Interrogatives, Instructions, and I-languages: An I-Semantics for Questions[1]

Terje Lohndal & Paul Pietroski
University of Maryland

1 Introduction

> "Prima facie a serious obstacle to the program of providing a truth-theoretic semantics for natural language is the fact that natural languages apparently contain an infinite number of sentences that do not appear to be truth evaluable even in use, specifically, imperatives [. . .] and interrogatives" (Lepore and Ludwig 2007: 263).

In this paper, we develop a simple idea in a minimalist setting: interrogative expressions are instructions for how to assemble mental representations that are apt for making queries. While this idea might seem trivial, at first glance, it can be developed in a theoretically spare yet still empirically attractive way. We discuss *wh*-movement as a paradigm example of how "movement to the edge" of a sentence has a semantic effect that differs from merely adding information (say, by means of a new argument/adjunct) or raising a quantifier. In particular, we offer a minimalist version of an old thought: the leftmost edge of a sentence permits a kind of abstraction that makes it possible to use a sub-sentential (mood-neutral) expression to ask a question; and *wh*-interrogatives turn out to be especially interesting, with implications for relative clauses, which also provide examples of how movement to the edge of a cyclically generated expression has a distinctive semantic effect. From this perspective, the edge of a phrase is a locus for a "secondary" semantic instruction, concerning the use of a mental representation that can be assembled by executing the "primary" instruction encoded by the rest of the phrase; cp. Chomsky (2005: 14). What follows is an attempt to articulate this general idea, in some detail, for interrogative expressions.

Within formal semantics, it is widely held that understanding the declarative sentences of a natural language – knowing what these sentences mean – is a matter of knowing their truth conditions. Since children naturally acquire spoken/signed languages that have endlessly many declaratives, it seems that each such sentence must have a truth condition that can be somehow computed, given finitely many assumptions about (a) the semantic properties of lexical items, (b) the relevant syntax, and (c) how the semantic properties of complex expressions are determined by (a) and (b). But the languages that children acquire also include endlessly many interrogative sentences that are understood just as well as their declarative counterparts. So if (1) has a computable truth condition,

(1) Jay saw Kay.

that raises a cluster of foundational questions about the corresponding *yes/no*-interrogative (2) and the *wh*-interrogatives (3)-(5),

(2) Did Jay see Kay?

(3) Who did Jay see?

(4) Who saw Kay?

(5) When did Jay see Kay?

along with further questions about relative clauses like (6)-(8) and complex declaratives like (9)-(10).[2]

(6) ...who Jay saw

(7) ...who saw Kay

(8) ...when Jay saw Kay

(9) Someone wondered/forgot/knew whether Jay saw Kay.

(10) Someone asked who Jay saw, and someone remembered when Jay saw Kay.

At the most basic level, one wants to know how the cognitive resources deployed in understanding interrogatives are related to the cognitive resources deployed in understanding declaratives and relative clauses. While the parallels between (4) and (7) seem especially vivid, there is presumably massive overlap in terms of the lexical knowledge and recursive capacities invoked to understand (1)-(10). But does this "core" semantic competence consist in tacit knowledge of a Tarski-style theory of *truth*, which is supplemented in some way that accommodates interrogatives (cp. Dummett (1976)'s discussion of Davidson (1967b)), or is natural language semantics less truth-centric? In terms of the expressions themselves, do (2)-(5) have truth-evaluable constituents that are combined with special question-forming devices: if so, how are interrogatives understood compositionally; if not, does this tell against the familiar idea (reviewed below) that relative clauses have truth-evaluable constituents, and would this in turn tell against truth-theoretic accounts of declaratives?

Over the past thirty years or so, intensive study of interrogatives has led to many insights (Hamblin 1973, Karttunen 1977, Higginbotham and May 1981, Groenendijk and Stokhof 1982, 1984, Higginbotham 1993), especially with regard to details concerning the kinds of expressions that can be used (cross-linguistically) to ask questions, and how these expressions are related to others in terms of form and meaning. Semanticists have also developed useful frameworks for thinking about how interrogatives are related to information (see e.g., Ginzburg and Sag (2001)). But central questions remain. In particular, as discussed in section 2.2, it is often said that an interrogative has a set of propositions – intuitively, a set of possible answers – as its semantic value. But it is not obvious that a few word meanings, combined as in (2)-(5), can determine a set of propositions in accord with the natural principles governing lexical items and composition. We stress this point, elaborated below: any posited meaning of an interrogative expression must be determined, in accord with independently plausible composition principles, by independently plausible lexical meanings.

From this perspective, one wants to know how expressions like (1)-(10) systematically interface with relevant aspects of human cognition. If a declarative like (1) is something like an instruction for how to build a truth-evaluable thought, perhaps each of (2)-(5) is an instruction for how to build a certain class of thoughts. But another possibility is that while hearing an interrogative often leads one to represent possible answers, understanding an interrogative requires both less and more: less, because representing answers is a potential effect (not a constitutive part) of understanding; and more, because an interrogative differs from any non-interrogative device for representing a set of answers (cp. McGinn (1977), Stainton (1999)). Maybe (1)-(10) are all instructions for how to construct concepts, with "sentential" concepts as special cases, and each grammatical *mood* is an instruction related to a certain kind of concept use.

One can invent a language in which certain sentences indicate propositions, and other sentences indicate sets of such abstracta, thereby offering an idealized model of certain speech acts. (Imagine a community in which a declarative is always used to assert the indicated proposition, and an interrogative is always used to request an assertion of some proposition in the indicated set.) Such invention can also suggest a grammar that at least accommodates (2)-(5) in a way that describes their interrogative character. And for these purposes, one can abstract from many details concerning *how* the lexical constituents of (2)-(5) combine to form expressions whose meanings make them apt for use in requesting information.[3] But we assume that children acquire I-languages in Chomsky (1986, 1995)'s sense: expression-generating *procedures* – intensions in Church (1941)'s sense (see also Frege (1892)) – that are biologically implemented in ways that respect substantive constraints of Universal Grammar on lexical meanings and modes of composition; where these procedures, acquired in conditions of limited experience via the human language faculty, generate expressions that pair phonological instructions to "perceptual-articulatory" systems with semantic instructions to "conceptual-intentional" systems. In this respect, we adopt fundamental assumptions of the Minimalist Program, taking each I-language "to be a device that generates expressions Exp = <Phon, Sem>, where Phon provides the "instructions" for sensimotor systems and Sem the "instructions" for systems of thought-information about sound and meaning, respectively, where "sound" and "meaning" are understood in internalist terms, "externalizable" for language use by the performance systems" (Chomsky 2000a: 91)

There are many ways of spelling out this old idea. But one can hypothesize that each sentence is a two-part instruction: a core (or "radical") component that directs construction of a sentential concept that can be used with different forces; and a further instruction for how to make sentential concept apt for a certain kind use (cp. Frege (1879)).[4] More specifically, drawing on Segal (1991) and McGinn (1977), we adopt an I-language version of a Tarski-style semantics that eschews truth values. On this view, there are no I-language expressions of type <t>. Rather, each sentence is an instruction to build a concept that applies to everything or nothing in the relevant domain, relative to an assignment of values to variables. And such a concept can be used, in concert with other cognitive systems, to assert that – query whether, or wish/pretend/joke that – it it applies to something/everything.

Given an independently plausible and spare syntax, this yields a simple procedure for generating interrogative interpretations. It also preserves descriptive adequacy with regard to a significant range of interrogatives and *wh*-expressions. But our goal here is to offer a promising account that speaks directly to some foundational challenges presented by non-declarative sentences. We cannot – and will not try to – deal with the many and varied empirical phenomena that have been analyzed and discussed in the rich descriptive literature on interrogatives, much less imperatives/exclamatives/etc. We focus instead on a few illustrative phenomena: argument and adjunct interrogatives, *yes/no*-interrogatives, and multiple *wh*-interrogatives. In our view, these basic cases already reveal difficult theoretical questions that are not answered by describing the facts in terms of sets of propositions.

2 I-semantics and Concepts

In this section, we briefly review the I-language/E-language distinction (Chomsky (1986)), and we endorse a version of the following idea (cp. Chomsky (1995)): human I-languages generate expressions that pair phonological instructions (PHONs) with semantic instructions (SEMs); where the latter can be described as (syntactic) instructions to build concepts (see Chomsky (2000a), Pietroski (2008, 2010)). Given this overtly psychological perspective on semantics, positing denotations for expressions is a first step that raises further questions: what are the corresponding mental representations; and how is their compositional structure related to that of the corresponding I-language expressions? Focusing on these questions may lead one to conclude that the original claims, about denotations, mixed distinct aspects of linguistic competence (concerning knowledge of meaning and knowledge of how meaningful expressions can be used in communication).[5]

2.1 Implemented Intensions and Typology

Chomsky (1986) distingushed I-languages from E-languages, stressing the difference between expression-generating procedures (intensions) and sets (extensions) of generable expressions. The "I" also connoted "idiolect", "individual", and "internal". As noted above, the expression-generating procedures that children naturally acquire must also be implemented by available human biology; and this is presumably a major source of constraint on which I-languages children can acquire, even if theorists do not know the details. One can invent E-languages that are "external" to any particular speaker, in the sense of being governed by public conventions that may violate principles respected by all natural languages. And such inventions may be useful for certain purposes. In particular, if an E-language has unboundedly many expressions, one might describe it in terms of a generative procedure that models certain aspects of the "human" I-languages that children can naturally acquire. But our inquiry is focused on these I-languages, the faculty that lets human children acquire them, and the mental representations with which generable expressions interface.

At least to a first approximation, one can describe human I-languages as implemented procedures that pair PHONs with SEMs; where PHONs (or PFs) are the aspects of generable expressions that interface with human perceptual-articulatory systems, and SEMs (or LFs) are the aspects of generable expressions that interface with human conceptual-intentional systems. This leaves room for many hypotheses about how SEMs are related to PHONs, syntax, and morphology. But the simplest idea, and hence an obvious starting point, is that expressions are PHON-SEM pairs (cp. Chomsky (1995)). Familiar facts suggest that an expression's PHON need not be isomorphic to the "logical form" of the thought expressed, taking logical forms to be structural aspects of mental representations with which SEMs naturally interface. So it seems that either (i) an expression's PHON need not be isomorphic to its SEM, or (ii) an expression's SEM need not be isomorphic to the corresponding logical form. We assume that (i) is correct, and that part of the goal is specify a relatively transparent mapping from SEMs to logical forms, while keeping the posited mismatches between SEMs and PHONs explicable; cp. May (1977), Chomsky (1981), Higginbotham and May (1981). The broader task is to specify a biologically implementable algorithm for generating complex SEMs that can employed as executable instructions for how to build mental representations of some kind – and to specify these instructions in empirically plausible ways – while also specifying the elements and structural properties of SEMs, along with the elements and structural properties of the corresponding mental representations; cp. Hornstein and Pietroski (2009).

One can accept this task and still hypothesize that understanding an expression of a human I-language is a matter of recognizing (or perhaps assigning) its truth-theoretic properties in the right way; see e.g., Higginbotham (1986), Larson and Segal (1995), Heim and Kratzer (1998). For as Larson and Segal (1995) make explicit, and other authors suggest, one can offer a proposal about how the pronounceable expressions of a human I-language are related to expressions of a hypothesized language of thought (cp. Fodor (1975, 2008)) that makes it possible to *represent* Tarskian satisfaction conditions. Indeed, we do not see how else sentential SEMs could actually have truth conditions, as opposed to merely being "interpretable" in this way from an externalistic perspective.

To recognize that *cow* is true of all and only the cows – or more precisely, that when *cow* is linked to a variable *v*, the resulting expression is satisfied by an assignment **A** of values to variables iff **A** assigns a cow to *v* – a speaker presumably needs some way of representing the cows, along with some way of representing variables and truth/satisfaction. Likewise, for Larson and Segal, understanding *brown cow* is a matter of generating (in the right way) a representation according to which this phrase is true of things that are both brown and cows. If only for simplicity, we assume that humans have concepts like COW and BROWN, along with some logical concepts like AND; where concepts are mental representations, composable in their own terms.[6] And we assume that speakers deploy such concepts in understanding. Ordinary speakers may also have semantic concepts like SATISFIES, which can be deployed to represent complex I-language expressions as having semantic properties that can be specified via concepts like AND, BROWN, and COW.[7] Though once one grants that theorists must say something about how SEMs are related to concepts, even for simple cases like *brown cow*, various possibilities come into view.

Instead of saying that SEMs have (and/or are represented as having) truth-theoretic properties, one can hypothesize that SEMs are instructions for how to fetch and combine mental representations, and that executing SEMs leads to the assembly of representations that may or may not have truth-theoretic properties. To a first approximation, one might view the SEM of each morpheme as an executable instruction for how to fetch a concept from a certain lexical address. And one might view each complex SEM as an executable instruction for how to formally combine concepts obtained by executing constituent SEMs. This leaves it open which if any aspects of SEMs/instructions should be characterized in terms of traditional semantic notions. For example, the SEM of *brown dog* might be described as: CONJOIN[FETCH@"brown", FETCH@"cow"]; i.e., conjoin concepts fetched from the lexical addresses (in the lexicon) associated with the PHONs of *brown* and *cow*. If we idealize away from polysemy, and assume that each lexical address indicates a single concept – and that there is only one available way to conjoin monadic concepts – there will only be one way of executing the semantic instruction. The resulting concept, AND[BROWN, COW], might have a satisfaction condition. But executing an instruction may lead to a product that has properties not specified in the instruction. So even if (some) concepts have Tarskian satisfiers, it isn't obvious that SEMs are related to concepts via semantic concepts like SATISFIES, as on more traditional approaches.

