

# Explaining DPs vs. CPs without syntax\*

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## 1 Introduction

This paper argues that *that*-clauses and DPs compose with embedding verbs in fundamentally different ways, building primarily on observations by Pietroski (2000) on the verb *explain*. Departing from Pietroski and others, I argue meaning alternations with embedded *that*-clauses and DPs are not a reflex of syntactic category, on the basis of evidence from a class of DPs which I dub *Propositional DPs* (PropDPs). In §2, I discuss Pietroski's observations concerning the verb *explain*, and his analysis in terms of  $\theta$ -role assignment. In §3, I critically discuss Pietroski's assumption that it is syntactic category that is responsible for the distinction between DPs and CPs. In §4, I introduce the theoretical machinery underlying the analysis: (i) Kratzer (2006) and Moulton's (2009, 2015) proposal that *that*-clauses denote properties of individuals with propositional content, and (ii) neo-Davidsonian event semantics (Parsons 1990, Lasnik 1995). In §5, I present the core of my analysis of embedded *that*-clauses and DPs: *that*-clauses are modifiers, whereas DPs are thematic arguments. In §6, I conclude.

## 2 Pietroski on *explain*

Pietroski noticed that, when  $P$  is a true proposition, *the fact that  $P$*  and *that  $P$*  are not inter-substitutable when embedded under the verb *explain*.

- (1) a. Angela explained [<sub>DP</sub> the fact that Boris resigned].      *explanandum*  
b. Angela explained [<sub>CP</sub> that Boris resigned].      *explanans*

Observe that (1a) does not entail (1b), and vice versa. Intuitively, the embedded DP in (1a) is interpreted as the thing that an Anita gave an explanation for (i.e., the *explanandum*), whereas in (1b) the embedded CP is interpreted as being Anita's explanation (i.e., the *explanans*).

Pietroski's account of this is that the  $\theta$ -role-assigning properties of *explain* are conditioned by the syntactic category of its complement. *Explain* assigns an embedded DP the THEME  $\theta$ -role, and an embedded CP the CONTENT  $\theta$ -role. Pietroski cashes this idea out in a neo-Davidsonian event semantics (see, e.g., Parsons 1990), assigning (1a) the Logical Form in (2a), (1b) the Logical Form in (2b).

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\*I'd like to express my gratitude to participants of CLS 52, for stimulating discussion and a fruitful question period. Many individuals have helped improve this work through thoughtful comments and/or acceptability judgements. I'd especially like to thank Klaus Abels, Nathan Klinedinst, Andrew Nevins, Keir Moulton, Yasu Sudo, and Wataru Uegaki.

- (2) a.  $\exists e[\text{explaining}(e) \wedge \text{AGENT}(e) = a \wedge \text{THEME}(e) = \text{the fact that Boris resigned}]$   
 b.  $\exists e[\text{explaining}(e) \wedge \text{AGENT}(e) = a \wedge \text{CONT}(e) = \text{that Boris resigned}]$

As such, Pietroski’s analysis blames the meaning alternation observed on idiosyncratic properties of *explain*.

## 2.1 Beyond explain

The facts concerning *explain* are in fact arguably part of a much broader class of meaning alternations, often discussed by philosophers of language under the rubric of “substitution failures” (see, e.g., Prior 1971; King 2002; Pryor 2007; Uegaki 2015). Typically, the observation is that *the fact/proposition that P* and *that P* are not inter-substitutable under a broad class of embedding verbs, as in (3), (4), and (5).

- (3) a. Jeff fears [<sub>CP</sub> that Shirley is upset].  
 b. Jeff fears [<sub>DP</sub> the fact/proposition that Shirley is upset].
- (4) a. Jeff is imagining [<sub>CP</sub> that Shirley is upset].  
 b. Jeff is imagining [<sub>DP</sub> the fact/proposition that Shirley is upset].
- (5) a. Jeff heard [<sub>CP</sub> that Shirley is upset].  
 b. Jeff heard [<sub>DP</sub> the fact/proposition that Shirley is upset].

These “substitution failures” are arguably part of a broader generalization that (i) embedded *that*-clauses specify the propositional content of the eventuality introduced by the verb, as is the case in the previous examples, and (ii) embedded DPs give rise to (potentially) more idiosyncratic meanings. The (b) examples sound odd, since *facts* and *propositions* are abstract objects which typically aren’t feared, imagined or heard. Replacing fact/proposition with an eventive content noun such as *rumour* gives rise to more sensible readings:

- (6) Jeff {fears | is imagining | heard} the rumour that Shirley is upset.

Any account of the meaning alternation we observe with *explain* should extend to embedding verbs more generally. Generally speaking, the resulting meaning of an embedding verb with an embedded *that*-clause seems to be almost fully systematic<sup>1</sup>, whereas the meaning of an embedding verb with a DP does not. We would like to understand why this should be, and in the following I focus on *explain* in order to help illuminate this phenomenon.

<sup>1</sup>As observed by Safir (1985), there is a small class of embedding verbs which does not fit neatly into this generalization, i.e., verbs of demonstration, such as *prove*, *demonstrate* etc. These verbs display other exceptional properties, and I set them aside for the purposes of this discussion. For my purposes, the phenomenon whereby an embedded *that*-clause specifies the content of an eventuality seems to be sufficiently general that it is unlikely to reflect idiosyncratic lexical facts.

