INTRODUCING INTERNALISM, VIA *CONJOINING MEANINGS: SEMANTICS WITHOUT TRUTH VALUES* – PAUL M. PIETROSKI (2018)[1]

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When I can, I evangelise for semantic 'internalism', or semantics stripped of truth-conditions. Instead of construing the meanings of words as things that specify referents, some internalists think of words as instructions to access concepts. Such a position is prominently defended in Chomsky (2000), the best overview of Chomsky's views on semantics, and Paul Pietroski's work (e.g., Pietroski (2003; 2006)). This paper aims to summarise Pietroski's more recent work, place its claims in a wider context, and provide some general motivation for the Pietroskian project. His 2018 book, *Conjoining Meanings: Semantics Without Truth Values* (henceforth, CM) is a 360-page criticism of truth-conditional semantics as well as a sketch of what he thinks a viable alternative might look like.[2] For more popular exposition, Pietroski has some accessible interviews online.[3] He also has a short precis of CM that covers the leading ideas of the book (Pietroski, 2020). Here, I provide a detailed (read: long!) summary which goes through the formal details too, so semanticists can see the system in action and get more of a look at the motivations behind it. I will go through the book chapter by chapter, section by section.[4] Bolded text indicates a chaper and section (**1.2.1** = chapter one, section 2, subsection 1).

CM is a minimalist program for semantic theory, seeking to simplify the mechanisms of semantic composition, and recapture the insights of truth-/model-theoretic semantics in a sparser system than the typed-lambda calculus. As such, it might be of interest to even those who are uninterested in the philosophical debate between referentialism and internalism which vexes Chomsky, but who just want an overview of a more constrained system. Pietroski's system gets rid of many of the standard composition rules like Function Application, Pronouns and Traces, Predicate Modification, etc., as well as standard tools like variables and lambda-abstraction. It should come to light how CM is not just a notational variant of standard semantic theory. After summarising the work, I also discuss differences between Chomsky and Pietroski, the relation of the system in CM to 'neo-constructionist' approaches to syntax, the strict context-insensitivity of meanings in CM, and how entailment is thought of.

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[1] I am grateful to Paul Pietroski for helpful discussion.

[2] There are other flavours of internalism around (Farkas, 2006), which are more philosophical in character. Pietroski's is aimed at naturalists who are interested in how philosophy can interact with cognitive psychology and linguistics.

[3] See links on his website: *https://terpconnect.umd.edu/~pietro/InterviewLinks.html*

[4] My model is Potts's (2008) helpful summary/review of *Structuring Sense* (Borer 2005a,b).

Chapter 0: Overture

Overture lays out some of the most important themes going forward. As a result, I'll dwell on it for a while. It is a constraint on any theory of meaning for natural language that natural-language meanings have to be (i) composable, (ii) biologically implementable (i.e., psychological), and (iii) account for constraints on ambiguities.

By "composable", I do not mean to invoke the principle of compositionality in one of its familiar forms of Function Application(FA).

(FA) The meaning of a complex expression [β [α]] is a function of its parts, i.e., $[\![[\beta\ [\alpha]]]\!] = [\![\beta]\!]([\![\alpha]\!])$.

"Composable" here just means that the meaning of a complex expression must be determinable from primitive meanings and their syntactic arrangement: no specific claims about how to interpret 'function' are involved. For reasons given below, the function-theoretic interpretation of compositionality is not one Pietroski favours (for extensive discussion of 'functionism', see Pietroski (2005)). The heart of CM is a spare typology that makes appeals to FA and the powerful e/t typology it invites seem dispensible.

A theory's biological-implementability means that our claims about semantic procedures are not claims about abstracta like shared languages or platonic objects, but about computational operations performed by a computational mind/brain. That is, our theory is a psychological theory about the semantic competence of a speaker-hearer.

Constrained ambiguity is the phenomenon of sentences having a fixed integer-number of semantic interpretations.

(1) John loves Mary. (1 reading)

(2) Everyone loves someone. (2 readings)

(3) love John s Mary. (0 readings)

In (2), we see a sort of homophony between structures. Ambiguity is all over the place in natural language. We will see much discussion of another sort of ambiguity: polysemy, where a single item has multiple senses.[5] That is, natural languages also allow for 'conceptual equivocality' – the same lexical item can be used to access different concepts at different times (e.g., *window* meaning the glass that fills the hole in the wall or the hole in the wall itself). I expand below.

Pietroski outlines the answer to all three issues: meanings, the output of syntactic analysis, are instructions to fetch and assemble concepts and truth-evaluable thoughts (and hence, are neither concepts (*pace* Fodor) nor extensions (*pace* your favourite

[5] Colloquially, we might say multiple meanings. But insofar as 'meaning' is a technical term for Pietroski, a lexical item doesn't have *multiple meanings* when it is polysemous, but rather, its meaning allows for retrieving more than one concept on different occasions of execution.

introduction to formal semantics textbook)). Instructions can compose (instructions to fetch BROWN and instructions to fetch COW and instructions to assemble those in some way yields BROWN COW), and can be biologically implemented just the way a Chomskyan 'I-language' can (i.e., something like how a computer program can be executed by electrical signals and bits of metal; it is a function/procedure that can be implemented by the mind/brain – more on this later).

0.1 Human Linguistic Meanings

This section is concerned with – of course – what human linguistic meanings are. This chapter doesn't provide sufficient conditions so much as some necessary ones. The trouble is that *meaning* itself is polysemous. Smoke means fire, red lights mean stop, the footprints mean a bear was here, I mean to provide some reasons to take semantic internalism seriously, etc. Pietroski thinks human linguistic meanings are something special, in that they combine in interesting ways, i.e., they compose. 'Slangs' (which are whatever human children naturally acquire; *s*-poken/*s*-igned *lang*uages) pair signals/pronunciations (sounds or gestures) with meanings/interpretations.

The distinctive feature of slangs is that the interpretations are somehow combinatorially determined. The present investigation is into what meanings are from the perspective of the study of Slangs only (cp. Brandom (1994), which takes itself to be as applicable to Martians as to humans).

This study is, then, quite different studying what the terms of mathematics and logic mean. Those are vexed problems for philosophers, who may want to know what, if anything, the possible world *w* in the set of possible worlds *W* refers to. Perhaps it is concrete worlds out there (Lewis, 1986), perhaps it is a property the actual world has (Stalnaker, 2012). Perhaps *W* doesn't refer. At any rate, we should be careful before we assume that the nature of invented languages like S5 modal logic reveals anything deep about Slang-meanings. Perhaps it will – but perhaps it won't. Formal semantics has mostly uncritically accepted that logic tells us something about natural language. But it is a hypothesis that the semantics used for an invented language are the appropriate ones for Slang sentences, and if the arguments in CM are right, the hypothesis is false.

Breaking the analogy from constructed ideal languages, then, Pietroski thinks the meanings of words – lexical meanings – are "intructions for how to access mental symbols that may be *introduced* in the course of acquiring a lexicon" (CM, p. 3). As will come into much clearer focus later, Slangs impose certain restrictions on the sort of mental symbols that the speaker-hearer is able to connect with signals; conditions on 'representational format'.

0.2 Meanings are not concepts

In a later section (**6. Massively monadic, potentially plural**), there will be much discussion about a specific axis along which words and concepts can come apart: their adicities. Here, Pietroski gives some big-picture reasons for rejecting the Fodorian view that lexical meanings are concepts (i.e., words just label concepts; the meaning of *w* is *W*).

Pietroski adopts a Fodorian conception of concepts as composable mental symbols with which concept-users can think about things (i.e., syntactically atomic mode of presentation, or MOP, possibly with an extension – the things you can think about with the MOP). A concept like RABBIT can be used to think about lots of things. What Pietroski wants to emphasise here is that the word *rabbit* allows us to access multiple concepts at different occasions of use – RABBIT:ANIMAL, for one, RABBIT:MEAT for another. This is important.

It looks like we need a distinction between homophony and polysemy. /baŋk/ does a lot of work in intro-to-semantics, it seems, being a paradigm case of homonymy in BANK-RIVER vs. BANK-FINANCE, but what often goes unnoticed is that the latter sense also displays polysemy! Even ignoring the geographical concept, /baŋk/ is ambigious between BANK-FINANCE:BUILDING and BANK-FINANCE:INSTITUTION. This is the same lexical item allowing multiple meanings, not two distinct lexical items sharing a pronunciation – look at (4).

(4) [The bank]$_i$ moved across the street after it$_i$ burned down.

Not every phonological form allows this sort of thing, as in (5). This sort of issue is not normally touched on by formal semantics textbooks – it is convenient when modelling to say the meaning of *bank*$_{\text{finance}}$ is the set of (possible) banks. But some interesting phenomena, like some co-predication cases being acceptable but others not, seem to be trivialised by that idealisation. That is, homonymous items, like COLD:DISEASE and COLD:WEATHER, don't interact with the grammar the same as polysemous items.

(5) #Mary went out into [the cold]$_j$, so she got one$_j$.

Assuming that co-indexation means that the lexical items are assigned the same semantic value. Nothing physical can move across the street after being destroyed, so the pertinent concept might be BANK:INSTITUTION, but nothing abstract can burn down, so the pertinent concept might be BANK:BUILDING. This is a case of *bank* displaying polysemy. These sentences co-predicate in a way that accesses multiple concepts. They are, nonetheless, absolutely interpretable. They also present a puzzle – I'll call them 'Chomsky-cases', like we refer to embedding-related puzzles as Frege-cases.

Thinking about banks-the-things-by-rivers and banks-the-things-with-CEOs is different, as discussions of lexical ambiguity often point out. More importantly here, thinking about banks-the-things-with-CEOs as brick-and-mortar buildings and banks-the-things-with-CEOs as abstract institutions are also different. Chomsky-cases then display conceptual equivocality *par excellence*. Chomsky-cases illustrate that meanings – something the grammar has access to – don't cut things as thin as concepts. The same context-insensitive meaning can be used to access multiple concepts at different times, perhaps within a

single sentence. Conceptual equivocality, then, tells strongly against the idea that meanings just *are* concepts (but, for discussion, see Quilty-Dunn (2020)[6]).

0.3 Meanings are not extensions

This is a discussion of some traditional problems in philosophy of language, but the actual conclusion of the section is argued for throughout the book. This section will be particularly interesting for philosophers – especially metaphysically-minded philosophers of language.

While it's patent that extensions don't cut things thin enough for 'meanings' (Frege, 1892), Pietroski argues, contra Lewis, that *possible* extensions don't either. The argument goes that there are no possible worlds where ghosts or unicorns exist, but these words seem to have meanings (and if they don't, how do we differentiate between *drawing of a ghost* and *drawing of a unicorn*?). Pietroski thinks Kripkean intuitions about aboutness suggest that these things couldn't exist, even if one-horned horses and undead spirits exist at some possible worlds. Those things, whatever they are, are *not* causally related to our unicorn-thoughts/ghost-thoughts. If the causal theory of reference is true, meaning can't be the same thing as reference. This stands quite apart from points about polysemy. Considering polysemy, we can see that *unicorn* can access many concepts like UNICORN:FAKE or UNICORN:TOY. Pietroski summarises: "If we ignore polysemy, the relevant point is that there are no ghosts or unicorns. If we don't ignore polysemy, the case against identifying meanings with extensions is even stronger" (CM, p. 16). Likewise, Twin-Earth cases equivocate between senses. Words like *water* may be used to access certain concepts that have extensions like H_2O, but they also display polysemy. WATER:KIND is only one of the concepts accessible via *water* – the stuff in Pietroski's well has a lower H_2O content than diet cola, but *water* can't be used to access DIET COLA.

