Function and Concatenation

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For any sentence of a natural language, we can ask the following questions: what is its meaning; what is its syntactic structure; and how is its meaning related to its syntactic structure? Attending to these questions, as they apply to sentences that provide evidence for Davidsonian event analyses, suggests that we reconsider some traditional views about how the syntax of a natural sentence is related to its meaning.

Many theorists have held, at least as an idealization, that every phrase–and in particular, every verb phrase–consists of (i) an expression semantically associated with some function, and (ii) an expression semantically associated with some element in the domain of that function. On this view, which makes it comfortable to speak of both verbs and functions as taking arguments, each phrase is semantically associated with the *value* of the relevant function given the relevant argument(s); the semantic contribution of natural language syntax is function-application, as in a Fregean *Begriffsschrift*; and the meaning of a sentence Σ is determined by the meanings of Σ's constituents, in the way that the sum of two numbers is determined by those numbers and the addition function. I want to urge a different conception of natural language semantics.

Some recent work suggests that phrases are concatenations of predicates, where a complex predicate of the form Φ^Ψ is satisfied by those things that satisfy both Φ and Ψ. On this view, which is motivated by certain eventish hypotheses about the logical forms of natural sentences, the semantic contribution of syntactic branching is predicate-conjunction *and not* function-application. There is a corresponding sense in which sentences of natural language do not manifest their logical forms. But syntactic structure may still determine logical form; although opportunities for confusion abound, especially if 'logical form' is understood in terms of notions like 'good inference'.

1. Background

Let's assume that (1) has the syntactic structure indicated in (1S):

(1) Brutus stabbed Caesar

(1S) {($_{\alpha}$Brutus) [$_{\Phi}$($_{\Phi}$ stabbed) ($_{\alpha}$Caesar)]}

where the subscripted labels indicate that 'Brutus' and 'Caesar' are syntactic arguments, while 'stabbed' and 'stabbed Caesar' are predicates. The verb 'stabbed' is a binary predicate; and so the verb phrase 'stabbed Caesar' is a monadic predicate, whose phrasal status could be highlighted with the label 'ΦP'. While (1S) may be an incomplete representation of syntactic structure, it is presumably correct as far as it goes. Matters are less clear, however, with regard to meaning.

1.1 In order to formulate a proposal about how the meaning of (1) is related to its syntactic structure, we need a theoretically perspicuous representation of that meaning. A traditional suggestion is

(1a) [Stabbed$_2$(Caesar$_i$)](Brutus$_i$)

construed as a sentence of a formal language in which a subscripted numeral indicates a predicate which takes that many (ordered) argument-terms; predicates express functions; and a subscripted 'i' indicates a label for some individual in a canonical domain. Let 'Stabbed$_2$'express the function λy.{λx. *true* if x stabbed y and *false* otherwise}; or more briefly, assuming exactly two truth-values, λy.{λx. *true* iff x stabbed y}. Let 'Brutus$_i$' and 'Caesar$_i$' be labels for Brutus and Caesar, respectively. Then (1a), a variant of 'Stabbed$_2$(Brutus$_i$, Caesar$_i$)', is true by stipulation iff [λy.{λx. *true* iff x stabbed y}(Caesar)](Brutus). This highlights the asymmetry of semantic arguments in a way that parallels the asymmetry between internal and external syntactic arguments, as indicated in (1S).[1]

Having introduced talk of meanings and representations of them, a few clarifications are in order. (Those who dislike *any* talk of meanings may employ favored paraphrases.) I will follow tradition and take meanings to be compositionally structured abstract entities, leaving it open whether meanings ever have concrete constituents. But I do not assume that our best theories will quantify over such abstractions, or that semantics is happily characterized as an investigation of them. On the contrary, my own view is that meanings are of interest mainly as projections of certain intrinsic properties of

sentences; it can be useful to model these properties, which are among the factors we gesture at when we say what sentences mean, with Fregean senses or Russellian propositions. That said, I am prepared to discover that a sentence has its meaning, wholly or in part, by virtue of bearing some interesting relation to that meaning. Perhaps there is even a theoretically frutiful sense in which natural sentences like (1) represent meanings; though I'm not betting on it.

There are nice questions about whether any formal expression like (1a), with stipulated *truth-conditions*, can adequately represent the *meaning* of a natural sentence. But let us set aside such questions, in order to focus on the semantic structure of (1). I assume that putative representations of meanings reflect hypotheses about the compositional structures of those meanings. According to (1a), the meaning of (1) has a function-argument architecture that involves a binary function expressed by 'Stabbed_2' and a unary function expressed by '$\text{Stabbed}_2(\text{Caesar}_i)$'. Given the disclaimers above, this is a fairly innocuous claim; the meaning of (1) has parts corresponding to Brutus, Caesar, and a certain function that maps these individuals (as ordered) to the truth-conditions of (1). But (1a) at least suggests a more tendentious hypothesis–*viz*., a semantics for English should associate the verb 'stabbed' with the binary function $\lambda y.\{\lambda x.$ *true* iff x stabbed y$\}$.

One can grant that '$[\text{Stabbed}_2(\ )](\ )$' represents the meaning of (1), minus the parts corresponding to Brutus and Caesar, without granting that 'Stabbed_2' represents the meaning of 'stabbed'. For '$[\text{Stabbed}_2(\ )](\ )$' may represent *more* than just the semantic contribution of the verb (plus function-application). That is, the meaning of (1) may not be wholly determined by the meanings of 'stabbed', 'Brutus' and 'Caesar'. I will return to this point, in the context of Frege's concept/object distinction. But for now, let me simply contrast (1a) with

(1b) $\exists e<\{[\text{Stabbed}_3(\text{Caesar}_i)](\text{Brutus}_i)\}(e)>$

(1c) $\exists e<\{[\text{Agent}_2(\text{Brutus}_i)](e)\ \&\ [\text{Stabbed}_1(e)\ \&\ [\text{Theme}_2(\text{Caesar}_i)](e)]\}>$.

By stipulation, 'Stabbed_3' expresses $\lambda y.\{\lambda x.\{\lambda e.$ *true* iff e was a stabbing by x of y$\}\}$, and 'Stabbed_1'

expresses λe. *true* iff e was a stabbing. The ampersands, existential quantifiers and variables are to be understood in the usual way. Characterizing thematic relations raises questions not germane to this discussion. So I hope that the quasi-technical notions 'Agent' and 'Theme' are understood well enough to make homophonic stipulations comprehensible: 'Agent_2' expresses λx.{λe. *true* iff x is Agent of e}; 'Theme_2' expresses λx.{λe. *true* iff x is Theme of e}.[2]

According to (1b), the meaning of (1) has a function-argument architecture that involves a ternary function expressed by 'Stabbed_3', a binary function expressed by '$\text{Stabbed}_3(\text{Caesar}_i)$', and a unary function expressed by '$[\text{Stabbed}_3(\text{Caesar}_i)](\text{Brutus}_i)$'. According to (1c), the meaning of (1) involves a unary function expressed by 'Stabbed_1'; two binary functions expressed by 'Agent_2' and 'Theme_2'; two unary functions expressed by '$\text{Agent}_2(\text{Brutus}_i)$' and '$\text{Theme}_2(\text{Caesar}_i)$'; a binary conjunction function; and two conjunctive unary functions expressed by '$\text{Stabbed}_1(e)$ & $[\text{Theme}_2(\text{Caesar}_i)](e)$' and '$[\text{Agent}_2(\text{Brutus}_i)](e)$ & $[\text{Stabbed}_1(e)$ & $[\text{Theme}_2(\text{Caesar}_i)](e)]$'.

