

Explain and the semantics of embedding*

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May 10th, 2016
London Semantics Day

1 Introduction

Goal

To explain why **DPs headed by content nouns** (content DPs) and ***that*-clauses** give rise to **systematic meaning alternations** with a wide variety of embedding verbs.

Claims to be made

- (i) Content DPs and *that*-clauses combine with verbs in fundamentally different ways: *that*-clauses are **intersective modifiers**, whereas content DPs are genuine **thematic arguments**.
- (ii) **Syntactic category** has no role to play in the analysis of this phenomenon.
- (iii) To get there, it is necessary to make some non-trivial assumptions about the semantics:
 - Logical Forms are **neo-Davidsonian**, i.e., all arguments (including internal arguments) are severed from the verb (Parsons 1990, Schein 1993).
 - No basic type distinction between **individuals** and **eventualities**.
 - *that*-clauses denote **properties of individuals with propositional content** of type $\langle e, t \rangle$ (Kratzer 2006, Moulton 2009, 2015).
 - **Attitude verbs** denote **properties of eventualities** of type $\langle e, t \rangle$, departing from the standard Hintikka semantics.

Empirical focus: PROPOSITIONAL DPs, and how they shed light on substitution failures involving content DPs and *that*-clauses.

(1) Jeremy explained $\left\{ \begin{array}{l} \text{that Cameron resigned} \\ \text{the fact that Cameron resigned} \\ \text{something} \end{array} \right\} \begin{array}{l} \textit{that-clause} \\ \textit{content DP} \\ \textit{propositional DP} \end{array}$

*For useful comments and discussion, I'm very grateful to Klaus Abels, Luke Burke, Ed Keenan, Nathan Klinedinst, Hans van de Koot, Andrew Nevins, Tim Stowell, Yasutada Sudo, Wataru Uegaki, Rebecca Woods, as well as audiences at CLS 52 and the UCLA Roundtable.

2 Pietroski (2000) on *explain*

Pietroski's premises

- (i) *That*-clauses denote **propositions**.
- (ii) *Facts* are **true propositions**.

- (2) *Context: Cameron resigning was a huge surprise, and we have no idea why it happened. Jeremy is an expert on politics, and told us that Cameron was under a huge amount of political pressure.*

Jeremy explained the fact that Cameron resigned. *explanandum reading*

Paraphrase: Jeremy explained why Cameron resigned.

- (3) *Context: There is a large commotion outside 10 Downing Street. We ask Jeremy what's going on.*

Jeremy explained that Cameron resigned. *explanans reading*

Paraphrase: Jeremy's explanation (for something) was that Cameron resigned.

- Given the premises, *that P* and *the fact that P* should be inter-substitutable, contrary to fact.
- **Pietroski's solution:** *explain* can assign two distinct θ -roles:
 - the THEME θ -role to DPs
 - the CONTENT θ -role to CPs.

- Cashed out with neo-Davidsonian Logical Forms.¹

- (4) Jeremy explained the fact that Cameron resigned.

$\exists e[\text{explaining}(e) \wedge \text{AGENT}(e) = \text{Jeremy} \wedge$
 $\text{THEME}(e) = \text{the fact that Cameron resigned}$]

- (5) Jeremy explained that Cameron resigned.

$\exists e[\text{explaining}(e) \wedge \text{AGENT}(e) = \text{Jeremy} \wedge$
 $\text{CONTENT}(e) = \text{that Cameron resigned}$]

- Substitution failures are widespread (see Prior 1971, King 2002 and Uegaki 2015 for discussion).

Content nouns

Fact, rumour, story, idea, hypothesis, proposition, myth, desire, belief, knowledge, thought, suspicion, fear, dream, hope, expectation

- (6) Jeff fears that he is balding.

(6) $\not\equiv$ (7), (7) $\not\equiv$ (6)

- (7) Jeff fears the $\left\{ \begin{array}{l} \text{rumour} \\ \text{hypothesis} \\ \text{story} \end{array} \right\}$ that he is balding.

¹ I depart from Pietroski here in treating thematic roles as functions instead of relations, following instead Carlson (1984), Parsons (1990), and Landman (1996, 2000) (the Unique Role Requirement).

(8) Jeff knows that he is balding. (8) $\not\equiv$ (9), (9) $\not\equiv$ (8)

(9) Jeff knows the $\left\{ \begin{array}{l} \text{rumour} \\ \text{hypothesis} \\ \text{story} \end{array} \right\}$ that he is balding.

(10) Jeff imagined that he is balding. (10) $\not\equiv$ (11), (11) $\not\equiv$ (10)

(11) Jeff imagined the $\left\{ \begin{array}{l} \text{rumour} \\ \text{hypothesis} \\ \text{story} \end{array} \right\}$ that he is balding.

(12) \llbracket Jeff fears that he is balding \rrbracket
 $= \exists s[\text{fear}(s) \wedge \text{EXPERIENCER}(s) = \text{Jeff} \wedge \text{CONTENT}(s) = \lambda w'.\text{Jeff is balding}_{w'}]$

- For some verbs, an entailment from the DP case to the CP case goes through.

(13) a. Jeff believes that he is balding. (13a) $\not\equiv$ (13b), (13b) \models (13a)
b. Jeff believes the rumour that he is balding.

Uegaki's (2015a,b) generalization

verbs which license the entailment from the (b)-type examples to the (a)-type examples are obligatorily declarative-embedding.

- **Exception:** *expect*

(14) *Jeff expects who will arrive late to the party.

(15) a. Jeff expects $[_{CP}$ that he will bald]. (15a) $\not\equiv$ (15b), (15b) $\not\equiv$ (15a)
b. Jeff expects $[_{DP}$ the rumour that he will bald].

- **Tentative conclusion:** substitution failures are the norm. The entailment from the (b)-type examples to the (a)-type examples sometimes goes through, due to arbitrary facts about what it means to be the theme of, e.g., *believe*.

Question

Why is the "CONTENT θ -role" only available to *that*-clauses, and the THEME θ -role only available to content DPs? Is syntactic category really what's at issue here?