### 3 Syntactic category

In this section, I argue that Pietroski is wrong to locate the source of the meaning alternation with *explain* in the syntactic category of the complement<sup>2</sup>. The logic of the argument is as follows: there exists a class of expressions which I dub *propositional DPs* (propDPs), which are syntactically nominal, but which nevertheless are compatible with both the *explanans* and the *explanandum* interpretations with *explain*. A non-exhaustive list of the expressions I classify as propDPs is as follows:

- (7) PropDPs
  - a. DPs headed by the noun *thing*, e.g., *the same thing*, *a different thing*, *most things*, *two things*, *something*, *everything*, etc.
  - b. The simplex *wh*-expression *what*.
  - c. Anaphoric expressions such as *it* and *that* (see Asher 1993).
  - d. Null operators in comparatives (see Kennedy & Merchant 2000)

The criterion for inclusion in the class of propDPs, specifically as opposed to content DPs (contDPs) such as *the fact*, is distributional. Embedding verbs in English can be usefully divided into three categories depending on their selectional properties. *Believe*-type verbs may embed both CPs and DPs – both contDPs and propDPs in the latter case. *Complain*-type verbs may embed CPs, but not DPs (neither contDPs nor propDPs). Most importantly for our purposes here, *think*-type verbs may embed both CPs, but only a sub-class of DPs – those which I have called propDPs here<sup>3</sup>. The selectional properties of these three classes of embedding verbs are illustrated below.

- (8) *believe*-type verbs
  - a. Abed believes [<sub>CP</sub> that Shirley is upset].
  - b. Abed believes [<sub>DP</sub> the rumour that Shirley is upset].
  - c. Abed believes [<sub>DP</sub> everything that Troy believes].
- (9) *think*-type verbs
  - a. Abed thinks [<sub>CP</sub> that Shirley is upset].
  - b. \*Abed thinks [<sub>DP</sub> the rumour that Shirley is upset].
  - c. Abed thinks [<sub>DP</sub> everything that Troy thinks].

On the basis of similar facts, King (2002) suggests that propDPs are *syntactically* distinct from other DPs. In the following, I give two independent arguments that propDPs are indeed nominal.<sup>4</sup>

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<sup>2</sup>King (2002) makes the same claim for other embedding verbs, but see Pryor (2007) for another critical take on these facts

<sup>3</sup>The fact that *think*-type predicates may embed propDPs undermines any purely syntactic explanation for their selectional properties, e.g., an account in terms of c-selection (Grimshaw 1979).

<sup>4</sup>Nathan (2006:2.2.3) also notes that what I call propDPs behave syntactically like other nominals. Nathan however is concerned with (what I call) propDPs embedded under question-embedding verbs such as *wonder*. These facts clearly bear on the task of formulating a fully-fledged semantics for propDPs, and I leave further consideration of propDPs under question-embedding predicates to future work.

### 3.1 PropDPs are syntactically nominal

#### 3.1.1 Evidence from case

The first piece of evidence that propDPs really are syntactically nominal is that they are sensitive to abstract case in a way which *that*-clauses aren't.

(10) Passivization

- a. It is widely believed [<sub>CP</sub> that Shirley is upset].
- b. \*It is widely believed [<sub>DP</sub> the rumour that Shirley is upset].
- c. \*It is widely believed [<sub>DP</sub> everything that Troy believes].

(11) Raising

- a. It seems [<sub>CP</sub> that Shirley is upset].
- b. \*It seems [<sub>DP</sub> the rumour that Shirley is upset].
- c. \*It seems [<sub>DP</sub> everything that Troy believes].

#### 3.1.2 Evidence from prepositional complements

The second piece of evidence that propDPs are syntactically nominal is that they surface as the complement of a preposition, where *that*-clauses are disallowed in this environment.

- (12)
- a. \*Annie heard about [<sub>CP</sub> that Jeff is getting married].
  - b. Annie heard about [<sub>DP</sub> the rumour that Jeff is getting married].
  - c. Annie heard about [<sub>DP</sub> something] – namely, that Jeff is getting married.

### 3.2 PropDPs and *explain*

Having established that propDPs are syntactically nominal, we can use them as a diagnostic for the source of the meaning alternations with *explain* and other verbs. Pietroski (2000) predicts that when a propDP is embedded under *explain*, the only available reading should be the explanandum reading, since when the complement of the verb is syntactically nominal, it is assigned the THEME role. In fact, propDPs are compatible with both *explanandum* and crucially *explanans* readings, as illustrated in (13). This undermines accounts of such meaning alternations in terms of syntactic category.

- (13)
- a. Angela explained the fact that Boris resigned,  
therefore Angela explained something. *explanandum*
  - b. Angela explained that Boris resigned,  
therefore Angela explained something. *explanans*

Importantly, this observation generalizes to the broader class of embedding verbs.

- (14)
- a. Jeff fears that Shirley is upset, therefore Jeff fears something.
  - b. Jeff is imagining that Shirley is upset, therefore Jeff is imagining something.
  - c. Jeff heard that Shirley is upset, therefore Jeff heard something.

## 4 Background

### 4.1 The property theory of *that*-clauses

Moulton (2009, 2015), building on work by Kratzer (2006), proposes that *that*-clauses denote (the characteristic function of) a set of individuals with propositional content, as given in (16). Contrast this with the standard assumption that a *that*-clause denotes a proposition (type  $\langle s, t \rangle$ ), as in (15).