In any case, there may be many human concepts that cannot be fetched or assembled via SEMs: acquirable I-languages may not interface with all the concepts that humans enjoy. So let us say that human I-concepts are concepts that can be fetched or assembled via SEMs. Likewise, there may be ways of assembling concepts that SEMs cannot invoke. We assume that any plausible account will need to posit, one way or another: conjunction of monadic concepts; a restricted form of saturation, or perhaps “theta-binding”, corresponding to combination of a verb with an argument (Carlson 1984); and something like quantification over assignment variants, to accommodate the kind(s) of abstraction associated with relative clauses and the external arguments of quantificational determiners (cp. Higginbotham (1985)). But whatever the details, let’s say human I-operations are those concept-combining operations that can be invoked via the syntax of SEMs.[8]

This invites a question characteristic of Chomsky (1995, 2000b)’s proposed minimalist program, applied to semantics: what is the sparest theoretical inventory, of I-concepts and I-operations, that allows for at least rough descriptive adequacy with regard to characterizing the concept-construction-instructions (or *Begriffsplans*) generated by human I-languages? In answering this question, one needs to distinguish Tarski (1935)’s technical notion of satisfaction from the intuitive sense in which instructions are satisfied when successfully executed. If Σ is a sentence of a language that has a Tarskian semantics – perhaps an idealized language of thought – one can say that Σ is “E-satisfied” by each sequence of entities (in the relevant domain of discourse) that meets a certain condition. But if Σ has E-satisfiers, these sequences need not and typically will not reflect the structure of Σ, and Σ need not be an instruction to *build* anything. By contrast, if Σ is a concept-construction-instruction, one can say that Σ is “I-satisfied” by fetching certain concepts and performing certain combinatorial operations. And Σ can be satisfied in this sense, requiring construction of a concept that at least partly reflects the structure of Σ, even if Σ has no E-satisfiers; cf. Davies (1987).[9]

Given this distinction, appeals to semantic typology must be motivated carefully. Let’s grant that humans enjoy concepts that exhibit at least some of the traditional Fregean hierarchy: singular concepts of type <e>, used to think about entities; truth-evaluable thoughts of type <t>; predicative concepts of type <e, t> that can combine with concept of type <e> to form a thought of type <t>; and so on, for some nontrivial range of types. lt doesn’t follow that human have I-concepts of these types. Indeed, the allegedly basic types <e> and <t> are especially suspect.

Many accounts of proper names eschew the idea that names are lexical items (that fetch concepts) of type <e>, in favor of the idea that *Jay* is more like “that person called *Jay*”– a complex predicative expression (used to assemble a complex monadic concept). More generally, expressions often said to be of type <e> may be better analyzed as devices for fetching monadic concepts that can be conjoined with others; see Pietroski (2011) and references there. And it is worth stressing that Tarski (1935) did not appeal to truth values, or expressions of type <t>, when he characterized truth in terms of satisfaction. Tarski treated sentences (of his invented language) as devices that classify sequences. And since it will be important that I-language sentences need not be instructions to build concepts of truth values, we conclude this subsection by introducing some relevant notation.

Consider a pair of operators, ↑ and ↓, that convert monadic concepts into monadic concepts as follows: for each thing in the domain, ↑C applies to it iff C applies to something, and ↓C applies to it iff C applies to nothing; where C ranges over monadic concepts. For example, ↑COW applies to you iff there is at least one cow. Correlatively, ↓COW applies to you iff nothing is a cow. So for each thing, either ↑COW or ↓COW applies to it. And nothing is such that both ↑COW and ↓COW apply to it. Given a suitable metalanguage, we can say: $\uparrow\text{C} \equiv \exists x[\text{C}(x)]$; $\downarrow\text{C} \equiv \neg\exists x[\text{C}(x)]$. But the idea is not that "↑C" abbreviates "$\exists x[\text{C}(x)]$".

The possibility to consider is that sentential SEMs invoke an operation that creates a concept of "all or none" from an assembled monadic concept. We take no stand here on which aspect of sentential syntax invokes this operation. But one can hypothesize that for some grammatical label S, an expression with this label is an instruction to execute the labeled instruction and then prefix the resulting concept with ↑. Given concepts of events, like SEEING-OF-KAY and DONE-BY-JAY, "closing up" can yield concepts like ↑AND[DONE-BY-JAY, SEEING-OF-KAY]. This concept applies to all or to none, depending on whether or not there was an event of Jay seeing Kay.[10]

Let us say that any concept of the form "↑C" or "↓C" is a *T-concept*, with "T" connoting Tarski, totality, and truthy.[11] There is no guarantee that human I-concepts include T-concepts. Even if humans enjoy such concepts, there is no guarantee that they can be assembled by executing semantic instructions. But that is true for concepts of any type. Still, one can imagine a procedure that generates instructions of the form CLOSE-UP:CONJOIN[... , ...]; where executing such instructions leads to assembling concepts of the form ↑AND[C, C']. And appeal to T-concepts can do at least much of the work done by supposing that sentences (are used to assemble concepts that) denote truth values.

So instead of saying that sentences exhibit a special type <t> that differs from the type exhibited by "brown cow", with expressions of type <t> as truth value denoters, one might offer an I-language semantics according to which sentences are special cases of predicates. Put another way, T-concepts are predicative concepts formed via distinctive operators, not concepts of distinctive things. So especially if it is unclear that human I-concepts include concepts of type <e>, the possibility of appealing to T-concepts should make theorists pause before assuming the traditional semantic typology in theories of I-languages.[12]

We do not deny that "post-linguistic" cognition often traffics in complete thoughts, with each monadic concept saturated or quantificationally bound. But human I-languages may interface with such cognition via formally monadic T-concepts, perhaps *because* I-languages do not themselves generate expressions of type <t>. And this is not mere speculation, given that the notion of a sentence has always had an unstable place in grammatical theory. It is notoriously hard to say which SEMs exhibit the special type <t>, especially if each SEM is (qua generable expression) an instance of some grammatical type exhibited by lexical items. One can stipulate that sentences are projections of some functional category, perhaps associated with tense. But no such stipulation seems especially good. So perhaps theorists should drop the idea that human I-languages generate expressions of type <t>, in favor of a less type-driven conception of semantics.

In any case, we do not want to rely on inessential typological assumptions when addressing foundational questions about how interrogatives and relative clauses are related to declaratives. It is hard see how concepts of truth values can be used to ask questions. And we suspect this feeds the idea that concepts of propositions are required. So we will not assume that I-languages generate expressions <t>, much less that interrogatives and relative clauses have constituents that denote truth values.

2.2 I-language Interrogatives and Question-Denoters

Following Hamblin (1958, 1973), many theorists have been attracted to some version of the idea that an interrogative denotes the corresponding set of possible answers – or the corresponding set of *true* answers (Karttunen 1977), or a *partition* of a suitable set of answers (Higginbotham and May 1981). Hamblin expressed the leading idea in terms of a point about how interrogatives are used in communication: "Pragmatically speaking a question sets up a choice-situation between a set of propositions, namely, those propositions that count as answers to it" Hamblin (1973: 48). And as noted above, we grant the utility of this idealization concerning use. But it is often said that a *yes/no*-interrogatives like (11) *denotes* the set indicated with (12), or perhaps the corresponding singleton set that includes only the true proposition in question.[13]

(11) Did Jay see Kay?

(12) {the proposition that Jay saw Kay, the proposition that Jay did not see Kay}

Likewise, it is often said that a *wh*-question like (13) denotes some set of propositions gestured at with (14),

(13) Who did Jay see?

(14) {the proposition that Jay saw Kay, the proposition that Jay saw Larry, the proposition that Jay saw Mary, ... , the proposition that Jay saw Jay}

or perhaps a partition of (14) – i.e., a set of conjunctions, each of which has each element of (13) or its negation as a conjunct. Any such proposal raises questions about the unmentioned elements of (14), indicated with the ellipsis. Do they include, for example, the following propositions (at least if true): that Jay saw the governor of Illinois; that Jay saw every governor convicted of a crime; that Jay saw every governor who saw him; that Jay saw every governor he saw? But set such issues aside, and assume that there is determinate set of propositions corresponding to (13). A more pressing question, from an I-language perspective, is how to translate the talk of expressions denoting abstracta into a plausible hypothesis about the SEMs of (11) and (13).

At least sometimes, talk of denotation is abbreviated talk of what speakers can *do* with expressions in communicative contexts – with no pretense of any proposal about how SEMs are used to assemble mental representations. But it can be tempting to say that (15), by virtue of its meaning,

(15) Jay saw Kay

has a certain proposition as its denotation; where "denotation" is a technical term of semantics, on par with Frege's term of art "Bedeutung", except that Frege stipulated that sentences of his invented language denote/Bedeut truth values. It is tempting to think that "denotation" can also be used, without serious equivocation, to talk about the representations assembled by executing SEMs. But as noted above, appeal to (I-concepts of) truth values should already raise eyebrows if the task is to describe human I-languages in terms of the sparest descriptively adequate typology. Appeal to (I-concepts of) propositions, in order to accommodate (11), should raise eyebrows high. Does the fact that (15) has an interrogative counterpart already show that (15) is not an instruction to assemble a mere T-concept, or that the constituents of (15) have denotations that can be combined to form a proposition that can be an/the answer to (11)?

If (15) denotes the proposition that Jay saw Kay, then it becomes very tempting to say that one way or another: the SEM of (11) combines some formal element Q with a complex constituent S that shares its denotation with (15); and the complex expression Q^S denotes (12), because Q denotes the requisite mapping function μ. From an I-language perspective, this would be to say that Q fetches a concept of μ, and hence that I-concepts include concepts of this sort. And if (16) is related to (15) by some process of abstraction, so that (16) denotes the proposition-part corresponding to "Jay saw _",

(16) . . . who Jay saw

then it becomes very tempting to say that one way or another: the SEM of (13) combines some formal element Q with a complex constituent R that shares its denotation with (16); and the complex expression Q^R denotes (14), because Q denotes the requisite mapping function, with parallel consequences for the space of I-concepts.

Many variants on these initial ideas have been proposed, in response to various facts (see among others Groenendijk and Stokhof (1984: chapter 1), Berman (1991: chapter 2), Higginbotham (1996) and Lahiri (2002) for summaries). We focus here on the Hamblin-Karttunen approach because it is simple, it is widely adopted (at least as an idealization), and it illustrates two foundational concerns that apply to at least many of the variants. The first concern has already been noted: in so far as the approach suggests a specific hypothesis about human I-languages, it suggests a rich typology of I-concepts, even for sentences that seem quite simple. One wonders if the same descriptive work could be done with fewer theoretical distinctions.

The issue here is not skepticism about abstracta. We suspect that at least often in the study of linguistic meaning, appeal to propositions is historical residue of an E-language perspective on I-languages that are used to assemble concepts. Populating the domain of denotations with propositions, while retaining the traditional (non-psychological) notion of denotation, is no substitute for the idea that SEMs are instructions to assemble concepts. Failure to be clear about this is a recipe for positing more typology than needed. For many purposes, economy of typology is not a high priority. But if the goal is to say how human I-languages interface with other aspects of human cognition, then part of the task is to describe the space of possible human I-concepts, and not merely to describe a space of possible concepts that might be employed by minds that can ask/answer questions.

The second concern is related. Even if one assumes that interrogatives denote questions, in some technical sense, this description of the facts concerning (11) and (13) is still not rich enough. For it does not yet distinguish an interrogative SEM from a noninterrogative SEM that has the same denotation. If questions are sets of propositions – or whatevers – then a speaker can label/describe a question without asking one.[14] Frege (1879) stressed that one can label/describe a truth value without making (or asking for) an assertion. So for purposes of his invented language, Frege introduced a distinction between markers of *force* and representations of *content* – so that the same force marker (e.g., a judgment stroke) could be combined with different content representations, while different force markers could be combined with the same content representation. With regard to human I-languages, there are various analog hypotheses concerning the left periphery of matrix sentences.

One might speculate that declaratives/interrogatives are covert performatives along lines indicated in (17) or (18); cp. Ross (1970), Lewis (1970), Lakoff (1972).

(17) (I hereby assert that) Jay saw Kay.

(18) (I hereby ask whether) Jay did see Kay.

But in our view, while performatives raise further interesting questions, (17) and (18) still exhibit the same declarative mood as (15) or (19)-(20).

(19) Mary (thereby) asserted that Jay saw Kay.

(20) Mary (thereby) asked whether Jay saw Kay.

Indeed, we think the SEM of (18) differs in kind from the SEM of any sentence that exhibits declarative mood. One can use (18) to ask a question. But this just shows, if it needs showing, that the mood of an uttered sentence is (at best) an imperfect indicator of the corresponding speech act's force; see footnote 3 above.

