The Interpretation and Meaning of Concealed Questions*

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1. Introduction: the Question Question

The observation that determiner phrases can act as indirect questions dates back to Baker (1968). Such determiner phrases are known as *concealed questions* (CQs). The sentences in (1) provide a few examples of CQs and help illustrate the intuitions about their meanings.

(1) a. Kim knows *the governor of California*.
b. Leslie has forgotten *the capital of Texas*.
c. Sandy told me *the time of the meeting*.

Some sentences may be ambiguous between sentences with CQs and sentences with regular DPs: (1a) has a reading in which Kim has met the governor of California, is friendly with him, and so forth; (1b) can mean that Leslie has lost her memories of Austin.[1] The relevant readings for this paper are those in which the DPs are treated as questions: Kim knows *who the governor of California is* (without ever having necessarily met him), or Leslie has forgotten *what the capital of Texas is* (while perhaps distinctly remembering a visit there).

Ever since the phenomenon was first observed, various theories have offered answers to two basic questions about the distribution of the construction. First, which predicates can take CQs as complements? Second, which nouns can serve as CQs under which circumstances?

(2) Which predicates can take CQs as complements?
a. John knows the capital of France.
b. *John wonders the capital of France.

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[1] As a diagnostic for this reading, substitute the proper name of the referent for the determiner phrase. *Kim knows Arnold Schwarzenegger* (who is the governor of California, at the time of this writing) or *Leslie has forgotten Austin* do not have CQ meanings, only the readings of Kim having met Arnold or Leslie losing memories of Austin.

Heim (1979), in addition to making a similar point about substitution of another DP with the same extension, suggests that many of these verbs are lexically ambiguous—*know* is two verbs, one which means "to be familiar with" and one which means "to hold certain knowledge." As evidence, she observes that some German dialects use different words for the two meanings (*kennen* for the former, *wissen* for the latter); and that the question-embedding meaning of many verbs does not predictably relate to the object-embedding meaning, except in a metaphorical way (e.g. $reveal_{question} \approx$ "to make known", $reveal_{object} \approx$ "to unwrap or unveil").

Heim offers several other reasons to not believe that the (concealed-)question-embedding meanings are not derived from manipulating non-question-embedding versions of the same predicates. I will assume for the rest of this paper that the two meanings of these verbs are unrelated, perhaps due to a lexical ambiguity, and the non-question versions can be entirely set aside.

(3) Which nouns can serve as CQs?

a. This department (like most others) has a single head.
John told me the department head.

b. This department has a single semanticist.
* John told me the semanticist.

c. This department has a single semanticist.
John told me the semanticist who teaches here.

Closely related is the question of interpretation—what meanings do question-embedding predicates and question-denoting determiner phrases have that allow them to combine? By considering all of these questions and examining the internal structure of CQs, this paper will offer an explanation of which predicates can embed CQs and of how they receive an interpretation.

Section 2 of this paper examines a variety of question-embedding predicates, noting a correlation between those that allow CQ complements, those that take propositions as well as questions, and those that allow an adverb to quantify over the question complement. Section 3 discusses three previous theories of which predicates allow CQs and demonstrates that none of them adequately capture the correlations of Section 2. Section 4 shows that Lahiri's (2000) theory of Interrogative Raising does explain the correlation between embedding propositions and allowing adverbial quantification. Sections 5 and 6 extend Lahiri's theory to concealed questions: the former looks at the range of possible forms and meanings of CQs, and the latter uses the conclusions of that section to develop a method of interpretation that accounts for the correlation between allowing CQs and the other two properties. Section 7 summarizes the conclusions of the paper and offers possible future directions for research.

1.1 Hamblin semantics for questions

As a starting point, I will work from the Hamblin (1973) account of questions as *sets of propositions*. The denotation of a proposition is the set of worlds in which the truth conditions for the proposition hold, i.e. the set of worlds in which the proposition is true; or, alternately, a function which maps to "true" those worlds in which the proposition holds. Propositions thus have the type $\langle s, t \rangle$.

(4) $[\![\textit{John left}]\!] = \lambda w_s$. John left in w

A question, having type $\langle st, t \rangle$, denotes a set of these propositions: in particular, those propositions that are answers to the question. The question *Who left?* denotes the set of propositions of the form *x left*. Often this set is named explicitly, as in (5a), but it can be given schematically as in (5b).

(5) a. $[\![\textit{who left}]\!] = \{[\![\textit{John left}]\!], [\![\textit{Mary left}]\!]...\}$

b. $[\![\textit{who left}]\!] = \{p: \exists x_e \,.\, p = \wedge[\text{left}(x)]\}$
$\lambda p_{\langle s, t \rangle} \,.\, \exists x_e \,.\, p = \lambda w_s \,.\, [x \text{ left in } w]$

Many of the points in this paper will rely on the Hamblin semantics for questions.