0.4 Meanings as modest *Begriffsplans*

Here, Pietroski gives a positive answer to the question of what meanings are. He thinks the meaning of *red dot* is something like the instruction Join[μ(*red*), μ(*dot*)], where μ(*red*) should be read 'the meaning of *red*'. Pietroski outlines some discussion of Frege and Tarski that we'll come back to in **2**. Here, the point is that Frege's ideal languages neither were intended to work as models for the semantic structure of natural languages, nor do they do that work very well. But Frege's point that a language can introduce a new representational format – a new stock of symbols – is preserved.

Pietroski also draws some attention to the importance of predicates in cognition. This makes up the basic typology of CM – rather than the traditional *e*, *t*, and functions therebetween of formal semantics, the CM-system entertains two types, M and D. M is for monadic predicates like BROWN, and D is for dyadic predicates like AGENT-OF-EVENT. The instructions may be sensitive to the type of their operands; joining two monadic

[6] It should be noted that Pietroski and Chomsky think that it is the *grammar* which interfaces with concept-assembly instructions. The sort of psycholinguistic evidence Quilty-Dunn discusses may tell us a good deal about how concept-representations are used in real-time processing, i.e., how the *parser* works.

predicates to yield a monadic predicate is M-junction (as with *red dot*), joining a monadic predicate with a dyadic predicate is D-junction (as in assigning a thematic-role to *cowboy*). There is also a mention of the syncategorematic polarization operators, ⇑ and ⇓, which, when applied to a predicate *P*, make it apply to everything/nothing if *P* applies to something. We will return to the details of the formal machinery in **7. Minimal Semantic Instructions**.

The interesting point is that such a sparse typology suffices for a lot of what we see in natural language, even if not all. In minimalist spirit, we might ask why natural language seems not to display triadic relations like GIVE(*x*, *y*, *z*) but is restricted to dyadic ones (Larson, 1988). Pietroski's answer is that universal grammar doesn't allow things of semantic type T(riad) – you have to do with M(onads) and D(yads). This typology may be imposed onto pre-existing representations – i.e., we might have triadic concepts in our Slang-external language of thought, but in order to connect them with pronunciations, these concepts would need reformatting into a (possibly complex) concept, which respects the M/D typology.

Chapter 1: Locating Meanings

This chapter defends the Slang-perspective employed, against alternative ideas like David Lewis's (1970).

1.1 Unbounded yet restricted

This section draws on traditional themes from generative grammar: a repeated question in syntactic theory is "why this interpretation and not another?". Why does (6) have to mean that John is a pleaser and (7) that John is a pleasee?

(6) John is eager to please.

(7) John is easy to please.

Considerations like these made Chomsky (1986a) posit null operator movement in the syntax, meaning the sentences are underlyingly quite different, like (6') and (7') are.

(6') John$_i$ is eager [t_i to please]].

(7') John$_i$ is easy [OP$_i$ [PRO to please t_i].

Why is (8a) more like with (8b) and not (8c)? Again, the answer may be syntactic, to do with syntactic conditions on how movement can take place (Chomsky, 1986b).

(8a) How did you wonder whether Bill fixed the cars?

(8b) For a long time, you wondered whether Bill fixed the cars.

(8c) You wondered whether Bill fixed the cars with a wrench.

The take home point is that Slangs pair pronunciations with a determinate integer number of interpretations, and syntactic theory seeks to explain why. That number might

be 0, in the case of word-salad. But even "incorrect" sentences may receive pairings with pronunciations – (9) can be paired with (10a), but not with (10b).

(9) *The children seem sleeping.

(10a) The children seem to be sleeping.

(10b) The children seem sleepy.

Likewise, (11) is generable and interpretable by the grammar. It may yield a thought that does not apply to anything, but there is a semantic interpretation.

(11) Colourless green ideas sleep furiously.

Pietroski proposes to take this much as given. He asks, after that fact, what it is that syntax pairs pronunciations with (rather than stipulating meanings must be like this or that, and seeing how syntax might pair with meanings). A driving question, then, is why *n* meanings for a string, and not *n*+1?

1.2 Procedure matters

Pietroski argues that extensionally equivalent sets of sound-meaning pairs won't do. The way these sets are generated matters for semantic theory. Drawing on a tradition that includes Frege, Church, and Chomsky, Pietroski argues that sets in intension are specified by a procedure of generating that set. That is to say that semantics isn't just about making sure sounds are matched with the right denotations, we want to identify the *rules* that govern semantic composition. For Chomsky, *language* in its LANGUAGE:KIND use refers to an internal – mentally-represented – procedure for pairing sounds and meanings, which an individual gains in the course of acquiring a language. Call this an I-language (Chomsky, 1986a).

Note the difference with other uses of 'intension'. When talking about an intensional semantics, Pietroski is NOT talking about possible-worlds semantics. The metalanguage for possible-worlds semantics remains extensional (Menzel, 2016). When talking about intensions, following Church and Chomsky, Pietroski is talking about procedures. In this case, then, intensional semantics seeks to get the procedures of composition right. And, if we are good Marrians in cognitive science, we are taking our theories to be descriptions of computational processes realised by the brain (Marr, 1982 [2008]). As such, our theories are like descriptions of a computer program, and like in programming, it will matter how our code is put together. Not all algorithms that sort a list are the same. Likewise, not all algorithms that pair sentences with their meanings are the same. We want our semantic theory to identify the program *actually* run by the human mind/brain.

Lewis's account of language, which introduces social convention, truth-conditions, etc., seems to complicate things. For Lewis, a language is defined extensionally. But having a set which consists of sound-meaning pairs could describe many different linguistic competences – some of which may violate principles of human language. Extensionally equivalent grammars are just as good as one another for Lewis (as they were for Quine,

whose reasons were behaviorist). Pietroski argues that we should stick to the I-language perspective, where we seek to characterise a speaker-hearer's mentally-represented linguistic competence, and think of grammars as internalised procedures pairing pronunciations with interpretations – not socially-conventionalised pairs of sounds and truth-conditions.

1.3 Looking ahead: what's truth got to do with it?

Perhaps nothing. Here, Pietroski takes on Davidson's (1967a [1993]; Davidson, 1967b [2006]) hypothesis that (D):

(D) If *L* is a Slang, then some theory of truth for L is the core of a correct theory of meaning for *L*.

There are some obvious problems with this theory of meaning, like the reason Tarski himself rejected it – natural languages allow the semantic paradoxes to occur:

(12) This sentence is false.

So, treating (D) as a hypothesis, we have some *prima facie* evidence against it. A lot of this will receive elaboration in **4. Truth or understanding** but for now, we only need Pietroski's remark: "Sometimes, philosophers and linguists talk as if it's *data* that Slang sentences have truth conditions. I think that's wrong" (CM, p. 72) – (D) is a hypothesis, and it may well be false. If we want a science of meanings, we need to be willing to find out what the extension of MEANING:KIND is. Stipulations like "we can know the [symbolic representation, Mentalese translation] of an English sentence without knowing the first thing about the meaning of the English sentence: namely the conditions under which it would be true. Semantics with no treatment of truth conditions is not semantics" (Lewis, 1970, p. 18) hinder us in finding out what the extension MEANING:KIND is, if it isn't extensions.

Chapter 2: Introducing concepts

This chapter spells out the idea of mental predicates that Pietroski uses. They are, as noted earlier, composable mental representations – with adicities and representational formats. While Pietroski mentions other uses of 'concept', the one he is sticking with is a Fodorian idea of a mental symbol that a thinker can use to think about things.

2.1 Representation and constituency

Pietroski lays out the foundational assumptions. Concepts can be used to think about things. The notion is intentional. We can think about things that exist, that don't exist, and that couldn't exist. Concepts may also apply to things, where application is non-intentional – its purely extensional. The terminology can be misleading. Intentional uses of concepts set up intensional contexts where the same object can be thought about in different ways (or a non-existent object can be thought about). Determining what a concept applies to is not intensional (and *a fortiori* not intentional). I *think* what Pietroski has in mind is certain uses of natural-kind concepts and the resolution of Frege cases. WATER:KIND and H2O apply to the same thing, but obviously can be used to think about

the thing differently (take a scientist or philosopher who wants to argue that WATER:KIND does not apply to H2O). Some concepts, like Pylyshynian FINSTs (a visual concept; something like a bare demonstrative that picks out an individual object in perception), may be more linked to the world directly – Pietroski cites Pylyshyn's (2007) book as helpful here (CM, p. 79). But lots of cases, the specific concepts used to apply to things matter a lot. More on this when we get to **5. Events and framing**. The key idea here is that thinking of concepts as symbols (things that have a syntax and a semantics) allows us to begin to account for the compositionality of thought, as well as frame hypotheses about the constituent structure of concepts.

We can think of *brown cow* as being semantically reflected by a concept like BROWN OR COW. This would be a compositional theory, just a terrible one. It seems that we can't think BROWN COW without thinking COW. Analyticity-afficionados may even claim we can't think BROWN COW without thinking ANIMAL, a bit like a syntactician thinks you can't understand *John wants to go to the park* without tokening *John* twice (once higher than *wants*, once higher than *go*). These are all hypotheses about the constitent structure of thought. The argument from productivity – the idea that we can have an infinite number of thoughts – is a familiar one. This sort of consideration is often used to suggest that thought is importantly language-like (Fodor, 1987; Fodor, 2008; Fodor & Pylyshyn, 1988). Pietroski is also keen to emphasise that the mode of combination of concepts is conjunction, not, say, disjunction (as in the terrible theory). It may not be *Tarskian* conjunction (cf. **2.5**). The point here is just that the conceptual system allows for unbounded combination of concepts, and that thought displays a sort of constituent structure (i.e., thinking JOHN LOVES MARY isn't the same as thinking MARY LOVES JOHN).

2.2 An old typology

Pietroski goes through some ideas from the history of logic. From here, we can try and get clearer on what the linguistically relevant concepts are – mental predicates. We can frame hypotheses about the structure of thought – or, if you prefer, the grammar of Mentalese. Pietroski notes the affinity with Language-of-Thought theories: "Some philosophers dislike talk of mental languages. But I see nothing wrong with the idea that certain biochemically realized procedures connect interpretations, often called *contents*, with head-internal signals of some kind" (CM, p. 85). This is a sort of exercise in 'natural logic'. We want to know about the different sorts of mental predicates we can naturally entertain (e.g., plural, mass, relational), and how we can stick these various predicates together to form a thought.

Pietroski sometimes uses the slogan: "other things being equal, longer is stronger". The more predicates you use, the more restrictive the thought. If COW applies to some things, BROWN COW applies to fewer things, HAIRY BROWN COW to fewer things still. Of course, the ceteris paribus clause is important, a longer thought is not always a stronger thought: conditionalization and negation are often ways to weaken thoughts. But from this, it follows that we can get from stronger thoughts to weaker ones: HAIRY BROWN COW gets

us BROWN COW which gets us COW. The notion of mental predicate is roughly what figures in the inferences of classical logic, at least insofar as it reflects our natural reasoning capacities: "in thinking about the structure of human concepts, and our natural capacities to recognize instances of calid reasoning, the intuitive force of Aristotelian syllogisms is potentially relevant data. […] predicates play a central role in a form of thought that is governed by a "natural logic" that treats predicate-reduction as a privileged form of inference" (CM, p. 95).