One can view (1b) and (1c), qua representations of meanings, as proposed elaborations of (1a). Perhaps '$[\text{Stabbed}_2(\ )](\ )$' represents a subsentential meaning that has further structure as indicated in '$\exists e<\{[\text{Stabbed}_3(\ )](\ )\}(e)>$', and perhaps still further structure as indicated in '$\exists e<\{[\text{Agent}_2(\ )](e)$ & $[\text{Stabbed}_1(e)$ & $[\text{Theme}_2(\ )](e)]\}>$'. In this sense, the three proposals are compatible, while differing in the amount of semantic structure explicitly posited.[3] But the proposals are incompatible, if they incorporate the obvious suggestions about how the parts of (1) are related to the meaning of (1). For (1b) at least suggests that the semantic contribution of the verb 'stabbed' is the ternary function expressed by 'Stabbed_3', while (1c) at least suggests that the semantic contribution of 'stabbed' is the unary function λe. *true* iff e was a stabbing. Correspondingly, (1c) suggests that the syntactic arguments are *not* associated with relevant entities in the domain of the (unary) function associated with 'stabbed'; rather, 'Brutus' and 'Caesar' are associated with "thematically separated" conjuncts of a complex event description.

Perhaps such suggestions should not be incorporated into hypotheses about meanings, which will prove interesting independently of how sentences are related to them. But however one defines 'hypothesis about meaning', we can ask which (if any) of the suggestions is best supported by available evidence. And if we settle on (1b) or (1c), as our hypothesis about how the parts of (1) are related to the meaning of (1), this raises (fruitful) questions about why the meaning of (1) has components that do not correspond to overt parts of (1). Of course, we must stay alive to the possibility that distinct formal sentences are equally good–and equally misleading–representations of the semantic facts (whatever they are). But in my view, there is ample evidence to support adoption of some eventish proposal as opposed to (1a), and there is sufficient evidence to tentatively adopt (1c) over (1b).

1.2 Arguments for adopting an event analysis should be familiar. So let me offer just a brief review. Davidson (1967) famously noted patterns of entailment like those exhibited in (1-5):

(1) Brutus stabbed Caesar

(2) Brutus stabbed Caesar with a knife

(3) Brutus stabbed Caesar on the Ides of March

(4) Brutus stabbed Caesar with a knife on the Ides of March

(5) Brutus stabbed Caesar on the Ides of March with a knife.

If (5) is true, so is (4); and *vice versa*. If (4) is true, so are (1-3); and if either (2) or (3) is true, so is (1). Speakers of English recognize these implications; and they usually treat "prepositional-phrase detachment" as an impeccable form of inference. These facts are at least partly explained, if prepositional phrases are interpreted as conjuncts of complex event predicates as in 'Stabbed(e, Brutus, Caesar) & With-a-knife(e)'. But evidence for this kind of view is not limited to entailment patterns; see Taylor (1985), Parsons (1990).

A compound sentence like

(6) Booth fled after he shot Lincoln

is true iff the events described by the sentential clauses are suitably related; (6) is true iff ∃e∃f[Fled(e, Brutus) & After(e, f) & Shot(f, he, Lincoln)]. Similarly,

(7) Booth pulled the trigger before Lincoln died

is true iff ∃e∃f[Pulled(e, Booth, the trigger) & Before(e, f) & Died(f, Lincoln)]. One can paraphrase (7) by replacing 'Lincoln died' with an overt event nominal, as in

(8) Booth pulled the trigger before Lincoln's death.

Likewise, (9) and (10) are nearly synonymous:

(9) Vesuvius erupted just before Pompeii was destroyed

(10) An eruption of Vesuvius occurred just before the destruction of Pompeii.

This suggests that (9) covertly involves the kind of quantification over events that is overt in (10).

As Gareth Evans observed, pairs of sentences like

(11) Shem hit Shaun sharply with a red stick

(12) Shem hit Shaun softly with a blue stick

can be true at the same time. But in such a case, the sentences have different "truth-makers." One hitting is sharp while a simultaneous hitting is soft. Moreover, (11-12) can be true while

(13) Shem hit Shaun softly with a red stick

(14) Shem hit Shaun sharply with a blue stick

are false. This makes sense, if (11-14) involve quantification over events as in, '∃e[Hit(e, Shem, Shaun) & Sharp/Soft(e) & With-a-red/blue-stick(e)'.[4]

Higginbotham (1983) and Vlach (1983) note that a perceptual report like

(15) Nora heard Fido bark.

differs from the corresponding propositional attitude report

(16) Nora heard that Fido barked.

In (15), 'bark' is untensed, and substituting coreferential expressions for 'Fido' preserves truth.

So one might analyze (15) as 'there was a hearing by Nora of a barking by Fido', which is true iff ∃e∃f[Heard(e, Nora, f) & Bark(f, Fido)]. This would also explain the ambiguity of

(17) Nora heard Fido bark in her apartment.

The adjunct phrase can be a predicate of the e-position event (the hearing) or the f-position event (the barking). Moreover, these considerations interact, as shown by

(18) Nora saw Fido run in the park after seeing Pat poke Pete gently with a pen
and also poke Pete less gently with a pencil at noon.

Those who wish to avoid appeal to events should try to deal with sentences like (18).

1.3 Finding evidence that supports thematically separated event analyses is harder. As the notation used in §1.2 suggests, many facts that suggest an eventish semantics can be accommodated without associating each syntactic argument (via some thematic role) with its own conjunct of an event description.[5] But Schein (1993) argues that plural expressions like

(19) Three linguists taught four students five theories

have readings that can only be represented by associating the syntactic arguments of the verb with (scopally independent) conjuncts of complex event predicates.

Prima facie, (19) has a reading on which three linguists (together) managed to teach each of four students five theories: the subject is collective, while 'four students' has scope over 'five theories' but not 'three linguists'. From an eventish perspective, this suggests twenty episodes of theory-teaching (all done by three linguists), with each student learning five theories. This in turn suggests a big teaching-event with subparts, much like a banquet is a big eating-event with subparts. So as a first pass, we might try to capture the meaning of (19) with

(20) ∃e{Agent(e, three linguists) & Taught(e) &
for four students x, ∃f:f<e[Recipient(f, x) & Theme(f, five theories)]}

where 'f<e' means that f is a part of e. We can go on to say that 'Theme(f, five theories)' abbreviates

'for five theories y, ∃g:g<f[Theme(g, y)]', while 'Agent(e, three linguists)' abbreviates 'for three linguists x, ∃d:d<e[Agent(d, x)]'. The idea is that an event with multiple participants is an event with parts; see Carlson (1984). Eventually, one wants to hear more about the relevant mereology.[6] But for present purposes, the important point is that there seems to be no viable alternative to a thematically separated eventish treatment of (19). For example,

(21) for four students x, ∃e[Taught(e, three linguists, x, five theories)]

fails to capture the Schein-reading, since it presumably implies that each of the linguists was involved in teaching each student; whereas (19) can be true, on the relevant reading, if the teaching labor was divided so that no linguist taught more than two students. (See Herburger [forthcoming] for related arguments.[7])

The verb 'explain' provides another argument for thematic separation. Consider

(22) Nora explained the fact that Fido barked

(23) Nora explained that Fido barked.