1.2 Karttunen's list of predicates

Karttunen (1977) divides question-taking predicates into nine categories.

(6) a. verbs of retaining knowledge: *know, be aware, recall, remember, forget*
b. verbs of acquiring knowledge: *learn, notice, find out, discover*
c. verbs of communicating (knowledge): *tell, show, inform, indicate, disclose, reveal*
d. decision verbs: *decide, determine, specify, agree on, control*
e. verbs of conjecture: *guess, predict, bet on, estimate*
f. opinion verbs: *be certain, have an idea, be convinced*
g. inquisitive verbs: *ask, wonder, investigate, be interested in*
h. verbs of relevance: *matter, be relevant, be important, care, be significant*
i. verbs of dependency: *depend on, be related to, have an influence on*

(adapted from Karttunen 1977, 8)

One important fact to stress is that Karttunen's divisions are not the only possible divisions, nor even necessarily the most useful from a theoretic standpoint. Little in this paper will rely on the lexical meaning of the predicates, for instance, whether a predicate expresses the retention of knowledge or the acquisition of knowledge. The categories are not homogenous, as a single category may include both adjectives and verbs (*be relevant* and *care*) or both transitive and ditransitive verbs (*reveal* and *tell*); many sections of this paper will explore the ways in which *ask* differs from *wonder*. Nonetheless, having a list of predicates provides a set of data against which to test facts about question complements, and thus it is worth spending a few paragraphs examining the list.[2]

The verbs of dependency and of relevance warrant a closer look. Dependency verbs can have question subjects and objects, either or both of which can be a CQ.

(7) a. Who wins the contest depends on who enters.
b. The winner of the contest depends on who enters.
c. Who wins the contest depends on the entrants.
d. The winner of the contest depends on the entrants.

Relevance predicates—other than *care* and other similar predicates such as *give a damn*—appear with question subjects (which can be extraposed) and CQ subjects (which cannot).

(8) a. Who left the party early is relevant (to the investigation).
b. It's relevant (to the investigation) who left the party early.

[2] Another fact about the predicates, within and particularly across categories, is that they have different pragmatic requirements. For example, *know* is factive (requires its complement to be true) whereas *be convinced* is not; *predict* requires that its complement occur after the act of prediction, while *remember* requires the opposite; most decision verbs require that their complement be under the control of the subject. These differences often prevent the use of strict minimal pairs, but the arguments below should be clear nonetheless.

(9) a. The time of the party is relevant (to the investigation).
b. * It's relevant (to the investigation) the time of the party.

Because these questions appear in subject position and predicates do not select subjects in the same way they select objects, many theories of subcategorization implicitly or explicitly set them aside (e.g. theories discussed below: Grimshaw 1979, Dor 1992; see especially Dor's footnote 2).

With a semantics for questions and a list of predicates that take them as complements, we can begin and examination of the distribution of CQs.

2. Which Predicates: A Generalization

This section offers a descriptive generalization in answer to the first question about CQs, the question of which predicates can take CQ complements. In particular, we will see that, barring certain caveats and apparent counterexamples, a predicate can take a concealed question as its complement if and only if it can take a proposition as its complement.

At first glance, this correlation seems unlikely. The four verbs in (10)-(13), all of which take question complements, seem to show the opposite, namely that there is no correlation.

(10) a. Kim knew the time.
b. Sandy knew that it was after 5 pm.

(11) a. * Kim cared the time.
b. Sandy cared that it was after 5 pm.

(12) a. Kim asked the time.
b. * Sandy asked that it was after 5 pm.

(13) a. * Kim wondered the time.
b. * Sandy wondered that it was after 5 pm.

Rather than claim directly that *care* and *ask* are exceptions to the correlation, I will compare both the ability to take CQs as complements and the ability to take propositions as complements to another, apparently unrelated effect, namely the *Quantificational Variability Effect*. As a correlation exists among predicates that take CQs and those that show QVE (with the exception of *ask*), and a correlation exists among predicates that show QVE and those that take propositions (with the exception of *care*), each generalization can be defended on its own terms. Later we will see that the correlations are no coincidence but instead follow from the methods of interpretation.