What, specifically, are the kinds of mental predicates we use? Pietroski thinks there are at least two: individual – monadic – concepts, and relational – dyadic – concepts. Some concepts have to interact with other concepts, and this has reflexes in inference (as noted by the medieval logicians).

(13) Every dog barks.

∴ Every yellow dog barks.

(14) Every man owns a dog.

¬∴ Every man owns a yellow dog.

Something will need to be said about this (**2.4**).

2.3 Composition by adicity

This section explores the typology of modern Fregean logic, and how this might differ to the resources of natural language (as Frege himself was at pains to emphasise). Frege pointed out how some concepts are, on their own, incomplete, and require other information to saturate them. Roughly, we can split concepts up into those that need saturating and those that saturate. Some concepts may even have partial states of saturation, like ABOVE. Fregean logic is quite powerful: it allows unbounded polyadicity. Indeed, we could have concepts that need two things filled (like ABOVE), and concepts that need three things filled (maybe like BETWEEN, more on this later). There is no upper bound on the things a concept applies to: *Ruvxyz* (a five-place predicate) is a perfectly fine Fregean concept; an *n*-tuple where $n = 5$. But, among natural concepts, there may be an upper bound. Perhaps it is four: we could hypothesise SELL(_,_,_,_) needs four saturaters, the buyer, the seller, the thing bought, and what it was bought for. At any rate, Fregean logic is a much more powerful system than our natural conceptual capacities. Frege himsel wanted to make sense of concepts like ANCESTRAL, is a Level Four type. But for a biological system, natural language, we want a system that is more constrained – and much of Pietroski's work here can be understood as trying to account for the data with a much weaker system than standard Fregean formal semantics. What sorts of concepts *can* we entertain?

2.4 Add a little *dyadicity*

Pietroski returns to the typology of mental predicates. Pietroski thinks there are at least two, monadic and dyadic, as mentioned earlier. These can be combined to yield more monadic concepts. The mode of combination in BROWN COW may be combining two

monadic concepts to yield a monadic concept: BROWN(_)^COW(_). This is 'M-junction'. To account for polyadicity, we need an operation that can take dyadic concepts, like ABOVE(_,_), so we can think thoughts like *above a painting*. 'D-junction' takes a dyadic concept and a monadic concept as its internal argument (i.e., the non-subject position), i.e., combine ABOVE(_,_) and PAINTING(_). Dyadic concepts are important for Neo-Davidsonian Event Semantics; thematic roles like AGENT(_,_) have a slot for the agent as well as the event they modify. D-junction implements a sort of existential closure, like Irene Heim's (1982) theory. The closure means the monadic concept involved applies to something. quite a weak operation (CM, p. 99). This isn't a variable-binding quantifier (hence Pietroski does not use a variable after the quantifier).

$$\exists[\text{ABOVE}(\_,\_)^{\wedge}\text{PAINTING}(\_)]$$

Above is the result of D-joining ABOVE(_,_) and PAINTING(_). The idea is that D-junction combines the predicate with its internal argument (the thing that is being aboved rather than doing the aboving), as well as adding to the thought the idea that there is something being aboved. The concept applies to something if and only if it is above a painting. Hence, the concept above is a monadic concept. M-junction takes two monadic concepts to yield a monadic concept, D-junction takes a monadic concept and a dyadic concept to *also* yield a monadic concept. Natural logic doesn't abhor dyadicity, but it isn't its greatest fan.

It's important to note that even if the concept built can apply to things (though you can build ROUND(_)^SQUARE(_)), it is NOT that the meaning of a sentence is intentional. Insofar as the distinction between a thought and the instructions to build that thought is important, the meaning of a sentence isn't like a truth-conditional theory. Remember: Pietroski thinks that, without that distinction, polysemy becomes a problem.

2.5 Flavors of conjunction

This section wraps up the chapter. Thinking of M-junction and D-junction as operations – programs – makes the talk of meanings as mechanically executable instructions much clearer. Combining Slang expressions is an instruction to M-join or D-join mental predicates. The semantic part of *brown cow* is something like a command: *M-join*[*fetch*@'brown', *fetch*@'cow']: M-join the mental predicates that are stored at the memory-addresses of the lexical items 'brown' and 'cow'. These operations are also much more restrictive than the logician's '&'. That idea may correspond very closely to the concept associated with the lexical item *and* (Schein, 2017), but the construction of a Neo-Davidsonian event representation does not use '&'. The more restrictive operations, M-junction and D-junction, are sensitive to the adicity of their arguments in a way that Tarskian conjunction isn't. Something will also have to be said about how a full thought – what corresponds to a sentence – is given by M-/D-joining predicates. The short story, elaborated in **7**. **Minimal Semantic Instructions** is that it doesn't all by itself. We will need to introduce another operation which applies to monadic concepts – polarization – to do that. But M-junction and D-junction go a long way.

Chapter 3. Invention and satisfaction

This chapter is an emphasis of Frege's insistence that his *Begriffschrift* was not intended to capture the workings of a natural language, and a retelling of the history of logic to emphasise this point too. Invented languages can be useful tools (Dutilh Novaes, 2012). Perhaps they describe the reasoning capacities of an ideal thinker. But they do not necessarily make for good linguistics or psychology.

3.1 You can't always get what you want

Pietroski emphasises some philosophical reasons for thinking our thinking is imperfect. We can have thoughts about things that don't exist and can be mistaken about identities. A perfect thinker has no use for a Fregean Sense, but we need concepts – representations of representations. For an ideal thinker, it is analytic that Hesperus is Phosphorus. Very Good Logicians can design systems with fatal flaws – like Russell's Paradox. It seems pretty clear that meanings/concepts, whatever you think they are, cut things much thinner than referents. Hence, we can invent languages that allow us to introduce concepts that organise our thoughts in such a way to make things clearer for us. Pietroski is keen to emphasise that language can *reformat* information and introduce new concepts.

The sort of typology that a Fregean system allows seems to quickly outrun our natural capacities. Standard formal semantics textbooks accept the inductive definition below:

(TYPES) *e* is a type, *t* is a type. If *u* and *v* are types, then <*u*, *v*> is a type (of a function from *u*'s to *v*'s. Nothing else is a type.

This means there are all sorts of types, <*e*,*t*>, <*e*,<*e*,*t*>>, >>, <*e*,<*e*,<*e*,*e*>>>, etc. At the first level of the hierarchy, there are two, *e*, *t*, and at the second level, there are the types of all the functions between *e*'s and *t*'s. Then functions to functions. By the fifth level, there are more than two million types. There are important concepts in the philosophy of mathematics that are Level Four types (Frege's Ancestral Relation, as mentioned earlier).

But it doesn't seem like natural language traffics in anything like this. Even a lot of the low level types (e.g., 'transitive' verbs, <*e*,<*e*,*t*>) don't seem to show up (cf. Kratzer (1996)). Likewise, abstractions seems restricted. You can't abstract on just anything to form a relative clause (e.g. abstract on *love* to get *which Romeo Juliet*). So, we shouldn't posit such a powerful innate system and end up with enormous overgeneration. Start more restrictively, with <M> and <D>; monadic concepts and dyadic concepts.

3.2 Tarski's satisfaction

This section goes through some of the semantic developments after Tarski (1944). The question here is, in effect, does a psychologised Tarskian semantics do good work as a theory of meaning in natural language? There have been some claims that it can, e.g. Larson & Segal (1995). So, supposing something like the standard predicate calculus to be the language of thought, let's say there are an infinite number of variables in Mentalese, and a number of unsaturated concepts. Saturating concepts with variables yields sentences of mentalese (and negation and conjunction apply to these sentences).

N.B. saturating with variables doesn't alter adicities of concepts. The variables may range over orderings of d-entities (things that can be thought about), and these orderings can satisfy sentences. Sequences – the orderings – basically do what a model-plus-variable-assignment does. Quantification falls out as there being a sequence or there not being a sequence satisfying a sentence. But sequences don't compose. The sequences that satisfy ¬COW(*x*) do not have the sequences that satisfy COW(*x*) as parts (and no sequence satisfies ¬ anyway). Like syntactic constituency, we want the meanings of phrases to be parts of the meanings of sentences.

Pietroski emphases that Tarski's treatment of quantification also differs importantly from Frege's, who thought that you could saturate a quantifier with a predicate. Treating quantifiers as predications over sequence-variants constitutes an important break from Fregean ideas about the type of quantifiers. A sequence can satisfy ∃*x*[COW(*x*)] without satisfying COW(*x*), i.e., without being a cow. So, quantifiers not only bind variables but also shift type from <*e, t*> to the type of sequences.

3.3 Supplementing PL: Taking Tarski to Church

We try to do better than last chapter by appealing to Church's (1941) lambda calculus, a standard tool in contemporary formal semantics. The lambda-operator in the lambda calculus may be something like a Tarskian quantifier, predicating over sequence variants. It generalises the sort of thing Tarski did with ∀ and ∃; turns them into claims about what orderings of things there are(n't). We can now talk about sub-sentential parts having meanings, so long as they're lambda-bound. We might need something like this abstraction tool for relative clause formation – that allows us to talk about something that would normally be incomplete as complete – but Church's tools for doing so are quite powerful. A mind equipped with this sort of language of thought may have language-meanings that correspond to instructions to apply functions.

This is basically the received view in formal semantics (Heim & Kratzer, 1998; Pietroski, 2002). This is, basically, the interpretation of truth-conditional semantics that Pietroski is concerned with. It's the one that fits with the Slang/I-language perspective outlined earlier, and can be framed as a hypothesis about the conceptual system of human beings. It may even be appropriate for modelling some of the thoughts we form with much effort and reflection. But, we can still ask whether the hypothesis is correct for the thoughts we can form using our linguistic resources alone. The following chapters give some reasons to doubt that.

Chapter 4. Truth or understanding

This chapter revives a criticism of truth-theories of natural language that vexed Tarski (1944): the semantic paradoxes. Sentences like (12), repeated as (15) provide some *prima facie* evidence against the hypothesis (D).

(15) This sentence is false.

(D) If *L* is a Slang, then some theory of truth for L is the core of a correct theory of meaning for *L*.

Rather than a theory of truth being the right account of sentence meaning, Pietroski thinks the right question is 'what can this sentence be understood as?' – what thought can the sentence assemble?

4.1 Revisiting the bold conjecture

This section starts laying out Pietroski's scepticism towards truth-conditional semantics: "One might concede that many Slang sentences thave truth conditions, but suspect that certain constructions introduce special complications […] Alternatively, one might think that no Slang sentences have truth conditions, but some constructions are especially useful [for making that point clear]. My skepticism is of the latter sort" (CM, p. 157). Even for sentences like (16), there are problems.

(16) John thinks Hesperus rose at dusk.

Disquotation fails:

(16') 'John thinks Hesperus rose at dusk' iff John thinks Hesperus rose at dusk.

Identifying the truth-conditions of many Austin-inspired cases is not trivial, but the example is clearly meaningful (Austin, 1962).

(17) France is hexagonal and France is a republic.

Even supposing a truth-theory to take as its inputs the outputs of syntactic analysis (not a phonological form) – i.e., something where quantifier-scope ambiguity has been resolved, anaphoric indices are marked, tense-marking is present – we still face problems. There are lots of ways this theory can take shape, but the point of this section is to argue that truth-theories take certain assignments as axiomatic and allow derivations to reach theorems. If a theory gets the right T-theorems, it's a good theory. But we face a dilemma: is it an axiom or a theorem that sentences like (15) shouldn't fall out of the theory? If it is an axiom, one wants to know why it is justified. If it is a theorem, how can it be ruled out while allowing structurally analogous sentences in?