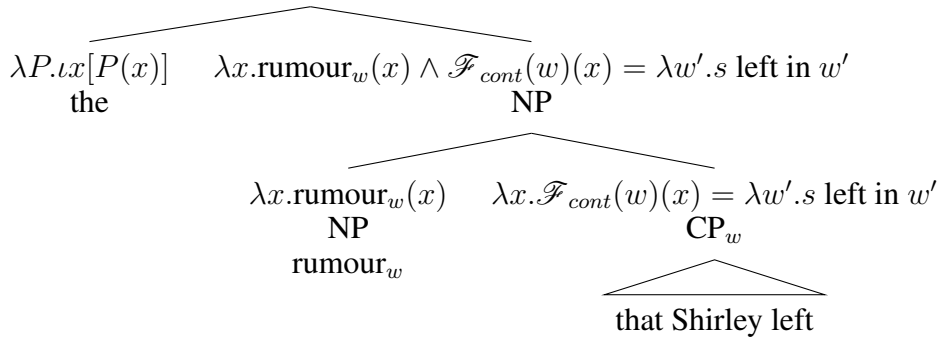
(15) Standard *that*-clause denotation:  
 $\llbracket_{\text{CP}} \text{ that Shirley left} \rrbracket = \lambda w'.s \text{ left in } w'$

(16) Kratzer/Moulton *that*-clause denotation:  
 $\llbracket_{\text{CP}} \text{ that Shirley left} \rrbracket = \lambda w.\lambda x.\mathcal{F}_{\text{cont}}(w)(x) = \lambda w'.s \text{ left in } w'$

Let us unpack the Kratzer/Moulton *that*-clause denotation.  $\mathcal{F}_{\text{cont}}$  is a (partial) function in the meta-language that takes two arguments: a world  $w$  and an individual  $x$ . It returns the content of  $x$  in  $w$  as a proposition. Adopting the Kratzer/Moulton denotation accounts for the fact that a *that*-clause may compose with a content noun, on the assumption that content nouns also denote sets of individuals with propositional content (see, e.g., Moltmann 2013 for discussion). This is because two expressions of type  $\langle e, t \rangle$  may combine via the rule of *Predicate Modification* (Heim & Kratzer 1998), as illustrated in (18).<sup>5</sup>

(17) Content noun denotation:  
 $\llbracket \text{rumour} \rrbracket = \lambda w.\lambda x.\text{rumour}_w(x)$

(18)  $\iota x[\text{rumour}_w(x) \wedge \mathcal{F}_{\text{cont}}(w)(x) = \lambda w'.s \text{ left in } w']$   
 DP



<sup>5</sup>Note that I assume an intensional semantics as in Heim & von Stechow (2011:8.2), according to which predicates take a world argument, realized as a pronominal element in the object language. Throughout, I suppress world pronouns at LF, and therefore  $\text{rumour}_w$  stands in for the LF in (i).

(i)

$$\begin{array}{c} \langle e, t \rangle \\ \swarrow \quad \searrow \\ \text{rumour: } \langle s, et \rangle \quad w: s \end{array}$$

I will argue that adopting the Kratzer/Moulton denotation for *that*-clauses will allow us to account for how *that*-clauses compose with verbs, and why this gives rise to the meaning alternations we observe with *explain* and other verbs.

## 4.2 Neo-Davidsonian event semantics

Kratzer and Moulton both assume that attitude verbs are associated with both an eventuality, and an individual argument – following Kratzer (1996) the assumption is that the external argument is “severed” from the verb (and later introduced via a thematic function), whereas the internal argument is included as part of the arity of the verb. I will depart from Kratzer and Moulton in this respect, instead adopting the position that *all* verbs simply denote (the characteristic function of) a set of eventualities.

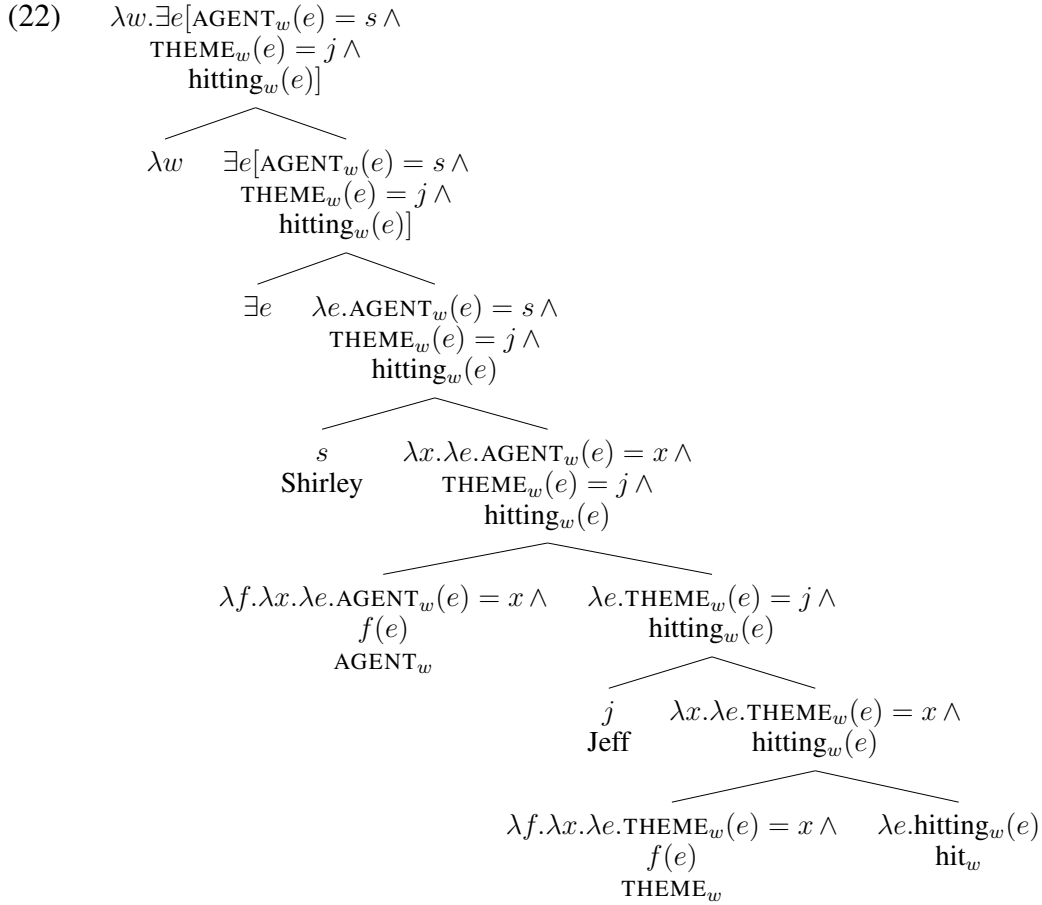
(19) Kratzer-style denotation for *believe*  
 $\llbracket \text{believe} \rrbracket = \lambda w. \lambda x. \lambda s. \text{belief}_w(x)(s)$