2.1 CQ-taking predicates

Let us take as a starting point the observation from Dor (1992) that, certain exceptions aside, five of Karttunen's categories of question-embedding predicates (knowledge retention, knowledge

acquisition, communication, decision, and conjecture) accept CQs and three (opinion, inquisition, relevance) do not.[3]

(14)	a.	*verbs of retaining knowledge*	John {knew / recalled / remembered / forgot} the winner of the Nobel Peace Prize.
	b.	*verbs of acquiring knowledge*	John {learned / noticed / found out / discovered} the winner of the Nobel Peace Prize.
	c.	*verbs of communicating (knowledge)*	John {told / showed} me the winner of the Nobel Peace Prize. John {indicated / disclosed / revealed} the winner of the Nobel Peace Prize.
	d.	*decision verbs*	The committee {decided / determined / specified} the winner of the Nobel Peace Prize.
	e.	*verbs of conjecture*	John {guessed / predicted} the winner of the Nobel Peace Prize.
	f.	*opinion verbs*	*John was {certain / convinced} the winner of the Nobel Peace Prize.
	g.	*inquisitive verbs*	John asked (me) the winner of the Nobel Peace Prize. *John {wondered / investigated / was interested (in)} the winner of the Nobel Peace Prize.
	h.	*verbs of relevance*	*John cared the winner of the Nobel Peace Prize.

Finding another phenomenon that divides the predicates into the same two groups will suggest the need for a unified explanation.

2.2 QVE-compatible predicates

Consider the Quantificational Variability Effect (QVE), discussed in Berman (1991) (as cited in Lahiri 2000, 2002). Generally speaking, certain adverbs (i.e. adverbs of quantity such as *mostly* or *to some extent*[4]) can quantify over the object of a verb, as seen in the sentences in (15) with their rough paraphrases.

[3] Karttunen's other question-taking predicates (*be relevant*, *be important*, *be significant*) take questions as subjects or extraposed subjects with an expletive *it* (*Who left is relevant*; *It is relevant who left*). Subjects, as noted before, fall outside the domain of lexical specification, for which reason I will not discuss them.

The judgments in (14) reflect Dor (1992); we will revisit these judgments later in the paper as we consider whether the ungrammatical sentences can be salvaged with prepositions.

[4] See Lahiri (2002) for a thorough discussion of the distinction between adverbs of quantity and adverbs of frequency such as *usually* and *seldom*, and for reasons to think the latter do not give proper QVE readings.

(15) a. The boys that live around the corner are, for the most part, idiots.
most$_x$ [*x* is a boy that lives around the corner] [*x* is an idiot]

b. Mary mostly likes Beethoven's Fifth Symphony.
most$_x$ [*x* is part of Beethoven's Fifth] [Mary likes *x*]

Adverbs such as *mostly* quantify over things with parts. Plural DPs can be broken into parts based on the meaning of the plural, and something like a symphony inherently consists of parts (the various instrumental parts; the key, the tempo, the volume; and so forth). Thus, *mostly* or *for the most part* can take scope over the entire sentence, with the DP as its restrictor.

Embedded questions sometimes, but not always, behave in the same manner. (For Lahiri, the fact that questions can be quantified over at all follows from a calculus of answers that allows the answers to questions to be separated into parts in the same manner as plural DPs. The details of his calculus do not bear on the issues in this paper and will not be repeated here.)

(16) a. Sue mostly remembers what she got for her birthday.
most$_x$[Sue got *x* for her birthday][Sue remembers that she got *x*]

b. #Sue mostly wonders what she got for her birthday.[5]
most$_x$[Sue got *x* for her birthday][Sue wonders...?]

The adverb *mostly* can quantify over an interrogative embedded under a verb such as *remember*, giving a meaning that can be roughly paraphrased as above: for most things that Sue got for her birthday, she remembers that she got it. No similar paraphrase is available with the verb *wonder*, and the sentence is ungrammatical. (These are only paraphrases; Lahiri's actual theory of interpretation and the meanings it assigns will be discussed in Section 4.)

Reexamining the list of question-taking predicates, we can see which ones allow QVE.

[5] There is a grammatical and felicitous reading of this sentence, a reading which exists in many of the ungrammatical sentences with adverbs that appear in this paper. On this reading, *mostly* quantifies not over the question (or its answers) but over events or situations: *At most events e, Sue wonders at e what she got for her birthday*. Such a reading is unsurprising—events and especially pluralities of events can be broken down into smaller pieces, perhaps depending on one's theory of event structure—and not relevant to the issue here.

(17) a. *verbs of retaining knowledge* — John mostly {knew / recalled / remembered / forgot} who plays for the Red Sox.

b. *verbs of acquiring knowledge* — John mostly {learned / noticed / found out / discovered} who plays for the Red Sox.

c. *verbs of communicating (knowledge)* — John mostly {told / showed / informed} me who plays for the Red Sox.
John mostly {indicated / disclosed / revealed} who plays for the Red Sox.

d. *decision verbs* — The managers mostly {decided / determined / specified} who would be starting for the Red Sox.

e. *verbs of conjecture* — John mostly {guessed / predicted} who would be starting for the Red Sox.

f. *opinion verbs* — John was mostly {certain / convinced} who plays for the Red Sox.

g. *inquisitive verbs* — #John mostly {asked / wondered / investigated / was interested (in)} who plays for the Red Sox.

h. *verbs of relevance* — #John mostly cared who plays for the Red Sox.