3 Syntactic category vs. semantic type

- *believe*-type verbs and *think*-type verbs

(16) a. Jeff believes $[_{CP}$ that Britta will be late].
b. Jeff believes $[_{DP}$ the {rumour|story|claim} that Britta will be late].

(17) a. Jeff {thinks|said} $[_{CP}$ that Britta will be late].
b. *Jeff {thinks|said} $[_{DP}$ the {rumour|story|claim} that Britta will be late].

- Is this due to c-selection (Grimshaw 1979, 1981) or case-assignment (Pesetsky 1982, 1991)? **No** – evidence from propositional DPs.

Propositional DPs

- (i) DPs headed by *thing*: *the same thing, a different thing, most things, two things, something, everything, etc.*
- (ii) The simplex *wh*-phrase *what*.
- (iii) Anaphoric expressions, such as *it* and *that*.
- (iv) Null operators in comparatives (Kennedy & Merchant 2000).

- **Observation:** although *think*-type verbs do not tolerate content DPs, they tolerate propositional DPs.

- (18) a. Jeff thinks that Britta will be late, and Shirley thinks the same thing.
 b. Jeff thinks that Britta will be late, and Shirley thinks that too.
 c. What does Jeff think *t*?
 d. Jeff is thinking everything that Shirley is.
- (19) a. Jeff said that Britta will be late, and Shirley said the same thing.
 b. Jeff said that Britta will be late, and Shirley said that too.
 c. What did Jeff say *t*?
 d. Jeff said everything that Shirley said

- Other verbs which pattern with *think* and *say* in disallowing content DPs, but allowing propositional DPs: *hope, argue, find out, etc.*

- **Possible response:** propositional DPs are syntactically CPs.

Syntactic properties of propositional DPs

- Evidence from prepositional complements:

- (20) a. Jeff hopes for [_{DP} a new bicycle].
 b. *Jeff hopes for [_{DP} that Shirley will leave soon].
 c. Jeff hopes for the same thing as Abed – namely, that Shirley will leave soon.
 d. Q: What does Jeff hope for *t*? A: [_{CP} that Shirley will leave soon].
 e. Abed hopes that Shirley will leave soon. Jeff hopes for that too.

- Evidence from passivization:

- (21) a. *It is believed [_{DP} the rumour].
 b. It is believed [_{CP} that Jeff has a new bicycle].
 c. *It is believed the same thing as Abed – namely, that Shirley will leave soon.
 d. Q: *What is it believed *t*? A: [_{CP} that Shirley will leave soon].
 e. It is believed by Abed that Shirley will leave soon. It is believed that by Jeff too.

- There is no syntactic distinction between content DPs and propositional DPs.²
- **Payoff:** no c-selectional/case-assignment differences between verbs like *believe* and verbs like *think*.
- **Propositional DPs and *explain***

Question

Does the assignment of CONTENT vs. THEME θ -roles reflect the syntactic category of the complement?

- (22) *Context: Cameron resigning was a huge surprise, and we have no idea why it happened. Jeremy is an expert on politics, and told us that Cameron was under a huge amount of political pressure.*
- Jeremy explained something – namely, the fact that Cameron resigned.
 - Q: What did Jeremy explain? A: The fact that Cameron resigned.
explanandum reading
- (23) *Context: There is a large commotion outside 10 Downing Street. We ask Jeremy what's going on.*
- Jeremy explained something – namely, that Cameron resigned.
 - Q: What did Jeremy explain? A: That Cameron resigned.
explanans reading

- Propositional DPs are compatible with both readings.

Summary of results

- *that*-clauses are associated with the CONTENT role.
- content DPs are associated with the THEME role.
- propositional DPs may be associated with either role.

4 The analysis

Roadmap

- §4.1 outline the semantics of *that*-clauses assumed here.
- §4.2 reminder of basic assumptions in neo-Davidsonian event semantics.
- §4.3 no basic type distinction for individuals and eventualities.
- §4.4 outline proposed LF for embedded *that*-clauses, and show how the system

² By way of contrast, the pro-form *so* patterns syntactically with *that*-clauses – it is disallowed as the complement to a preposition (ia), and it may survive passivization (ib). Hence I do not include *so* in the class of propositional DPs.

- (i) a. Jeff hopes (*for) so.
b. It is believed so.

outlined here derives the distinction between *that*-clauses and content DPs.

4.1 Semantics of *that*-clauses and content DPs

- The basic meaning of a *that*-clause is a **property of individuals with propositional content** of type $\langle e, t \rangle$ (Kratzer 2006, 2013, 2014, Moulton 2009, 2015). A covert functional head, F_{PROP} implements the **proposition-to-property shift**.³

$$(24) \quad \llbracket F_{\text{PROP}} \rrbracket = \lambda p_{st} \cdot \lambda x_e \cdot \mathcal{F}_{\text{cont}}(w)(x) = p$$

- Where $\mathcal{F}_{\text{cont}}$ is a function in the metalanguage which maps a world w and an abstract object x to x 's propositional content in w (Kratzer 2006, Moulton 2009, Uegaki 2015, etc.).
- The (simplified) LF of an embedded declarative is therefore as follows:

$$(25) \quad \dots \text{that Mary left.}$$

- *That*-clauses combine with content nouns via *Predicate Modification (PM)* (Heim & Kratzer 1998).

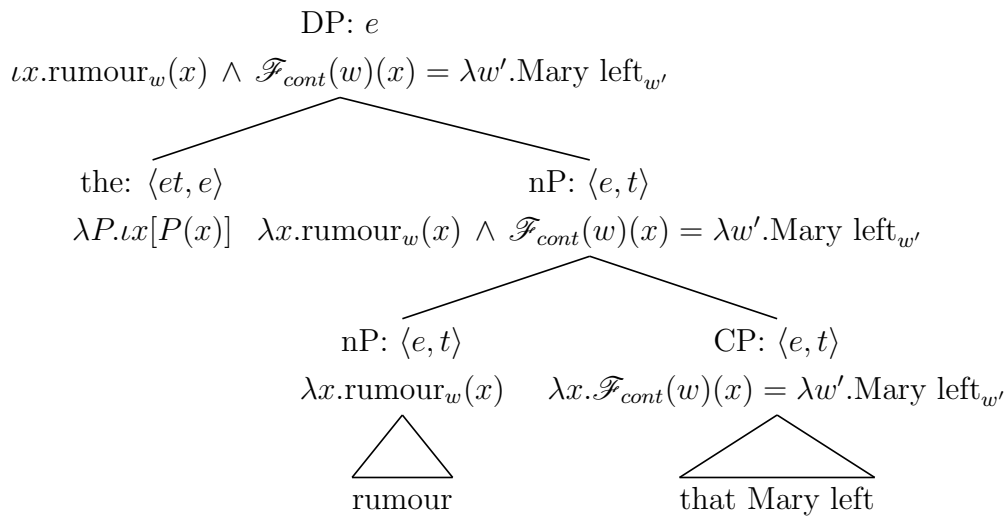
$$(26) \quad \llbracket [n \sqrt{\text{rumour}}] \rrbracket = \lambda x \cdot \text{rumour}_w(x)$$