While (22) is roughly synonymous with 'Nora explained why Fido barked', (23) is true (roughly) iff Nora *said* that Fido barked and thereby explained something else. If Nick asked why the cat ran away, and Nora replied 'Because Fido barked', then (23) is true but (22) is not. Similarly, if Nick asked why Fido barked, and Nora replied 'Because Fido saw the cat', then (22) is true but (23) is not. These facts are hard to account for if 'explained' expresses a ternary function, especially if the fact that Fido barked is not an entity distinct from (the proposition) that Fido barked. Given sentences like (22), one would be led to say that 'explained' expresses the function λy.{λx.{λe. *true* iff e is an explaining by x of y}}; where e is an explaining by x of y, only if y is the explanandum–the thing x explained. But this conflicts with (23), which is true (roughly) iff Nora's *explanans* is that Fido barked. This suggests that the meanings of (22-23) should be represented with (24-25), respectively:

(24) ∃e[Agent(e, Nora) & Explained(e) & Theme(e, the fact Fido barked)]

(25) ∃e[Agent(e, Nora) & Explained(e) & Content(e, that Fido barked)]

where the Theme of an explaining is the thing explained (the explanandum), and the Content of an explaining is the thing said in giving the explanation.[8]

Causative constructions can also be used to argue for thematic separation. As many theorists have discussed, sentences like

(26) Pat boiled the soup

have meanings that seem to be structured along lines indicated by

(27) ∃e∃x{Agent(e, Pat) & R(e, x) & Boiled(x) & Theme(x, the soup)};

where 'R' stands for some relation that an event e (done by the Agent) bears to the boiling of the soup, and 'Boiled' captures the meaning of the intransitive verb in

(28) The soup boiled.

I assume that the meaning of (28) is correctly represented with

(29) ∃e[Boiled(e) & Theme(e, the soup)}.

If (27) is true, so is (29); and arguably, this explains why (28) is true if (26) is. Following Chomsky's (1995) development of Baker's (1988) version of a much older idea, I think the *syntax* of (26) involves a hidden verbal element–like the overt causative element in many languages–with which the intransitive verb 'boiled' combines. And if the syntactic structure of (26) is

(26S) $\{(_{\alpha}$ Pat) $[(_{\Phi}$ *v*–boiled$_j$) $[_{\Phi}$ t_j $(_{\alpha}$ the soup)]]$\}$

where intranstive 'boiled' raises to combine with the covert *v*, then we cannot explain the entailment in terms of facts about the lexical meaning of a transitive verb 'boiled$_T$'. For (26) doesn't contain any lexical item with the meaning of the transitive verb.[9]

Were it not for well known objections to causative analyses–see Fodor (1970), Fodor and Lepore (2000)–I would leave matters here. But since replies are needed, let me sketch a proposal defended elsewhere; see Pietroski (1998, 2000a, forthcoming-a, c.). Suppose the meaning of (26) is given by

(30) ∃e{Agent(e, Pat) & ∃x[Terminater(e, x) & Boil(x)] & Theme(e, the soup)}

where a Terminater of event e is itself an event that is a *final part* of e. It is a common thought that causatives are somehow related to "accordion-style" events that begin with actions but end with certain effects of those actions. And we can gloss 'Agent(e, x)', ignoring plural subjects for simplicity, as 'x performed an action that is an Initiater of e'; where an Initiater of e is the *first part* of e. On this view, (26) is true iff: Pat performed an action that *started* an accordion-style event, whose Theme is the soup, that *ended with* an event of boiling. The boiling in question has to be the boiling of the soup, given that the Theme of an accordion-style event is the thing affected at the end of that event; see Tenny (1994). Thus, (28) is true if (26) is. But (26) is not synonymous with

(31) Pat caused the soup to boil.

For the truth of (31) does not ensure that there is an event that meets the requirements imposed by (30).

Suppose that Pat set fire to a house that contains a pot of cold soup. Then (31) might well be true, while (26) is false. But (30) can also be false, since not every effect of an action will be the final part of some accordion-style event that begins with the action. The truth of (26) requires a *single* event that starts with Pat's action and ends with a boiling of the soup.[10] Thus, (26) is not synonymous with

(32) Pat caused^{+} the soup to boil

where 'caused^{+}' means caused *via some normal method*. We can also represent the meaning of (33) with (34), which differs from both (35) and (36), neither of which capture the meaning of (33):

(33) Pat boiled the soup on Monday

(34) $\exists e\{\text{Agent}(e, \text{Pat}) \ \& \ \exists x[\text{Terminater}(e, x) \ \& \ \text{Boil}(x)] \ \& \ \text{Theme}(e, \text{the soup}) \ \& \ \text{OM}(e)\}$.

(35) $\exists e \exists x\{\text{Agent}(e, \text{Pat}) \ \& \ \text{Cause}^{+}(e, x) \ \& \ \text{Boil}(x) \ \& \ \text{Theme}(x, \text{the soup}) \ \& \ \text{OM}(e)$.

(36) $\exists e \exists x\{\text{Agent}(e, \text{Pat}) \ \& \ \text{Cause}^{+}(e, x) \ \& \ \text{Boil}(x) \ \& \ \text{Theme}(x, \text{the soup}) \ \& \ \text{OM}(x)$.

It is a fair question why (33) cannot have the meaning indicated in

(37) $\exists e\{\text{Agent}(e, \text{Pat}) \ \& \ \exists x[\text{Terminater}(e, x) \ \& \ \text{Boil}(x) \ \& \ \text{OM}(x)] \ \& \ \text{Theme}(e, \text{the soup})\}$.

But I think the answer lies with syntactic details, motivated in part by cross-linguistic data, concerning

the covert causative element in (33) and how it can be combined with overt elements; see Baker (1988), Pietroski (forthcoming-c). Verbal compounding often eliminates ambiguity, as even English illustrates:

(38) He likes to hunt elephants with a gun

(39) He likes to elephant-hunt with a gun.

Only (38) can be used to report a desire to give the elephants a sporting chance. And (33) is arguably subject to a similar constraint. In any case, given the motivations for causative analyses of sentences like (26) and the availability of a reply to standard objections, we have reason to adopt such analyses; and such analyses, in so far as they avoid the objections, evidently require thematic separation as in (30).

2. Natural Syntax and Fregean Concepts

Let us return now to (1), its syntactic structure, and the three hypotheses about its meaning:

(1) Brutus stabbed Caesar (1S) $\{(_{\alpha}\text{Brutus})\ [_{\Phi}(_{\Phi}\ \text{stabbed})\ (_{\alpha}\text{Caesar})]\}$

(1a) $[\text{Stabbed}_2(\text{Caesar}_i)](\text{Brutus}_i)$

(1b) $\exists e<\{[\text{Stabbed}_3(\text{Caesar}_i)](\text{Brutus}_i)\}(e)>$

(1c) $\exists e<\{[\text{Agent}_2(\text{Brutus}_i)](e)\ \&\ [\text{Stabbed}_1(e)\ \&\ [\text{Theme}_2(\text{Caesar}_i)](e)]\}>$

If (1c) represents the meaning of (1), the relation of natural language syntax to this meaning may differ from the relation of predicate calculus syntax to the stipulated meanings of (1a-c). This is worth noting.

2.1 If one takes the syntax and meaning of (1) to be as indicated in (1S) and (1a), with no further elaboration of (1a), the obvious hypothesis is that the constituents of (1a) represent the meanings of the corresponding constituents of (1). Given this, the contribution of natural syntax to the meaning of (1) is presumably the same as the contribution of formal syntax to the stipulated meaning of (1a): the semantic correlate (or *Bedeutung*) of each phrase is the value of the function expressed by the constituent predicate Φ given the entity labelled by the argument-term α; or abbreviating, $\|\Phi\hat{}\alpha\| = \|\Phi\|(\|\alpha\|)$, where '‖...‖' stands for 'the semantic correlate of ...'. This is not to say that syntax is semantically inert, since applying a function to an argument differs from simply listing a function and some element in its domain. But the

idea is that the contribution of syntax is minimal, in that no specific content is added. By contrast, consider the following grossly implausible theses: ||Φ^α|| = ||Φ||(the person closest to ||α||); ||Φ^α|| = *true* iff ||Φ||(||α||) = *true* or ||α|| is blue.