Each of the sentences in (17a-17f) can be continued with an exceptive clause like *...but not the first baseman*. For example, *John mostly knew who plays for the Red Sox, but not the first baseman* would mean that John knew who played second base for the Red Sox, who played third base, who played shortstop, and so forth, but not who played first base. Similarly, *John mostly learned who plays for the Red Sox, but not the first baseman* means that John didn't learn who plays first base for the Red Sox; *the managers mostly decided who would be starting for the Red Sox, except the first baseman* means that the managers didn't decide which first baseman would start the game; and so forth. The sentences in (17g-17h) cannot be continued in this way because the adverb cannot quantify over Red Sox players: *John mostly wondered who plays for the Red Sox, but not the first baseman* cannot mean that John wondered who plays second base for the Red Sox, who plays third base, and so on, but that he didn't wonder who plays first base.

With the exception of opinion verbs (and *ask*, which will recur as a problematic predicate), the ability of question-embedding predicates to show QVE correlates with the ability to embed concealed questions. With a promissory note to explain the counterexamples, we can state the following correlation:

(18) *The CQ~QVE correlation*
A predicate can take concealed questions as complements if and only if it displays the Quantificational Variability Effect.

2.3 Proposition-taking predicates

Another feature of question-taking predicates is that some, but not all, can also take propositions as complements.

(19)	a.	*verbs of retaining knowledge*	John {knew / recalled / remembered / forgot} that Pedro was the starting pitcher for the Red Sox last night.
	b.	*verbs of acquiring knowledge*	John {learned / noticed / found out / discovered} that Pedro was the starting pitcher.
	c.	*verbs of communicating*	John {told / showed / informed} me that Pedro was the starting pitcher. John {indicated / disclosed / revealed} that Pedro was the starting pitcher.
	d.	*decision verbs*	The managers {decided / determined / specified} that Pedro would be the starting pitcher
	e.	*verbs of conjecture*	John {guessed / predicted} that Pedro would start. John estimated that Pedro had started 50 games this season.
	f.	*opinion verbs*	John {was certain / was convinced} that Pedro was the starting pitcher.
	g.	*inquisitive verbs*	*John {asked / wondered / investigated / was interested (in)} that Pedro was the starting pitcher.[6]
	h.	*verbs of relevance*	John cared that Pedro was the starting pitcher.

With the exception of *care*, the predicates that show QVE can take propositions, and vice versa. We can postulate the following correlation:

(20) *The QVE~Proposition correlation*
A predicate displays the Quantificational Variability Effect if and only if it can take propositions as complements.

The counterexample *care* will need to be explained; another counterexample is the set of verbs (e.g. *believe*) that take propositions as complements but do not take question complements at all.

[6] *Ask* can be used with something that looks like a proposition with a meaning like "request": *John asked that we leave at once*. This is not really a proposition—the construction requires the subjunctive mood (*John asked that we (*do) not leave*; *John asked that we {be/*are} present*) and cannot occur with complements that are not controllable on request (**John asked that it be raining*; compare *John asked whether it was raining*). In any case, this is a different meaning than the "verb of inquisitiveness" meaning on which it does take questions.

For the time being, consider (20) as a correlation about question-taking predicates; we will return to both counterexamples in Section 4.2.

2.4 The correlations assembled

The distributional facts of the last three sections are at the heart of this paper. In the previous two subsections, we saw two correlations in the distribution of question-taking predicates, repeated here.

(18) *The CQ~QVE correlation*
A predicate can take concealed questions as complements if and only if it displays the Quantificational Variability Effect.

(20) *The QVE~Proposition correlation*
A predicate displays the Quantificational Variability Effect if and only if it can take propositions as complements.

Because predicates do not select particular adverbs, neither (18) by itself nor (20) by itself enables us to say much about the selectional restrictions of predicates. However, by the transitivity of the biconditional, we can state another correlation:

(21) *The CQ~Proposition correlation*
A predicate can take concealed questions as complements if and only if it can take propositions as complements.

This correlation does state something about the selectional restrictions of predicates. A theory of selectional restrictions will need to capture this correlation.

A summary of the data that led to this conclusion is seen in the table in (22).