(20) Neo-Davidsonian denotation *believe*  
 $\llbracket \text{believe} \rrbracket = \lambda w. \lambda s. \text{belief}_w(s)$

According to neo-Davidsonian event semantics (see, e.g., Parsons 1990 and Lasnik 1995) all arguments are severed from the verb. The logical form of a simply transitive sentence is given in (21):

(21)  $\llbracket \text{Shirley hit Jeff} \rrbracket = \lambda w. \exists e [\text{AGENT}_w(e) = s \wedge \text{THEME}_w(e) = j \wedge \text{hitting}_w(e)]$

I implement this system compositionally by assuming (following recent work by e.g., Lohndal 2014) that arguments are uniformly introduced in the specifier of a functional head. The LF of (21) will be assumed to be as follows:



Currying thematic functions as in (23) allows composition to proceed via Function Application.

$$(23) \quad \llbracket \text{AGENT} \rrbracket = \lambda w_s. \lambda f_{\langle e, t \rangle}. \lambda x_e. \lambda e_e. \text{AGENT}_w(e) = x \wedge f(e)$$

As noted by Lohndal (2014), it is very probably incorrect to posit functional heads which denote thematic functions in the object language, since cross-linguistically thematic distinctions are not lexicalized. I label the functional heads according to the thematic function they introduce (i.e., AGENT, THEME, etc.), but this is to be understood as a notational convenience. The thematic labels are to be understood as a stand-in for whichever functional heads are responsible for introducing thematic arguments.

#### 4.2.1 Events and individuals

Throughout, I have used  $e$  as the name of a variable ranging over events,  $s$  as the name of a variable ranging over states, and  $x, y$ , etc. as the names of variables ranging over individuals. I have been deliberately non-specific as to whether or not this reflects a type distinction between eventualities and individuals. Authors working in event semantics differ here: it is common to assume that the model includes a distinct domain of individuals ( $D_e$ ) and events ( $D_v$ ). Others, such as Lasersohn

(1995), assume that the model includes a single domain of entities ( $D_e$ ), which includes individuals and eventualities as sorted sub-domains. One consequence of the latter system is that there is no longer any type distinction between expressions ranging over eventualities, and those ranging over other entities, as illustrated in the more explicit lexical entry for the verb *hit* in (24)<sup>6</sup>. This assumption will be crucial for the analysis outlined in §5.

$$(24) \quad \llbracket \text{hit} \rrbracket = \lambda w \in D_s. \lambda e \in D_e. \text{hitting}_w(e)$$

Since assuming no type distinction between eventualities and other entities is quite uncommon in the literature, it is worth spending a little time motivating this idea. Predicates may impose various restrictions on their arguments. For example, the verb *love* does not tolerate an inanimate subject.

$$(25) \quad \# \text{This table loves me.}$$

It is of course possible to give a *grammatical* explanation for this – perhaps expressions denoting animate entities, and those denoting inanimate entities are of different semantic types, e.g.  $e_a$  vs.  $e_i$ . We could then say that *love* is only defined for external arguments of type  $e_a$ . There is however a very plausible alternative explanation available which doesn't require us to complicate the grammar unnecessarily: as a matter of its lexical semantics, *love* presupposes that its external argument is capable of having a mental state. As a matter of world knowledge, we typically know that tables are incapable of holding mental states. The same reason can be extended to the distinction between eventualities and other individuals.

$$(26) \quad \begin{array}{l} \text{a. The run was long.} \\ \text{b. \#The run was blonde.} \end{array}$$

Positing a type distinction between eventualities and other individuals provides one with the apparatus to capture the infelicity of (26b) as a type-mismatch. This is arguably unnecessary, however, given that we typically know, as a matter of world knowledge, that running events do not have hair and therefore cannot be blonde.