4.2 Lies, damned lies, and semantics

Pietroski expands these ideas. Having made a number of concessions (if a theory T assigns truth-conditions to structural descriptions of English declaratives, give or take (1), this theory is a plausible core of a theory of meaning (non-declaratives will fall into of place) and such a theory is *interpretive*, i.e., the theorems of the truth-theory are good paraphrases of the English sentences). Taking TRUE (i.e., True-In-Mentalese) to be the relevant thing rather than truth is still no good. You will still need some account of indexicals and demonstratives. The thing is, (15) can't be filtered out on the basis of its syntactic properties, so it is going to have to be ruled out by the semantic theory. And for the claim that every meaningful sentence has a truth-condition to hold, (15) *will* have to be ruled out. Relativising truth to contexts is still no good. T-theorems will still be about the context-relative truth-conditions of sentences, rather than utterances. It's worth noting, as Pietroski points out, that Kaplan's strategy of dealing with context-sensitivity and Davidson's strategy of dealing with context-sensitivity are quite different. The former

takes the context-sensitivity to be baked into the meaning – the context-sensitivity of truth-value can be read off the lexical-syntactic properties of the sentence. But for Davidson, who wants truth to be relativised to times and speakers, we deal with truth as a theory of *actions of using the language*. Both strategies may be bad, maybe for different reasons. In dealing with a theory of meaning that applies to linguistic objects – sentences – there may be a problem.

4.3 Back to troublemakers

Pietroski returns to the the general problem. Given that Slangs are biologically implemented procedures or pairing sounds and meanings (i.e., an I-language in Chomsky's sense), (D) is probably false. The sentences are not truth-evaluable at all.

Pietroski considers an alternative that a false truth-theory (i.e., a bad logic) might still underlie a correct theory of meaning for a Slang. That is, you might say something like the extension of the Mentalese predicate TRUE(_) is quite different to what sentences are *correctly* described as true, but the generalisations of natural language semantics are about TRUE(_) nonetheless. Perhaps liar sentences can fall under TRUE(_) and FALSE(_). But now, what motivates the connection between understanding and truth? And whatever the notion of implication is in such a theory, it is not ⊨.

It might be that, further down the line, meanings interact with systems of thought, world-knowledge, belief, etc., to form truth-evaluable judgments. But the output of syntactic analysis seems too cognitively thin to do all that work all alone. We could instead ask about a theory of understanding. We may need to reconstruct a lot of machinery; logical entailment can't be phrased the same way in a theory of understanding as in a theory of truth. Indeed, the inferential mechanisms may be much more restricted than classical logic (*cf.* CM, p. 167, fn. 8). But that will require more work.

Chapter 5. Events and framing

I have said repeatedly in this review that it is important to Pietroski (as it was to Frege) that meanings cut things thinner than extensions. Here, we see a connection of this idea with general cognitive-psychological phenomena like framing effects. In my view, this is one of the most compelling ideas in the general internalist framework. We can conceptualise things – via sentences – in several different ways. We'd then expect this to play a role in our judgment systems generally. This chapter is dedicated to arguing that it does exactly that. Different descriptions of the same event can direct attention to different features of it, lead to different ways of thinking about it, and may – in extreme cases – even lead to different evaluative judgments (*cf.* Frege, 1892).[7] I suspect this is the sort of thing Chomsky has in mind when he writes that "Terms of language may indicate positions in belief systems, which enrich further the complex perspectives they afford for viewing the world" (2000:137). Perspectives, modes of presentation, etc. are ways of

[7] There are some concrete proposals about how the concepts accessed by a lexical meaning direct attention in cognitive-psychological experiments, e.g., how truth-conditionally equivalent quantifiers affect visual attention quite differently **Invalid source specified.**.

looking at the world (N.B. an intentional notion). They are particular conceptualisations of a thing, event, etc. And that language naturally consistenly offers us many of these, even when, on reflection, there was *really* only one thing, event, etc., that's worth noting.

5.1 Reporting what happened

This section motivates some general Davidsonian event analyses (see Maienborn (2011) for review). The idea is that lexical heads really predicate over events. Davidson suggested a sentence like (18) is interpreted as (18').

(18) Jones buttered the toast.

(18') ∃*e*[Buttered(Jones, the toast, *e*)]

That is, (18) is understood as saying that something happened, which was a buttering by Jones, of the toast. The relevant something is an event. Besides the familiar problem of adverbial modification Event Semantics solves, we see an immediate plausibility. But, again, meanings cut things thinner than things. There can be one event that we can describe in several, contradictory ways. The way events are individuated mentally tells against some word-world relation like denotation. Consider (19) and (20), Pietroski's examples:

(19) Al chased Theo gleefully.

(20) Theo chased Al gleelessly.

These can, at first glance, be true together. But if Al and Theo are chasing *each other* around a tree, it becomes extremely difficult to claim there are two events in the same spatiotemporal location (around the tree). There is only one event, then, and if it is gleeful, it cannot be gleeless (and vice versa). Other examples are available – buyings and sellings are located in the same time/place, but one can be legal while the other illegal (Williams, 2015).

5.2 Getting framed

This section reviews some of the literature made famous by Kahneman and Tversky (for popular exposition see Kahneman (2011)). I'll assume some familiarity here, but the point is that our natural reasoning is highly sensitive to how questions are put. Our natural inference mechanisms can lead us far from truth-preserving inferences if questions are phrased a certain way. Even if two questions are equivalent in satisfaction conditions, we can be easily misled by framing, and might answer very differently. Pietroski writes, referring to event-semantic logical forms like (18'), "instead of treating "logical forms" […] as specifications of truth conditions that sentences [have], we can view the invented sentences as initial *models* of thoughts that can be constructed by executing concept-assembly instructions. From this perspective, the forms are what matter, not the stipulated truth-conditions" (CM, p. 202).

5.3 The uncomfortable event position

This chapter runs through some more arguments for event semantics. Suppose we stop analysing verbs in terms of events. We would lose a compositional account of adverbial modification as well as an account of the inferences sentences like (21) license, when they quantify over *two* events:

(21) Scarlet stabbed Mustard clumsily with a grey dagger and proficiently with a red dagger.

I'll skim over the details, but it's hard to account for the right inferences without the idea that adverbs and verbs really modify some same thing, i.e., there is an E-*position* in Higginbotham's (2000 [2009]) sense. They need not be events in the ordinary sense, stative verbs admit the same modification – but the idea is that there's a place for an argument for an event/state/situation. Examples like (21), where the stabbings can take place simultaneously, involving the same actors, suggests we need quite a fine-grained individuation of events themselves (*pace* Davidson, incidentally).

We can also supplement event semantics with thematic roles – ways of participating in an event. These can have syntactic reflexes (they're what's kept constant in voice-alternations, e.g.). We can say that Agents are those who do an action and Patients are those who have an action done to them. In (19) and (20), the *same event* is represented, but with different thematic role assignments. Crucially, this is to do with how the event is represented, not the nature of the event. Semantics is not metaphysics. But we can see how the meaning of the sentence yields different representations/conceptualisations of the self-same event, leading to different psychological attitudes towards it. Otherwise put, we have a framing effect.

5.4 Trying to restore comfort

This section resituates event semantics within an internalist framework rather than trying to make a truth-theoretic account work. There are puzzles for event semantics, particularly to do with how various (subparts of) events relate to one another. Are dyings the results of killings? The same event? Different events? Do they stand in a mereological relation? Should we think of adverbs as relativised to the events they modify? The theoretical virtues of the last strategy are quite unclear. The questions remain open within event semantics. It's clear some closely related events are not identical – we can have stabbings that are killings, but also stabbings that result in dyings hours later. Some of the relevant facts may even be strictly grammatical – it's been suggested that the reason (22) is good but (23) isn't is to do with a *syntactic* fact (Borer, 2005b).

(22) John played his tuba for three minutes.

(23) *John played his tuba in three minutes.

This is to say, it's formal properties that determine some properties of conceptualisation of events like whether they have an endpoint or not. Whether we really need to say

properties like telicity are explained by properties of language-independent events (out there, in the world) becomes more puzzling.

5.5 Schein's resolutions

This section is a discussion of Barry Schein's truth-theoretic account of event semantics (see Schein (2012) for introduction, see the introduction to Schein (2017) for discussion of foundational issues). Schein takes there to be description-neutral mind-independent events, but also a 'cinerama semantics' where 'scenes' are events presented in specific ways. Perhaps, as Pietroski notes, there isn't much difference between his view and Schein's – after all, Pietroski does think concepts apply (or don't apply) to *things*. I won't get into details, but Pietroski's scepticism of the work semantics can do for metaphysics comes through. Pietroski notes, though polysemy and the liar paradox may still be problems for truth-theoretic accounts, all this "may not be an argument against Schein, as opposed to a different way of describing his conclusions" (CM, p. 228).

Chapter 6. Massively monadic, potentially plural

Now that so many of the conceptual foundations have been laid, Pietroski starts working through some of the positive explanatory proposals. This chapter lays out the idea that Slangs introduce new concepts by forcing already-available concepts into a new representational format. The format-constraint is needed for M-junction and D-junction to be able to work with the concept. A triadic concept could not be M- or D-joined, so must be reformatted into smaller concepts.

6.1 Review and foreshadowing

This section, unsurprisingly, reviews and foreshadows. The concepts fetched by lexical items must be either monadic or dyadic. We may, as noted above, have many concepts that are neither dyadic nor monadic. BETWEEN(_,_,_) may be an example. Maybe we have 0-adicity concepts like JOHN. But language doesn't seem to just add labels to such concepts (again, *pace* the Fodorian view that meanings just *are* concepts). Language imposes certain constraints on the concept for it to be labelable; it can introduce concepts. This point explains some otherwise surprising data. According to Pietroski, even JOHN has to be reformatted into a monadic concept JOHN(_) to be lexicalised. Type *e* has no correlate in M/D typology.

6.2 Four generalizations

Four important phenomena can be explained with Pietroski's reformatting theory: proper nouns are not denoters, there is a flexibility to interpretation, there are never three or more arguments to a verb, and there are only a limited number of ways of participating in an event.

We can say "Which John did you mean?", or that "He's a real Napoleon", for example. There are some good reasons to think 'individuals' are grammatically built up – proper noun interpretation is syntactically driven (Borer, 2005a) – but that's somewhat independent. There is no *a priori* reason to think that names pick individuals out rather than predicates. We can also often coerce verbs and their argument structure. While we

typically expect some verbs to be transitive or intransitive, we can assign interpretations to deviant structures without the conventional number of arguments. Maybe, as a Neo-Davidsonian form suggests, the difference between supposedly obligatory arguments and optional adjuncts is not so stark as often assumed.

It is also striking that there are so few constructions that are 'ditransitive' (that take two objects and a subject). Why do we not have a sentence like (24) or (25)?

(24) John jimmied the lock the screwdriver.

(25) The church betwixts the graveyard the post office.

Supposedly ditransitive constructions like *gave Mary a book* seem, on closer inspection, to really be two layered transitives (Larson, 1988). Why does language not traffic in three-place relations? (Note, again, the powerful Fregean typology over-generates.)

Language also seems to have consistent ways of assigning thematic roles to arguments. Internal arguments are Patients/Themes, external arguments are Agents. Why the asymmetry? Why can't a verb just take its Agent and Theme at the same time?

The resolution to all these puzzles is, of course, that the relevant concepts have to be monadic or dyadic. Names have to be predicates because they have to be type M, coercion effects result because verbal concepts cannot be fully specified for argument structure, being type M, ditransitives would require a triadic concept, and subject-object asymmetries result because the verb has to D-join to its object first (and existentially close), and only after can it join with its subject.