(22)

	QVE	Propositions	Concealed Questions
verbs of retaining knowledge	✓	✓	✓
verbs of acquiring knowledge	✓	✓	✓
verbs of communicating	✓	✓	✓
decision verbs	✓	✓	✓
verbs of conjecture	✓	✓	✓
opinion verbs	✓	✓	*
inquisitive verbs	*	*	✓(ask), *(other)
verbs of relevance	*	✓	*

The apparent lack of correlations in the last three rows represent the promissory notes issued above: an explanation of why opinion verbs do not take CQ predicates, an explanation of why *ask* does, and an explanation of why verbs of relevance (in particular, *care*) take propositions.

Before making good on those promises with accounts of QVE and CQs, I will examine in the next section three previous accounts of selectional restrictions, taking the CQ~Proposition correlation as true and examining the prediction each theory makes about it.

3. Which Predicates? Prior Approaches

There are a number of previous explanations for the fact that only some question-taking predicates are compatible with concealed questions as objects. This section examines three of them. Section 3.1 lays out the proposal from Grimshaw (1979) that predicates are specified for both syntactic and semantic selection properties. Section 3.2 presents Case Theory, Pesetsky's (1982) revision of this proposal. Finally, Section 3.3 examines Dor (1992), which gives a purely semantic account of the distribution of concealed questions.

3.1 Prior approach one: the lexical answer (Grimshaw 1979)

Grimshaw (1979) argued for the need for two independent systems in the lexicon, which she termed *c-selection* (the selection a predicate makes for its syntactic complement) and *s-selection* (the selection a predicate makes for its semantic complement). She proposed the Autonomy Hypothesis, which states that the two kinds of selection are independent of one another.[7]

The semantic types considered by Grimshaw are propositions and questions and, additionally, *exclamatives*, illustrated in their matrix form in (23).

(23) a. How tall Susan is! (≠ *How tall is Susan?*)
b. What a fool Susan is! (≠ *What fool is Susan?/How foolish is Susan?*)

Matrix exclamatives show *wh*-movement but no subject-Aux inversion. Embedded, where questions also do not exhibit subject-Aux inversion, some clauses are ambiguous between exclamations and questions. Adding an intensifier such as *very* or *extremely* disambiguates in favor of the exclamation.

(24) a. Martin knows how tall Susan is.
(= *Martin knows what her height is* or *Martin knows that she is notably tall*)
b. Martin knows how very tall Susan is.
(= *Martin knows that she is notably tall*, ≠ *Martin knows what her height is*)

(Not all clauses are ambiguous: for instance, embedded *whether*-questions have no exclamative reading, and exclamatives with the form *what a N*, such as the one in (23b), cannot be interpreted as questions when embedded.) Embedded exclamatives, like questions, can also be expressed by determiner phrases: *Susan's remarkable height*, *the incredible fool Susan is*.

With this in mind, we can look at predicates such as *think*, *be amazing*,[8] *wonder*, *find out*, and *care*, to see whether each can take, as a complement, a clause expressing (a) a proposition, (b) a question, or (c) an exclamative; or (d) a determiner phrase expressing a question or exclamative; or (e) a null complement.

[7] Grimshaw (1981) tempers the strength of the Autonomy Hypothesis to explain why no predicate takes CQ complements without taking propositional questions as well. That modification will not affect the discussion here.

[8] The construction *It's amazing that/how...* may be an instance of a clause as an extraposed subject, in which case it does not properly fall under the domain of selectional restriction, as noted above. As I will say nothing about exclamatives beyond this section, I present the *be amazing* sentences only to review Grimshaw's theory as completely as possible; if they should not be part of this theory, they can be safely removed.

(25) a. John thinks that the time is 3 pm.
b. * John thinks what time it is.
c. * John thinks how incredibly late it is.
d. * John thinks the time/the incredible lateness of the hour.
e. * I think the time is 3 pm, and John thinks too.

(26) a. John appreciates that this task was difficult.
b. * John appreciates who completed this task.
c. John appreciates how incredibly difficult this task was.
d. * John appreciates the incredible difficulty of the task.

(27) a. * John wonders that the time is 3 pm.
b. John wonders what time it is.
c. * John wonders how incredibly late it is.
d. * John wonders the time/the incredible lateness of the hour.
e. * I wonder what time it is, and John wonders too.

(28) a. John found out that the time is 3 pm.
b. John found out what time it is.
c. John found out how incredibly late it is.
d. John found out the time/the incredible lateness of the hour.
e. I found out what time it is, and John found out too.

(29) a. John cares that the time is 3 pm.
b. John cares what time it is.
c. * John cares what an idiot James is.
d. * John cares the time/the incredible lateness of the hour.
e. I care what time it is, and John cares too.