We assume that each grammatical mood – an aspect of certain naturally generable linguistic expressions – is a feature that makes sentences apt for certain uses, in a way that makes this feature neither necessary nor sufficient for the use in question; cp. McGinn (1977), Segal (1991). Competent speakers know that (11) and (13) are well-suited to the task of answering questions, while (15) and (19)-(20) are well-suited to the task of making claims. A speaker can claim that someone asked a question, with special implications if the speaker performatively claims that she herself is asking a question. But our task here is not to offer any specific account of the complexities concerning the relation of mood to force in human communication. Rather, given the distinction between mood and force, we want to specify the semantic role of mood in a suitably neutral way.

From an I-language perspective that aims to keep semantic typology spare, an obvious hypothesis is that a sentence is a bipartite instruction: the main part, whose execution leads to construction of a T-concept, which may be modified by a process corresponding to *wh*-extraction (see below); and a second part, associated with the sentential left periphery edge, whose execution makes an assembled concept fit for a certain kind of use (say, declaration or querying).[15] We assume that a T-concept can be used to declare that it applies (to one or more things), or to query whether it applies.[16] Likewise, a "*wh*-concept" can be used to classify, or to query which thing(s) it applies to. But it may be that before any I-concept can be used in any such way, it must be "fitted" to the relevant cognitive/linguistic performance system. And the relevant systems may differ in ways that require diverse kinds of fitting. Humans can represent and perform speech acts of many sorts (cp. Austin (1962)), some of which correspond to "basic" interior actions like endorsing and wondering.[17] But in using a T-concept to form a thought and endorse it, a thinker may need to *adapt* the T-concept in some formal way (leaving the content unchanged) that makes the concept accessible to the biological process of endorsement, whatever that is.

We see no reason to assume that T-concepts are essentially tailored to endorsement (or "judgment"). Moreover, even if a T-concept can be directly endorsed, using a T-concept to wonder if it applies – or put another way, to wonder whether it is to be endorsed – a thinker may need to make the T-concept formally accessible to the biological process of wondering. Given a system that can systematically combine fetchable I-concepts by means of I-operations, it would amazing if the resulting products came directly off the assembly line in a ready-for-endorsing/wondering format. The relevant interfaces may not be uniform and transparent, as if endorsing/wondering was *simply* a matter of copying an assembled concept into a suitable declaration/query workspace. So even if some interior actions can be performed directly on concepts assembled by executing semantic instructions, it may be that for at least some of the action types imperfectly correlated with grammatical mood, performing actions of those types requires additional preparation of grammatically assembled concepts. In which case, grammatical mood may itself be an aspect of a complex sentential instruction for how to build a concept and prepare it for a certain kind of use; cp. Segal (1991). Though to repeat: a concept can be prepared (i.e., ready) for a certain use – say, by applying the I-operation associated with a given mood – yet not be so used; and a concept might be so used without being prepared in this moody way. Correlatively, our suggestion is that the edge of a sentence is important in preparing a concept for a given use, be it to utter a command, ask a question or to make a statement. An edge provides a locus for directing "adjustment" of a sub-sentential concept in an appropriate way.

For simplicity, suppose that declarative mood is the instruction DECLARE, while interrogative mood is the instruction QUERY. We take no stand on the details of how DECLARE is related to acts of endorsing propositions – as opposed to (say) entertaining hypotheses, or stating the antecedent of a conditional – or how QUERY is related to acts of seeking information, as opposed to (say) asking rhetorical questions, or merely giving voice to uncertainty. Perhaps subdistinctions will be required. But as a potential analogy, a common view is that external arguments of verbs are associated with a relational concept, AGENT-OF, that co-classifies segregatable thematic participants: CAUSERS, EXPERIENCERS, and so on.[18] It may be that DECLARE likewise munges segregatable speech acts. And for the moment, it is enough to envision a procedure that can generate instructions of the form shown in (21) and (22);

(21) DECLARE: CLOSE-UP: CONJOIN[... , ...]

(22) QUERY: CLOSE-UP: CONJOIN[... , ...]

where executing such instructions leads to assembling T-concepts, like ↑AND[DONE-BY-JAY, SEEING-OF-KAY], and then preparing such concepts for use in declaration or posing a *yes/no*-query.[19]

Given this way of setting up the issues, one can – and in the following sections, we will – go on to ask what further typology of instructions is required to accommodate a range of basic facts concerning interrogative SEMs. But we conclude this section with a few remarks about relative clauses, since part of our goal is to offer a syntax/semantics that captures the apparent commonalities across *wh*-questions and relative clauses. Unsurprisingly, the notion of a T-concept must be extended to include concepts that contain variables. And this extension to relative clauses will further illustrate our claims about the semantic role of movements to edges.

2.3 Abstraction: T-concepts, Variables, and Relative Clauses

As noted above, ↑AND[DONE-BY-JAY, SEEING-OF-KAY] applies to everything or nothing, depending on whether or not something was both done by Jay and a seeing of Kay. Or more briefly, ↑AND[DONE-BY-JAY, SEEING-OF-KAY] applies to x iff (x is such that) Jay saw Kay. For simplicity (cp. footnote 8 above), suppose the embedded conjuncts have singular constituents that can be replaced with variables like *v*’ or *v*” – mental symbols that might be fetched via grammatical indices like “1” and “2” – as shown in (23-(25).

(23) ↑AND[DONE-BY(JAY), SEEING-OF(*v*’)]

(24) ↑AND[DONE-BY(*v*’), SEEING-OF(KAY)]

(25) ↑AND[DONE-BY(*v*’), SEEING-OF(*v*”)]

In one sense, the concept SEEING-OF(*v*’) is dyadic; it applies to a pair <e, e’> iff e was an event of seeing e’. But formally, SEEING-OF(*v*’) is a concept of events, just like SEEING-OF-KAY. Likewise, there is a sense in which (23) is dyadic; it applies to <x, e’> iff x is such that Jay saw e’. Though formally, (23) is a T-concept, and hence a concept of all or none. Similar remarks apply to (24). And of course, there is a sense in which (25) is triadic; it applies to a triple <x, e’, e”> iff x is such that e’ saw e”. Nonetheless, (25) is a T-concept. So let’s say that relative to any assignment of **A** of values to variables: SEEING-OF(*v*’) applies to e iff e was an event of seeing whatever **A** assigns to *v*’; (23) applies to x iff (x was such that) Jay saw whatever **A** assigns to *v*’; (24) applies to x iff whatever **A** assigns to *v*’ saw Kay; and (25) applies to x iff whatever **A** assigns to *v*’ saw whatever **A** assigns to *v*”. Assignments can also be described as mappings–from variables to entities–that satisfy T-concepts: SAT[**A**, (23)] iff Jay saw **A**(*v*’); SAT[**A**, (24)] iff **A**(*v*’) saw Kay; SAT[**A**, (25)] iff **A**(*v*’) saw **A**(*v*”). And while T-concepts are not concepts of assignments, a capacity to represent assignment-relativization would be valuable for a cluster of reasons.

Imagine a mind that can refer to some of its own concepts and form complex concepts like SAT[α, (25)]; where α is either a default (or randomly chosen) assignment, or an assignment that “fits” a given conversation in the sense of assigning the nth thing demonstrated to the nth variable (and assigning values to any speaker/place/time indices in the appropriate way). Such a mind might be able to form concepts like AND[SAT[α, (25)], RELEVANT(α)]; cp. Kaplan (1978b,a). And it might not be a big leap to representing assignments as differing minimally, in the sense of differing at most with respect to the value of a single variable; cp. Tarski (1935). Existential quantification over assignments could then be used to convert “variable T-concepts” into complex monadic concepts that apply to some but not all individuals.

Consider (26) and (27).[20]

(26) ∃**A**[ASSIGNS(**A**, x, *v*’) & MINDIF(**A**, α, *v*’) & SAT(**A**, ↑AND[DONE-BY(JAY), SEEING-OF(*v*’)])]

(27) ∃**A**[ASSIGNS(**A**, x, *v*’) & MINDIF(**A**, α, *v*’) & SAT(**A**, ↑AND[DONE-BY(*v*’), SEEING-OF(KAY)])]

Relative to any choice for α, concept (26) applies to x iff some assignment **A** meets three conditions: **A** assigns x to the first variable; **A** is otherwise just like α; and **A** satisfies (23). More briefly, (26) applies to x iff Jay saw x. Likewise, (27) applies to x iff x saw Kay. More interestingly, consider (28) and (29).

(28) ∃**A**[ASSIGNS(**A**, x, *v*’) & MINDIF(**A**, α, *v*’) & SAT(**A**, ↑AND[DONE-BY(*v*’), SEEING-OF(*v*”)])]

(29) ∃**A**[ASSIGNS(**A**, x, *v*”) & MINDIF(**A**, α, *v*”) & SAT(**A**, ↑AND[DONE-BY(*v*’), SEEING-OF(*v*”)])]

Relative to α: (28) applies to x iff x saw α(*v*”); and (29) applies to x iff α(*v*’) saw x.[21]

This implements a limited kind of lambda abstraction, corresponding to extraction of a *wh*-expression. So let’s abbreviate (28) and (29), respectively, as in (30) and (31).

(30) λ*v*’.↑AND[DONE-BY(*v*’), SEEING-OF(*v*”)]

(31) λ*v*”.↑AND[DONE-BY(*v*’), SEEING-OF(*v*”)]

But note that such abstraction can be specified in terms of T-concepts, without appeal to truth values or concepts of type <t>, as Church (1941)’s own discussion makes clear. Concepts of individuals can be used to build concepts of all or none, which can be used to build concepts of assignments, which can be used to build concepts of individuals. So a relative clause like (32) or (33) can be a complex instruction, with the embedded sentence as an instruction for how to build a (variable) T-concept.

(32) [$_{CP}$ who$_1$ [C [$_{TP}$ who$_1$ saw her$_2$]]]

(33) [$_{CP}$ who$_2$ [C [$_{TP}$ he$_1$ saw who$_2$]]]

The higher copy of *who* – traditionally described as occupying a specifier position of a covert complementizer – is then part of an indexed instruction for how to convert an assembled T-concept into a concept like (30) or (31).

There are various ways of encoding *wh*-instructions. But for concreteness, given any index *v*, let ABSTRACT-*v* be an instruction for how to prefix a T-concept with the operator “λ*v*.”. Then a *wh*-question can be treated as an instruction, of the form shown in (34), for how to build a concept like (30) or (31) and prepare it for querying.

(34) QUERY: ABSTRACT-*v*: CLOSE-UP: CONJOIN[... , ...]

We want to stress that from *any* plausible I-language perspective, lambda abstraction has to be viewed as a formal operation on mental representations, as opposed to represented semantic values. Indeed, a standard type theory makes it especially clear that *wh*-movement to the edge is a special kind of concept construction instruction. So we'll illustrate the point with a more familiar proposal. On the treatment of relative clauses in Heim and Kratzer (1998), the SEM of (35) has the form shown in (36) , with expressions of type <t> indicated as such with superscripts.

(35) Every dog chased some cat.

(36) [[every dog]^[1^[[some cat]^[2^[t_1 chased t_2]$^{<t>}$]]$^{<t>}$]]$^{<t>}$

The idea, which can be encoded in various ways, is that the indices on the raised quantifiers correspond to (ordered) lambda-abstraction on open sentences: "every dog" and "some dog" are quantificational expressions of type < <e, t>, t>; "every dog" combines with an expression (of type <e, t>) that denotes the function determined by abstraction on the first variable applied to a sentence (of type <t>) that has one free variable; "some cat" combines with an expression that denotes a function (of type <e, t>) determined by abstraction on the second variable applied to a sentence (of type <t>) that has two free variables. Semantic values for the constituent expressions can be recursively specified as shown below, with the relevant semantic types indicated for explicitness.

(37) A standard semantic derivation of a relative clause

Expression	**Semantic type**	**Semantic value**
[t_1 chased t_2]	<t>	T iff CHASED(A1, A2)
2^[t_1 chased t_2]	<e, t>	λx.T iff CHASED(A1, x)
[some cat]	< <e, t>, t>	λX.T iff ∃x:CAT(x)[Xx = T]
[some cat]^[2^[t_1 chased t_2]]	<t>	T iff ∃z:CAT(z)[CHASED(A1, z)]
1^[[some cat]^[2^[t_1 chased t-2]]]	<e, t>	λx.T iff ∃z:CAT(z)[CHASED(x, z)]
[every dog]	< <e, t>, t>	λX.T iff ∀y:DOG(y)[Xy = T]
[every dog]^[1^[some cat]^[2^[t_1 chased t_2]]]	<t>	T iff ∀y:DOG(y)[∃z:CAT(z)[CHASED(y, z)]]

Like all expressions, the expressions of type <t> have their semantic values relative to assignments of values to variables. But relative to any assignment, there are only two possible values: TRUTH and FALSITY. So for example, "T iff CHASED(A1, A2)" is shorthand for: TRUTH if the thing assigned to the first index chased the second, and otherwise FALSITY. With this in mind, focus on the two crucial steps, which involve a shift from an expression of type <t> to an expression of type <e, t>.