$$(27) \quad \text{PM}(\llbracket \text{rumour} \rrbracket)(\llbracket \text{that Mary left} \rrbracket) = \lambda x_e \cdot \text{rumour}_w(x) \wedge \mathcal{F}_{\text{cont}}(w)(x) = \lambda w' \cdot \text{Mary left}_{w'}$$

- **Composition of a content DP:**

$$(28) \quad \llbracket \text{the} \rrbracket = \lambda P_{\sigma t} \cdot \iota x_{\sigma} [P(x)]$$

$$(29) \quad \dots \text{the rumour that Mary left.}$$



³ I depart here from Kratzer (2013, 2014) and Moulton (2009, 2015), who assume that *that* is semantically contentful. I show in a later section that this makes undesirable predictions for conjoined *that*-clauses.

Summary so far

- The semantic value of a content DP is an individual of type e .
- The semantic value of a *that*-clause is a property of type $\langle e, t \rangle$.

4.2 Neo-Davidsonian event semantics

- All arguments are severed from the verb. I will assume, therefore, that verbs (specifically, verbalized roots) uniformly denote properties of events, e.g.,^{4,5}

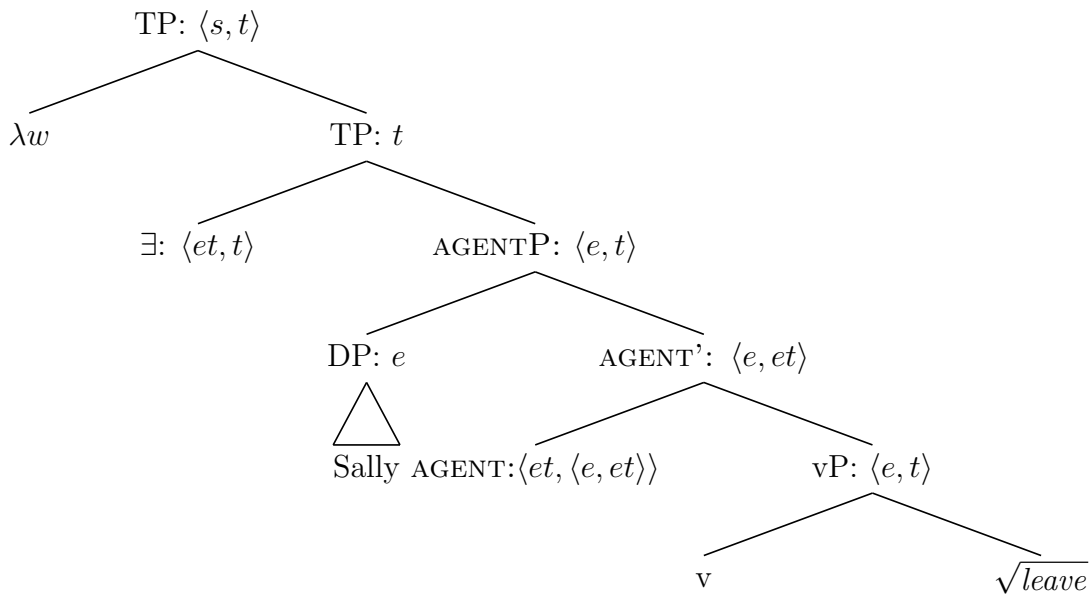
$$(30) \quad \llbracket [\text{vP } v \sqrt{\text{leave}}] \rrbracket = \lambda e. \text{leaving}_w(e)$$

- All arguments are introduced via *thematic functions*, which I define as follows.^{6,7}

$$(31) \quad \begin{array}{l} \text{a. } \llbracket \text{AGENT} \rrbracket = \lambda f. \lambda x. \lambda e. \text{AGENT}_w(e) = x \wedge f(e) \\ \text{b. } \llbracket \text{THEME} \rrbracket = \lambda f. \lambda x. \lambda e. \text{THEME}_w(e) = x \wedge f(e) \\ \text{etc.} \end{array}$$

- LF of a simple intransitive sentence:

$$(32) \quad \text{Sally left.}$$



$$(33) \quad \dots = \lambda w. \exists e [\text{AGENT}_w(e) = \text{Sally} \wedge \text{leaving}_w(e)]$$

⁴ I use e, e' , etc. as names for variables ranging over events. I do not, however, assume any basic type-distinction between individuals and events. I discuss this further in §4.3.

⁵ See Ahn (2016) for a recent argument based on *out*-prefixation that internal arguments must be severed from the verb too.

⁶ Ultimately, it is probably not correct to posit thematic functions in the object language, since thematic distinctions never seem to be lexicalized cross-linguistically (see Lohndal 2014 for discussion). The functional heads I label AGENT, THEME etc. are placeholders for the functional heads responsible for introducing thematic arguments.

⁷ Currying thematic functions this way allows them to introduce a thematic argument as a specifier. This gels nicely with a constructivist semantics for the extended verbal projection (see e.g., Lohndal 2014).

4.3 Eventualities and individuals

- I have implicitly assumed no basic type distinction between *individuals*, such as chairs, tables and people, and *eventualities*⁸, such as running, swimming and talking. Both are subsets of domain of entities D_e .
- A basic type-distinction should only be made where there is a (linguistic) reason for doing so. Nothing much goes wrong if we dispense with it.