6.3 Mismatches revisited

We can see here some of the concrete effects of reformatting. Focusing initially on proper names, Pietroski argues that rather than picking out an individual like an indexical, names are mental *predicates*. Functional elements are responsible for interpretation of a lexical item as a proper name specifically (cf. Borer (2005a)). These elements and covert indices may be responsible for rigidification (Kripke, 1980). Maybe the pre-lexical concept is something like a semantic type *e*, but the flexibility that proper names show *linguistically* suggests that they are more like predicates until rigidified with more information like definiteness. This is an example where adicity has been increased (from pre-lexical CAESAR, like type *e*, to lexicalised CAESAR(_), type M).

There are also examples where adicity has been decreased. To lexicalise concepts like TALLER it seems that we need to find circumlocutions or introduce prepositional phrases.

(26) *John talls Bill.

(27) John is taller than Bill.

Likewise, for concepts like BREAK which might apply to break-er, break-ee, and breaking-event, it seems we actually have a covert element responsible for introducing the causer as a distinct structural piece, as in (28) (Kratzer, 1996; Pietroski, 2003a).

(28) [$_{TP}$ John [v_{CAUSE} [broke [a mug]]]

Rather than a *genuinely transitive* verb that relates three things, we have separation. The little-*v* is an instruction to fetch a causative concept (dyadic). This is a neat explanation for how 'analyticities' result – language seems to *add* something to conceptual structure in its reformatting. A pre-lexical concept that has to be reformatted into M or D for lexicalisation means that the two post-lexical concepts are analytically related.

6.4 Number neutrality

Adding to the discussion, Pietroski now discusses properties of nominal phrases (namely, the mass/count distinction and plurality). Here, a 'second-order' monadic concept is introduced to deal with plurality. I will delay full formal details for **7. Minimal Semantic Instructions** again.

Pietroski suggests – in line with suggestions like Borer's (2005a) – that nouns are mass by default, and additional functional structure countifies the noun. There might be a root noun, like $\sqrt{rock}$ which can be introduced into a functional structure. Simplifying hugely, let's say it is combined with a count-feature [+count], to yield [+count [$\sqrt{rock}$]]. The meaning of this phrase, when executed, yields the M-joined concept, ONE-OR-MORE(_)^ROCK(_). We might also have a [[ONE-OR-MORE(_)^ROCK(_)]^MORE-THAN-ONE(_)] as the concept retrieved by *rocks.* So, given an appropriate view of syntax, we can treat plurality and count/mass as more instances of M-junction, simplifying the semantic mechanisms quite radically. As a result, the slots in concepts are number-neutral (numerosity is, formally, just another concept of type M). We can assign more than one thing to a single slot, because the concept can apply to more than one thing. Concepts are *potentially* plural. This isn't to say that we think of things as mass and *then* countify them. The concept retrieved by *chicken* the mass noun (typically the white meat) is not a part of the concept retrieved by *three chickens*. It is that the concept retrieved by *chicken* is mass and number neutral, and the functional structure is responsible for further conjuncts.

7. Minimal Semantic Instructions

This chapter tries to recast some of the main insights of formal semantics in the conjunctivist, M-D system. Here is where some of the formal details get cashed out. Here is a super-summary of the preceding:

- There are two types of concepts that word-meanings can be used to 'fetch': concepts of type M (monadic concepts), that apply to one thing, like BROWN(_); and concepts of type D (dyadic concepts) that apply to two things, like AGENT(_,_) or UNDER(_,_).

- There are two compositional operations: M-junction, which takes two monadic concepts and joins them to form a single monadic concept, like BROWN(_)^COW(_), and D-junction, which takes a dyadic concept and joins it with a monadic concept *to form a monadic concept.* It also closes the concept. The backwards-E is not to be interpreted having existential import, it is only a closure operation. For example, ∃[AGENT(_,_)^JONES(_)] yields a monadic concept that applies to events that have Jones as their agent. It is not an assertion that there are any such events.
- Words are instructions to retrieve monadic or dyadic concepts. Phrasal structure gives instructions to M-/D-join these concepts. *v*Ps retrieve monadic concepts that apply to events.

7.1 Introduction

This section recapitulates some of the major themes of the preceding chapters: I-languages pair meanings with pronunciations, and, like pronunciations are instructions to the articulatory system, we can think of meanings as instructions to the conceptual system. Meanings for I-languages are interestingly combinatorial (i.e., allow for compositionality).

7.2 Elementary phrases

Pietroski assumes MERGE(*x*, *y*), the syntactic operation, to be the combination of two simpler operations, LABEL and UNIFY (i.e., UNIFY forms an unordered set of syntactic objects, LABEL picks a head). This allows for a-categorial roots. Pietroski floats the idea that labels like V and N might retrieve concepts like TENSABLE(_) or INDEXABLE(_).

The meaning of *cow* is an instruction to fetch a concept stored at its lexical address. Let's assume that to be the concept COW(_). Read μ(*x*) as 'the meaning of *x*', the internalist corollary to ⟦*cow*⟧. Remember: the meaning of a lexical item is not a concept, it is an instruction to retrieve a concept stored at an address. Sample, for *cows*:

μ([$_N$ +pl [*cow*]]) = M-join(μ(*cow*), μ(+pl))

= M-join(fetch@*cow*, fetch@+pl)

= M-join(COW(_), MORE_THAN_ONE(_))

= COW(_)^PLURAL(_)

D-junction makes things more complicated. It might be that prepositions and verbs always fetch dyadic concepts, or that there is an operation, Join, that is sensitive to the adicity of its arguments. Either way, these things combine with an internal argument, and for verbs, possibly an external argument too. Pietroski discusses whether to adopt the hypothesis that verbs D-join with their internal arguments, or whether they D-join with a THEME(_,_), which is D-joined to the verb's internal argument.

Essentially, the label, V, is treated as an instruction to fetch a dyadic concept, THEME(_,_), or PATIENT(_,_) – more broadly, INTERNAL(_,_). Let's call the address of INTERNAL(_,_)

'INT', i.e., μ([V [NP]]) = M-Join(μ(V), D-Join(*fetch*@INT, μ(NP)). These turn concepts that apply to things that participate in events into concepts that apply to events participated in by things. Pietroski notes the affinity with type-shifting mechanisms: D-joining an argument with a thematic-role turns it from a monadic concept that applies to things to a monadic concept which applies to events.

What about agents? Like Kratzer (1996), Pietroski suggests this is added by additional functional structure (specifically, little *v*) above the verb. For causatives, e.g., there is a dyadic concept, which is μ(v_{CAUSE}), that the external argument can M-join to. Let's assume 'EXT' to be the address of EXTERNAL(_,_), i.e., AGENT(_,_).

(29) μ([[$_{NP}$ John] [$_{vP}$ v_{CAUSE} [$_{VP}$ boiled [$_{NP}$ the water]]]])

= M-Join(D-Join(fetch@EXT, μ(John), D-Join(μ(v_{CAUSE}, M-Join(μ(boiled), D-Join (fetch@INT, μ(the water)))))))

The concept assembled by executing the instruction (29) is the sentential concept (30):

(30)

∃[EXTERNAL(_,_)^JOHN(_)]^[∃[TERMINATER(_,_)^[BOILED(_)^∃[INTERNAL(_,_)^THE-WATER(_)]]]

This is a monadic concept which applies to events. I assume for those familiar with the composition rule of predicate-modification or event-identification, this is mostly familiar enough. The major differences is *John* is analysed as a predicate D-joined to the thematic role concept rather than as a type *e* argument in its slot. There is also no event variable, also obviating the need for a special event-identification rule.

7.3 Tense, sentences, and relative clauses

Events and states may be related to reference-times and speech-times (Hornstein, 1990). Pietroski recasts this in terms of those concepts, i.e., a tense-morpheme like *-ed* or T_{past} means an instruction to fetch (31), which we can abbreviate SIMPLE-PAST(_).

(31) ∃[AT(_,_)^REFERENCE-TIME(_,_)^∃[BEFORE(_,_)^SPEECH-TIME(_)]

SIMPLE-PAST(_) is a monadic concept that applies to an event.

We can think of sentences as true or false *simpliciter* only after 'polarizing' them, argues Pietroski. Tarski thought we can go from formal language sentences like those in (32) to closed sentences, satisfied either by each sequence or no sequence, like those in (33).

(32) *Fa*, *P*, *Fx & Gx*

(33) ∀*x*(*Fa*), ∀*x*(*P*), ∀*x(Fx & Gx*)

For Pietroski, there are two syncategorematic operators that create predicates from predicates (I'll explain the point of this shortly): ⇑ and ⇓. ⇑DOG(_) applies to everything if DOG(_) applies to something, and nothing otherwise. ⇓DOG(_) applies to everything if

DOG(_) applies to nothing, and to nothing if DOG(_) applies to something. Call the condition DOG:

(DOG) DOG(_) applies to something.

So, we can say:

⇑DOG(_) applies to everything if DOG, nothing if ¬DOG.

⇓DOG(_) applies to nothing if DOG, everything if ¬DOG.

⇑⇑DOG(_) applies to something iff ⇓⇓DOG(_) does.

⇓⇓DOG(_) applies to something iff ⇑⇑DOG(_) does.

(i.e., if DOG, then ⇓DOG(_) applies to nothing, meaning ⇓⇓DOG(_) applies to everything. If DOG, then ⇑DOG(_) applies to something (everything), meaning ⇑⇑DOG(_) applies to everything).

⇑⇓DOG(_) applies to something iff ⇓⇑DOG(_) does.

⇓⇑DOG(_) applies to something iff ⇑⇓DOG(_) does.

and so on. These function as corrolaries of ∃*x* and ¬∃*x*, but clearly don't bind variables. Further, the system still does not allow any definition of predicate negation (so the polarisation operators are not understood as predicates of sequences *a la* Tarski).

⇑[BROWN(_)^COW(_)] clearly differs from [⇑BROWN(_)^⇑COW(_)]. The former applies to everything if BROWN(_)^COW(_) applies to something (i.e., there is a brown cow), the latter applies to something if BROWN(_) applies to something and COW(_) applies to something – not necessarily the same thing. You might begin to see where this is going – relative clauses receive treatment through these.

Either way, the polarized concepts ('T-concepts', for Tarski, truthy, and total) might be built up not by Tense phrases but Complementizer phrases. But, again, we want to clearly distinguish the sentence's meaning – the instruction to build the thought – from the (possibly truth-evaluable) thought built up. A declarative sentence's complementizer is something like means +Pol, an instruction to polarize up. This is *not* another conjunct, it is an instruction to stop composing the tensed phrase in a certain way (*cf.* phase-theoretic approaches to syntax). Negated sentences might instruct the conceptual system differently; using -Pol.[8]

It's worth bearing in mind that Pietroski's aim is to simplify the operations of composition. In the discussion about to start, about relative clauses and indexicality, having concepts of abstractions and assignments is not a concession to semantic externalism, simply because current model-theoretic semantics uses these notions. The

[8] Perhaps something like this would allow us to recapture NPI-related generalisations without talk of truth-theoretic downward entailment.

question is, really, do we need the mechanisms of *lambda*-abstraction, *variable* assignment, etc. to account for that? If we do, we aren't just adding more mental representations, we're positing additional computational operations for our mental capacity. If simpler operations can be made to do the same work, they should be preferred. (Spoiler: some idea of abstraction will need to be posited.) Again – the goal is not to demolish the achievements of mainstream semantics, just as Chomsky (1995) had no intention to demolish the achievements of Government & Binding Theory. The goal is to reconstrue the results with as simple a system as possible. So, let's look at pronouns and relative-clause formation now that we have the machinery of M-junction, D-junction, and polarization.