Grimshaw's argument, in a nutshell, runs as follows. The mapping between syntactic and semantic forms is not one-to-one, nor even many-to-one or one-to-many: items in the same syntactic category can have meanings equivalent to different semantic categories, and meanings of the same semantic category can be represented by forms of different syntactic types. Therefore, both syntactic selection and semantic selection must be specified, and one does not follow from the other.

To elaborate: the same syntactic category can function as more than one semantic category; for instance, propositions, questions, and exclamatives can all be clauses, i.e. CPs. However, there are predicates such as *think* that accept proposition CPs as complements but not question CPs, and there are predicates such as *wonder* that accept question CPs but not proposition CPs. Therefore, predicates cannot be lexically specified for syntactic complements without mention of semantic restrictions. By the same token, the same semantic category can be realized as more than one syntactic category; for instance, questions and exclamatives can both be either NPs or CPs. Again, some predicates such as *wonder* accept questions that are CPs but not questions that are NPs, and thus it is also not sufficient for predicates to be lexically specified

for semantic complements with no syntactic restriction. In summary, the lexicon needs both c-selection and s-selection, and the two are specified independently.

The predicates in (25)-(29) have the following lexical specifications.

(30)

	c-selection	**s-selection**
think	[___ CP]	< ___ P>
amazing	[___ CP]	< ___ P, E>
wonder	[___ CP]	< ___ Q>
find out	[___ (CP, DP)]	< ___ P, Q, E>
care	[___ (CP)]	< ___ P, Q>

That is to say, some predicates take only CP complements and some take DP complements as well; some take their complements obligatorily and some optionally; some take propositions, some questions, some exclamations, in some combination; and there are no correlations among these facts.

At a first look, the Autonomy Hypothesis is appealing. Even the question-taking predicates discussed in Section 2 seem to confirm the hypothesis—taking *know* and *wonder* as representative of the first five rows of table (22) and of the seventh row, respectively, there appears to be no correlation between a predicate taking or not taking a concealed question (DP, in c-selection) and taking or not taking a proposition (P, in s-selection).

(31)

	c-selection	**s-selection**
know	CP, DP	Q, P
ask	CP, DP	Q, *P
wonder	CP, *DP	Q, *P
care	CP, *DP	Q, P

However, if the assertion in the previous section is correct—that *ask* and *care* are explicable as exceptions—then there is a correlation, and the Autonomy Hypothesis does not capture it. Indeed, it predicts that there will be no correlation, as each predicate in a language is specified individually, without pattern. For CQs in particular, being marked for [___ DP] and being marked for <___ Q> are properties that are independent of each other and of any other property, so being marked for both—i.e. taking CQs as complements—is an accidental fact about any given predicate.

3.2 Prior approach two: the syntactic answer (Pesetsky 1981)

Case Theory (Pesetsky 1981) is a refinement of the Autonomy Hypothesis. Case Theory simplifies Grimshaw's system by eliminating c-selection, folding its work into the fact that predicates must be specified for Case. Consider the paradigm in (32), a smaller version of the paradigm in the last section looking only at two predicates and at CP vs. DP questions:

(32) a. John knew what the time was.
b. John knew the time.
c. John wondered what time it was.
d. * John wondered the time.

Using c-selection and s-selection, both *know* and *wonder* take questions as complements; both take CPs; but only the former takes DPs.

Case Theory treats the paradigm in (32) as an example of quirky case. In languages that show overt morphology for case, some predicates require objects with unusual case marking. (Icelandic is an often-invoked example. As a default, predicates take objects with accusative case, and most predicates have this default. But not all: for instance, *bjarga* 'rescue' requires dative case on its object.) Predicates that don't take CQs exhibit quirky case: *know* sets no case requirement and thus appears with both CPs and DPs, but *wonder* requires its object to have no case at all (Pesetsky hypothesizes a [+∅-case] feature, analogous with the presumable [+Dative case] that *bjarga* requires of its object). Since DPs must have case and CPs do not, a predicate whose object must be [+∅-case] can take the latter as its object but not the former.

As a corollary, Pesetsky notes that, because a PP does not require Case, predicates that select for questions semantically but require caselessness on their objects and thus do not take CQs will be fine with PPs, in particular ones headed by *about*.

(33) a. John cares *(about) the time.
b. Mary inquired *(about) the murderer of Caesar.
c. Bill wondered *(about) John's whereabouts. (= Pesetsky 1991, 33a-c)

The same is true of adjectives, which can never take DPs as complements, though some take questions in CP form.

(34) a. John is uncertain what time it is.
b. John is uncertain *(about) the time. (= Pesetsky 1991, 34-35)

Pesetsky (1991), citing Abney (1985), notes that *about* is not a dummy preposition without semantic contribution: "*John asked about the time* need not be a request to name a specific time of day (e.g. ten o'clock), but may be a general request for information concerning some particular time of day (e.g. why ten o'clock and not noon was chosen for some event)." This point is taken up again in Section 5.1.1.