- (34) a. John’s running was slow.
b. #John’s running was blonde.

- **Standard assumption:** *John’s running* denotes an event, and *blonde* denotes a property of individuals. If events and individuals have different semantic types, then (34) is predicted to result in a type-mismatch.

- (35) a. The assailant is fierce.
b. #The wardrobe is fierce.

- Uncontroversially, predicates place certain sortal restrictions on their arguments, not just type restrictions. Whether or not this is really linguistic is a moot point – the fact is that the predicate *fierce* requires its argument to be an *animate* individual. For concreteness, we can encode this in the denotation of the adjective via a presupposition.

(36) $\llbracket \text{fierce} \rrbracket = \lambda x_e : \text{animate}_w(x). \text{fierce}_w(x)$

- The explanation for the unacceptability of (35b) carries over straightforwardly to the unacceptability of (34b). The predicate *blonde* places a sortal restriction on its argument (here: that it be animate), and since events aren’t animate, the sentence is judged unacceptable.

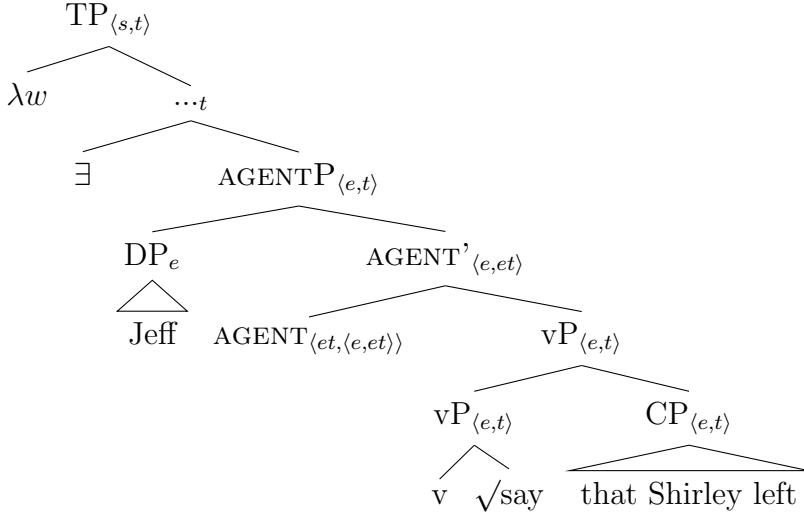
4.4 Semantics of clausal embedding

Claim made here

Both verbs and *that*-clauses denote **properties** of type $\langle e, t \rangle$. They compose via **Predicate Modification**, much like *that*-clauses and content nouns.

- (37) Jeff said that Shirley left.

⁸ Following Bach (1986), I use the term “eventualities” to encompass both **events** and **states**.



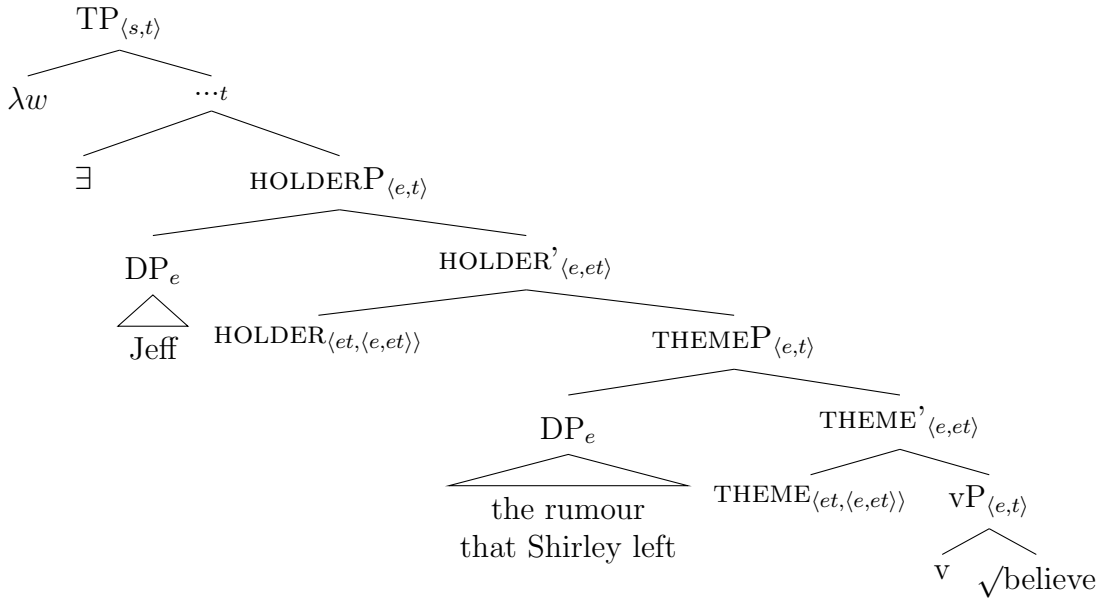
- The *that*-clause combines with the verb via PM and specifies its content.⁹

$$(38) \quad \llbracket \text{vP} \rrbracket = \lambda e. \text{saying}_w(e) \wedge \mathcal{F}_{\text{cont}}(w)(e) = \lambda w'. \text{Shirley left}_{w'}$$

$$(39) \quad \llbracket \text{TP} \rrbracket = \lambda w. \exists e [\text{saying}_w(e) \wedge \text{AGENT}_w(e) = \text{Jeff} \wedge \mathcal{F}_{\text{cont}}(w)(e) = \lambda w'. \text{Shirley left}_{w'}]$$

- Content DPs denote individuals, and therefore cannot combine directly with verbal meanings. Rather, I assume they must be integrated into the structure via a thematic function.

$$(40) \quad \text{Jeff believes the rumour that Shirley left.}$$



⁹ Hacquard (2006) (citing a suggestion by Irene Heim, p.c.) was the first to suggest that attitude verbs are associated with a Davidsonian eventuality with propositional content (thanks to Keir Moulton, p.c., for pointing this out). There are clear connections between the Hacquard's system and the one outlined here, but there are also non-trivial differences. See Appendix B for further discussion.