(38) Abstraction 1

Expression	**Semantic type**	**Semantic value**
[t_1 chased t_2]	<t>	T iff CHASED(A1, A2)
2^[t_1 chased t_2]	<e, t>	λx.T iff CHASED(A1, x)

(39) Abstraction 2

Expression	**Semantic type**	**Semantic value**
[some cat]	< <e, t>, t>	λX.T iff $\exists$x:CAT(x)[Xx = T]
1^[[some cat]^[2^[t_1 chased t-2]]]	<e, t>	λx.T iff $\exists$z:CAT(z)[CHASED(x, z)]

The truth values do not, relative to any assignment, determine the relevant functions. And the indices do not denote functions of type <t, <e, t> >; any such function would always map the same truth value to the same function. So replacing "T iff CHASED(A1, A2)" with "λx.T iff CHASED(A1, x)" would border on incoherence *if* "T iff CHASED(A1, A2)" was really serving as an assignment-relative specification of a truth value. A representation of a truth value is no basis for a representation of a function.[22] By contrast, the following psychological hypothesis is perfectly sensible: the I-language expression "[t_1 chased t_2]" is a (complex) instruction for how to build a concept of type <t>; likewise "2^[t_1 chased t_2]" is an instruction for how to build a concept of type <e, t> – viz., by executing "[t chased t_2]" and converting the resulting concept of type <t> into a concept of type <e, t>. One can imagine a Tarskian language of thought with sentences like "T iff CHASED(A1, A2)" or "CHASED(A1, A2)", and a psychological operation that converts such sentences into expressions like "λx.T iff CHASED(A1, x)" or "λx.T iff CHASED(A1, x)"; where such expressions of a Church-style mentalese have (functional) denotations that can be recursively specified by appealing to sequences and variants.

We have been at pains to avoid assuming this standard typology, in part because we do not see how concepts of truth values could be used to ask questions. (And we suspect that we are not alone, given the tendency to supplement the usual typology with appeals to propositions and sets thereof.) But even on the standard view, it seems that *wh*-extraction ends up being treated (at least from an I-language perspective) as instruction to convert a sentential concept into a predicative concept. And given this conception of *wh*-extraction, one need not treat sentential concepts as concepts of truth values – much less concepts of propositions – in order to accommodate relative clauses and their *wh*-question counterparts. On the contrary, by treating sentential concepts as concepts of all or none, one is more or less forced into treating *wh*-extraction as an instruction for how to use a sentential concept to form a concept of individuals that can be used in predication or in querying. Again we see how movement to the edge can have a crucial semantic effect, as expected if "External Merge correlates with argument structure, internal Merge with edge properties, scopal or discourse-related [...]" (Chomsky 2005: 14). Our approach encodes this "duality of semantics" in part via the idea that for both relative clauses and interrogatives, movement to the edge exploits internal Merge to create instructions for how to modify concepts assembled by executing instructions that are formed by external Merge.

3 The Syntax of SEMs

As noted above, for any given I-language, syntacticians and semanticists share the task of specifying both the implemented procedure that generates boundlessly many SEMs and the principles governing how those SEMs interface with mental representations. In attempting this joint task, one tries to construct the simplest overall account that does justice to the facts. But it is all too easy to simplify a syntactic theory of the generable SEMs by positing a sophisticated (and perhaps unimplementable) mapping from the posited grammatical forms to mental representations. Likewise, one can purchase simplicity in semantics by complicating the syntax in ways that require generative procedures that children cannot acquire. This invites a minimalist strategy urged by Hornstein and Pietroski (2009): start with the sparest remotely plausible conceptions of *both* syntax and semantics – where the relevant notion of sparsity concerns the posited procedures, not just the generated expressions/representations – and ask if relatively simple interface principles would still accommodate a significant range of "core" phenomena; and if so, try to describe more recalcitrant phenomena as interaction effects between the representations assembled via SEMs and other aspects of cognition, where these need not be limited to pragmatic effects as classically conceived. Having urged a reduction in semantic typology, we now turn to syntax. In our view, a rather simple procedure generates *wh*-expressions that are a little more complicated than is often acknowledged, with important ramifications for how interrogative SEMs can be interpreted.

3.1 Syntactic assumptions

We adopt a minimalist approach to syntax, according to which the computational primitives should be as few as possible (Chomsky 2005, 2007, 2008, Boeckx 2008, Hornstein 2009, Hornstein and Pietroski 2009). Specifically, while it seems obvious that human I-languages employ a Merge operation to combine various expressions, we do not take this operation as basic. Rather, we assume that when two expressions can be Merged to form a third, this is because the constituents had certain characteristics–say, Edge Features (Chomsky 2008) or Labels (Hornstein 2009). We also assume that Merge manifests in two ways (Chomsky 2004): as External Merge, or "first-merge", of a lexical item with another generable expression; and as Internal Merge, or so-called movement, of an expression with (a copy of) one of its constituents. Empirical facts suggest that another operation establishes certain "agreement" dependencies between lexical items. Generating SEMs may require other basic operations. But we assume this much without further comment. In this section, we suggest a syntax of interrogatives that maps transparently onto logical forms of the sort envisioned in section two, given some independently plausible assumptions about how SEMs are "spelled out".

3.1.1 The syntax of interrogatives (Cable (2010))

Going back to Baker (1970), most syntactic approaches to questions have assumed that one way or another, a Q(uestion)-morpheme is merged into the left periphery of the sentence – typically, in what would now be called the C(P) domain – with consequent effects, like auxiliary-fronting and/or characteristically interrogative intonation. This makes it tempting to blame characteristically interrogative meaning on the same left-peripheral morpheme. Our view differs, at least in the details. Following Cheng (1991) and Cable (2010), we argue that the crucial interrogative element is not the Q-morpheme itself. Rather, there is a distinct but semantically related "Q(uestion)-particle" (see also Hagstrom (1998) and Kishimoto (2005)). While this Q-particle is phonologically empty in many languages, including English, Cable presents intriguing evidence for an overt Q-particle in Tlingit–a Na-Dene language of Alaska, British Columbia and the Yukon. Consider (40), a typical example of a Tlingit *wh*-question.

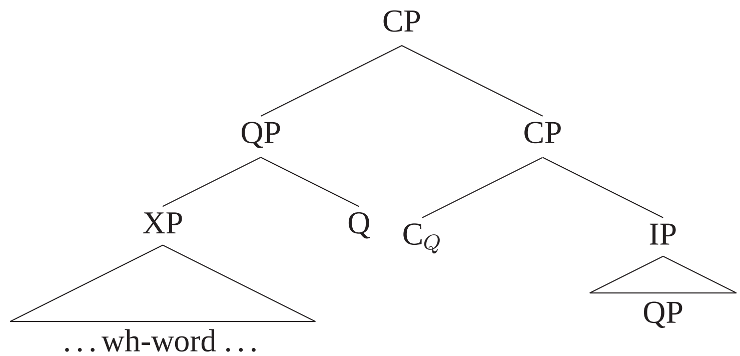
(40) Waa sá tudinookw I éesh?
how Q he.feels your father
'How is your father feeling?' (Cable 2010: 3)

The following structure shows how questions generally are formed in Tlingit.

(41) [. . . [$_{QP}$ [. . . *wh*-word . . .] *sá*] (focus particle) . . . main predicate . . .] (Cable 2010: 4)

(41) illustrates that the *wh*-word has to precede the main predicate of the *wh*-question and that the *wh*-word is also typically initial in the clause. Next, the *wh*-word is followed by the Q-particle *sá*. Notice that this particle either directly follows the *wh*-word or a phrase containing the *wh*-word. Cable's representation of the syntax, shown in (42), captures the gist of his analysis (Cable 2010: 38).

(42)



Cable offers evidence that the Q-particle is the real target of the rules/operations governing question formation. When the *wh*-word is fronted, so is the entire QP, and Cable argues that nothing about the *wh*-word itself matters in this respect (Cable 2010). The examples below illustrate this claim.[23] In particular, the locality of the *wh*-word itself is irrelevant: what matters is the locality of the QP to the left periphery, as suggested by (43)-(45) (Cable 2010: 33).

(43) [$_{NP}$ [$_{CP}$ Wáa kligéiyi] xáat] sá i tuwáa sigóo?
how it.is.big.REL fish Q your spirit it.is.glad
'How big a fish do you want? (A fish that is how big do you want?)

(44) *[$_{NP}$ [$_{CP}$ Wáa sá kligéiyi] xáat] i tuwáa sigóo?
how Q it.is.big.REL fish your spirit it.is.glad

(45) *[$_{NP}$ [$_{CP}$ Wáa kligéiyi] sá xáat] i tuwáa sigóo?
how it.is.big.REL Q fish your spirit it.is.glad

This example shows that *wh*-operators may be inside islands if and only if the Q-particle is outside the island. Thus, this example shows that it is only the features of the Q-particle that determine whether fronting is possible or not.

A related point is that the Q-particle must always front in a *wh*-question, as in (46)-(47) (Cable 2010: 32).

(46) [Goodéi woogoot<u>x</u> sá]$_i$ [has uwajée t$_i$ i shagóonich]?
where.to he.went Q think your parents.ERG
'Where do your parents think he went?'

(47) *[Goodéi$_i$ [has uwajée [woogoot<u>x</u> sá] i shagóonich]?
where.to think he.went Q your parents.ERG

This suggests that the Q-particle is a central to *wh*-fronting. For if the *wh*-fronting rule only made reference to the *wh*-word, we would expect (47) to be acceptable. Moreover, a Q-particle must always appear at the right edge of whatever phrase one fronts in a *wh*-question (Cable 2010: 44-45).

(48) [Aadóo yaagú] sá ysiteen?
who boat Q you.saw
'Whose boat did you see?

(49) *[Aadóo sá yaagú] ysiteen?
who Q boat you.saw

The unacceptability of (49) lends further support to the hypothesis depicted in (42) above.

For these reasons, we follow Cable's suggestion that languages like Tlingit should inform analyses of languages with no overt Q-particle. So for English, we will assume a silent Q-particle that is merged with the *wh*-word[24] In addition to allowing for a more language-invariant mapping from SEMs to logical forms, this will allow for attractively simple conception of the underlying generative procedures, for the slight cost of positing slightly more elaborate SEMs for languages like English.

3.1.2 Spell-Out and the mapping to logical forms

For purposes of offering an explicit proposal about how Cable-style syntactic structures could be "read" as semantic instructions, we adopt a particular minimalist syntax that has independent virtues; see Lohndal (In progress). Though one can remain agnostic about various details. Given the facts discussed here, one could equally well adopt slightly different syntactic assumptions, including those of Cable (2010). The point is not that our general treatment of interrogatives and relative clause requires the particular syntax adopted here, but rather, that a relatively spare syntax would suffice.

Initially, we show how the proposed syntax (from Lohndal (In progress)) works in some detail. Then we return to more traditional representations for ease of exposition. But as will become clear, our proposed logical forms will reflect the proposed Spell-Out system, which dovetails with a conception of SEMs as instructions to build concepts.

Every theory makes assumptions about how syntactic structures are mapped onto logical forms. It could be that syntactic structures are logical forms and that there effectively is no mapping. But we assume, standardly, that there is a mapping from syntactic structures to logical forms, and that it is an open question what this mapping is. On our view, SEMs are instructions to build concepts. SEMs need to be mapped onto logical form and we will call this point of transfer Spell-Out. A standard assumption within Minimalism is that transfer happens in chunks (Uriagereka 1999, Chomsky 2000a, 2001) of a certain size. There is disagreement on what the size of the chunks are, but the core idea in Lohndal (In progress) is that each application of Spell-Out corresponds to a conjunct in logical form. One motivation is to enable a relatively transparent mapping to Logical Forms that manifest full "thematic separation" of arguments from predicates (Carlson (1984), Schein (1993), Pietroski (2005a)), by spelling out each argument and the predicate separately.[25]

Lohndal develops a syntax where there is no categorical distinction between specifiers and complements. The core syntactic relation is that of a head and a non-head that are in a sisterhood relation. There is furthermore a derivational constraint that bans two elements that can only be phrases from being set-merged, cf. Moro (2000, 2008), Chomsky (2008), Narita (2011).

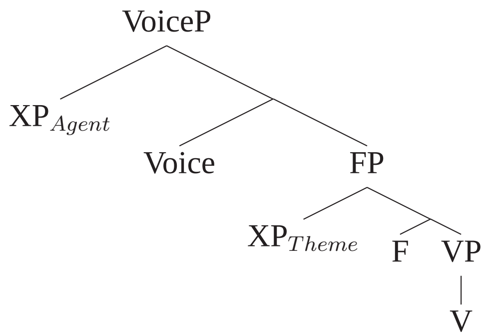
(50) *[XP XP].

There are many views one can take on the nature of this constraint; see Speas (1990: 48), Uriagereka (1999), Moro (2000, 2008), Alexiadou and Anagnostopoulou (2001, 2007), Richards (2010) and Chomsky (2008, 2010) for much discussion. There is a relevant difference compared to Uriagereka (1999) and Narita (2009, In press, 2011). The former argues that only left-branches can be spelled out separately, whereas the latter argues that there is optionality as to where Spell-Out applies. In the present system, there is no optionality: Spell-Out always has to target the complement of the head that constitutes the spine of the relevant tree that is being built.