One can emphasize semantic minimality by identifying functions with sets of ordered pairs. For if ||Φ|| is such a set, S, one can claim that ||Φ^α|| just *is* the second element of the ordered pair in S with ||α|| as its first element. The syntax of a Fregean *Begriffsschrift* is semantically minimal in this sense, since this keeps all aspects of meaning manifest. But following Frege (1891) , one can distinguish sets (or 'value-ranges') from the essentially *unsaturated* mappings (from arguments to truth values) for which he introduced the technical term 'concept'. No set, not even a set of ordered pairs whose second elements are truth-values, is a Fregean concept. Speaking loosely, we might say that concepts are the semantic contributions of sentences-minus-argument-terms. And one can grant that the English verb-plus-sentential-frame '__ [stabbed __]' is associated with a Fregean concept, from ordered pairs of individuals to truth-values, while doubting that the contribution of the verb 'stabbed' is a function from such ordered pairs to truth values. Given a natural language, one can ask how the semantic role of Fregean concepts is divided between verbs and syntax. It is an empirical question whether natural languages respect the Functionist thesis, ||Φ^α|| = ||Φ||(||α||), and are—in this respect—like a *Begriffsschrift* whose syntax makes the minimal semantic contribution. *Natural* syntax may bear a semantic load. (In particular, natural syntax may contribute the specific content of conjunction.)

Finding evidence that bears on this question is a nontrivial task. Setting aside (for the moment) the existential quantifier in (1b) and the variable it binds, (1b) does not challenge the Functionist thesis. One can say that $|||[_{\Phi}(_{\Phi}$ stabbed) $(_{\alpha}$Caesar)]|| = ||stabbed||(||Caesar||) = λx.{λe. *true* iff e is a stabbing by x of Caesar}. And one can say that $||\{(_{\alpha}$Brutus) $[_{\Phi}(_{\Phi}$ stabbed) $(_{\alpha}$Caesar)]}|| = λe. *true* iff e is a stabbing by Brutus of Caesar, while still maintaining that the semantic correlate of sentence (1) is a truth-value. Perhaps (1) includes a syntactic argument that (1S) fails to represent, as in

(1S') $\{[_{\Delta}(_{\Delta}\textit{some})(_{\Phi}\textit{event})]\{_{\Phi}\ (_{\alpha}\text{Brutus})\ [_{\Phi}(_{\Phi}\ \text{stabbed})\ (_{\alpha}\text{Caesar})]\}\}$

where covert elements are italicized, and the subscript 'Δ' indicates that the determiner 'some' combines with a predicate to form a structured syntactic argument.[11] Alternatively, perhaps (1) has only two syntactic arguments, but *sentences* (as opposed to mere syntactic structures) are *truth*-evaluable analogs of structures like the one indicated by (1S); where existential closure is the default way of turning an event predicate into something truth-evaluable. It would be nice to consider this possibility in light of Chomsky's (2000b) suggestion that expressions with multiple arguments are interpreted in *phases*, especially since his phase-markers include covert causative verbs (which are associated with existential closure on the view urged above); see also Uriagerecka (1999), Pietroski (forthcoming-c). But let us set aside questions about where the existential quantifier in eventish logical forms comes from, and focus on combinations of overt elements that clearly are syntactic constituents.

Consider (2) and its syntactic structure:

(2) Brutus stabbed Caesar with a knife

(2S) $\{(_{\alpha}\text{Brutus})\ [_{\Phi}[_{\Phi}(_{\Phi}\ \text{stabbed})\ (_{\alpha}\text{Caesar})][_{\Phi}\ \text{with a knife}]]\}$.

I assume that 'with a knife' is a syntactic predicate, if only because of constructions like

(40) Caesar saw Brutus with a knife.

One might say that 'with a knife' *as it occurs in (2)* expresses a function $\mathbf{W}_1$, from functions to functions; while 'with a knife' *as it occurs in (40)* expresses a function from individuals to truth-values. Thus, following Montague (1970), one might represent the meaning of (2) with

(2a) $\mathbf{W}_1\{[\text{Stabbed}_2(\text{Caesar}_i)]\}(\text{Brutus}_i)$.

In my view, this leads to an unsatisfactory semantics.[12] But more important for present purposes is that the Functionist thesis $\|\Phi\text{^}\alpha\| = \|\Phi\|(\|\alpha\|)$, understood as a claim about how the syntax of a sentence is related to the meaning of that sentence, has to be modified *however* we deal with (2). Whether or not an expression counts as Φ-ish depends on the *syntax* of that expression. One can hypothesize that the

meaning of 'stabbed Caesar with a knife' has two major constituents: a function from individuals to truth values; and a function from functions to functions. But even if this is true, which I doubt, it doesn't preserve the Functionist thesis motivated by the straightforward mapping from (1S) to (1a). Appeals to type-shifting effectively concede this point.

One can claim that the Functionist thesis is an idealization–and that adjunction is a deviation from the ideal manifested by (1). But I find this implausible, since adjunction is a syntactically recursive and semantically compositional aspect of natural language. If we set aside sentential connectives (which are of limited interest) and sentential complements (which require special treatment on any view), adjunction is where the recursivity/compositionality of natural language lives. Verbs take a very finite number of arguments, but they can combine with endlessly many adjuncts. So it strikes me as perverse to treat adjunction as a "nonideal" feature of natural language, just because it doesn't fit a Functionist mold.

2.2 Suppose we represent the meaning of (2), ignoring the existential quantifer, with

(2b) $\{[\text{Stabbed}_3(\text{Caesar}_i)](\text{Brutus}_i)\}(e)$ & With-a-knife(e).

Treating adjuncts like 'with a knife' as conjuncts in complex event predicates nicely accounts for the semantic contributions of such adjuncts. But where does the *conjunction* come from? One might conjecture, heroically, that (2) includes a covert conjoiner as in

(2S*) $\{(_\alpha\text{Brutus})\ [_\Phi[_\Phi(_\Phi\ \text{stabbed})\ (_\alpha\text{Caesar})]$ *and* $[_\Phi$ with a knife$]]\}$.

A simpler–and less clearly false–hypothesis is that the syntax itself contributes the conjunctive aspect of meaning. The formal details are easier to present, once one abandons the idea that 'stabbed' expresses a ternary function. But the basic idea is simple: 'Brutus stabbed Caesar' and 'with a knife' correspond to unary predicates of events; and the natural syntax of adjunction, which makes it possible to combine these predicates, corresponds to a kind of function-*conjunction* (as opposed to function-*application*). This is the radical aspect of Davidson's (1967) proposal. Positing a hidden argument was a minor variation on a traditional semantic theme; but the conjunctive treatment of adjuncts was an innovation.[13]

Especially if one is impressed by the fact that adjunction is the source of subsentential recursivity (and open-ended compositionality), one might wonder if *all* syntax makes the same kind of semantic contribution. Functionists will try to preserve the "semantic uniformity" of syntax, by assimilating adjunction (via type-shifting) to argumentation; on this view, all syntax makes the same *minimal* contribution. But eventish theorists can try to assimilate argumentation to adjunction, treating all syntax as making the same conjunctive contribution. Initially, it is hard to see how 'stabbed Caesar' could be a conjunctive predicate. But a thematically separated event analysis represents the meaning of the verb phrase with '$\text{Stabbed}_1(e)$ & $[\text{Theme}_2(\text{Caesar}_i)](e)$'. While this raises the question of where the conjunction comes from, a possible answer is that natural language syntax bears this semantic load; concatenation itself contributes an aspect of meaning.