## 5 Analysis

### 5.1 The semantics of clausal embedding

Granting our background assumptions, which have been independently argued for in other works, we are now in a position to propose a minimal analysis of embedding *that*-clauses under attitude verbs. The analysis is based on the idea that not just abstract objects such as *facts* and *ideas* may have propositional content, but also eventualities, such as *belief states* and *saying events* (for independent work arguing for this conclusion, see Hacquard 2006 on the interaction between aspect and modality). Once we allow for contentful eventualities, one straightforward

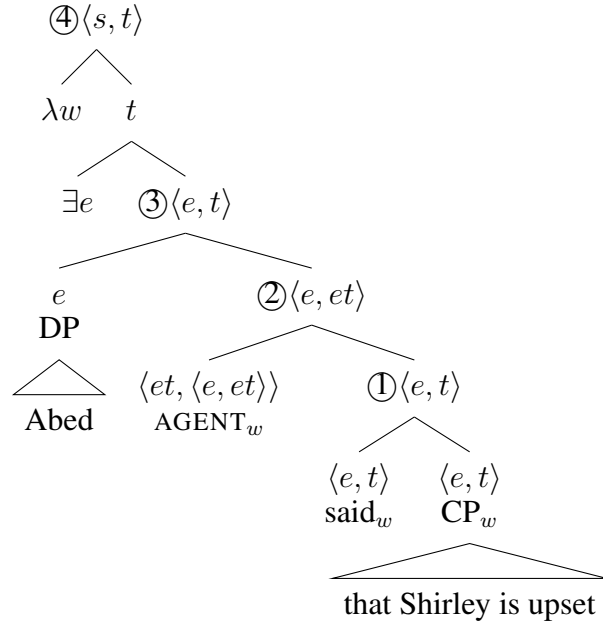
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<sup>6</sup>I remain agnostic here concerning the ontological status of *worlds*. For our purposes, it is sufficient to assume a distinct domain of worlds  $D_s$  in the model. Presumably, there is some mereological relationship between events and worlds, but the details of how to combine events and worlds will not concern us here. See Beck & von Stechow (2015) for further discussion.



consequence is that *that*-clauses, which we take to be of type  $\langle e, t \rangle$ , may combine with verbs via Predicate Modification. We illustrate this below for a simple speech report:

(27) Abed said that Shirley is upset.



- (28) a.  $\llbracket \text{CP} \rrbracket = \lambda x. \mathcal{F}_{cont}(w)(x) = \lambda w'. s \text{ is upset in } w'$   
 b.  $\llbracket \text{said}_w \rrbracket = \lambda e. \text{saying}_w(e)$   
 c.  $\llbracket \textcircled{1} \rrbracket = \text{PM}(\llbracket \text{said}_w \rrbracket, \llbracket \text{CP} \rrbracket) = \lambda e. \text{saying}_w(e) \wedge \mathcal{F}_{cont}(w)(e) = \lambda w'. s \text{ is upset in } w'$   
 d.  $\llbracket \textcircled{2} \rrbracket = \lambda x. \lambda e. \text{AGENT}_w(e) = x \wedge \text{saying}_w(e) \wedge \mathcal{F}_{cont}(w)(e) = \lambda w'. s \text{ is upset in } w'$   
 e.  $\llbracket \textcircled{3} \rrbracket = \lambda e. \text{AGENT}_w(e) = a \wedge \text{saying}_w(e) \wedge \mathcal{F}_{cont}(w)(e) = \lambda w'. s \text{ is upset in } w'$   
 f.  $\llbracket \textcircled{4} \rrbracket = \lambda w. \exists e [\text{AGENT}_w(e) = a \wedge \text{saying}_w(e) \wedge \mathcal{F}_{cont}(w)(e) = \lambda w'. s \text{ is upset in } w']$

A partial computation of the meaning of (27) is given in (28). The computation of the meaning of the node labelled  $\textcircled{1}$  (step (28c)) is crucial. Here, CP composes with the (neo-Davidsonian) verbal denotation via Predication Modification, since both the verb and the CP denote predicates of type  $\langle e, t \rangle$ . The CP denotes (the characteristic function of) the set of entities with the proposition content in  $w$  that *Shirley is upset*, and the verb denotes the (characteristic function of) the set of saying events (which, recall, are entities in  $D_e$ ). Composing the two via PM returns the (characteristic function of) the set of entities that are saying events in  $w$ , and which have, in  $w$ , the propositional content that *Shirley is upset*. The remainder of the computation consists of function-argument composition, resulting in the proposition in (28d) which can be given the following English paraphrase: there exists an event

$e$ , such that the agent of  $e$  is Abed,  $e$  is a saying event, and the content of  $e$  is the proposition that Shirley is upset.

## 5.2 Reconciling a neo-Davidsonian account of attitude verbs with a Hintikkan semantics

This analysis extends in a straightforward way to other attitude verbs, such as *believe*, which on this account has a very simple lexical entry, as in (29).<sup>7</sup>

$$(29) \quad \llbracket \text{believe} \rrbracket = \lambda w. \lambda s. \text{belief}_w(s)$$

This is very much at odds with the standard semantics for attitude verbs such as *believe* and *know* given in the literature, following foundational work by Hintikka (1969), which suggests that attitude verbs quantify over possible worlds. A representative Hintikkan lexical entry is given in (30).

$$(30) \quad \llbracket \text{believe} \rrbracket = \lambda w. \lambda p_{st}. \lambda x_e. \forall w' [w' \in \text{Dox}_{x,w} \rightarrow p(w') = 1] \\ (\text{Dox}_{x,w} = \{w' \mid \text{it is compatible with what } x \text{ believes in } w \text{ for } w \text{ to be } w'\})$$

Despite appearances to the contrary, however, a neo-Davidsonian semantics for *believe* as in (29) is not incompatible with Hintikkan truth-conditions for sentences involving attitude verbs. All that is necessary is a shift in perspective: rather than capturing Hintikkan truth-conditions via quantification over possible worlds in the object-language, we can instead achieve the same result by stating a Hintikkan meaning postulate, which fleshes out the notion of what it means, for a given individual  $x$ , to be  $x$ 's belief state.