I'll start with indices. I think Pietroski is roughly thinking of these as what the meaning of *i* when given a syntactic representation like *John$_i$ shaved himself$_i$*. μ(*i*) fetches a monadic concept like FIRST(_) or INDEXED-WITH(_,[1]), where [1] is a Pylyshynian demonstrative, an extra-linguistic mental representation that tracks something salient. Fetching the concept at address [1] will still be monadic. Assignments do not assign semantic values to indices, then, but indices track use of mental pointers. It is interesting to note that, rather than Kaplanian characters, the concepts assigned to demonstratives are motivated by work in the cognitive sciences (see also Fodor & Pylyshyn (2014) on reference in the visual circle).

Relative clauses like (33) show off this machinery.

(33) who she stabbed

We can assume the standard syntactic representation for such a clause, (33'), involving displacement of a lower copy.

(33') [$_{CP}$ who$_j$ [Ø$_C$ [she$_i$ [$_{VP}$ stabbed [t_j]]]]

This leads to a polarized complex concept a bit like *i*-STABBED-*j*(_). What this applies to depends, of course, on what *i* and *j* apply to, and that will depend on what the mental pointers [1] and [2] are storing. I won't dwell on Pietroski's involved argument against the standard treatment, but it is important to note that even with the machinery allowed by the Fregean typology, dealing with relative clauses requires you to have a syncategorematic notion of abstraction, i.e., even in the Heim & Kratzer (1998) system, there is some non-truth-functional notion of abstraction that allows you to get the meaning of (33').

There may be a weaker notion of abstraction that is similar to the sort of thing standard semantics does. Sticking with *i*-STABBED-*j*(_), we can say the concept applies relative to an assignment *A* iff *A*[*i*] was stabbed by *A*[*j*], where *A*[*x*] is whatever thing the assignment *A* assigns to a mental pointer *x*. This is familiar from standard Tarskian semantics. Some assignment *A** is like *A* other than whatever *A* assigns to *j*, *A** assigns the pointer *j* (i.e. *A** just says "whatever thing is assigned to *j* stabbed the thing *A*[*i*]".

While this is a sort of abstraction, it's not the same as lambda-abstraction. For one, it is neutral between plurality/mass/count (CM, p. 322). It is also restricted to polarized predicates. All Pietroski has posited here is that we can abstract certain sorts of polarized concepts relative to indices, and its result is, again, another predicate. Lambda-abstraction, on the other hand, is not restricted by the type of its operand.

Relative clauses can apply to some things but not all things, unlike ⇑-concepts which apply to all things, and ⇓-concepts, which apply to no things. Given an assignment *A*, *i*-STABBED-*j*(_), being polarized, applies to everything or nothing in that assignment. But its abstracted version may not. Borrowing Pietroski's notation, TARSKI{*j*, *i*-STABBED-*j*(_)} applies to something in an assignment *A* if and only if *A*[*i*] stabbed that thing. We can abbreviate this something like (34).

(34) λ*j*.*i*-STABBED-*j*

But this is far from making the above-outlined proposal a notational variant of a lambda-abstraction based semantics. The mechanism is considerably more restricted, as noted earlier, and this is a mental predicate of type M, not a Fregean function of type <e, t>. The meaning of a relative pronoun might be the instruction ABSTRACT, that allows for this sort of relativisation to index, and the meaning of the null-complementizer an instruction to polarize (as the relative clause has to be thought of as applying to the phrase it modifies). It is also important to note that the meaning itself is not relative to assignment. The meaning of *i* is "fetch whatever is at index *i*". So, because it is only the concept accessed that is relative to assignment, the context-sensitivity is strictly extra-grammatical here. Again, we see the importance of the distinction between instruction-to-retrieve and whatever-is-retrieved.

Lastly, let's move to negation. Assuming a syntactic structure where the subject has undergone displacement (perhaps for EPP-reasons), as in (35), we can think of the negated T^0 as an instruction to polarise down.

(35) [-Q [She$_i$ [$_T$ did[n't [t_i stab him$_j$]]]]]

Abbreviating (31) as PAST(_), we can say [$_T$ did[n't [*she*$_i$ stab him$_j$]]] builds a concept like:

(36) ⇓PAST-*i*-STAB-*j*(_)

That is, the meaning of [$_T$ did[n't [*she*$_i$ stab him$_j$]]] is an instruction to build a concept that applies to nothing if there was a past event of *i* stabbing *j* and applies to everything otherwise.

7.4 Quantification

This is the real challenge for Pietroski's conjunctivism. Everything up to now has been relatively straightforward (perhaps barring relative clauses). But it is no coincidence that analyses of quantifiers have been the real success stories of modern semantics (Barwise & Cooper, 1981). Indeed, Aristotle's treatment of quantification was what left logic in

trouble until Frege. So, what are we going to say about the meanings of sentences like (37) and (38)?

(37) Every spy stabbed him.

(38) She stabbed every spy.

Let's assume a quantifier-raising account, where there is string-vacuous displacement to SpecCP in (37) and covert movement (LF-raising) in (38):

(37') [[Every spy]$_i$ [$_{TP}$ t_i [stabbed [him$_j$]]]]

(38') [[Every spy]$_k$ [$_{TP}$ she$_l$ [stabbed t_k]]

Pietroski does not think combining the meaning of a (possibly type-shifted) relative clause with the meaning of a quantificational expression gives you the meaning of (37) or (38). That is, combining anything like ∀:SPY(_) with λ*i*.*i*-STABBED-*j* is not the thought corresponding to (37).

Instead, we can think of quantifiers as predicates too: predicates applying to pairs. By analogy from events, we can think of pairs as having internal and external arguments, and hence, being *ordered* pairs. EVERY(_) applies to ordered pairs iff all their internal participants are also among their external participants. SOME(_)/NO(_)/MOST(_) apply iff some/none/most of the internal participants are external participants too.

This is a bit like saying EVERY(_) is true of certain ordered pairs of sets. But it is not the same. That formulation would also allow formulations of the set-of-all-sets: an undesirable consequence. Borrowing Pietroski's example, EVERY(_) does not apply to {<{*x*:*x* is a positive integer}, {*x*:*x* is a positive odd integer}}. The second set is a subset of the first – true – but the set is not a member of the first. Plural interpretations are not the same as sets of individuals here. This is direct quantification over predicates (**6.4.2** has relevant discussion of George Boolos's philosophy of logic).

But if this system is trying to recapture the successes of mainstream semantics, what do we say about conservativity? Why is it that quantifiers and relative clauses *always* have the sort of parallelism in (39)? Or, otherwise put, why *can't* natural language lexicalise some-but-not all or not-only?

(39) Every student runs; every student is a student, every one of them runs.

(40) #Some-but-not-all students run; some-but-not-all students are students, some-but-not-all of them run.

(41) #Not-only students run; not-only students are students, not-only they run.

The Pietroski-characterisation of quantifiers as having internal-/external-arguments makes this remarkably natural. Quantificational determiners must fetch concepts of pairs whose external arguments are selected from their internal arguments. What is the nature of these arguments and how are they composed? The internal argument is an ordinary

type-M predicate. What about the external argument? It seems to be a polarised sentential expression – like a relative clause.

Let's think about (42).

(42) Every cow arrived.

I'll follow Pietroski's presentation of the composition. Let's start with the stipulation MAX:P(_)applies to something iff they are all-and-only the Ps (or, in the case of a mass-concept, all-and-only the P). *Every* – which might be syntactically decomposable – might contain a maximizing operator.

(42')
[EVERY(_)^∃[INTERNAL(_,_)^MAX:$\sqrt{\text{COW}}$(_)^ONE(_)]]^∃[EXTERNAL(_,_)^ARRIVED(_)]

This tells you why *every cow* is not interpreted as *every cow from some cows* but is interpreted as *every one of the cows*. Perhaps *the* contributes maximality too. Combining this apparatus with previous mechanisms, we can see how to interpret (37') as (43):

(37') [[Every spy]$_i$ [$_{\text{TP}}$ t_i [stabbed [him$_j$]]]]

(43) ∃[EXTERNAL(_, _)^MAX:TARSKI{*j*, *i*-STABBED-*j*(_)}]

(43) is a monadic concept, formed by D-junction. It applies to events whose external-arguments (agents) are things that stabbed *A*[*j*]. It can combine with MAX:SPY(_), and be polarised up.

(44) ⇑[MAX:SPY(_)^∃[EXTERNAL(_, _)^TARSKI{*j*, *i*-STABBED-*j*(_)}]]

This allows us to think the truth-evaluable thought, EVERY SPY STABBED HIM$_j$.

7.4 So many expressions, so little time

Pietroski here mentions some loose ends. I'll begin wrapping up and editorialising. There is a lot left to do. For people who think the mechanisms of formal semantics are fine, I wonder how much what is presented above will convince them. I think it's a promising start for how to start thinking about composition without function application, lambda-abstraction, etc. We might start thinking about concepts like CONTENT-OF(_,_) and APPLIES-AT(_,_) for propositional attitudes and modal verbs. Who knows how to start thinking about conditionals? But just as we didn't really know how exactly to think about the PRO/trace distinction when Chomsky first suggested Merge as the fundamental syntactic operation, we might find out something surprising when we try and restrict ourselves to M-/D-junction plus-or-minus a bit.

As an aside, I'd like to note how there might be a difference in how semanticists think about their theories and how syntacticians often do. This is partly, I think, elaborating Pietroski's point about procedure mattering, but it's important to see how our theory makes predictions about the data. We don't just want to stipulate conditions such that they happen to pair the right LFs with the right denotations, they ought to do so naturally. So, rather than coming up with a theory that allows everything, in principle, and then stipulating such that we never see, e.g., non-conservative quantifiers, we should have a theory that makes the lack of non-conservative quantifiers expected. This seems to me to be what makes a practice scientific, but I think some semanticists might differ on the point. My evidence is anecdotal, so I won't labour this. Either way, it should be clear how Pietroski's project is motivated by exactly the sorts of things that motivated the Minimalist Program in syntactic theory.

Concluding: some broader issues.

Rather than summarise Pietroski's summary, **Chapter 8: Reprise**, I'll raise a handful of issues that might be of interest to philosophers and linguists. One is how Pietroski's views on reference and externalism seem to differ importantly from Chomsky's. Another is how much interpretational work this shifts to the syntax, which I see as congenial to the anti-lexicalist, "neo-constructionist" approach to the syntax-semantics interface (as Pietroski himself points out often). Thirdly, I'll touch on the differences between semantics and pragmatics in a Pietroskian system, and how this differs from most theories of semantics which automatically relativise to context (by adding a little superscript *c* to ⟦ ⟧; ⟦ ⟧^{c}). Lastly, I'll mention how entailment is thought of in the CM system.