(41) $\llbracket \text{THEMEP} \rrbracket = \lambda e. \text{belief}_w(s) \wedge \text{THEME}_w(s) = \iota x[\text{rumour}_w(x) \wedge \mathcal{F}_{\text{cont}}(w)(x) = \lambda w'. \text{Shirley left}_{w'}]$

(42) $\llbracket \text{TP} \rrbracket = \lambda w. \exists s[\text{belief}_w(s) \wedge \text{HOLDER}_w(s) = \text{Jeff} \wedge \text{THEME}_w(s) = \iota x[\text{rumour}_w(x) \wedge \mathcal{F}_{\text{cont}}(w)(x) = \lambda w'. \text{Shirley left}_{w'}]]$

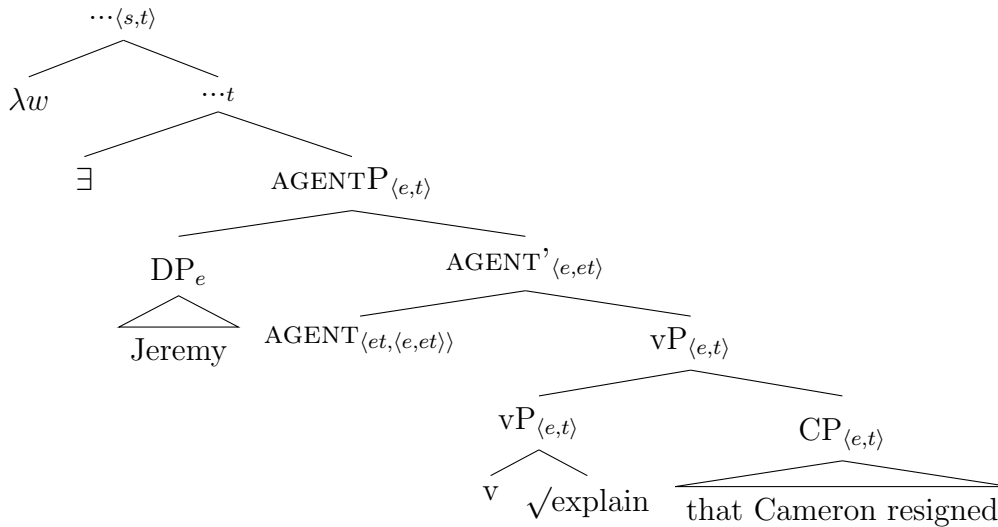
- **believe-type verbs vs. think-type verbs**

- I cash out the distinction between *believe*-type verbs and *think*-type verbs, by assuming that *think*-type verbs do not introduce a THEME, and are therefore essentially intransitive.

- **A tentative suggestion:** we can make sense of the incompatibility between *think*-type verbs and a THEME using technology from Distributed Morphology. Assuming that the spellout of the root is conditioned by the functional heads in the extended verbal projection, we could say that, e.g. $\sqrt{\text{think}}$ does not have well-defined spellout in the context of THEME (or, whichever functional head THEME stands in for).

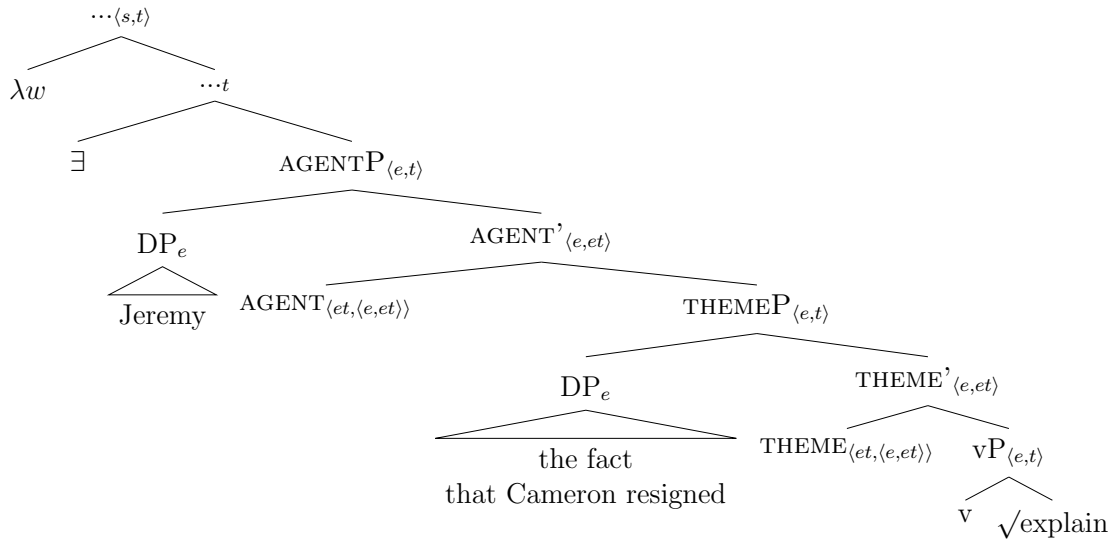
- **explain that P vs. explain the fact that P**

(43) Jeremy explained that Cameron resigned. explanans reading



(44) Jeremy explained the fact that Cameron resigned.

explanandum reading



5 Loose ends

To-do list

- (i) a semantics of propositional DPs that predicts the availability of both THEME and CONTENT readings.
- (ii) a reconciliation of the neo-Davidsonian semantics for attitude verbs with the standard Hintikkan semantics.
- (iii) how to rule out stacked *that*-clause modifiers, and rule in *that*-clause conjunction.