Of course, one wants to know where the thematic functions come from, since they play the crucial role of mapping an individual like Caesar to a function. *If* one can maintain that in 'stabbed Caesar', $\|({}_{\alpha}\text{Caesar})\| = \lambda e.$ *true* iff Caesar was Theme of e, then a Conjunctivist hypothesis about the contribution of syntax is tempting. For one can say that $\|({}_{\Phi}\text{ stabbed})\| = \lambda e.$ *true* iff e was a stabbing; $\|[_{\Phi}({}_{\Phi}\text{ stabbed})\ ({}_{\alpha}\text{Caesar})]\| = \lambda e.$ *true* iff e was a stabbing & Caesar was Theme of e; $\|({}_{\Phi}\text{ with a knife})\| = \lambda e.$ *true* iff e was (done) with a knife; and $\|[_{\Phi}[_{\Phi}({}_{\Phi}\text{ stabbed})\ ({}_{\alpha}\text{Caesar})][_{\Phi}\text{ with a knife}]]\| = \lambda e.$ *true* iff e is a stabbing & Caesar was Theme of e & e was with a knife. The obvious generalization, which might have be to modified in light of further data, is:

$$\|\Phi \text{\^{}} \Psi\| = \lambda e.\ \textit{true} \text{ iff } \|\Phi\|(e) = \textit{true} \ \&\ \|\Psi\|(e) = \textit{true}$$

where 'Ψ' ranges over both adjoined predicates and syntactic arguments.[14] At this point, one might kick away the ladder of function-talk entirely, and simply speak of predicates satisfied by events. But regardless of terminology, one wants to know how a name like 'Caesar' can be semantically associated with a class of events, as suggested by (1c) and the Conjunctivist conception of how natural syntax contributes to meaning.

A simple answer is that sentences have hidden thematic constituents, as indicated below:

$\{<_{\Phi}$ *Agent*$(_{\alpha}$Brutus$)> [_{\Phi}(_{\Phi}$ stabbed$) <_{\Phi}$ *Theme*$(_{\alpha}$Caesar$)>]\}$.

I don't rule out discovery of such sentential components, perhaps in the form of thematic features that verbs assign to their arguments; see Hornstein (forthcoming). But "thematic separationists" need not assume a thematically elaborated syntax. Syntactic position is at least correlated with thematic role. And investigation suggests that within any sentence, a lower argument is never associated with the role of Agent, while a higher argument is never associated with the role of Theme; see Pesetsky (1995). Indeed, Baker (1988, 1997) argues that syntactic position *determines* thematic role; see Pietroski (forthcoming-c) for discussion and defense. If this is correct, but not because sentences have thematic constituents (that are associated with certain syntactic positions), then the *interpretation* of syntactic arguments is constrained by a Baker-style mapping from syntactic position to thematic role; that is, the (source of) the Baker-style mapping is itself a determinant of meaning.

One way or another, separationists must say that syntactic arguments are always interpreted "through a thematic lens." But this makes sense from an eventish perspective. Each syntactic argument has to be associated with some *way of participating in* an event of the sort described by the verb. More formally, we can relativize the semantic correlates of argument terms to syntactic positions, in the following innocent sense: while the name 'Caesar' is always associated with Caesar, the specific semantic contribution of the *name as syntactic argument* depends on the relevant syntactic position; the semantic contribution can be λe. *true* iff Caesar was Theme of e, or λe. *true* iff Caesar was Agent of e, depending on whether 'Caesar' is the internal or external argument. It is part of the hypothesis encoded by (1c) that a name makes its semantic contribution *via* some thematic relation. So thematic separationists should embrace this idea. Let '$\|\text{Caesar}\|_{\Theta}$' stand for the semantic correlate of 'Caesar' *relative to* any syntactic position associated with the thematic function Θ; and assume, following Baker, that each syntactic position (in which 'Caesar' can appear) determines such a function. Then we can say:

$\|\text{Caesar}\|_{\Theta} = \lambda e.\ \textit{true}$ iff $\exists x[x = \text{Caesar} \ \& \ \Theta(e, x) = \textit{true}]$.

Notational variations, including phrase markers in which the labels of argument terms are associated with unary thematic features, are possible. But the idea is that for purposes of interpretation, syntactic arguments are associated with functions from events to truth-values. While this is a kind of type-shifting, it is fairly innocuous and *very* limited. Relativized semantic axioms, like the one above, can capture the shifted contributions of argument terms in a uniform way; and this (single) kind of shift, from an individual x to functions from events (in which x is a certain kind of participant) to truth-values, is empirically motivated by the evidence for thematic separation. Given the Functionist tradition, it can seem strange to say that argumentation–not adjunction–is what calls for special treatment. But from an eventish perspective, this is unsurprising. How *could* one interpret the concatenation of an event predicate with a name for person, except by invoking thematic roles? If the contribution of syntax to meaning is Conjunctivist, the point is obvious; 'stabbed & Caesar' makes no sense. In short, "thematic shifting" may be what lets us employ labels for things in truth-evaluable claims governed by an eventish (but not Functionist) semantics.[15]

2.3

Still, thematic shifting can seem like just a trick–a way of encoding certain facts, in a manner congenial to one's theory, without explaining them. Even if this is preferable to type-shifting treatments of adjunction, why not eschew both tricks and just say that the syntax of adjunction makes a Conjunctivist contribution to meaning, while the syntax of argumentation makes a Functionist contribution? But absent an account of what it would be for natural language to have different kinds of syntax, this is just another way of encoding the facts without explaining them. While natural language lets us combine various kinds of expressions, subject to certain constraints, this hardly shows that there are various modes of combination. To be sure, adjuncts differ from arguments in ways that matter for syntactic transformations. Correspondingly, we have reasons for labelling adjunct phrases differently than

arguments; though syntacticians would (very much) like to know which facts the difference in labels labels. But semantics isn't supposed to care about labels. The spirit of recent developments in syntactic theory also suggests that we should, in so far as possible, try understand syntactic structure as emerging from a single operation of Merge that simply concatenates items; see Chomsky (1995). And we won't find unifications we don't look for. That's mainly rhetoric, however. So let me end this section with a little case study, by way of suggesting that a Conjunctivist conception of how syntax contributes to meaning can have empirical payoffs in unexpected places.

Baker and Stewart (forthcoming)–henceforth B&S–discuss the African language Edo, which allows serial verb constructions like

(41) Ozo will cook food eat. [Òzó ghá lé èvbàré ré]

The meaning is that Ozo will cook some food and eat it, but with a further restriction along the following lines: the cooking and eating must be part of a unified process in which Ozo cooks the food with the plan of eating it. One cannot use the serial verb construction, which contains a single overt object, to describe a scenario in which Ozo was planning to feed someone else–but then ate the food when his guest failed to arrive. Similarly, if Ozo buys a book and then reads it (as planned) when he gets home, one can say 'Ozo buy the book read'. But if he comes across a book in the store, reads it *and then* decides to buy it, one cannot say 'Ozo read the book buy'.[16]

B&S argue for the following syntactic structure, abstracting away from details not germane here:

(41S) $\{(_{\alpha}\text{Ozo})\ [_{\Phi}[_{\Phi}(_{\Phi}\ \text{cook–}v)\ [_{\Phi}(_{\alpha}\ \text{food}_{k})\ \ e]]\ [_{\Phi}(_{\Phi}\ \text{eat–}v)\ [_{\Phi}(_{\alpha}\ \textit{pro}_{k})\ \ e]]]\}$

where 'cook' and 'eat' each raise, from the nearby position indicated with '*e*', to a higher position in which they can incorporate with a covert "small verb" indicated by '*v*'. An underlying assumption is that 'food' and (the covert object) '*pro*' are, by virtue of their syntactic relation to (the original positions of) 'cook' and 'eat', still associated with the role of Theme.