8.1 Chomskyan internalism vs. Pietroskian internalism

Chomsky has many complaints about the reference-relation that philosophers of language tend to take for granted. Some are motivated by the sorts of things I've raised above (the Chomsky-cases). However, what he wants to do about it is very different from Pietroski. While he is quite sympathetic to the Pietroskian project, he isn't as harsh on mainstream semantics. Chomsky's sympathies are often with the sort of Larson & Segal (1995) project, or with simply psychologised versions of model-theoretic semantics (where truth-conditions are understood as truth-in-a-mental-model). Consider this passage from *Lectures on Government and Binding*:

> […] weather-it behaves as though it were referential, but it can have no referent.
>
> The latter property is not as strange as it sounds; in fact, it is not uncharacteristic of what are often considered "referential expressions." If I say, "the flaw in the argument is obvious, but it escaped John's attention," I am not committed to the absurd view that among the things in the world are flaws, one of them in the argument in question. Nevertheless, the NP *the flaw in the argument* behaves in all relevant respects in the manner of the truly referential expression *the coat in the closet* – for example, it can be the antecedent of *it* and serves as an argument, taking a θ-role. Suppose now

> that we make a rather conventional move, and assume that one step in the interpretation of LF is to posit a domain *D* of individuals that serve as values of variables and as denotata. Among these individuals are specific flaws that can appear in arguments (cf. "the same flaw appears in both arguments"), John's lack of talent, and so on. Then we might also assume that weather-*it* denotes a designated member of *D*, and is thus "referential" in the sense required for our discussion. (Chomsky, 1981, p. 324).

Similarly, in *New Horizons*:

> Within internalist semantics, there are explanatory theories of considerable interest that are developed in terms of a relation *R* (read "refer" [9]) that is postulated to hold between linguistic expressions and something else, entities drawn from some stipulated domain D (perhaps semantic values). The relation *R*, for example, holds between the expressions *London* (*house*, etc.) and entities of D that are assumed to have some relation to what people refer to when they use the words *London* (*house*, etc.), though that presumed relation remains obscure. As noted, I think such theories should be regarded as a variety of syntax. The elements they postulate are on a par, in the respects relevant here, with phonological or phrase-structure representations, or the hypothetical brain configuration C; we might well include D and *R* within the SD (the linguistic expression), as part of an interface level. (Chomsky, 2000, pp. 38-29)

That is, unlike Pietroski, Chomsky (sometimes!) sounds quite happy to take model-theoretic semantics as it is, just psychologised. I think this tells us two things: semantic internalism need not be as radical as Pietroski's, and that Pietroski's project need not be of interest only to reference-sceptics. Pietroski's sparser typology could be of interest to anyone who thinks semantics can do without Fregean types. And for those unconvinced by the above system, you can keep model-theoretic semantics while accepting the arguments against shared languages, etc. You may want to say in response to **5.1-5.4** that buyings and sellings are different individuals *in mental models*. But it still – to me – seems odd to say that there is some relation *R* that holds between verbs and event-concepts, mass-nouns and stuff-concepts, count-nouns and thing-concepts, and whole sentences and the-True-and-False-concepts.

[9] Pietroski (personal communication) says that he thinks the distance between him and Chomsky might not be so great, as the relation *R* Chomsky talks about is, really, whatever is going on in binding-phenomena. That is still very much a part of the grammar. There might, however, be other differences between Chomsky and Pietroski on the issue of concepts (particularly on issues of comparative cognition and the differences between lexical items and concepts). While lexicalization can introduce new concepts for Pietroski, Chomsky sometimes voices scepticism of the distinction altogether (Chomsky & McGilvray, 2014, p. 27).

8.2 Neo-constructionist approaches to syntax

There is a clear affinity between Pietroski's project and the sort of approach Borer (2003) calls neo-constructionist. She discusses the majority view: 'endo-skeletal' models, where the lexical semantics of the verb forms the structure around it. Here, the semantics of the verb determine a predicate-argument structure, which in turn, determines a lexico-syntactic structure. That is, because of the meaning of, e.g., *arrive*, an argument-structure is determined where a theme must be projected but not an agent, and then a syntactic structure like [$_{VP}$ *arrive* [$_{NP\ theme}$ __]] is projected.

She proposes an alternative: a 'constructionist' view where the syntactic structure is prior to the interpretation. That is, the syntactic structure determines an event-structure, which leads to the interpretation of arguments. It is not because themes must occupy CompVP that they are found there, it is that whatever is placed in CompVP must be interpreted as a theme (whatever is Spec*v*P is an agent, etc.). The Universality of Theta-Assignment Hypothesis is turned on its head.

Borer's own work extends this approach to the mass/count distinction, telicity, proper name interpretation, amongst other things (Borer, 2005a; 2005b; 2013a). In such an explanation, more and more work is done by the syntax in determining the semantics. And this is very congenial to the sparse mechanics in Pietroski's work. To take the mass/count distinction, if it can simply be read off its embedding structure whether the NP is to be interpreted as count or mass, we can see how we end up with complex concepts like $\sqrt{\text{COW}}$(_)^ONE(_). For Borer, nouns are mass by default and have to be countified by additional functional structure. In Pietroskian terms, that additional functional structure means M-joining the countifier concept ONE(_).

Borer also notes the flexibility of syntactic category and argument-structure (Clark & Clark, 1979; quoted in Borer 2017). *Siren*, which is normally a noun, can be coerced into a verb-interpretation.

(45) a. The fire stations sirened throughout the raid
b. The factory sirened midday and everyone stopped for lunch
c. The police sirened the Porsche to a stop
d. The police car sirened up to the accident
e. The police car sirened the daylights out of me

This may be a challenge for those who think the denotation of *siren* is quite strictly specified as type *e*, and then type-shifting principles of various sorts take over, etc. If, on the other hand, *siren* retrieves SIREN(_) and is free to M-join with ∃[INTERNAL(_,_)^THE-PORSCHE(_)], no complication results. I think the dovetailing of Pietroski's sparser typology and neo-constructionist accounts is quite welcome. This sort of thing has a clear effect on where to draw the semantics/pragmatics distinction, to which I now turn.

8.3 Semantics versus pragmatics

I think, given how much work the syntax is doing in such an account, it's convenient to see Pietroski as a 'semantic minimalist'. The terminology is extremely confusing, given

the meaning of 'minimalist' in syntax, and my characterisation of Pietroski's project as a minimalist program for semantics, but what I mean is a minimalist in the philosophy of language. The position was staked out by Cappellan & Lepore (2005), and Borg (2006; 2012). The idea is, roughly, the semantic system works with information the syntactic system gives it, and nothing else. It is semantically *minimalist* in that it thinks what information can truly be called semantic is minimal – context does not play a role in semantics. Anything that requires contextual information is beyond semantics. Pietroski's theory differs from theirs in that it does not think the input to the semantic system is rich enough to determine a truth-evaluable proposition, and he is quite keen to emphasise the effect of context on words. But the meanings of words – the instructions they are paired with – are context-invariant. The instructions may be executed differently on different uses, but they are not themselves context-sensitive.

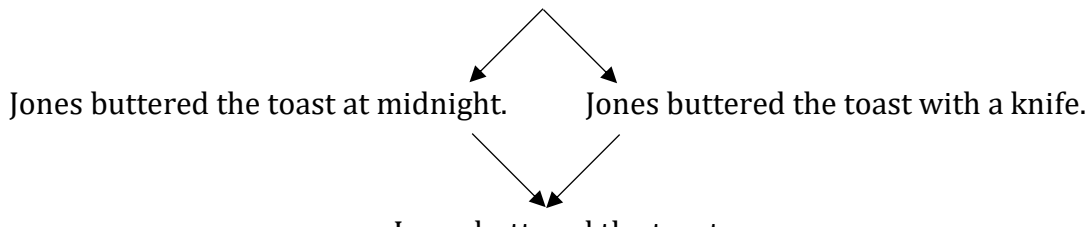
I suspect a lot of the insights of mainstream semantics are, by Pietroski's lights, pragmatics. It is not that they are false, but misplaced in a theory of sentence-meaning. Note also there is room for utterance-meaning to be quite different. A Stalnakerian project of characterising the referential/truth-conditional properties of utterances, as opposed to sentences, can still cohere with Pietroski's (Stalnaker, 2006; Pietroski, 2006). So, while much ink has been spilled about definiteness, presupposition, etc. – I think for Pietroski, while previous studies of these have captured real insights about the conceptual-intentional systems that language, at some point, interfaces with, semantics proper does something less ambitious.

Even if you think truth-conditional theories are fine as they stand, as long as we adjust our talk from semantic properties of sentences to semantic properties of utterances, open questions remain. The fact remains that sentences do have some properties that enter into (possibly truth-theoretic) interpretations of their utterances. What are those properties? How, if at all, do they interact with context? Any theory of meaning in natural-language will have to face these issues.

8.4 Entailment

We can ask what the data are for semantic theory. Sometimes, it's said that it's entailment-relations between sentences. For example, the major motivation for event-quantification in Davidson (1967b [2006]) is that it gives an account for the inferences in (46), "Davidson's diamonds" (Schein, 2012):

(46) Jones buttered the toast at midnight with a knife.



What is the relation in (46) indicated by the arrow? Is it the same relation that logicians normally indicate with the double-turnstile ⊨? That relation means that the sentence on the right-hand side is never false while the sentence on the left-hand side is true. But is this really what semanticists study? Assuming that we are restricting ourselves to a species of *linguistic* competence, we would want to say that our gloss on the → in (46) is not like the relation between (47) and (48).

(47) A cat sat on a mat.

(48) There are infinitely many primes.

An utterance of (48) is always true, including whenever (47) is true. We might want to say that (47) ⊨ (48). But that's not a linguistically interesting relation.

Equally, it's an open question whether the inference in (49) is grounded by a linguistically interesting relation (Quine, 1951 [1980]; Fodor, 1998). It always be true, but is this interesting as a fact about meaning, or conceptual structure?

(49) John is a bachelor, so John is unmarried.

Separating inferences underwritten by principles of the grammar from inferences supported by world-belief is a messy issue. But many entailments are of the latter sort. Relations like the above suggest that what semanticists study is not ⊨. Perhaps some relations are underwritten by the grammar, like the one between (50) and (51).

(50) John boiled the water.

(51) The water boiled.

But, however you deal with separating grammatical inferences from world-belief-based inferences, in the CM system, the →'s in (46) just can't be ⊨, because ⊨ relates propositions with truth-values. The sentences in (46) do not have truth-values in the CM system. Hence, it makes no sense to talk about a consequent sentence never being false when its antecedent is true. Rather than some model-theoretic relation ⊨, there is some proof-theoretic relation ⊢ that holds between them. Pietroski thinks entailment-relations are really part-whole relations (cf. the representation (30) in **7.2**). The relationship between (50) and (51) as well as the relationships in (46) are more restricted than the logician's notion of entailment (see also Williams (2013, p. 28) for discussion). Positing only limited inferential mechanisms (e.g. an analogue of conjunction-elimination) as a part of our 'natural logic' system suffices to explain those. These might count as interesting explananda, given a theory of natural logic. But we should be careful when saying an inference is good just because of the linguistic properties of its premisses/conclusion. And we should be very hesitant to say that this is the same thing as the entailment relation that logicians study.

5. Very final remarks.

Barbara Partee, at some point, made reference to what she called "Cresswell's Most Certain Principle": "For two sentences α and β, if in some possible situation α is true and

β is false, α and β must have different meanings" (Cresswell (1982) quoted in Partee (1995, p. 312)). As far as the methodological principle goes, a reflective speaker-hearer's judgment on the truth or falsity of an utterance can be informative. But just as acceptability intuitions are not the whole story about grammaticality, truth-value judgments are only a step in getting towards meanings. Extra-linguistic (and hence, non-semantic) information may also play a role in such intuitions, for example. It is also interesting to note the slide in recent history from Cresswell's Most Certain Principle – that truth-conditions *supervene* on meanings – to the stronger claim, "to know the meaning of a sentence *is* to know its truth-conditions" (Heim & Kratzer, 1998, p. 1, emphasis mine).