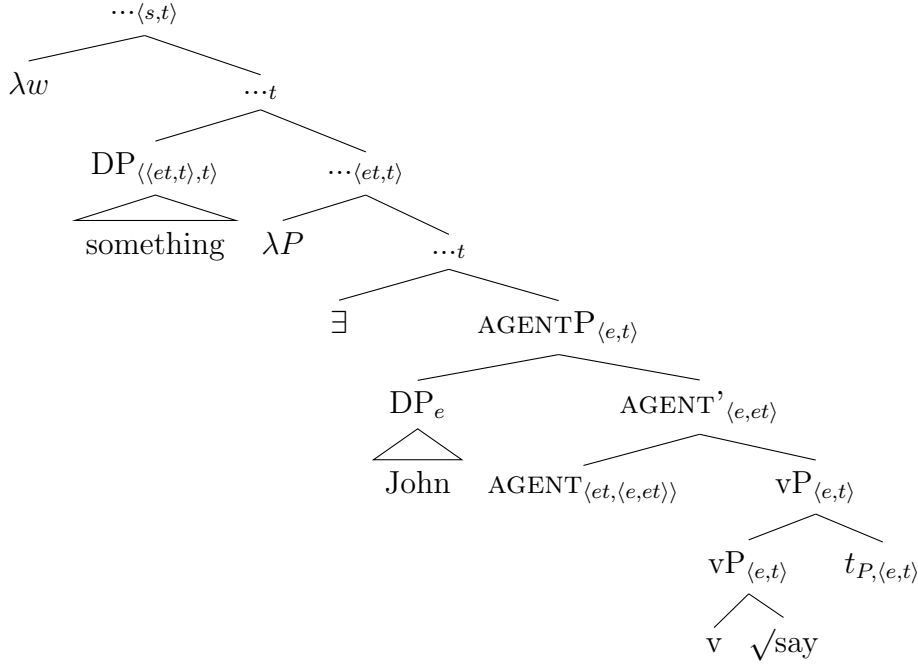
• Semantics of propositional DPs

$$(45) \quad \llbracket \text{THING} \rrbracket = \lambda P_{et}. \forall x, y [(P(x) \wedge P(y)) \rightarrow \mathcal{F}_{cont}(x) = \mathcal{F}_{cont}(y)]$$

$$(46) \quad \llbracket \text{SOME} \rrbracket = \lambda P_{\sigma t}. \lambda Q_{\sigma t}. \exists x_{\sigma} [P(x) \wedge Q(x)]$$

$$(47) \quad \llbracket \text{SOMETHING} \rrbracket = \lambda Q_{et, t}. \exists P_{et} [(\forall x, y [(P(x) \wedge P(y)) \rightarrow \mathcal{F}_{cont}(x) = \mathcal{F}_{cont}(y)]) \wedge Q(P)]$$

(48) John said something.



(49) $\llbracket \text{vP} \rrbracket = \lambda e. \text{saying}(e) \wedge P(e)$

(50) $= \lambda w. \exists P_{et} [(\forall x, y [(P(x) \wedge P(y)) \rightarrow \mathcal{F}_{cont}(w)(x) = \mathcal{F}_{cont}(w)(y)]) \wedge \exists e [\text{saying}_w(e) \wedge \text{AGENT}_w(e) = \text{John} \wedge P(e)]]]$

- **Hintikkan semantics for attitude verbs**

- Standard Hintikkan semantics for, e.g., *believe*.

(51) $\llbracket [\sqrt{\text{believe}}] \rrbracket = \lambda p_{st}. \lambda x_e. \forall w' [w' \in \text{Dox}_{x,w} \rightarrow p(w') = 1]$

Where $\text{Dox}_{x,w} = \{w' \mid \text{it is compatible with what } x \text{ believes in } w \text{ for } w \text{ to be } w'\}$

- A neo-Davidsonian semantics for *believe*(!!!)

(52) $\llbracket [\sqrt{\text{believe}}] \rrbracket = \lambda s. \text{belief}_w(s)$

- We can simply encode the Hintikkan semantics as a *meaning postulate* about what it means for s to be a *belief*-state of which x is the HOLDER.

(53) **Hintikkan meaning postulate for *believe***

In a world w , Given a state s , and an individual x , if $\text{belief}_w(s)$ and $\text{HOLDER}_w(s) = x$, then for every world w' , if $w' \in \text{Dox}_{x,w}$, then $w' \in \mathcal{F}_{cont}(w)(s)$.

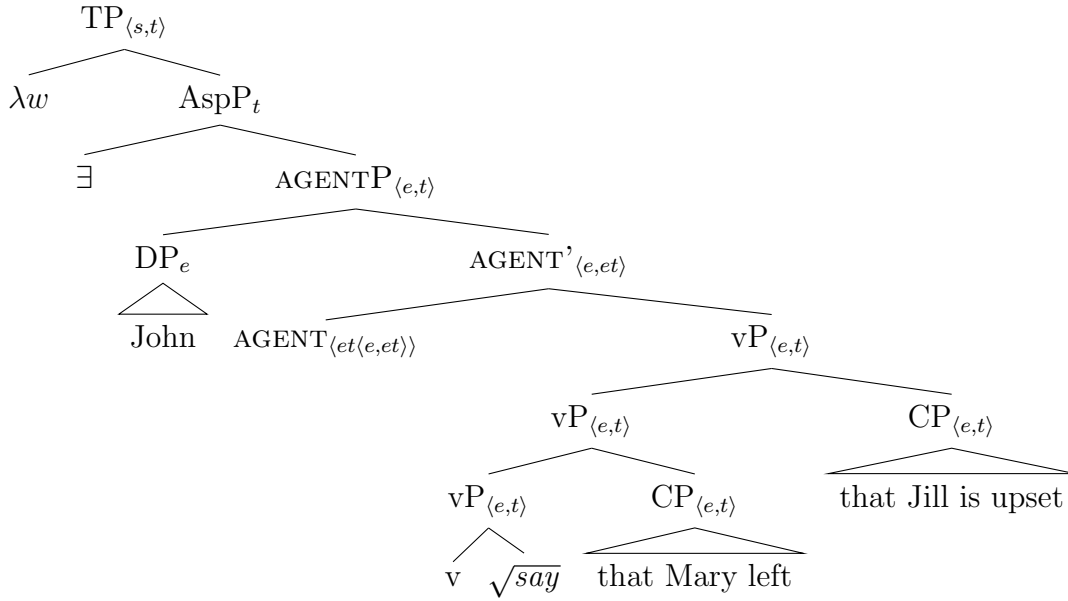
- Scha (1981) makes a similar suggestion for distributive inferences licensed by plurals. *The girls sneezed* implies that each girl in the collection picked out by *the girls* sneezed, but it is not necessary to posit a universal quantifier in the object language to capture this.