Case Theory does eliminate one of Grimshaw's selectional requirements by reducing it to an element already required by the grammar, namely specification for case. However, this specification is, like c-selection, independent of s-selection. The fact that *know* allows DPs and *wonder* does not is still specified lexically for the predicates, and while it is now specified with Case instead of c-selection, Case Theory leaves the distribution of CQs in the same state as the Autonomy Hypothesis does. In particular, a predicate marked with [∅-case] could also be marked s-selectionally as <___ P, Q> and thus take proposition clauses as complements (caseless Ps) but not concealed questions (cased Qs). The fact that the CQ~Proposition correlation states that no such predicate exists is then an accident of the grammar..

3.3 Prior approach three: the semantic answer (Dor 1992)

Dor (1992), going against the predictions of the Autonomy Hypothesis and Case Theory, postulates a semantically-based distribution of concealed questions. As discussed in Section 2.1, he observes that some of Karttunen's predicates but not others can appear with CQ objects (again, setting aside the dependency verbs in (6i) with their CQ subjects as outside the realm of lexical specification) and sets out to determine what property the CQ-taking predicates have that the others do not. What he finds is a variation on factivity centered around the syllogism in (35).

(35) John [PRED-ed] what X was.[9]
<u>X was Y.</u>
∴ John knew that X was Y. (= Dor's (18))

If a predicate satisfies the syllogism in (35), it has *Positive Epistemic Commitment* (PEC), formally defined in the paper as "impl[ying]…that its cognitive subject *has* assigned the true value to the variable represented by a *wh*-phrase." The opposite property, *Negative Epistemic Commitment* (NEC), is defined analogously, with the syllogism in (36).

(36) John [PRED-ed] what X was.
<u>X was Y.</u>
∴ John did not know that X was Y. (= Dor's (26))

A predicate that satisfies this syllogism "implies…that its cognitive subject has *not* assigned the true value to the variable represented by a *wh*-phrase" and is therefore an NEC predicate.

Broadly speaking, the predicates in the first five categories in Karttunen's classification in (6) are PEC-predicates, while those in the others (excepting verbs of dependency) are NEC. Dor therefore concludes that only PEC-predicates take exclamatory complements, and only non-NEC predicates take concealed questions. The difference between the two sets is *ask*, which is non-NEC (because one can ask a question while knowing the answer), but is also not PEC (because one can ask a question without knowing the answer). Thus it cannot take exclamations, but it can take concealed questions.

This theory is appealing, particularly insofar as it might be possible to find a correlation between a predicate being non-NEC and taking propositional complements (Dor does not explore complements other than exclamations and CQs). However, it has certain empirical gaps. For example, within the class of inquisitive predicates Dor groups *inquire* with *wonder* (and separate from *ask*) as a NEC predicate on the basis of the following syllogism.

(37) John inquired where the meeting was to be held.
<u>The meeting was to be held in the office.</u>
∴ John did not know that the meeting was to be held in the office.

But for many speakers this syllogism is not valid; *inquire* does not differ from *ask* at all in this

[9] The first premise of the syllogism structure involves the embedded question *what X was*. Dor does not seem to intend the syllogism to require this sort of identity question—his syllogisms use the question *where the meeting was to be held*—but instead apparently intends *what X was* and *X was Y* to stand in for any question and its true answer. The syllogisms that appear below therefore do not hold strictly to the form *what X was*, either.

respect. That is to say, if John already knows the answer and is stating a question (for confirmation, say, or to make the answer public), the first sentence in (37) is as acceptable as *John asked where the meeting was to be held*. Nevertheless, even for those speakers who find (37) invalid (i.e. for those speakers for whom *inquire* is a non-NEC predicate), *inquire* does not take concealed questions.[10]

Conjecture verbs do not neatly categorize as non-NEC predicates. Dor considers *guess* a PEC-predicate, which would mean that *John guessed where the meeting was to be held* entails that he knew the location. Though one meaning of *guess* is *guess correctly*, it seems more likely as a scenario that, if John guessed where the meeting was to be held, he did not actually know. This is even clearer with *estimate* and *predict*.

(38) John estimated how tall the building was.
<u>The building was 45 stories tall.</u>
?∴ John knew that the building was 45 stories tall.
∴ John did not know that the building was 45 stories tall.

(39) John predicted who the winner of the World Series would be.
<u>The Red Sox were the winners of the World Series.</u>
?∴ John knew that the Red Sox would be the winners of the World Series.
∴ John did not know that the Red Sox would be the winners of the World Series.