## 5.3 Deriving the *explanandum* vs. *explanans* readings

With the neo-Davidsonian approach to clausal embedding in place, the meaning alternations we observed with the verb *explain* simply fall out as a result of how semantic composition *must* proceed. The fact that an embedded *that*-clause is *always* interpreted as the *explanans* becomes part of a broader generalization that a *that*-clause embedded under a verb always contributes the propositional content of the eventuality introduced by the verb.

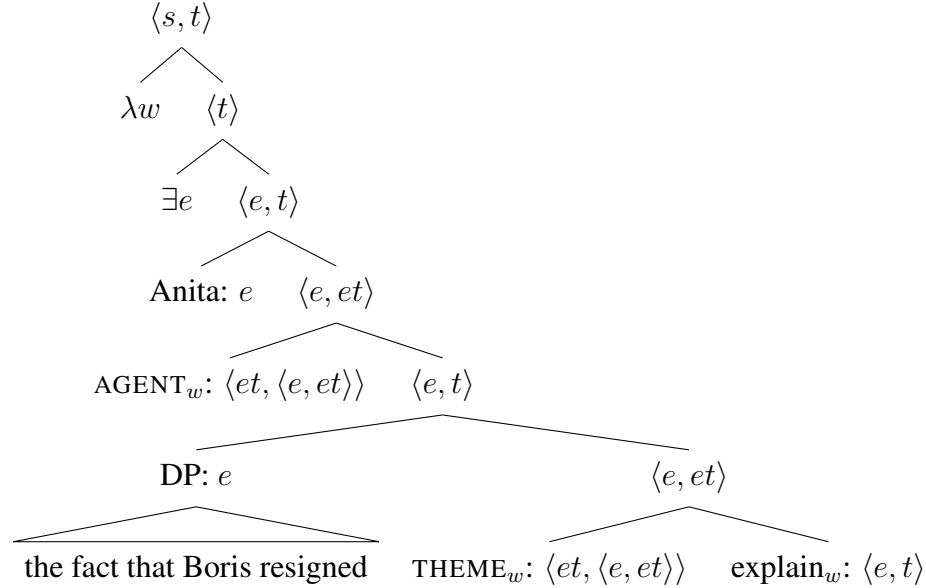
$$(31) \quad \text{a. } \llbracket \text{explain} \rrbracket = \lambda w. \lambda e. \text{explaining}_w(e) \\ \text{b. } \llbracket \text{that Boris resigned} \rrbracket = \lambda x. \mathcal{F}_{cont}(w)(x) = \lambda w'. b \text{ resigned in } w' \\ \text{c. } \llbracket \text{the fact that Boris resigned} \rrbracket = \\ \iota x [\text{fact}_w(x) \wedge \mathcal{F}_{cont}(w)(x) = \lambda w'. b \text{ resigned in } w']$$

The contDP (31c) denotes an entity; it is of type  $e$ . It *cannot* compose with the verb directly (which, recall, simply denotes a property of events) without leading to a type-mismatch further down the line. In the neo-Davidsonian framework outlined

<sup>7</sup>I assume here that *all* attitude verbs take an eventuality argument, even stative ones. This is in line with Hacquard (2006), but contra Katz (2000), Katz (2003), and Katz (2008), who claims no stative predicates (including stative attitude verbs such as *believe*) introduce an eventuality argument. If Katz's arguments go through, this is of course problematic for the proposal outlined here. I leave a more detailed consideration of Katz's arguments for future work, but see Ernst (2016) for arguments contra Katz.

here, thematic arguments, which are of type  $e$ , must be integrated into the LF via a thematic head. The LF underlying the *explanandum* reading is therefore as follows:

(32) *Explanandum LF*

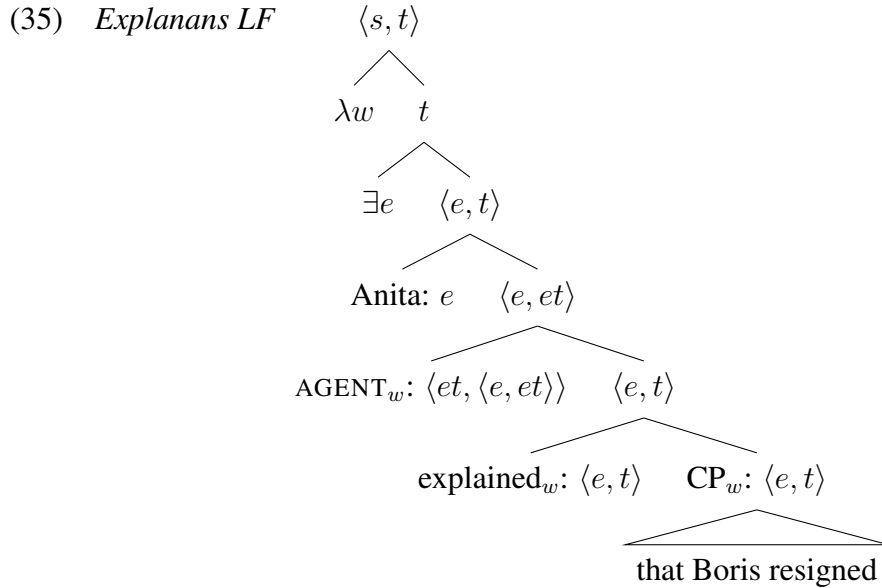


(33)  $\llbracket (32) \rrbracket = \lambda w. \exists e [\text{AGENT}_w(e) = a \wedge \text{THEME}_w(e) = ix[\text{fact}_w(x) \wedge \mathcal{F}_{cont}(w)(x) = \lambda w'. b \text{ resigned in } w'] \wedge \text{explaining}_w(e)]$