- The only real evidence for so-called “phrasal distributivity” (i.e., a universal quantifier in the object language) comes from the interaction between plurals and other quantificational expressions. There is no parallel evidence that attitude verbs involve quantification in the object language.

- **Stacked CPs**

- Treating *that*-clauses as modifiers might seem to predict that stacking CPs should be acceptable, contrary to fact.

(54) *John said [_{CP} that Mary left] [_{CP} that Jill is upset].



(55) ... = $\lambda w. \exists e[\text{saying}_w(e) \wedge \text{AGENT}_w(e) = \text{John} \wedge \mathcal{F}_{cont}(e) = \lambda w'. \text{Mary left}_{w'} \wedge \mathcal{F}_{cont}(e) = \lambda w''. \text{Jill is upset}_{w''}]$

- \mathcal{F}_{cont} is a *function*. The functionhood of \mathcal{F}_{cont} rules out the Logical Form in (55) as a contradiction, since the content function applied to a given *saying* event supplies a uniquely specified proposition.

- **Conjoined CPs**

- Evidence from conjoined CPs supports our decision to locate the proposition-to-property shift in a high functional head, rather than in the complementizer *that* (as in, e.g., Moulton 2009).

(56) John said [_{CP₁} that Mary left] and [_{CP₂} that Sally is upset].

- If we locate the proposition-to-property shift in *that*, we predict (56) to lead to a contradiction, just so long as conjunction takes scope over CONT.

(57) a. $\llbracket \text{CP}_1 \rrbracket = \lambda x. \mathcal{F}_{cont}(w)(x) = \lambda w'. \text{Mary left}_{w'}$
 b. $\llbracket \text{CP}_2 \rrbracket = \lambda x. \mathcal{F}_{cont}(w)(x) = \lambda w'. \text{Sally is upset}_{w'}$

$$(58) \quad \text{PM}(\llbracket \text{CP}_1 \rrbracket)(\llbracket \text{CP}_2 \rrbracket) = \lambda x. (\mathcal{F}_{\text{cont}}(w)(x) = \lambda w'. \text{Mary left}_{w'}) \\ \wedge (\mathcal{F}_{\text{cont}}(w)(x) = \lambda w'. \text{Sally is upset}_{w'})$$

$$(59) \quad \llbracket (56) \rrbracket = \lambda w. \exists e [\text{saying}_w(e) \wedge \text{AGENT}_w(e) = \text{John} \wedge \mathcal{F}_{\text{cont}}(w)(e) = \lambda w'. \text{Mary left}_{w'} \\ \wedge \mathcal{F}_{\text{cont}}(w)(e) = \lambda w'. \text{Sally is upset}_{w'}]$$

- We can resolve this issue via F_{PROP} .

$$(60) \quad \llbracket F_{\text{PROP}} \rrbracket = \lambda p. \lambda x. \mathcal{F}_{\text{cont}}(w)(x) = p$$

- We can take *that* to be semantically vacuous (i.e. to denote an identity function).

$$(61) \quad \llbracket \text{that} \rrbracket = \lambda p_{st}. p$$

- Assuming that *and* denotes boolean conjunction, the result of conjoining two propositions is a proposition.

$$(62) \quad \text{and}(\llbracket \text{CP}_1 \rrbracket)(\llbracket \text{CP}_2 \rrbracket) = \lambda w'. \text{Mary left}_{w'} \wedge \text{Sally is upset}_{w'}$$

$$(63) \quad \llbracket F_{\text{PROP}} \rrbracket((63)) = \lambda x. \mathcal{F}_{\text{cont}}(w)(x) = \lambda w'. \text{Mary left}_{w'} \wedge \text{Sally is upset}_{w'}$$

- Combining the resulting denotation with the rest of the sentence results in the right truth-conditions.

$$(64) \quad = \lambda w. \exists e [\text{saying}_w(e) \wedge \text{AGENT}_w(e) = \text{John} \wedge \mathcal{F}_{\text{cont}}(w)(e) = [\lambda w'. \text{Mary left}_{w'} \wedge \\ \text{Sally is upset}_{w'}]]$$

- **Open problem**

$$(65) \quad * \text{John fears} \llbracket_{\text{DP}} \text{the rumour that he is going bald} \rrbracket \llbracket_{\text{CP}} \text{that he is getting old} \rrbracket.$$

$$(66) \quad = \lambda w. \exists s [\text{fear}_w(s) \wedge \text{HOLDER}_w(s) = \text{John} \wedge \text{THEME}_w(s) = \iota x [\text{rumour}(x) \\ \wedge \mathcal{F}_{\text{cont}}(w)(x) = \lambda w'. \text{John is going bald}_{w'}] \\ \wedge \mathcal{F}_{\text{cont}}(w)(s) = \lambda w''. \text{John is getting old}_{w''}]$$

6 Conclusion

- I develop a neo-Davidsonian analysis in which the difference between content DPs and *that*-clauses falls out as a matter of course: content DPs denote/quantify over individuals, and therefore must be integrated into the Logical Form as thematic arguments, whereas *that*-clauses are interpreted as *modifiers*.
- This has the advantage of providing a completely uniform account of (i) how *that*-clauses combine with nouns, and (ii) how *that*-clauses combine with verbs.
- To the extent that this account is successful, it can be considered an indirect argument for the position that ALL arguments, not just external arguments, are severed from the verb (see Lohndal 2014 for an overview).

- **Syntactic residue:** there is a small class of verbs which are incompatible with both content DPs and propositional DPs, but which surprisingly allow *that*-clauses.

- (67) a. Jeff complained that Britta messed up.
 b. *Jeff complained the rumour that Britta messed up.
 c. *Jeff complained the same thing as Abed – namely, that Britta messed up.
 d. Q: *What did Jeff complain *t*? A: [_{CP} that Britta messed up].
 e. Abed complained that Britta messed up. *Jeff complained that too.
- (68) Verbs which embed a *that*-clause, but not a propositional DP: *complain, pray, boast, brag, object, advise, warn, caution, counsel, marvel*.