From a semantic perspective, it is striking that the complex verb phrase is analyzed as a

concatenation of predicates, each of which is a concatenation of predicates; in Edo, there is evidently no covert connective between 'cook food' and 'eat *pro*'. From a syntactic perspective, the most striking feature of (41S) concerns the unpronounced object of the second verb, whatever one takes that covert element to be. As the coindexing indicates, (41) requires that the food cooked be the food eaten, as if '$food_k$' were the object of both 'eat' and 'cook'; but as the phrase marker indicates, 'food' does not c-command the position occupied by '*pro*'. So unless B&S have the syntax wrong, or current syntactic theory is badly mistaken, it cannot be that 'food' syntactically binds '*pro*'. Indeed, part of the puzzle these constructions present is that they seem to exhibit mandatory cointerpretation without c-command. B&S thus suggest, without offering a specific proposal, that the right eventish semantics will ensure that 'food' specifies the Theme of *both* the cooking *and* the eating. I think this promissory note can be cashed, given the view urged here.

Suppose that each small verb treats its sister–i.e., the verb with which it incorporates–as a kind of internal argument, and that this argument is interpreted "through a thematic lens" in the sense described above. And suppose that the first small verb is associated with an "Initiater" lens, while the second small verb is associated with a "Terminater" lens, in conscious imitation of the earlier discussion of causatives. This effectively posits two small verbs, *v* and *v**. So lens metaphors aside, suppose that '*v*–cook' is true of events that start with a cooking, while '*v**–eat' is true of events that end with an eating. Or more formally, and paralleling the earlier thematic relativization of arguments like 'Caesar': $\|v\text{–cook}\| = \lambda e.$ *true* iff $\exists x[\text{Cooking}(x) \,\&\, \text{Initiater}(e, x)]$; $\|v^*\text{–eat}\| = \lambda e.$ *true* iff $\exists x[\text{Eating}(x) \,\&\, \text{Terminater}(e, x)]$. The idea is that *any* first part of an accordion-event, an event that starts with an action and ends with some later (causally related) event, is an Initiater of e; basic actions may not be the only Initiaters of the accordion-events they Initiate. In particular, Ozo's cooking of the food can Initiate an event that starts with Ozo turning on the stove and ends with Ozo eating the last mouthful of food. (Compare an event of going to the airport, which has lots of subparts, but starts with getting in the car.) Similarly, any last part

of an accordion-event e is a Terminater of e; so the event of Ozo's eating the food can Terminate a complex accordion event that the cooking Initiates.

If branching predicates are conjunctive predicates, we get the desired results:

$|||[_{\Phi}(_{\Phi}$ cook–*v*$)\ [_{\Phi}(_{\alpha}$ food$_k$$)\ \ e]||| = \lambda$e. *true* iff $\exists$x[Cooking(x) & Initiater(e, x)] & Theme(e, food$_k$); and

$|||[_{\Phi}(_{\Phi}$ eat–*v*$)\ [_{\Phi}(_{\alpha}\ pro_k)\ \ e]]|| = \lambda$e. *true* iff $\exists$x[Eating(x) & Terminater(e, x)] & Theme(e, pro_k).

So the semantic correlate of the whole serial-verb phrase is

λe. *true* iff $\exists$x[Cooking(x) & Initiater(e, x)] & Theme(e, food$_k$) &

$\exists$x[Eating(x) & Terminater(e, x)] & Theme(e, pro_k).

The complex serial-verb phrase is true of events that start with a cooking, have the food as Theme, end with an eating, and have *pro* as Theme. On the assumption that each event has a single Theme, '*pro*' must be interpreted as the food, since '*pro*' represents the Theme of an event that has the food as its Theme. So the complex serial-verb event must start with a cooking of the food and end with an eating of that very food. And (41) is true iff Ozo is the Agent of some such event.

Initially, one might wonder how 'food' could specify the *Theme* of the serial-verb event, given that 'food' is the syntactic object of a verb that specifies how that event *begins*. But this is a point at which thematic separation (together with a Conjunctivist account of syntactic branching) pays off. By virtue of its syntactic position, 'food' is associated with the role of Theme; so it is interpreted as a Theme-specifier, regardless of what happens in the rest of the sentence. Similar remarks apply to '*pro*'. And branching is interpreted as function-conjunction, regardless of the functions conjoined. This allows for a kind of "nonlocal" semantic relation, since each (nonplural) event can have only one Theme. Languages that do not allow for the double-headed structures indicated in (41S) may not manifest this kind of mandatory cointerpretation without c-command. But the Edo facts suggest that a semantics for natural language should treat syntactic arguments of verbs as separate conjuncts in an event description, with natural syntax itself as the source of the conjunction.

3. Logical Form as Eventish Semantic Form

If the meaning and syntax of (1) are as shown in (1S) and (1c)

(1) Brutus stabbed Caesar

(1S) $\{(_{\alpha}\text{Brutus})\ [_{\Phi}(_{\Phi}\ \text{stabbed})\ (_{\alpha}\text{Caesar})]\}$

(1c) $\exists e<\{[\text{Agent}_2(\text{Brutus}_i)](e)\ \&\ [\text{Stabbed}_1(e)\ \&\ [\text{Theme}_2(\text{Caesar}_i)](e)]\}>$

then we can say that the syntactic and semantic *forms* of (1) are as shown in

(42) $\{(_{\alpha}\ ...)\ [_{\Phi}(_{\Phi}\ ...)\ (_{\alpha}\ ...)]\}$

(43) $\exists e<\{[\text{Agent}_2(\ ...)](e)\ \&\ [S_1(e)\ \&\ [\text{Theme}_2(\ ...\ )](e)]\}>$

which abstract away from idiosyncratic features of (1) and its lexical items. For example, 'Shem poked Shaun' presumably has the same syntactic and semantic forms. If conjunction is the semantic correlate of concatenation, and syntactic position determines thematic role, then the syntactic form of (1) determines its semantic form–modulo the existential quantifier (briefly discusssed above).[17] There is a tradition of taking the logical form of a sentence Σ to be the form of Σ's meaning. So one might well say that (43) represents the logical form of (1), and that the logical form of Σ is determined by the syntactic form of Σ–at least for sentences of this type, and perhaps for all sentences.

I am inclined to endorse this view and stop here. But there is also a tradition of doubting that sentences of a natural language like English really *have* logical forms–or meanings–as opposed to being associated with things that have logical forms. (Compare the Cartesian view that people are minds who "have" heads only by virtue of bearing some relation to bodies that have heads.) In my view, this negative claim about natural language is either unmotivated or a product of stipulation; although natural sentences may in fact be associated with things that have semantic structures of their own. And this, alas, requires some comment.