An assumption is that all arguments are introduced by functional projections above the verb, as in Lin (2001), Borer (2005), Bowers (2010). Agents are introduced by Voice^0, cf. Kratzer (1996), Alexiadou et al. (2006). It should be clarified that the nature of the label does not really matter; see Chomsky (1995), Harley (1995), Folli and Harley (2007), Pylkkänen (2008), Ramchand (2008), Sailor and Ahn (2010) for much discussion. The importance of this assumption is that the Agent is introduced by a separate functional projection. Compare the earlier appeal to DONE-BY-JAY as a conjunct in T-concepts. Themes are also introduced by functional heads; cf. Baker (1996), Lin (2001), Borer (2005), Bowers (2010). One can label the relevant head F^0, for lack of a better name. Kratzer (1996) argues against thematic separation for internal arguments, but see Williams (2008), Lohndal (To appear) for replies. So while we earlier appealed to conjuncts like SEEING-OF-KAY, since appeal to T-concepts is neutral on this aspect of thematic separation, we think such conjuncts should be elaborated as follows: and[SEEING(e), ∃x[THETA(e, x) & KAY(x)]; where THETA(e, x) is the thematic concept associated with being the internal argument of "see". Likewise, DONE-BY-JAY should be elaborated as ∃x[$^+$THETA(e, x) & JAY(x)]; where $^+$THETA(e, x) is the thematic concept associated with being the external argument of 'see'.

Based on these assumptions, consider the structure in (51).[26]

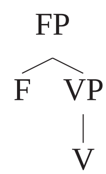
(51)



The following discussion will show how this structure gets built and what structures get spelled-out during the structure building process.

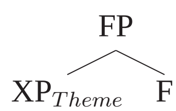
Due to (50), when B has merged with VP and then XP_{Theme} wants to merge with the BP phrase, such a merger cannot take place. Instead, for XP_{Theme} to merge with BP, the complement of B needs to be spelled out. Because of the relational character of BPS, B is now a head and can merge with the phrase XP_{Theme}. (52) shows the structure before Spell-out.[27]

(52)



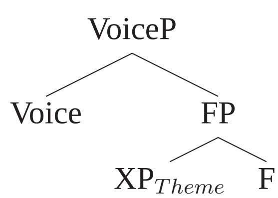
(53) is the structure after Spell-out and merger of Theme.

(53)



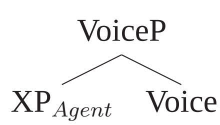
The next element to be merged is the Voice head (54).

(54)

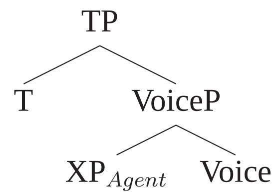


Then the XP_{Agent} wants to be merged into the structure. But VoiceP and XP_{Agent} cannot be merged, so again, the complement of Voice needs to be spelled out. The resulting structure is given in (55).

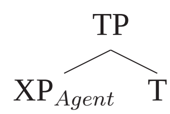
(55)



The VoiceP in (55) can now be merged with further heads, but as soon as a new phrase wants to be merged, Spell-Out will be triggered again. Let us for concreteness move the subject to the canonical subject position, which in English I take to be SpecTP. First T merges with VoiceP, creating a TP, as shown in (56).

(56)


When the subject, XP_{Agent}, moves, Spell-Out is triggered again, so that we end up with (57).[28]

(57)


The present system will guarantee that each application corresponds to a conjunct at logical form. That is, the syntax will give us the simplified logical form in (58); where ’A1’ and ’A2’ indicate the contributions of arguments/variables.

(58) ∃e[Agent(e, A1) & Theme(e, A2) & verb(e)]

Of course, this will require what we referred to as theta-binding in section 2.1, that is, the argument has to be integrated into a thematic predicate. There are various ways this can be done; see Carlson (1984), Lohndal (In progress) for two views.

As we have shown above, relative clauses also require an abstraction instruction in order to implement the idea behind lambda-abstraction. That is to say, the Spell-Out system proposed here does not itself suffice for all the semantic computation. But as Pietroski (2011) shows, an even more restricted version of the posited abstraction instruction can accommodate quantification. Furthermore, and this will be crucial below, the IP complement of C has to be spelled out before the *wh*-element can be merged with the C head. This means that the *wh*-element will introduce a conjunct at logical form. This raises further questions, to which we now turn, about the role of edges in our system.

Within traditional phase-based systems of the sort developed in Chomsky (2000a, 2001), the notion of an edge plays an important role. A phase head spells out its complement, but both the phase head and its specifier(s) are accessible for further computation (agreement, movement, etc.). On this approach, an edge is important especially for purposes of movement: unless a constituent moves to the edge of a phase head, this constituent will not be able to undergo further movement because of Spell-Out. From this perspective, one can think of edges as escape hatches. But on our approach, the issue is not about escaping. Rather, there are several Spell-Out domains, and these together create instructions. The left peripheral edge in interrogatives makes it possible to modify a sub-sentential concept such that this concept can be used for querying. So one can think of edges as "secondary" instructions. But there is no single instruction that all edges issue. The details depend on the location and relevant content/features of the edge in question.

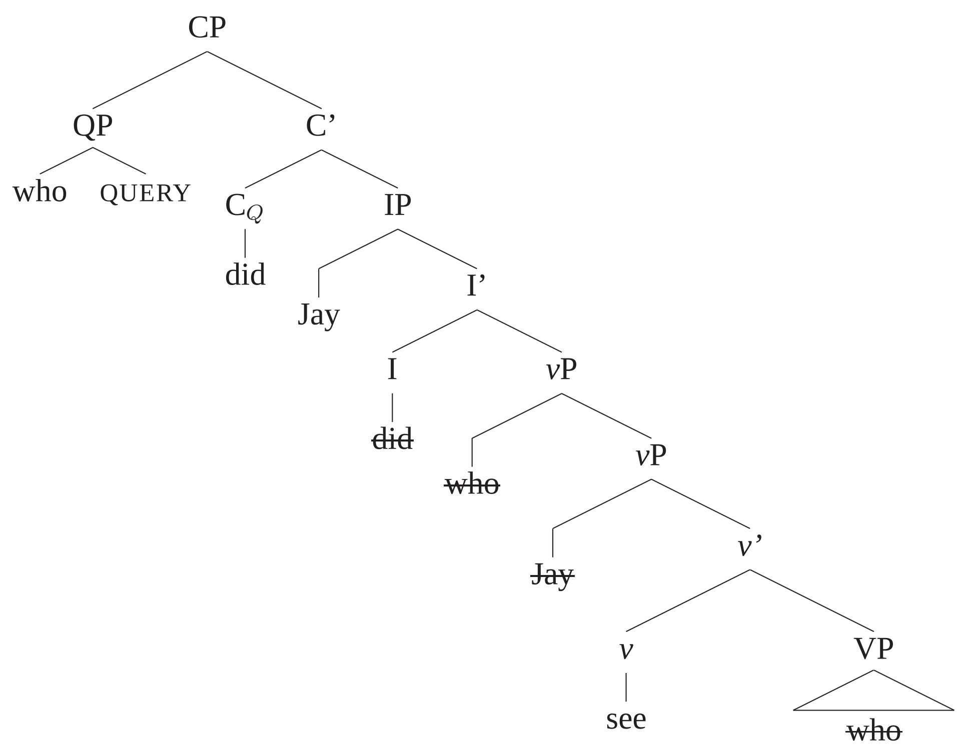
3.2 Argument interrogatives

Returning now to (59),

(59) Who did Jay see?

consider the syntactic representation in (60); where the *wh*-expression is indexed, and striking through means that the constituent is phonologically empty.

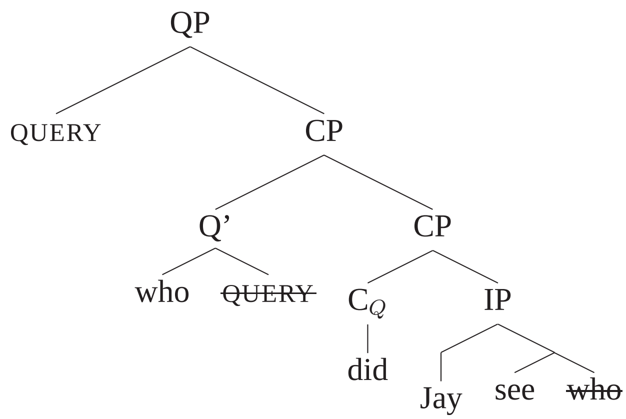
(60)



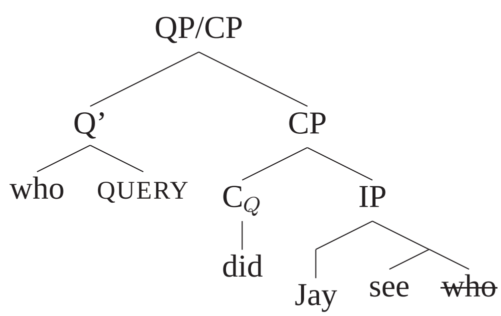
This structure is *nearly* ideal for purposes of describing (59) as an instruction for how to build a concept of things Jay saw, and then prepare this concept for use in querying. Recalling section two: think of the IP as a tensed instruction to build a T-concept that applies to x, relative to some assignment α, iff there was an event of Jay seeing $\alpha(1)$; and think of the CP, with *who* on the left edge, as an instruction for how to build a concept of things Jay saw by abstracting on the first variable of a concept assembled by executing the IP. The problem is that in (60), QUERY is combined with *who*, instead of being combined with the entire CP.

On our view, *who* is not an instruction for how to fetch a concept that gets modified by the operation triggered by QUERY. Rather, *who* is part of an "edge" instruction that directs abstraction on a T-concept. And we want QUERY to direct modification of the abstracted concept. Moreover, given the syntax offered in section three, Q' cannot be a bipartite instruction for how to form a concept that combines with the concept formed by executing the C' or IP. But suppose that QUERY either raises again, as in (61), or "reprojects" its grammatical label as in (62);

(61)



(62)



where the slash at the top of (62) reflects the derivational *history*, in which Q' projects its own label after moving into a specifier position of C.

Either way, the idea is that the internal merge of [who QUERY] with the CP is an instruction, also a CP, whose execution (Spell-Out) leads to assembly of the abstracted concept. But (62) reflects the hypothesis that once [*wh* QUERY] has internally merged with the CP, QUERY can reproject its own label. And one can say that this relabeling is itself the instruction to prepare the abstracted concept, of things Jay saw, for use in querying. In (61), the order of operations is directly reflected in the branching structure. But such movement violates plausible constraints on extraction; and on the current proposal, moving QUERY – a head– would not trigger an additional Spell-Out domain. So we favor (62) But however encoded, the idea is that – perhaps due to a constraint on Spell-Out, of the sort suggested above – QUERY is not executed as part of the instruction Q', which has *who* as a constituent. Rather, QP is an instruction to execute CP and prepare the resulting concept (of things Jay saw) for querying. If it helps, one can think of C as a Spell-Out instruction that permits a certain kind of parataxis: an assembled T-concept becomes available as a target for a certain kind of manipulation, as opposed to merely being available as a conjunct of a larger concept; cp. Pietroski (1996)'s neo-Fregean version of Davidson (1968). From this perspective, Q' is an instruction to target the first variable – which would otherwise be treated as a name for whatever $\alpha(1)$ turns out to be – and treat it as the only free variable in a concept whose event variable has been closed; cp. Heim and Kratzer (1998), discussed above.

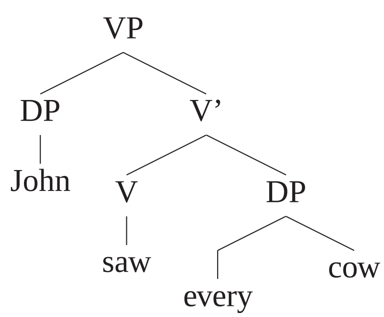
This does not yet explain *how* a structure like (62) can be generated and used an instruction for how to build a concept of things Jay saw, even given that the embedded IP can be generated and used as instruction for how to build a relevant T-concept. While the covert first-merged occurrence of *who* corresponds to an indexed variable – like *him1*, but with even less predicative content – one wants to know why the overt internal-merged occurrence (at the left periphery) has a different interpretation.[29]

Put another way, the first-merged occurrence comports with an intuitive view that Beck (2006) defends in detail: by itself, the meaning of *who* is somehow deficient. This raises of the question of why a raised *wh*-word is part of a more interesting instruction, instead of merely being spelled out (again) as an indexed variable. What role does movement to the edge play, in terms of determining the instruction generated? And posed this way, the question suggests the answer hinted at above: executing the instruction Q', thereby manipulating a T-concept in the relevant way, involves production of a second occurrence of the indexed variable (as in familiar formal languages where the quantification over assignment variants is explicit). In short, movement to the edge creates the relevant instruction, which would otherwise not have been generated. So let us say a bit more about the generated instruction.

