also have a sub-belief $e_2$ with content *Anton snowboarded*.

**2. Theme-Event Content Matching.** Verbs which take entities with content as their Themes differ in how the content of the Theme relates to the content of the event. For verbs like *believe*, the two must be the same, and (9a) thus entails (9b). With other verbs, e.g. *imagine*, [V [the N CP]] does not entail [V CP].

(9)  a.  Katya believes/imagines the rumor that Anton snowboarded.
b.  Katya believes/imagines that Anton snowboarded.

We propose that verbs like *believe* come with a presupposition of *Theme-Event Content Matching*:

(10)  THEME-EVENT CONTENT MATCHING
Theme-Event Content Matching holds for a predicate of contentful events $P$ iff:
$$\forall x, e \in \text{dom(Cont)}, (P(e) \wedge \text{Theme}(e) = x) \rightarrow Cont(e) = Cont(x)$$

**3. Solving Sharvit's puzzle** Once equality semantics adopts the idea that some attitude verbs have incremental content, (7), and recognises that objects of *believe* have to have the same content as the believing event, (10), we correctly predict that (1b) is a SDE, but not a SUE environment, and the NPI should be licensed.

(11)  Let $P$ = *Katya doesn't believe the rumor that Anton snowboarded*,
$Q$ = *Katya doesn't believe the rumor that Anton snowboarded last Friday*,
$p = \{ w' | \text{Anton snowboarded in } w' \}$, $q = \{ w' | \text{Anton snowboarded last Friday in } w' \}$
a.  *P is true*: $\exists!x[\text{rumor}(x) \wedge \text{Cont}(x) = p]$
$\neg\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge \text{Cont}(e) = \text{Cont}(\iota x[\text{rumor}(x) \wedge \text{Cont}(x) = p])]$
b.  *Q's presupp. is true*: $\exists!x[\text{rumor}(x) \wedge \text{Cont}(x) = q]$
c.  *Assume that Q is false, then the following is true*:
$\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge \text{Cont}(e) = \text{Cont}(\iota x[\text{rumor}(x) \wedge \text{Cont}(x) = q])]$
d.  *By Mapping to Subevents, (7), and the truth of (9c), it follows that*:
$\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge \text{Cont}(e) = p]$
e.  *(9a) and (9d) contradict each other, and thus Q must be true*:
$\neg\exists e[\text{belief}(e) \wedge \text{Holder}(e) = \text{Katya} \wedge \text{Cont}(e) = \text{Cont}(\iota x[\text{rumor}(x) \wedge \text{Cont}(x) = q])]$

Assume that in (11) $P$ is true, presupposition of $Q$ is true, but $Q$ is false. If $Q$ is false, then Katya must have a belief with content $\{ w' | \text{A. snowboarded last Friday in } w' \}$. Then due to MSE, (7), Katya must also have a sub-belief with content $\{ w' | \text{A. snowboarded in } w' \}$. But this contradicts $P$. Hence, $Q$ must be true. Thus, the proposal predicts the environment to be SDE, but not SUE, and derives acceptability of the NPI.

**PROBLEM OF SUBSET SEMANTICS:** Note that adopting Theme-Event Content Matching will not help the subset semantics. Its problem is that if there is a unique *rumor that Anton snowboarded last Friday* and a unique *rumor that Anton snowboarded*, due to the property in (12), they must be the same rumor, and this is why (1b) is SUE. Equality semantics avoids this issue because for it no rumor that $q$ is a rumor that $p$, (13).

(12)  $\forall x, \forall p \supset q [Cont(x) \subseteq q \rightarrow Cont(x) \subseteq p]$

(13)  $\forall x, \forall p \supset q [Cont(x) = q \rightarrow Cont(x) \neq p]$