Rather than the Lewisian position where "semantics with no treatment of truth-conditions is not semantics", semantics (Lewis, 1970, p. 18), Pietroski's project represents a retreat to a more traditional position where, really, semanticists study meanings, whatever they are. Truth-conditions were only ever interesting because they allowed us to start getting at meaning, like Cresswell's formulation suggests. But we can now relax the assumption that truth-conditions *are* meanings, and start building a psychological theory of concept-assembly, allowing us to deal with conceptual equivocality, and sentences that resist truth-evaluation.

Over the course of this summary, we looked over how Pietroski's M-/D-junction operations allow for composition of meanings to get something like Neo-Davidsonian event representations without appeal to function-application, lambda-abstraction, variables, etc. A sparser theory can do the work. As noted in **7.3**, this is not simply a notational variant. Logically trivial things like predicate-negation can't be defined in the M/D system. The system also avoids the problem of overgeneration we raised in **3.2**. Many issues normally handled by semanticists are pushed out into the pragmatics. WE maintain that semantic interpretations are context-insensitive. We also draw a sharp distinction between the meaning of an item, which is an instruction to fetch/assemble a concept, and the extra-linguistic concept fetched by a meaning. I think a fruitful comparison for the project is the substance-free theory in phonology (Hale & Reiss, 2000; 2008). They resist phonetic grounding for phonological representations based on very similar considerations to Pietroski's – they too want a characterisation of I-languages. They write, "We are advocating that phonologists, qua phonologists, attempt to explain less, but in a deeper way" (Hale & Reiss, 2000, p. 181). I think Pietroski wants to tell us something similar: semanticists, *qua semanticists* (and not pragmaticists, or reasoning-scientists, or behavioural economists, etc.) should explain less, but do so more deeply.

BIBLIOGRAPHY

Austin, J. L., 1962. *How to Do Things With Words.* Oxford, UK: Oxford University Press.

Barwise, J. & Cooper, R., 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy,* 4(2), pp. 159-219.

Borer, H., 2003. Exo-Skeletal vs. Endo-Skeletal Explanations: Syntactic Projections and the Lexicon. In: J. Moore & M. Polinsky, eds. *The Nature of Explanation in Linguistic Theory.* s.l.:CSLI Publications, pp. 31-67.

Borer, H., 2005a. *Structuring Sense: Volume I: In Name Only.* Oxford, UK: Oxford University Press.

Borer, H., 2005b. *Structuring Sense: Volume II: The Normal Course of Events.* Oxford, UK: Oxford University Press.

Borer, H., 2013a. *Structuring Sense: Volume III: Taking Form.* Oxford, UK: Oxford University Press.

Borer, H., 2013. Derived Nominals and the Domain of Content. *Lingua,* Volume 141, pp. 71-96.

Borer, H., 2017. The Generative Word. In: J. McGilvray, ed. *The Cambridge Companion to Chomsky.* Cambridge, UK: Cambridge University Press, pp. 110-133.

Borg, E., 2006. *Minimal Semantics.* Oxford, UK: Oxford University Press.

Borg, E., 2012. *Pursuing Meaning.* Oxford, UK: Oxford University Press.

Brandom, R. B., 1994. *Making It Explicit: Reasoning, Representing, and Discursive Commitment.* Cambridge, MA: Harvard University Press.

Cappellan, H. & Lepore, E., 2005. *Insensitive Semantics: A Defense of Semantic Minimalism and Speech Act Pluralism.* s.l.:John Wiley and Sons Ltd.

Chomsky, N., 1981. *Lectures on Government and Binding: the Pisa Lectures.* Dordrecht, the Netherlands: Foris Publications Holland.

Chomsky, N., 1986a. *Knowledge of Language: Its Nature, Origin, and Use.* New York, NY: Prager.

Chomsky, N., 1986b. *Barriers.* Cambridge, MA: The MIT Press.

Chomsky, N., 1995. *The Minimalist Program.* Cambridge, MA: The MIT Press.

Chomsky, N., 2000. *New Horizons in the Study of Language and Mind.* Cambridge, UK: Cambridge University Press.

Chomsky, N. & McGilvray, J., 2014. *The Science of Language: Interviews with James McGilvray.* Cambridge, UK: Cambridge University Press.

Church, A., 1941. *The Calculi of Lambda Conversion.* Princeton, NJ: Princeton University Press.

Clark, E. & Clark, H., 1979. When Nouns Surface as Verbs. *Language,* Volume 55, pp. 767-811.

Creswell, M., 1982. The autonomy of semantics. In: S. Peters & E. Saarinen, eds. *Processes, Beliefs, Questions, Vol. 16.* Amsterdam: Springer Netherlands, pp. 69-86.

Davidson, D., 1967a [1993]. Truth and Meaning. In: A. Moore, ed. *Meaning and Reference.* Oxford, UK: Oxford University Press, pp. 92-110.

Davidson, D., 1967b [2006]. The Logical Form of Action Sentences. In: E. Lepore & K. Ludwig, eds. *The Essential Davidson.* Oxford, UK: Oxford University Press, pp. 37-49.

Dutilh Novaes, C., 2012. *Formal Languages In Logic.* Cambridge, UK: Cambridge University Press.

Farkas, K., 2006. Semantic Internalism and Externalism. In: E. Lepore & B. C. Smith, eds. *The Oxford Handbook of the Philosophy of Language.* Oxford, UK: Oxford University Press, pp. 323-340.

Fodor, J. A., 1987. *Psychosemantics: The Problem of Meaning in the Philosophy of Mind.* 3rd ed. Cambridge, MA: The MIT Press, A Bradford Book.

Fodor, J. A., 1998. *Concepts: Where Cognitive Science Went Wrong.* Oxford, UK: Oxford University Press.

Fodor, J. A., 2008. *LOT2: The Language of Thought Revisited.* Oxford, UK: Oxford University Press.

Fodor, J. A. & Pylyshyn, Z., 1988. Connectionism and Cognitive Architecture: A Critical Analysis. *Cognition 28(1-2),* pp. 3-71.

Fodor, J. A. & Pylyshyn, Z. W., 2014. *Minds Without Meanings: An Essay on the Content of Concepts.* Cambridge, MA: The MIT Press.

Frege, G., 1892. On Sense and Reference. In: A. Moore, ed. *Meaning and Reference.* Oxford, UK: Oxford University Press, pp. 23-42.

Hale, M. & Reiss, C., 2000. Phonology as Cognition. In: N. Burton-Roberts, P. Carr & G. Docherty, eds. *Phonological Knowledge: Conceptual and Empirical Issues.* Oxford, UK: Oxford University Press, pp. 161-184.

Hale, M. & Reiss, C., 2008. *The Phonological Enterprise.* Oxford, UK: Oxford University Press.

Heim, I., 1982. *The Semantics of Definite and Indefinite Noun Phrases.* Ph.D., University of Massachusetts: s.n.

Heim, I. & Kratzer, A., 1998. *Semantics in generative grammar.* 2nd ed. Malden, MA: Blackwell's Publishing.

Higginbotham, J., 2000 [2009]. On Events in Linguistic Semantics. In: *Tense, Aspect, and Indexicality.* Oxford, UK: Oxford University Press, pp. 18-52.

Hornstein, N., 1990. *As Time Goes By: Tense and Universal Grammar.* Cambridge, MA: The MIT Press.

Kahneman, D., 2011. *Thinking Fast and Slow.* New York: Penguin.

Kratzer, A., 1996. Severing the External Argument from its Verb. In: R. J. & Z. L., eds. *Phrase Structure and the Lexicon. Studies in Natural Language and Linguistic Theory, Vol. 33.* Dordrechy: Springer, pp. 109-137.

Kripke, S., 1980. *Naming & Necessity.* New York, NY: Blackwell.

Larson, R. K., 1988. On the Double Object Construction. *Linguistic Inquiry,* 19(3), pp. 335-391.

Larson, R. K. & Segal, G., 1995. *Knowledge of Meaning.* Cambridge, MA: The MIT Press.

Lewis, D., 1970. General Semantics. *Synthese,* 22(1), pp. 18-67.

Lewis, D., 1986. *On the Plurality of Worlds.* Oxford, UK: Oxford University Press.

Maienborn, C., 2011. Event Semantics. In: C. Maienborn, K. von Heusinger & P. Portner, eds. *Semantics: An International Handbook of Natural Language Meaning.* The Hague: Mouton de Gruyter, pp. 802-829.

Marr, D., 1982 [2008]. *Vision: A Computational Investigation Into the Human Representation and Processing of Visual Information.* Cambridge, MA: The MIT Press.

Menzel, C., 2016. The Extensionality of Possible World Semantics. *Stanford Encyclopedia of Philosophy.*

Partee, B. H., 1995. Lexical Semantics and Compositionality. In: L. Gleitman & M. Liberman, eds. *Invitation to Cognitive Science - Part I: Language (series ed. Daniel Osherson).* Cambridge, MA: The MIT Press, pp. 311-360.

Pietroski, P. M., 2002. Function and Concatenation. In: G. Preyer & G. Peter, eds. *Logical Form and Language.* Oxford, UK: Oxford University Press, pp. 91-117.

Pietroski, P. M., 2003a. Small Verbs, Complex Events: Analyticity Without Synonymy. In: N. Hornstein & L. Antony, eds. *Chomsky and his Critics.* Malden, MA: Blackwell Publishing, pp. 179-214.

Pietroski, P. M., 2003. The character of natural language semantics. In: A. Barber, ed. *Epistemology of Language.* Oxford, UK: Oxford University Press, pp. 217-256.

Pietroski, P. M., 2005. *Events and Semantic Architecture.* Oxford, UK: Oxford University Press.

Pietroski, P. M., 2006. Character Before Content. In: J. Thomson & A. Byrne, eds. *Content and Modality: Themes from the Philosophy of Robert Stalnaker.* Oxford, UK: Oxford University Press.

Pietroski, P. M., 2018. *Conjoining Meanings: Semantics Without Truth Values.* Oxford, UK: Oxford University Press.

Pietroski, P. M., 2020. Précis of Conjoining Meanings: Semantics Without Truth Values. *Croatian Journal of Philosophy,* 20(60), pp. 271-282.

Potts, C., 2008. Review of Hagit Borer - Structuring Sense. *Language,* 84(4), pp. 343-369.

Pylyshyn, Z., 2007. *Things and Places: How the Mind Connects With The World.* Cambridge, MA: The MIT Press. A Bradford Book.

Quine, W. V. O., 1951 [1980]. *Two Dogmas of Empiricism, in "From a Logical Point of View".* Cambridge, MA: Harvard University Press.

Schein, B., 2012. Event Semantics. In: G. Russell & D. G. Fara, eds. *The Routledge Companion to Philosophy of Language.* Abingdon, UK: Routledge, pp. 280-294.

Schein, B., 2017. *'And': Conjunction Reduction Redux.* Cambridge, MA: The MIT Press.

Stalnaker, R. C., 2006. Reply to Pietroski. In: J. Thomson & A. Byrne, eds. *Content and Modality: Themes from the Philosophy of Robert Stalnaker.* Oxford, UK: Oxford University Press, pp. 257-261.

Stalnaker, R. C., 2012. *Mere Possibilities.* Princeton, NJ: Princeton University Press.

Tarski, A., 1944. The Semantic Conception of Truth: and the Foundations of Semantics. *Philosophy and Phenomenological Research,* 4(3), pp. 341-376.

Williams, A., 2015. *Arguments in Syntax and Semantics.* Cambridge, UK: Cambridge University Press.