The idea is that spelling out *see who* – i.e., executing this semantic instruction, with *who* as an internal argument of *see* – will yield a concept like the following: SEE(E) & $\exists$X[THEME(E, X) & 1(X)]; where 1(x) is a concept that applies, relative to α, to whatever α assigns to the first index. The idea, defended in Pietroski (2011), is that the conceptual template $\exists$x[THEME(e, x) & ϕ(x)] is invoked by an aspect of phrasal syntax (viz., being the internal argument of a verb like *see*). Correlatively, spelling out the embedded IP in (61) will yield a T-concept like the following: $\uparrow$[$\exists$x[EXPERIENCER(e, x) & JOHN(x)] & SEE(E) & $\exists$x[THEME(e, x) & 1(x)]].

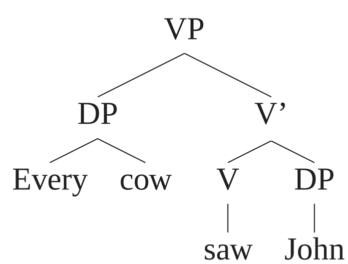
The C head is then merged, and the QP is moved to SpecCP, yielding (60). So it remains to motivate the reprojection step to (61) or (62). In discussing this kind of relabeling operation, Hornstein and Uriagereka (2002) focus on the fact that quantificational determiners can be semantically asymmetric. For example, *every cow is an animal* neither implies nor is implied by *every animal is a cow*. As many authors have noted (see, e.g., Larson and Segal (1995)), determiners seem like transitive verbs, in taking a pair of arguments in a certain order; cp. Montague (1974). While *see* combines with a Theme-argument before combining with an Experiencer-argument, *every* apparently combines with a restrictor-argument before combining with a scope-argument. Indeed, Hornstein and Uriagereka speculate that quantifiers raise out of the VP shell because the determiner-plus-restrictor phrase must combine with an expression with an expression of the right sort – i.e., an expression whose label marks it as a potential external/scope-argument of a determiner phrase (see also Higginbotham and May (1981)). Note that in (63),

(63)



cow can be read as the internal argument of *every*, but *every* has no external argument. So if SEM that includes *every* is executable only if this (asymmetric) determiner has an external argument, then (63) is not an executable SEM. In (64),

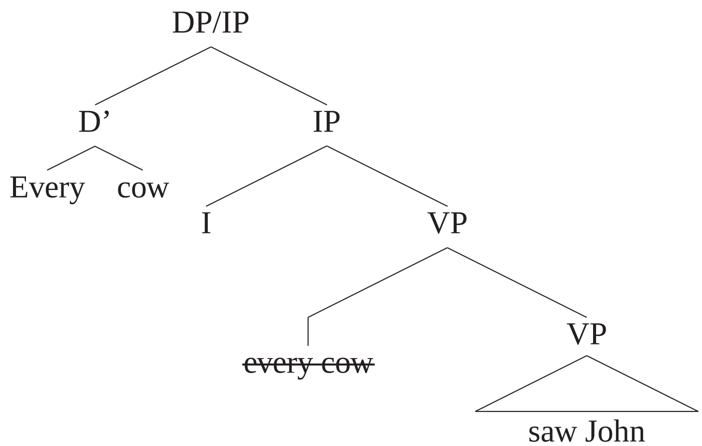
(64)



one might think that *saw John* can be interpreted as the external argument of *every*. Initially, this makes it tempting to think that displacement is not required in such cases. But one must not forget the event variable. In (64), the VP-internal *every cow* is marked as the external argument of *saw*; and that is presumably part of the explanation for why the cows are represented as experiencers of events of seeing John. So *saw John* cannot be interpreted as the external argument of *every*, unless a single generable SEM can be an ambiguous instruction that gets executed in more than one way in the construction of a single thought.[30] Put another way, (64) is not an expression/instruction that marks *saw John* as the external argument of *every*. This is unsurprising if *saw me* is an instruction to build a concept of events. So if *every cow* needs to combine with a more sentential instruction – to build a T-concept, or a concept of truth values – then *every cow* must displace. And if the raised DP combines (i.e., internally merges) with a phrase headed by any functional element F, with the higher DP in a "specifier" position of F, then the resulting expression will still not be labeled as one in which *every* has an external argument.

By contrast, suppose that *every* reprojects, yielding the structure shown in (65);

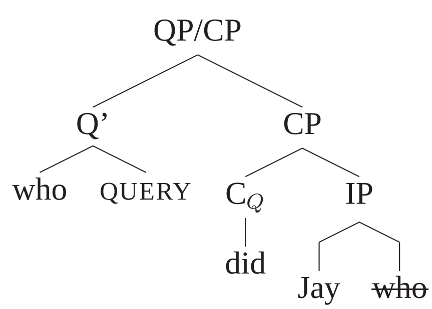
(65)



where for simplicity, the index is shown on the determiner's internal argument, suggesting that the indexed variable is restricted to the cows. The idea is that in (65), the IP is marked as the external argument of *every*.[31]

Our suggestion is not that in (66), QUERY is itself a quantifier taking the CP as its external argument.

(66)



But one can, if one likes, think of QUERY as an element that can combine with an indexed *wh*-word to form a constituent that combines with CP to form a reprojected instruction for how to build a concept as follows: execute CP, thereby obtaining a T-concept that is ready for manipulation; abstract on the indexed variable; and prepare resulting monadic concept for use in querying.

Our “mood-as-instruction” conception of questions retains important aspects of an account that can at first seem very different. Following Karttunen (1977), many authors have argued that question words are – or at least are tightly associated with – existential quantifiers. For a recent interesting argument, involving data from acquisition, see Crain et al. (2009), though Caponigro (2003) argues against this view. In at least one sense, and perhaps two, we agree. For on our account, a raised *wh*-expression combines with an instruction to form a T-concept. With regard to (59), a concept of events of Jay seeing $\alpha(1)$ is used to build a concept that applies to x iff there was at least one such event; as noted in section two, T-closure has the effect of existentially closing a variable. More importantly, we take a raised *wh*-expression to be an instruction existentially quantify over assignment variants, so that executing the CP is a way of building a concept that applies to x iff there was an event of Jay seeing x.

Recent proposals have suggested that *wh*-words are semantically deficient in the sense that *wh*-words in all languages have only a focus-semantic value and that their normal semantic value is undefined Beck (2006), Cable (2010). This yields an interesting account of so-called “LF”- or “Focus-intervention effects” across various languages, and it provides a rationale for why *wh*-words are focused in so many I-languages. Rizzi (1997) has also clearly demonstrated that there is a close syntactic relationship between *wh*-phrases and focus (see also Büring (1997) and Schwarzschild (1999)). The examples in (67)-(68) (Rizzi 1997: 298) show that a focalized constituent and an interrogative constituent are incompatible.

(67) *A chi IL PREMIO NOBEL dovrebbero dare?
to whom the prize nobel should.they give
‘To whom THE NOBEL PRIZE should they give?’

(68) *IL PREMIO NOBEL a chi dovrebbo dare?
the nobel prize to whom should.they give
‘THE NOBEL PRIZE to whom should they give?’

Rizzi takes the complementary distribution to suggest that *wh*-phrases and focused phrases move to the same projection in the left periphery.

Relatedly, Hagstrom (1998), Yatsushiro (2001), Kratzer and Shimoyama (2002) and Beck (2006) have argued that Q-particles are operators over sets. Drawing on Hagstrom, Cable (2010) suggests that Q-particles are actually variables over choice functions; while on Hagstrom’s theory, Q-particles are existential quantifiers over choice function variables. But from an E-perspective, choice functions are intimately related to existential quantification over assignment variants; and we assume that (on anyone’s view) it takes work to turn talk of operators and choice functions into specific proposals about the procedures that generate SEMs and the procedures that use SEMs to build mental representations. So far from being at odds with existential treatments of *wh*-expressions, our proposal can be viewed as a way of encoding (via Cable's syntax) an insight that motivates such treatments.

In this context, it is worth noting that cross-linguistically, the interrogation particle is often the disjunction marker; see Kuroda (1965) and Jayaseelan (2001, 2008). Consider the example below, from Japanese.

(69) John-ka Bill-ga hon-o kat-ta.
John-or Bill-NOM books-ACC bought-PAST
'John or Bill bought books.' (Kuroda 1965: 85)

(70) John-ga hon-o kat-ta-ka?
John-NOM books-ACC buy-PAST-Q
'Did John buy books?' (Kuroda 1965: 87)

As Jayaseelan (2008: 4) stresses, this invites an interesting question:

> If the question particle is a device of clausal typing, as is standardly assumed since Cheng (1991), any marker should be able to fill this function. Then why is it that in so many languages - with a regularity that is far greater than by chance - the question particle is also the disjunction marker?

Jayaseelan's own proposal is that "a disjunction that takes a variable as its complement is interpreted as infinite disjunction. This is the meaning of an existential quantifier" (Jayaseelan 2001: 75). Our account captures this idea by treating *wh*-extraction as instruction to existentially quantify over assignment variants, thereby accommodating the existential property.

3.3 *Yes/no*-interrogatives

If one takes interrogatives to be devices for denoting sets of propositions, then it is natural to start with *yes/no*-interrogatives. For as noted in section one, *wh*-interrogatives immediately raise questions about which propositions are in the relevant sets. By contrast, we have stressed the parallel between *wh*-interrogatives and relative clauses. So if our proposal applies straightforwardly to (71),

(71) Did Jay see Kay?

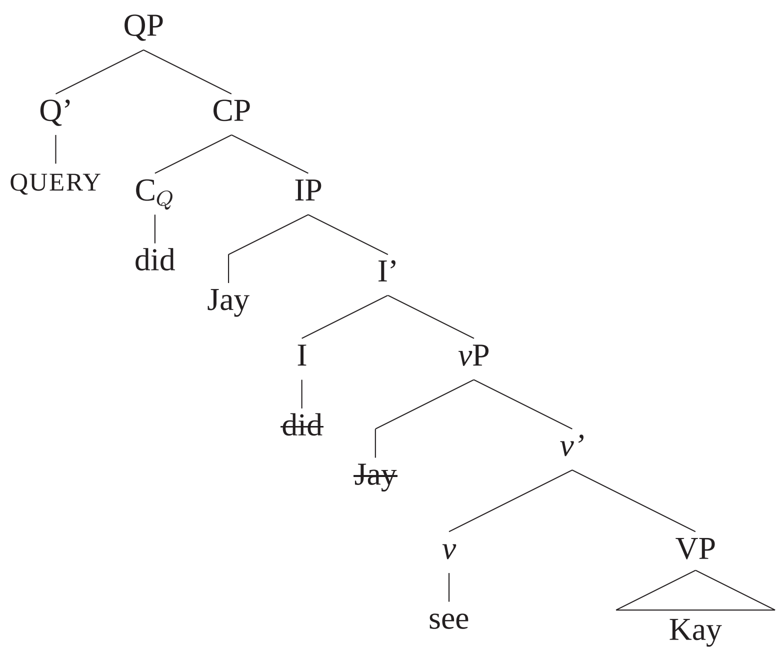
that is a point in our favor.

Again, we assume that English has a covert *yes/no*-operator that other languages express overtly, as in the Malayalam example (72).

(72) John wannu-(w)oo?
John came-or
'Did John come?' (Jayaseelan 2001: 67)

More specifically, consider the syntactic representation in (73).[32]

(73)



If the IP is an instruction for how to build a T-concept, then the QP can simply be an instruction to execute the IP and prepare the resulting T-concept for use in querying. The relevant query can still concern which things fall under the assembled: all or none? In this sense, *yes/no*-queries are like *wh*-queries. Though for a *yes/no*-query, one can equally well ask if at least one thing falls under the assembled T-concept. In this sense, *yes/no*-queries are special cases of *wh*-queries, with the relation to existential quantification even more obvious.

Given the absence of any *wh*-word in (73), there is no need for appeal to quantification over sequence variants. Correlatively, there is no need for appeal to reprojection. From this perspective, the need for reprojection – however encoded – arises when QUERY is combined with an abstraction instruction. And this suggests another sense in which *yes/no*-queries are special cases, as opposed to paradigmatic cases that should shape our general conception of interrogatives. Any T-concept, by virtue of its form, applies to all or none; and such a concept can be used, given suitable preparation, to ask a binary question. But to ask a more refined (nonbinary) question, one needs a concept whose form makes it possible for the concept to apply to some but not all things. If such a concept is formed by abstraction on a T-concept, then preparation for querying is presumably delayed until after the abstraction operation has been performed. Since that is the only role for appeal to reprojection in our account of *wh*-interrogatives, we can avoid such appeal in our account of *yes/no*-interrogatives. But it does not follow that the latter are somehow semantically basic.

So while it can initially seem attractive to say that each interrogative denotes a trivial set of answers, thus making it tempting to say that a *yes/no*-interrogative denotes a less trivial set, we think it is better (all things considered) to treat all interrogatives as instructions for how to assemble a concept and prepare it for use in asking which things fall under the concept. This reflects our suspicion that the parallels between interrogatives and relative clauses run deep, with *yes/no*-interrogatives being especially simple cases that do not make the parallel obvious.

3.4 Adjunct interrogatives

Often, the semantics for adjunct interrogatives has seemed especially difficult.[33] But given an event semantics that associates grammatical arguments with thematic concepts, both arguments and adjuncts correspond to conjuncts of assembled concepts. And this suggests a relatively simple theory of adjunct interrogatives like (74).