At least for present purposes, let us say that Propositions are those things (whatever they are) that stand in *logical* relations. Propositions are potential premises/conclusions, each of which has a certain

"logical position;" each Proposition *follows from* certain others. Let us assume that Propositions have compositional structure, and that–modulo indeterminacy and certain referential failures–each use of a natural sentence is associated with a Proposition. But let us leave open the following possibilities: a natural sentence may not be isomorphic with the Proposition it is used to "express"; and the relevant notion of association, which awaits characterization, may be use-sensitive in a way that precludes association of each natural sentence with a single Proposition–or even a single function from Kaplan-style contexts to Propositions. (Though if these possibilities are actual, one might wonder if there is a determinate mapping from natural sentences to Propositions.)

Propositions are effectively defined as bearers of logical form. So let us grant that *if* the semantic form of sentence Σ differs from the form(s) of the associated Proposition(s), then the logical form "of Σ as used" is really the logical form of something else; in which case, Σ's semantic form shouldn't be identified with Σ's logical form. But *pace* Frege-Russell-Wittgenstein, it is *not* obvious that syntactic/semantic form diverges importantly from logical form. The most famous examples of the alleged divergence–*viz*., quantificational constructions–evaporated upon further investigation. For example, if (42) is also the syntactic form of

(44) Brutus stabbed the emperor

while the associated logical form is '$\exists x\{E(x) \ \& \ \forall y[E(y) \dashrightarrow y = x] \ \& \ S(b, x)\}$', there appears to be a significant mismatch. But a more plausible syntactic representation is

(45) $\{[_{\Delta}(_{\Delta}\text{the})(_{\Phi}\text{ emperor})]\ \{(_{\alpha}\text{Brutus})\ [_{\Phi}(_{\Phi}\text{ stabbed})\quad t\ ]\}\}$

with 'the emperor' treated as a determiner phrase that raises, leaving a trace. And we can rewrite the Russellian hypothesis about logical form using restricted quantifiers (but ignoring events), as

(46) $\text{the}(x){:}E(x)\{S(b, x)\}$

where 'the' is satisfied by certain ordered pairs of extensions; see Neale (1990, 1993). Still, whatever one says about particular cases, analytic philosophy–born of modern logic, and long suspicious of

transformational grammar–has bequeathed to us the idea that Propositional structures may not align with the syntactic structures of natural sentences. And this fits with an associated conception of logic.

If logic is the study of nonpsychologistic principles of Good Inference–or laws concerning The True, or The World at the most abstract level of generality–then the facts about what follows from what are independent of which inferences we *find* compelling; and these facts are, at least in principle, independent of the psychological states that underly our ability to recognize the good arguments we do recognize. Correspondingly, 'P follows from Q' seems to be normative in a way that 'speakers find the inference from Σ to Σ* impeccable' is not.[18] So perhaps claims about the logical forms of sentences are normative in a way that claims about the semantic forms of natural sentences are not. Maybe facts about Good Inference are uncovered by a process of reflective equilibrium that *begins* with judgments heavily influenced by grammar, but leads (via the devlopment of formal languages with various virtues) to judgments about which inferences we *ought* to treat as impeccable. And logic-influenced judgments, which are arguably better justified than our original judgments, may suggest that Propositions are structured differently than sentences. On this view, Propositional structure reflects ideal reasoning–*i.e.*, the use of sentences with certain structures in accordance with certain rules of inference; and claims about the logical form of a natural sentence Σ are claims about which logical position one *ought* to associate with (a given use of) Σ.

Maybe there is an interesting project here, grounded by determinate facts, which will suggest that natural language sentences have structures that render them nonideal for purposes of conducting inferences. But if so, the moral would seem to be that logic and semantics are fundamentally different enterprises. Natural sentences *don't* have logical forms, in any interesting sense, if claims about logical forms are normative claims about how sentence-users should reason. And there is no reason to assume that semantic facts, at least some of which are reflected in the semantic forms of sentences, are facts (revealed in reflective equilibrium) about how we ought to reason. If we reject psychologistic

conceptions of logic, we should be ready to reject logicist conceptions of semantics according to which sentential meanings are (functions from uses of sentences to) Propositions. The facts in virtue of which natural sentences have their semantic forms may well be psychological facts of the sort that logic is alleged to be independent of.[19]

There is, however, yet another wrinkle. Assume there is a language of thought, and that each use of a natural sentence–now using 'natural' to mean 'natural and public'–is associated with a sentence of mentalese, while leaving open the following possibilities: the compositional structure of a mentalese sentence may not match that of an associated natural sentence, even if the latter can be used to "signal" the former; and the relevant notion of association, which awaits characterization (perhaps in the form of some brutely causal mechanism akin to transduction), may be use-sensitive in a way that precludes association of each natural sentence with a single mentalese sentence–or even a single function from Kaplan-style contexts to mentalese sentences. One might say that the *mental form* of a natural sentence, as used in a context, is (the semantic form of) the associated mentalese sentence. If the semantic forms of natural sentences differ from their mental forms, but we have reason for thinking that mental forms reflect aspects of natural sentence meanings, there will be little point in identifying logical form with either notion of "underlying" form.[20]

Given these complications, perhaps we should just drop the term 'logical form'. It might be better to speak of: semantic forms, understood as properties of natural sentences (independent of their relation to Good Inferences and any language of thought); logical positions, understood as "addresses in an inferential space" modelled by Propositions that reflect which inferences we *ought* to treat as impeccable; and sentences of mentalese, whose semantic structures may (or may not) diverge from their public counterparts. But however we choose to speak, the phrase 'logical form' has been historically used to gesture at a neighborhood of facts that at least include some descriptive facts concerning sentences and their (intrinsic) grammatical properties. I have suggested that at least some of these facts concern the

thematically separated semantic forms of natural sentences. I have also noted related senses in which natural languages differ from a *Begriffsschrift*, whose compositional semantics is Functionist, while still suggesting that the semantic forms of sentences (or least those aspects of semantic form discussed here) are determined by their syntactic forms. Perhaps a theory of logical position and/or mentalese will reveal interesting aspects of meaning not grammatically determined; but such speculations, while not implausible, still await defense. On the other hand, while there is no *a priori* guarantee that natural sentences have semantic forms that capture (interesting aspects of) their meanings, available evidence suggests that a certain development of Davidson's event analysis is on the right track as a proposal concerning the semantic forms of sentences. So if we want to study the facts in the "logical form neighborhood", pursuing thematically elaborated event analyses–along with a Conjunctivist conception of how natural syntax contributes to meaning–looks like a good bet.[21]

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Notes

1. But one idealizes, by associating expressions of natural language with *functions* (whose extensions are not vague), or language-independent *entities* (with determinate properties). And the fact that a sentence Σ has certain *truth*-conditions may well be an interaction effect, involving contextual factors not amenable to Kaplan-style relativization, with the meaning of Σ being one *contributing factor*; see Chomsky (1975, 2000a), Pietroski (forthcoming-b). In which case, semanticists don't specify *truth*-conditions; they specify something that *constrains and contributes to* truth-conditions. But set these complications aside.

2. For an introduction to thematic roles that bears on the present discussion, see Larson and Segal (1995). Davidson's (1967) and Castaneda (1967) used variants of (1b) and (1c), '∃e[Stabbed(e, Brutus, Caesar)]' and '∃e[Agent(e, Brutus) & Stabbed(e) & Theme(e, Caesar)' that I will also use occasionally.

3. Perhaps {<x,y>: x stabbed y} = {<x,y>: ∃e[e was a stabbing by x of y} = {<x,y>: ∃e[x was Agent of e & e was a stabbing & y was Theme of e]}, and speakers of English know this; see Parsons (1990).