The interpretation of a thematic argument relative to a verbal root can be idiosyncratic. According to this account, it is simply a fact about the root  $\sqrt{\text{explain}}$  that a THEME is interpreted as an *explanandum*. As such, this account fails to *guarantee* that an embedded contDP receives a distinct interpretation to an embedded *that*-clause. Nothing blocks the existence of attitude verbs, for which the THEME specifies the propositional content of the eventuality introduced by the verb. A putative case of such as a verb is *believe*. Note (34b) entails (34a), since the propositional content of the rumour in (34b) is identified with the propositional content of Abed's belief-state. Nevertheless, this is compatible with (34a) and (34b) have distinct Logical Forms, with *rumour that...* integrated as a thematic argument of *believe*.

- (34) a. Abed believes that Jeff is balding.  
 b. Abed believes the rumour that Jeff is balding.

Moving onto the *explanans* reading, the interpretation of an embedded *that*-clause relative to an attitude verb is guaranteed as a by-product of how semantic composition proceeds. The only licit way for a verb and a *that*-clause to combine is via Predicate Modification.



(36)  $\llbracket (35) \rrbracket = \lambda w. \exists e [\text{AGENT}_w(e) = a \wedge \text{explaining}_w(e) \wedge \mathcal{F}_{cont}(w)(e) = \lambda w'. b \text{ resigned in } w']$

Since *that*-clauses are always interpreted as modifiers which supply propositional content, a Pietroski-style Logical Form for the explanans reading is inevitable consequence of the semantic computation.

#### 5.4 Embedding PropDPs

As was shown in §3.2, propDPs are compatible with both the the *explanans* and the *explanandum* reading, and by extension, may either be integrated as thematic arguments, or specify the propositional content of an eventuality. The standard assumption is that DPs uniformly either denote or quantify over individuals. This of course allows us to account for the *explanandum* reading rather straightforwardly.

(37) Angela explained the fact that Boris resigned, *explanandum*  
 therefore Angela explained something.

(38)  $\llbracket \text{Angela explained something} \rrbracket = \lambda w. \exists e, x [\text{AGENT}_w(e) = a \wedge \text{THEME}_w(e) = x \wedge \text{explaining}_w(e)]$

Accounting for the availability of the *explanans* reading is more challenging. One possibility is to posit an ambiguity in propDPs – they have a reading where they denote/quantify over properties, rather than individuals, as in (39).

(39) Semantics of a propDP (first attempt)  
 $\llbracket \text{something}' \rrbracket = \lambda Q_{\langle et, t \rangle}. \exists P_{\langle e, t \rangle} [Q(P)]$

The simple denotation in (39) allows a propDP to compose with a neo-Davidsonian verbal denotation directly, accounting for the entailment in (40).

(40) Angela explained that Boris resigned,  
therefore Angela explained something. *explanans*

(41)  $\llbracket \text{Angela explained something}' \rrbracket =$   
 $\lambda w. \exists e, P [P(e) \wedge \text{AGENT}_w(e) = a \wedge \text{explaining}_w(e)]$

The denotation in (39) cannot account for more complex cases however. Consider the following example.

- (42) context: Robert and Georgy are talking about the rules of chess.
- a. Robert explained that there are sixteen pieces each, that the goal is to checkmate, and that each player has one queen. Georgy (only) explained that there are sixteen pieces each.
  - b. Georgy explained most things that Robert did.

Observe that (42b) is intuitively false in the scenario sketched above. The denotation in (39) is too weak to capture this. To capture this intuition, we need *most things* to indirectly quantify over the propositional contents. We can accomplish this by restricting the domain of quantification to properties that constitute respectable *that*-clause denotations, i.e., properties of having some proposition content. Here is a second attempt at a working denotation for *something*. It restricts the domain of quantification to properties of having some propositional content.

(43) Semantics of a propDP (second attempt)  
 $\llbracket \text{something}' \rrbracket =$   
 $\lambda Q_{\langle et, t \rangle}. \exists P_{\langle e, t \rangle} [\exists p_{\langle s, t \rangle} [\forall x [P(x) \rightarrow \mathcal{F}_{cont}(w)(x) = p]] \wedge Q(P)]$

The denotation in (43), if correct, poses a compositional challenge, assuming that an account based on pervasive lexical ambiguity is to be dispreferred. Why is it that propDPs can come to mean something like (43)? I leave further investigation of this interesting question to future work.

## 5.5 Constraining the system

### 5.5.1 Stacked *that*-clauses

On the neo-Davidsonian view outlined here, embedded *that*-clauses are semantically modifiers. One question that immediately arises is why embedded *that*-clauses cannot be stacked, like other modifiers, i.e., why is (44) unacceptable?

(44) #Abed believes [<sub>CP</sub> that Jeff is old] [<sub>CP</sub> that Shirley is upset].