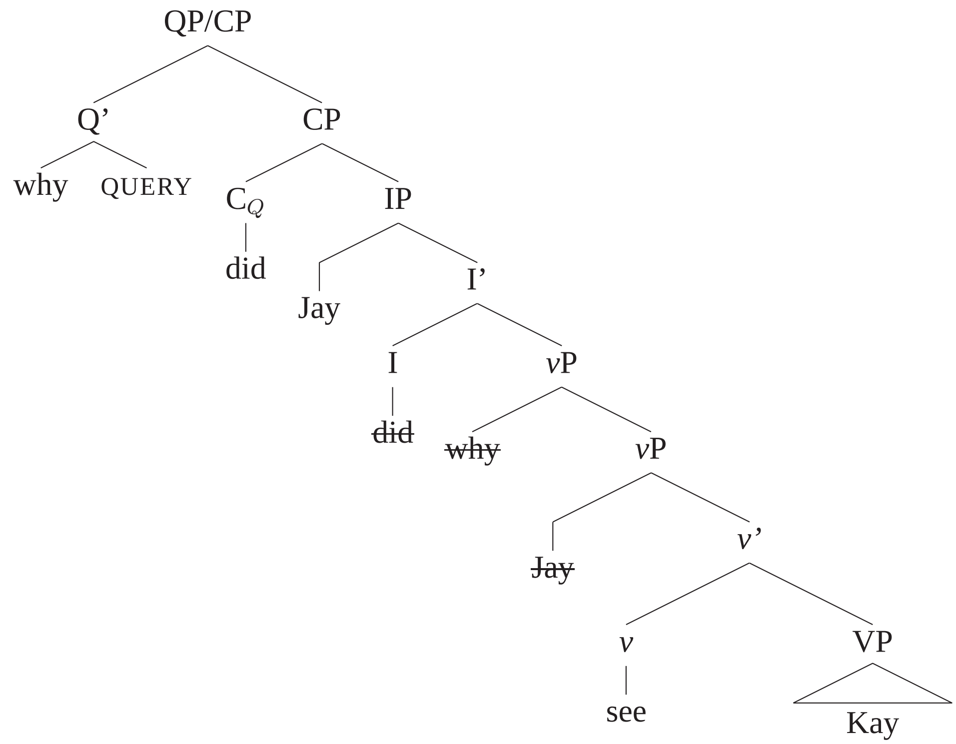
(74) Why/how/when did Jay see Kay?

In a language like Tlingit, we see that Q-particles are overt also in adjunct interrogatives (75).

(75) Waa sá sh tudinookw I éesh?
how Q he.feels your father
'How is your father feeling?' (Cable 2010: 3)

We assume, therefore, that (74) has the reprojected structure shown in (76)[34]

(76)



To a first approximation, the VP in (76) is an instruction for how to build a concept of Jay-saw-Kay events that had a further feature: $\alpha(1)$ was a cause/manner/time of their occurrence. Creating the corresponding T-concept, and then abstracting on the variable, yields a concept of causes/manners/times of Jay-saw-Kay events. Such a concept can then be prepared for a use of asking what falls under the concept. To be sure, pragmatics will play a role with regard to what a satisfactory answer requires. A given event of Jay seeing Kay might have many causes; and there might have been may such events, at different times, each done in a different manner. But likewise, if a speaker asks who Jay saw, pragmatics will play a role with regard to what a satisfactory answer requires. Jay may have seen many people, the vast majority of whom are irrelevant to the speaker's *question*, which is not to be confused with the interrogative SEM used to assemble the concept with which the question is asked. Our aim is not to provide a theory of how speakers use concepts in contexts to ask questions that might well be modeled with partitions; cp. Higginbotham and May (1981), Higginbotham (1993). Our aim has been to say how SEMs can be generated and used as instructions to build concepts that can then be used in many ways. And for these purposes, adjunct-interrogatives pose no special difficulties, given an "eventish" semantics of the sort adopted here.

3.5 Multiple *wh*-interrogatives

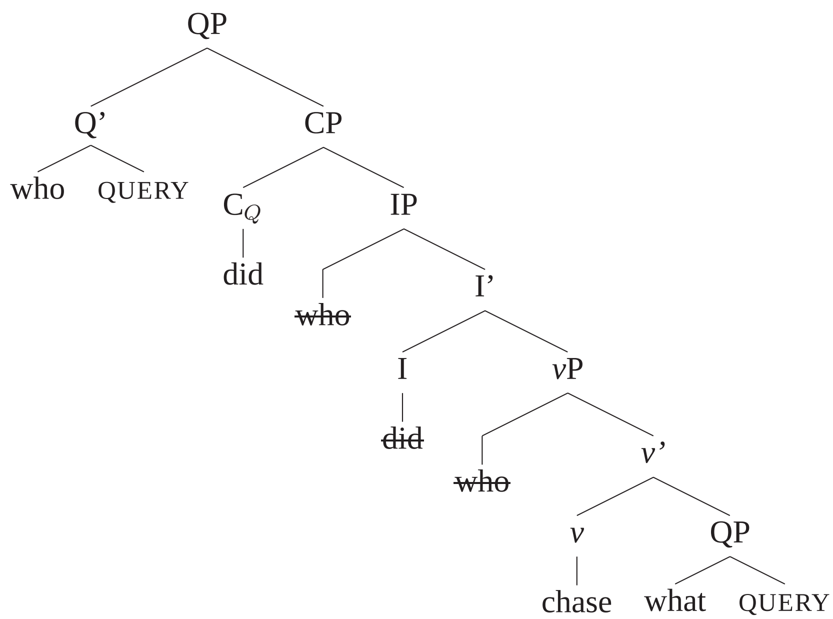
One might, however, think that multiple *wh*-interrogatives do pose a special difficulty. Examples like (77) have been important in linguistic theory since Baker (1970) and Kuno and Robinson (1972).

(77) Who saw what?

And it may be that such examples present special complications on any account of *wh*-expressions. But we do not think they tell against our proposal about the syntax/semantics interface.

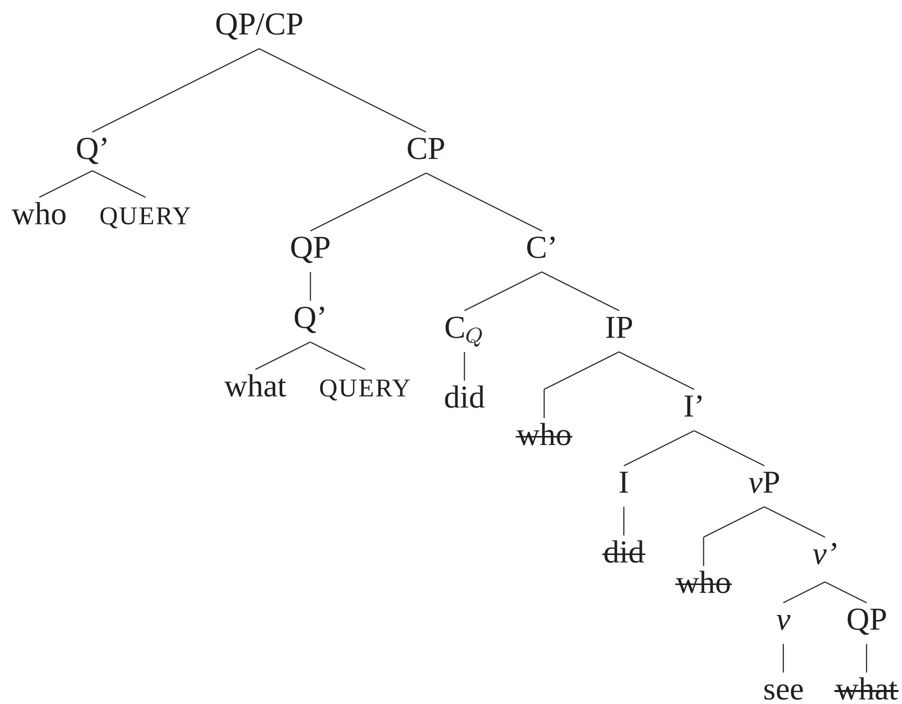
Initially, one might imagine the syntactic structure in (78).

(78)



But given well-known syntactic arguments, *what* needs to move; see Lasnik and Uriagereka (1988: 102-104), building on Huang (1982), for a clear summary. While this movement is not triggered by a type/label mismatch–at least not of the sort illustrated by displacement of quantifiers–the familiar idea is that *wh*-movement corresponds to creation of a variable. As noted above, *wh*-expressions seem to be semantically bleached in a way that invites a pure existential or free choice analysis. Certainly, *what* differs from *her*, in that the former cannot support a deictic interpretation. So let's suppose that *what* does indeed raise, as in (79),

(79)



with the following result: the embedded CP, formed by internally merging [what QUERY] with a C’, is an instruction for how to build a concept of things such that α(who) saw *something*; but this CP remains labeled as such, allowing for subsequent internal merger with [who QUERY]. That is, only the topmost QUERY reprojects, and only one *wh*-expression per cycle triggers genuine abstraction. On this view, the matrix QP/CP is an instruction for how to build a concept of things who saw *something*, and then prepare this concept for use in querying.

This does not yet predict a pair-list reading for (77). Indeed, it raises the question of why (77) differs in meaning from (80).

(80) Who saw something?

But we take it that answers to (80) – e.g., “Jay saw something” – are at least partial answers to (77). And we note that a relative clause like (81)

(81) . . . student who saw what

does not have an interpretation according to which it describes pairs <x, y> such x is a student and x saw y. Moreover, a declarative like (82) corresponds to an interrogative like (83),

(82) Jay gave Kay a dollar yesterday.

(83) Who gave who what (and) when?

suggesting the possibility of "n-tuple list" interpretations. We see no reason for thinking that such interpretations can be generated directly by the core recursive operations that characterize I-languages. So we suspect an interaction between a concept with *one* free variable and pragmatic processing, prompted by occurrences of Q-constituents that did *not* direct preparation of a concept for querying at the initial interface.

If (77) directs construction of a concept of things who saw *something*, but the existential is still somehow associated with an unexecuted occurrence of QUERY, then answers like "Jay saw something" might well feel incomplete, compared with answers like "Jay saw a/the turnip". Put another way, once a concept of those who saw something is formed and prepared for use in querying, it might be used (in combination with other cognitive capacities) to pose two questions: who falls under that concept; and for whoever falls under it, what did they did see? So far as we know, any account of multiple *wh*-interrogatives will require some such appeal to cognitive apparatus that goes beyond basic I-operations, in order to accommodate the phenomenon of "n-tuple list" interpretations. If this is correct, then theorists may as well retain a simple semantics according to which (77) and (80) need not direct construction of different concepts. For these expressions differ manifestly in ways that can affect subsequent use of the concept constructed.[35]

Since May (1977) and Higginbotham and May (1981), much attention has been devoted to interrogatives that also have "regular" quantifiers, as in (84).

(84) Who said everything?

While it is often said that (84) is ambiguous, our own view is that (84) is – like its relative clause counterpart – a univocal instruction for how to build a concept that applies to individuals who said everything. The complication is that *who* is number neutral, as illustrated in (85) and (86);

(85) ...student who said everything that needed to be said

(86) ...students who said everything that needed to be said

where (86) has not only a distributive reading, but also a collective reading according to which it (directs construction of a concept that) applies to some students if they *together* said every relevant thing. So one might answer (84) by listing some people who together said everything, or some people each of whom said everything. And if each thing got said, it got said by one or more people. But it does not follow that (84) is structurally homophonous, with one reading where *everything* takes scope over *who*. On the contrary, absent compelling reasons to the contrary, we assume that the QP/CP position to which [who QUERY] raises must be higher the position occupied by a regular quantify that was initially the internal argument of a verb.

Finally, we note in passing that all the issues raised here can be raised again with regard to embedded interrogatives, as in (87 - 90).

(87) . . . asked/wondered/knows whether/if Jay saw Kay

(88) . . . asked/wondered/knows who Jay saw

(89) . . . knows/asked/wondered who saw what

(90) . . . knows/asked/wondered who said everything

A thorough treatment that accommodates the relevant varieties of verbs and clausal complements is well beyond the scope of this paper; see, e.g., Lahiri (2002) for discussion. But on our view, (matrix) interrogative mood is an instruction for how to prepare a concept for use in querying, regardless of what speech act is actually performed with that concept. And if interrogative sentences are (perhaps reprojected) QPs, then verbs like *ask/wonder/know* – words that are themselves instructions to fetch concepts of actions/states that have intentional "contents" (see Pietroski (2005a)) – can presumably take QP complements. From the perspective urged here, a SEM can be an instruction for how to build a concept of askings whose content is (given by) an interrogatively prepared T-concept, or an interrogatively prepared concept of things Jay saw. This requires a conception of speech-acts/mental-states whose contents are (given by) concepts as opposed to propositions. But if I-language sentences are not bound to truth values, much less propositions, we need no reason to insist that verbs like *ask/wonder/know* fetch concepts of actions/states whose contents must be propositional.