4. If one tries to account for (1-5) by saying that adverbs express functions from functions to functions, without appeal to events, (11-14) present a stumbling block; see Taylor (1985). If (11-12) are true, each adverb must express a function F, such that [F(λx. *true* iff x hit Shaun)](Shem) = *true*; and similarly for the complex adverbs 'sharply with a red stick' and 'softly with a blue stick'. But if (13-14) are false, 'softly with a red stick' and 'sharply with a blue stick' must not express any such function F.

5. As in Davidson (1967); though cf. Davidson (1985). Moreover, one might say that 'Stabbeb$_3$' gives the meaning of 'stabbed', *because* the English verb is satisfied by ordered triples <e, x, y> such that: [Agent$_2$(x)](e) & [Stabbed$_1$(e) & [Theme$_2$(y)](e)]; see note 3. But this isn't thematic *separation*, since the syntactic arguments still make their semantic contributions via (the function expressed by) the verb.

6. And (20) doesn't yet capture the meaning of (19), which implies that three linguists were *the* Agents of the relevant teaching–not just participants in some mass-teaching. Schein, following Boolos (1985), adopts second-order representations of plurality. The resulting modification of (20) is:

$\exists e<\exists S:\{|S| = 3 \ \& \ \forall x \in S[Linguist(x)]\}\forall x[Agent(e, x) <--> x \in S] \ \& \ Taught(e) \ \&$

for 4 students x, $\exists f:f<e[Recipient(f, x) \ \& \ \exists S:\{|S| = 5 \ \& \ \forall x \in S[Theory(x)]\}\forall x[Theme(f, x) <--> x \in S]]>$.

7. Schein also argues that if we treat 'three linguists' as a label for some (plural) entity in the domain of the function associated with 'taught', the resulting semantics will either lead to paradox or fail to account for certain entailments that speakers recognize–e.g., that there is at least one linguist if the linguists sang.

8. For more details, see Pietroski (2000b, forthcoming-c). With many English verbs, the difference between 'that P' and 'the fact/claim/belief that P' is not apparent. For example, if you doubt the claim that P, you doubt that P. But the Japanese translation of 'doubted the claim that Kenji killed Mariko' involves marking the sentential complement of 'utagatta' with the accusative case morpheme 'o': [Kenji-ga Mariko-o koroshita-koto]-o utagatta; where 'ga' is a nominative case morpheme, and 'koto' is some kind of complementizer or nominalizer. A different construction involves the morpheme 'to', which is used in the translation of 'explains that ...' and generally seems to be correlated with the role of Content: [Kenji-ga Mariko-o koroshita]-to utagatta.The meaning, which parallels 'explained that P', is roughly: doubted *something* (for example, that Mariko committed suicide) *by thinking* that Kenji killed Mariko. Similar remarks apply to 'hiteishita' ('denied') and 'koukaishita' ('regretted'). My thanks to Mitsue Motomura for this data.

9. The transitive verb in (22) has the intransitive 'boil' as a part; *cf*. Hale and Keyser (1993). Positing two lexical items, 'boil_T' and 'boil_I', is unparsimonius. And while the inference from (26) to (28) seems analytic, I am supicious of analytic connections between lexical items; see Pietroski (forthcoming-a, c).

10. Cf. Parsons (1990). I return to the notion of unification below in the context of serial verbs. But the idea of "breaking a causal chain" is familiar and entrenched in law; see Hart and Honore (1959). In any case, one can reply to Fodor and Lepore by saying that there is no event (or at least no event relevant to semantics cares about) that both starts with the arsonist's action and ends with the soup boiling.

11. For discussion of generalized quantifiers and their semantics, see Barwise and Cooper (1981),

Higginbotham and May (1981), Larson and Segal (1995). Perhaps all arguments have the syntactic form $[_{\Delta}(_{\Delta}...)(_{\Phi}...)]$. Names like 'Brutus' might contain a covert determiner akin to Kaplan's (1989) 'dthat'.

12. It is notoriously difficult to see how this *explains* the relevant facts concerning (speakers recognition of) entailments; see note 4. And one wants motivation for the claim that 'stabbed Caesar' is the semantic argument in (2) but the semantic predicate in (1); *cf*. Frege's (1892) appeal to *Bedeutung*-shifting.

13. Similarly, if the meaning of 'doctor from Seattle' is given by 'Doctor(x) & From-Seattle(x)', the contribution of syntax is function-conjunction; and insisting that 'from Seattle' expresses a function from functions to functions leads to complications. See Heim and Kratzer (1998) for formal discussion.

14. There are many cases to consider, including (so-called) nonconjunctive adjectives. But even if ||first big dog|| ≠ λx. *true* iff ||first||(x) = *true* & ||big||(x) = *true* & ||dog||(x) = *true*–because of various context-sensitivities, failures of the idealization mentioned in note 1, or something else–there is *some* conjunctive aspect to the meaning of 'his first big dog'. And syntax may well be the source.

15. From this perspective, functional aspects of meaning are covert. But what about connectives and determiners? Perhaps 'P or Q' is true iff ∃x{External(x, P) & [Or(x) & Internal(x, Q)]}. An ordered pair of *truth values* can have P as its external argument, satisfy 'or', and have Q as its internal argument. And perhaps 'Every Φ is ψ' is true iff some ordered pair of sets that satisfies 'every' has the relevant *extensions* as internal and external arguments. See Larson & Segal (1995), Pietroski (forthcoming-c).

16. I'm indebted to Mark Baker for conversation and data. A different Edo construction, with an overt pronoun following the second verb, does not imply any plan that connects the events in question. And appeals to unified events are not *ad hoc* if they can be correlated with independent syntactic phenomena.

17. Poverty of stimulus considerations might suggest that these aspects of meaning reflect innate aspects of universal grammar. Other aspects of meaning are so reflected; see Crane and Pietroski (2000) for a review. If branching syntax means AND, as opposed to (say) OR, one would like to know *why*; and mere appeals to communicative efficiency are unsatisfying. So perhaps we should think about how conjunction

is related to the mereology of "banquet-style" and/or "accordion-style" events.

18. But note that facts about grammaticality, which are independent of what speakers find *acceptable*, are not independent of the psychological states that underly speaker's linguistic abilities; and while one can define normative notions of grammaticality, the linguist's notion remain descriptive.

19. This skims over many issues that deserve attention, like why linguistic competence seems to inovlve a capacity to recognize *some* impeccable inferences as such; and why we should view certain sets of formal sentences as formalizations of the inferences we naturally make. But in so far as one takes 'logical form' to be a nonpsychologistic/normative notion (cf. note 19), one cannot just assume that facts about logical forms (whatever they are) bear interestingly on facts about the meanings of sentences. Nor can one assume that natural sentences have meanings only by virtue of being translatable/regimentable into sentences of a *Begriffschrift*. One can stipulate that the Meaning of Σ is a function from potential uses of Σ to the Propositions associated with those uses. But any facts about which Meanings natural sentences have may consist largely in facts concerning semantic forms. See note 1; and see McGilvray (1999) for further discussion, in the context of Chomsky's (2000a) views, which I have been echoing.

20. Especially if mentalese sentences align better with Propositions, and/or talk of a *truth*-conditional semantics involves less of an idealization for mentalese than it does for spoken languages; see note 1. Fodor suggests the more radical possibility that spoken sentences don't have semantic forms (or meanings) of their own: their semantic properties are due entirely to their (heavily context-sensitive) association with mentalese sentences, which are the primary bearers of meaning. But as it stands, this is speculation in need of defense, especially given the apparent successes of natural language semantics.

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