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A Content type-shifting

- My analysis presupposes that content DPs are *always* interpreted as individuals of type e .
- King (2002) provides a brief argument that content DPs may denote propositions, and Uegaki (2015) implements this idea as a type-shifter `CONT` from individuals of type e to propositions of type $\langle s, t \rangle$. `CONT` is defined as below:¹⁰

$$(69) \quad \llbracket \text{CONT} \rrbracket = \lambda x_e. \mathcal{F}_{cont}(w)(x)$$

- King’s observation is that both *that*-clauses and content DPs are compatible with predicates of truth and falsity.

- (70) a. That Shirley is a fraud is false.
 b. The rumour is false.

- King assumes that *that*-clauses always denote propositions, and that predicates of truth and falsity are predicates over propositions. It follows that in order to account for the acceptability of (70b) it must be at least possible for *the rumour* to denote a proposition.

- (71) King-type denotation for predicates of truth and falsity
 $\llbracket \text{false} \rrbracket = \lambda p_{st}. \lambda w. p(w) = 0$

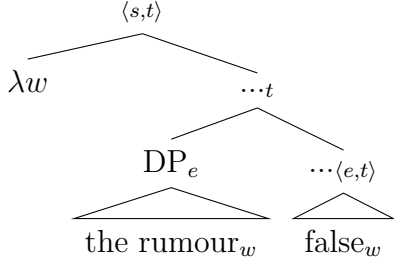
- In my framework, it is in fact completely straightforward to account for the acceptability of (70b). I simply assume that predicates of truth and falsity are predicates over individuals with propositional content.

$$(72) \quad \llbracket \text{false} \rrbracket = \lambda x_e. \mathcal{F}_{cont}(w)(x)(w) = 0$$

- (72) is simply applied to the individual denoted by (70b).

- (73) The rumour is false.

¹⁰Uegaki in fact provides a somewhat more complex denotation in the end, but the details will not be relevant here.



$$(74) = \lambda w. \widehat{\mathcal{F}}_{cont}(w)(\iota x[\text{rumour}(x)])(w) = 0$$

- Evidence against the type-shifting/ambiguity theory of content nouns are examples such as the following (*propositions* cannot spread quickly):

(75) The rumour is false and is spreading quickly.

B A definiteness effect and the formulation of F_{PROP}

- Recall the formulation of the functional head responsible for the proposition-to-property shift:

$$(76) \llbracket F_{\text{PROP}} \rrbracket = \lambda p_{st}. \lambda x_e. \mathcal{F}_{cont}(w)(x) = p$$

- This is not an innocent formulation. *Equating* p with the content of x is what is responsible for ruling out stacked *that*-clauses.
- The resulting semantics of a simple *belief* statement are as follows:

$$(77) \llbracket \text{John believes that Mary left} \rrbracket = \lambda w. \exists s[\text{AGENT}_w(s) = \text{John} \wedge \text{belief}_w(s) \wedge \mathcal{F}_{cont}(w)(s) = \lambda w'. \text{that Mary left}_{w'}]$$

- One potential problem is that (77) is intuitively true in a scenario where the content of John's belief state is *that Mary left and that Sally is upset* – or indeed any proposition entailing *that Mary left*.
- I conjecture here that we can capture such entailments by virtue of the algebraic structure of the domain of eventualities (Bach 1986), and the relation of the domain of eventualities to the domain of propositions.
- John's belief state s , where $\mathcal{F}_{cont}(w)(s) = \lambda w'. \text{that Mary left and Sally is upset}_{w'}$ can be represented as the sum of two sub belief-states s' and s'' , where $\mathcal{F}_{cont}(w)(s') = \lambda w'. \text{that Mary left}_{w'}$ and $\mathcal{F}_{cont}(w)(s'') = \lambda w'. \text{that Sally is upset}_{w'}$.
- One conceivable formulation of F_{PROP} which does without this complication is as follows (this results in a similar semantics for attitude verbs to that proposed by Hacquard 2006).

$$(78) \llbracket F_{\text{Hacquard}} \rrbracket = \lambda p_{st}. \lambda x_e. \mathcal{F}_{cont}(w)(x) \supseteq p$$

$$(79) \dots = \lambda w. \exists s[\text{AGENT}_w(s) = \text{John} \wedge \text{belief}_w(s) \wedge \mathcal{F}_{cont}(w)(s) \supseteq \lambda w'. \text{that Mary left}_{w'}]$$

- Adopting (78) however means we lose our explanation for the unacceptability of stacked *that*-clauses. We would like to see independent evidence for adopting (76).
- The definiteness effect with the content noun *fact* mediates between the two:

(80) John believes {#a|the} fact that Mary left.

(81) $\lambda w.\exists s, x[\text{HOLDER}_w(s) = j \wedge \text{belief}_w(s) \wedge \text{THEME}_w(s) = x \wedge \text{fact}_w(x) \wedge \underline{\mathcal{F}_{cont}(w)(x)} \supseteq \lambda w'.\text{Mary left}_{w'}]$

(82) $\lambda w.\exists s, x[\text{HOLDER}_w(s) = j \wedge \text{belief}_w(s) \wedge \text{THEME}_w(s) = x \wedge \text{fact}_w(x) \wedge \underline{\mathcal{F}_{cont}(w)(x)} \supseteq \lambda w'.\text{Mary left}_{w'}]$

(83) *Identity criterion for facts*

$\forall x, y[(\text{fact}(x) \wedge \text{fact}(y) \wedge (\mathcal{F}_{cont}(x) = \mathcal{F}_{cont}(y))) \rightarrow (x = y)]$

$\wedge \forall x, y[(\text{fact}(x) \wedge \text{fact}(y) \wedge (x = y)) \rightarrow (\mathcal{F}_{cont}(x) = \mathcal{F}_{cont}(y))]$

- In other words, for two facts to be distinct, it is a necessary and sufficient condition that they have distinct propositional content.
- Adopting the semantics in (81) accurately predicts the infelicity of “John believes a fact that Mary left”, given that the indefinite article triggers an anti-uniqueness presupposition on its domain of quantification (Heim 1991). The semantics in (82) fails to predict infelicity.
- Not all abstract entities have such stringent distinctness conditions. Two distinct rumours, for example, but have identical propositional content. This is because the existence of a rumour presupposes the existence of a speech act, and the spatiotemporal properties of this speech act can distinguish two otherwise content-identical rumours.