4 Conclusion

Interrogatives present a wide range of challenges to syntacticians and semanticists. We have argued that adopting an I-language perspective focuses attention on certain theoretical questions and raises others. If one sets aside talk of truth values and communication, one cannot assume that the meaning of an interrogative is the set of (possibly true) answers to the question at hand, and that a theory of meaning should reveal how such sets are compositionally determined by interrogative expressions. Rather, we argue, I-languages generate semantic instructions (SEMs) for how to assemble concepts and prepare them for various uses. In particular, an interrogative SEM can be used to build a T-concept and prepare it for use in querying – perhaps with an intervening step of abstracting on some variable in the T-concept, as with relative clauses. In offering a syntax and semantics that conspire to yield these results, we have posited a QUERY element for English, as well as languages that have overt question particles. And we have argued that this element, together with an operation of reprojection in the left periphery, serves as instruction for how to prepare a concept for use in asking what falls under that concept. On this view, the relation between mood and force is still pragmatically inflected. But interrogatives are indeed apt for the use of asking questions, as opposed to being devices that denote questions. We have illustrated how this proposal applies to *yes/no*-interrogatives, argument/adjunct-interrogatives, and multiple *wh*-interrogatives.

We have also emphasized some implications of our proposal for the role of edges. We have argued that the left edge provides an instruction for how to assemble and prepare a concept for use, e.g., in querying. Edges can be viewed as semantic instructions, and not primarily as escape hatches, as on other approaches. In this sense, edges are not distinct from non-edges, though the "mode" of their semantic instructions turns out to be somewhat different, if the present paper is on the right track with regard to the "duality" of semantic instructions.

Many other questions remain unanswered. In particular, we have offered only hints of how quantifiers, *wh*-elements, QUERY, and interrogative verbs like *wonder* interact. Moreover, by setting aside issues communication, we have bracketed many empirical puzzles concerning the pragmatics of querying. In this sense, we have focused on a small subset of the issues that have animated the study of interrogatives. In compensation, we have emphasized the importance of considering both syntax and semantics in tandem. This is because we think the simplest overall account will posit an expression-generating procedure that employs its elementary operations to generate SEMs that may exhibit a little more structure than the SEMs that would be required given more powerful semantic operations. In comparing theories of I-languages, simplicity of operations – and not just generated structures – counts for a lot.

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Notes

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[2]Question marks indicate characteristic interrogative intonation. The absence of final punctuation in (6)-(8) indicates the non-sentential status of these clauses, which are superficially like the embedded *wh*-clauses in (10). For simplicity, we set aside "echo-questions" like *Jay saw Kay?* and *Jay saw who?*, which also involve focus of some kind. See Bolinger (1987) and especially Artstein (2002) for discussion, in addition to the canonical references on questions given below in the main text.

[3]Correlatively, one can introduce a notion of semantic value that is geared to what speakers can *do* with expressions, and then speak of propositions/questions as the semantic values of declarative/interrogative sentences.

[4]While grammatical moods are correlated with certain kinds of speech act force (cp. Austin (1962)), we assume that "[. . .] mood is a matter of meaning, whereas force is a strictly pragmatic affair" (McGinn 1977: 304). In suitable contexts, one can use declaratives to issue commands, interrogatives to make assertions, etc. So on the view urged below, moods are not instructions for how to use (or represent the use of) expressions. Rather, moods direct processes that make sentential concepts available for certain uses.

[5]Cp. Chomsky (2000b), Pietroski (2005b). In terms of Marr (1982)'s levels of explanation, positing denotations can be useful in specifying a computable function, thereby raising the question of how that function is computed. But part of the answer may be that the function initially described is computed in stages, perhaps starting with a "primal sketch" that serves as input to subsequent computations with a different character.

[6]We follow the standard convention of using SMALL CAPS for concepts.

[7]Here and throughout, we take AND to be a concept that can combine with two monadic concepts to form a third. Making adicities explicit, the familiar idea is that COW( ) can combine with a singular concept like BESSIE to form a complete thought; a concept like ABOVE(,) can combine with two singular concepts;

and SATISFIES(,) can combine with (i) a concept of an expression that may contain a variable and (ii) a concept of an assignment of values to variables. Given a concept of biconditionality – and a capacity to form assignment-relative singular concepts like A[*v*], which applies to whatever A assigns to *v* – speakers could form complex concepts like those indicated below:

(a) IFF[SATISFIES(**A**, "cow":*v*), COW(**A**[*v*]);

(b) IFF[SATISFIES(**A**, "brown":*v*), BROWN(**A**[*v*])];

(c) IFF[SATISFIES(**A**, "brown cow":*v*), AND[SATISFIES(**A**, "cow":*v*), SATISFIES(**A**, "brown":*v*)]]; and

(d) IFF[SATISFIES(**A**, "brown cow":*v*), AND[COW(**A**[*v*], BROWN(**A**[*v*])]];

where the first two biconditionals encode (hypothesized) aspects of lexical knowledge, the third encodes an aspect of compositional knowledge, and the fourth encodes a derivable conclusion.

[8]Complex expressions of Frege (1892)'s invented language can be viewed as instructions for how to create ideal concepts that are always formed by means of a saturating operation that accommodates concepts of (endlessly) higher types; see Horty (2007) for useful discussion of Frege on definition. But obviously, there is no guarantee that human I-languages can invoke such an operation; see Pietroski (2010, 2011).

[9]Recall that Davidson (1967a,b) and Montague (1974) did not present their claims as psychological hypotheses about human I-languages; cf. Higginbotham (1986), Larson and Segal (1995), and Heim and Kratzer (1998). The conjecture that there are Tarski-style theories of truth for such languages, and that such theories can serve as theories of meaning for the I-languages that children acquire, is very bold indeed. It may be more plausible to say that expressions of an I-language can be I-satisfied.

[10]Perhaps DONE-BY-JAY has a simple decomposition: DONE-BY(JAY). But event concepts constructed via I-language expressions may not have singular constituents, especially if names like *Jay* are indexed. Consider, for example, the complex concept ∃X:AND[FIRST(X), PERSON-CALLED-*Jay*(X)]DONE-BY(X); where FIRST(X) is a monadic concept that applies to whatever is indexed with the first index (cp. Pietroski (2011)). We return to some details concerning variables and assignments of values.

[11]While no T-concept is a concept of a truth value, each monadic concept C has two T-closures – ↑C and ↓C – that in turn have T-closures that exhibit the Boolean structure required for classical truth tables. For any such concept C and entity X, ↑↑C applies to X iff ↓↓C does; each of these doubly-closed concepts applies to X iff ↑C applies to X – i.e., iff C applies to something. Likewise, ↑↓C applies to X iff ↓↑C does, since each of these concepts applies to X iff ↓C does – i.e., iff C applies to nothing. Note also that ↑AND[C, C'] applies to X iff something falls under the concept AND[C, C'], which applies to X iff X falls under both C and C'. But AND[↑C, ↑C'] applies to X iff (X is such that) something falls under C *and* something falls under C. So ↑AND[BROWN, COW] is a more restrictive concept than AND[↑BROWN, ↑COW].

[12]See Partee (2006) for related discussion. Perhaps the real empirical motivation for this typology lies with facts that invite appeal to (instructions to fetch concepts of) higher types like < <e, t>, <e,t>,t> >. But if so, that is worth knowing. For at least in many cases, these facts can be accommodated without such appeal (and the consequent threat of overgeneration); see Pietroski (2011).

[13]For Hamblin and Karttunen, propositions are individuated roughly as sentences are, and hence more finely than sets of possible states of the represented world. This is not the case for Groenendijk and Stokhof where questions refer to alternative states of the world. Thanks to Barry Schein (personal communication) for reminding us of this difference.

[14]If a question is a set like (12) or (14), then by representing such a set, one thereby represents a question. One can stipulate that interrogatives present questions in special way. But then one wants to know what this "way" is, and whether the facts can be accommodated just as well by appealing to an equally interrogative way of presenting ordinary entities.

[15]This is a modern implementation of ideas going back to Ross (1970), Lewis (1970) and Lakoff (1972). Chomsky (2004) refers to it as the "duality of semantics" thesis, and a lot of recent work in the cartographic tradition has sought to map out the fine details of the left periphery of the clause, cf. Rizzi (1997), Cinque (1999).

[16]The notion of a "query" has also been used by Ginzburg (1992, 1996), but in a very different sense. For Ginzburg, a "query" is 'a move per (conversational) turn'.

[17]See, among many others, Searle (1965, 1969), Bach and Harnish (1982) and Portner (2007) for more on philosophical and linguistic aspects of speech acts.

[18]Cf. Baker (1988), Dowty (1991), Pesetsky (1995), Pylkkänen (2008).

[19]From this perspective, one can view a matrix sentence as a tripartite instruction: a "lower" portion that directs construction of a concept of events/states of some kind; a "middle" portion that directs construction of a T-concept; and an "upper" portion that directs a more specific tailoring of the assembled concept to the demands of specific interfacing systems that are often described abstractly in terms of propositions. In expressions that involve quantifier raising, the middle portion may be an instruction for how to construct a series of increasing complex T-concepts; see Pietroski (2011).

[20]MINDIF(A, α, *v'*) is our way of writing A $=_{v'}$ α; A differs from α at most with respect to what A assigns to *v'*.

[21]For if MinDif(**A**, α, *v'*), then **A**(*v"*) = α(*v"*). And if MinDif(**A**, α, *v"*), then **A**(*v'*) = α(*v'*).

[22]Though cp. Kobele (2006) on representations of sequences and functions.

[23]It should be noted that in declarative sentences the Q-particle occurs with *wh*-words functioning as indefinites. This is illustrated in (i).

(i) Yá x'úx' akwgwatóow aadóoch sá?
this book will.read who.ERG Q
'People will read this book.' (Cable 2010: 24)

[24]Such a particle may also be present in sentences like "the person Jay saw", generalizing from "the person who Jay saw".

[25]Lohndal (In progress: chapter 3) reviews a range of facts that tell in favor of thematic separated logical forms, and offers a corresponding syntax outlined here.

[26]This structure has been slightly simplified for present purposes.

[27]In sentences like (i), the PP *on the table* cannot be the complement of the verb.

(i) She put the food on the table.

The reason is that the PP will then be spelled out together with the verb, which will not yield the PP as a separate conjunct in logical form. For the latter to happen, *on the table* either has to be an adjunct or a specifier of a functional projection that is merged above the verb. See Bowers (2010) for extensive empirical arguments that the latter analysis is the most viable one, which requires the verb to move in order to obtain the correct linear order (see already Larson (1988), Chomsky (1995), Koizumi (1995)).

[28] There are obviously a range of syntactic consequences of the present proposal. The reader may think of obvious challenges, involving basic cases of *wh*-movement, cases of VP-fronting and serial verb constructions. These can all be analyzed within the present syntax, as Lohndal (In progress) demonstrates.

[29]We adopt the standard idealization that intermediate traces of displacement are interpretively inert, and so we focus exclusively on the "head" and "tail" of the "chain", cf. Chomsky (1995), Fox (2002).

[30]One can posit this more complicated mapping from SEMs to concepts, cf. Steedman (1996), Jacobson (1999). But from an I-language perspective, this is a real cost, even if one can respond to overgeneration concerns by positing further constraints that exclude unattested interpretations.

[31]Donati (2006) offers a similar argument for reprojection, in the context of Italian free relatives. Barring additional assumptions (like a Chain Uniformity Condition, cf. Chomsky (1995)), there is nothing that prohibits this reprojection. Our aim here is not provide an "instructionist" semantics of quantification. But an obvious thought (see Pietroski (2011)) is that the entire DP is instruction for how to build a complex concept that applies to some ordered pairs <x, y> iff: every value of "y" is value of "x" (i.e., every internal is an external); the values of "y" are the cows (i.e., the potential values of the restricted variable); and each value of "x" is such that John saw it (i.e., each such value meets the condition imposed by concept obtained by executing the IP). Some ordered pairs meet these conditions iff John saw every cow.

[32]Cable (2010: 214, fn. 21) argues that *yes/no*-interrogatives have a separate particle that may or may not be homophonous with the *wh*-question Q-particle. Though for Tlingit, he is skeptical that this is a true Q-particle (Seth Cable, personal communication). In any case, we won't assume that English has a separate Q-particle for *yes/no*-questions. But one can supplement our syntax/semantics accordingly.

[33]For example, Hintikka and Halonen (1995: 637) say, "The theory of [...] "normal" *wh*-questions is by this time firmly under control, unlike that of *why*-questions, and the explanation of this discrepancy is thought to lie in the complexity of the semantics of *why*-questions".

[34]Chametzky (1996) argues that adjuncts are label-less, and we have some sympathy with his leading ideas in this respect; see Hornstein and Pietroski (2009). Though as Hornstein and Nunes (2008) argue, one can preserve Chametzky's insights, while allowing that adjuncts can be optionally labeled, cp. Hunter (2011). For present purposes, however, it does not matter if the adjunct that combines with QUERY is labeled. For simplicity, we also abstract away from differences concerning location of *why* as opposed to other adjuncts, see Rizzi (2001), Thornton (2008) for discussion.

[35]There are various syntactic issues that we will not address here. One concerns the difference between languages that have multiple-*wh* fronting and languages that do not; see Bošković (2002) and Stoyanova (2008) for recent analyses. We are assuming that the logical form does not change depending on whether there is phonological multiple-*wh* fronting or not.