To consider why this should be, it is useful to consider what constrains stacking of thematic arguments in a neo-Davidsonian system. Consider the Logical Form in (45). (45) expresses a contradiction. This is because thematic roles are *functions* from a world and an eventuality to an individual. This guarantees that thematic roles map each world-eventuality pair to a *unique* individual. Consequently, a given *hitting* event has a unique THEME.

(45)  $\lambda w. \exists e [\text{AGENT}_w(e) = s \wedge \text{THEME}_w(e) = j \wedge \text{THEME}_w(e) = t \wedge \text{hitting}_w(e)]$

As pointed out in Moulton (2009), this kind of explanation can be extended in order to rule out stacking of embedded *that*-clauses. (44) has the Logical Form in (46).

$$(46) \quad \lambda w. \exists s [\text{HOLDER}_w(s) = a \wedge \mathcal{F}_{cont}(w)(s) = \lambda w'. j \text{ is old in } w' \wedge \mathcal{F}_{cont}(w)(s) = \lambda w''. s \text{ is upset in } w'']$$

(46) is contradictory in the same way as (45); the functionhood of  $\mathcal{F}_{cont}$  guarantees that stacked *that*-clauses give rise to a contradiction<sup>8</sup>. One thing that is crucial for this explanation to go through is that the semantics of the *that*-clause *equates* the propositional-content of an eventuality with a set of worlds. It is fair to ask whether this is an arbitrary choice for the semantics of the *that*-clause, since an alternative semantics invoking a notion of entailment is conceivable, as in (47).

$$(47) \quad \llbracket \text{that Shirley is upset} \rrbracket = \lambda x. \mathcal{F}_{cont}(w)(x) \subseteq \{w' \mid s \text{ is upset in } w'\}$$

One independent piece of evidence that (47) is incorrect comes from a definiteness effect that can be observed with DPs headed by certain content nouns.

$$(48) \quad \# \text{Jeff explained a fact that Shirley is upset.}$$

Intuitively, for two facts to be distinct they must have distinct propositional content. Bearing this in mind, we can explain the definiteness effect in (48) on the basis of the semantics for *that*-clauses we have posited here. The indefinite article triggers an anti-uniqueness presupposition on its domain of quantification (Heim 1991), and the meaning assigned to (48) is as follows. Here, the domain of quantification is *facts with the propositional content that Shirley is upset*. On the semantics given here, where the proposition *that Shirley is upset* is equated with the content of the fact, there can only be one such fact, and therefore it is the violation of the the anti-uniqueness presupposition that gives rise to the infelicity in (48).

$$(49) \quad \lambda w. \exists x, e [\text{fact}_w(x) \wedge \mathcal{F}_{cont}(w)(x) = \lambda w'. s \text{ is upset in } w' \wedge \text{AGENT}_w(e) = j \wedge \text{THEME}_w(e) = x \wedge \text{explaining}_w(e)]$$

## 6 Conclusion

In this short paper, I have sketched an approach to the semantics of embedding which is based on a novel fusion of the semantics for *that*-clauses developed by Kratzer (2006) and Moulton (2009, 2015), and a neo-Davidsonian event semantics, according to which *all* arguments are severed from the verb (Parsons 1990; Lasnik 1995).

<sup>8</sup>This approach to ruling out stacking of thematic arguments, and by extension stacking of *that*-clauses, comes with a family of problems. The straightforward prediction is that co-referential names can be expressed as multiple thematic arguments of a predicate, and this turns out to be unacceptable, as shown in (i). This is however plausibly a matter for the grammar.

(i) \*Lois loves [<sub>DP</sub> Clark Kent] [<sub>DP</sub> Superman].

Similarly, in the domain of *that*-clauses, a prediction is that *that*-clauses which express tautologies can be stacked. This is of course unacceptable too, although here it is not clear whether to blame the grammar or pragmatic reasons. I leave a more detailed investigation of these facts to future work.

1995). The differing behaviour of contDPs such as *the fact that...* and *that*-clauses when embedded under verbs such as *explain* is problematic for any approach to the semantics of embedding. I presented empirical evidence against a simple analysis of these facts in terms of the syntactic category of the complement from the behaviour of propDPs, which I show pattern with contDPs in some respects and *that*-clauses in others. I went on to develop a semantic analysis, according to which it is no accident that *that*-clauses always seem to specify the propositional content of an individual or eventuality. Rather, this falls out by virtue of how semantic composition *must* proceed: *that*-clauses are modifiers of type  $\langle e, t \rangle$ , which combine with nouns and verbs alike via Predicate Modification.

To the extent that they are convincing, the force of the arguments here is that *that*-clauses should be treated as *modifiers* in the semantics – it is not clear how this bears on the question of the syntactic status of *that*-clauses. Logically speaking, the modifier/argument distinction is independent from the complement/adjunct distinction, although a common assumption seems to be that adjuncts are modifiers and vice versa, and arguments are complements and vice versa. The question which naturally arises is whether or not it is feasible to treat embedded *that*-clauses as adjuncts. This is in fact the position that has been argued for *that*-clauses embedded under manner of speaking verbs such as *whisper* by Stowell (1981) and others, but embedding under other verbs is different. For example, the majority of embedded *that*-clauses are transparent for *wh*-extraction. This is unexpected if embedded *that*-clauses are uniformly adjuncts, since adjuncts are typically islands for *wh*-movement. This remains an open issue, and I leave it to future work to determine exactly what is at stake here for a theory of the syntax-semantics interface.

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