In both cases, John may have been right (i.e., he may have estimated that the building was 45 stories tall, or he may have predicted that the Red Sox would win the World Series) and even have been confident that he was right, but in neither case did he know. Thus *estimate* and *predict* do not seem to be PEC predicates at all, and in fact appear to be NEC predicates.

[10] My own intuition that (37) is invalid is not strong, and at least one reader questioned the judgment. Nevertheless, every informant I asked accepted *inquire* in a context in which the inquirer already knew the answer to the question and wanted to make the answer public. Searching with Google and with Amazon.com's contents-searching feature turns up numerous examples from published books and articles, such as:

(i) During dinner Anna Mihalovna talked of the rumours from the war, of dear Nikolay, **inquired** twice when his last letter had been received, **though she knew perfectly well**, and observed that they might well be getting a letter from him to-day. (Leo Tolstoy, *War and Peace*, translation at Bibliomania (http://www.bibliomania.com/); also used in Rosemary Edmond's translation)

(ii) "Did you hear that?" [Threepio] **inquired rhetorically** of his patient companion, referring to the throbbing sound. (George Lucas, *Star Wars: A New Hope*)

(iii) When it came time to pay the bill, I **inquired** if they took credit cards, **but I was sure I knew the answer already**. ("Lebanese specialties, with character", May 21, 2003, *The [New Hampshire] Union Leader*: http://www.theunionleader.com/Gourmet_show.html?article=21479&archive=1)

Of course, some speakers *do* accept the syllogism in (i), and to complicate matters further, *inquire* historically did take concealed questions as objects. The OED separates the question-taking meaning of *inquire* into the usages "with interrogative clause as object" and "with simple object". The latter, it notes, is "now less usual", but the citations indicate that *inquire* used to appear with concealed questions: *You must enquire your way* (Shakespeare, *Coriolanus*); *The wily mother...Wi' heart-struck, anxious care, inquires his name* (Burns, "Cotter's Saturday Night"); and many others. In the end, *inquire* is at least partially a challenge for Dor's categorization, and the details of an analysis of the synchronic variation and diachronic change, I leave to future researchers.

Nevertheless, both take CQs (*John estimated the height of the building*; *John predicted the winner of the World Series*).

Finally, *care* does not fit the pattern. The NEC syllogism does not hold with *care* (i.e. (40) is invalid), so *care* does not have a negative epistemic commitment.

(40) John cared where the meeting was to be held.
The meeting was to be held in the office.
*∴ John did not know that the meeting was to be held in the office.

Nevertheless, as we saw earlier, *care* does not take CQs (**John cared the location of the meeting*).

Dor's program is sound, but as a semantic account of the distribution of CQs it contains too many empirical gaps to be correct. For this reason, we will now move away from past accounts and look more carefully at QVE with questions, to see why the correlations in Section 2 follow from facts about the predicates—and thus do not need to be specified individually for each one—and how the apparent counterexamples can be explained.

4. Quantificational Variability Effects and Propositions

In section 2.3, we observed a correlation between predicates that show QVE and those that take propositions as complements. In this section, we will demonstrate that this correlation is not an accident, but derives from interpretation mechanisms.

4.1 Deriving the QVE~Proposition correlation

Lahiri's (2000) explanation of QVE centers on another distinction between verbs that do exhibit QVE, such as *know* and *remember*, and those that do not, such as *ask*. Verbs like *know* seem to be ambiguous between type ⟨*st*, *et*⟩ (proposition-taking predicates) and ⟨⟨*st*, *t*⟩, *et*⟩ (question-taking predicates), whereas verbs like *wonder* have only the latter type[11]—that is, verbs that exhibit QVE are verbs that can take either propositions or questions, while verbs that do not exhibit QVE can take only questions as complements, and not propositions.

In order to explain QVE, Lahiri distinguishes between *know* and *wonder* by type. Instead of maintaining the ambiguity in verbs that take both propositions and questions as complements, he postulates that they have only the type ⟨*st*, *et*⟩, while verbs that take only questions have the expected type ⟨⟨*st*, *t*⟩, *et*⟩. This creates a type mismatch when a verb of the former sort takes a question complement, and Lahiri resolves this mismatch with a rule of *Interrogative Raising* (IR). IR resembles Quantifier Raising (QR) in resolving a type mismatch by moving the offending object to the top of the tree and leaving behind an interpretable trace.[12] In the case of IR, the

[11] As a reminder, this is a different ambiguity of type than the one discussed in footnote 1. The ⟨*e*, *et*⟩ version of these predicates, such as *know* on the *kennen*-like "be familiar with" meaning, exists independently of this apparent ambiguity.

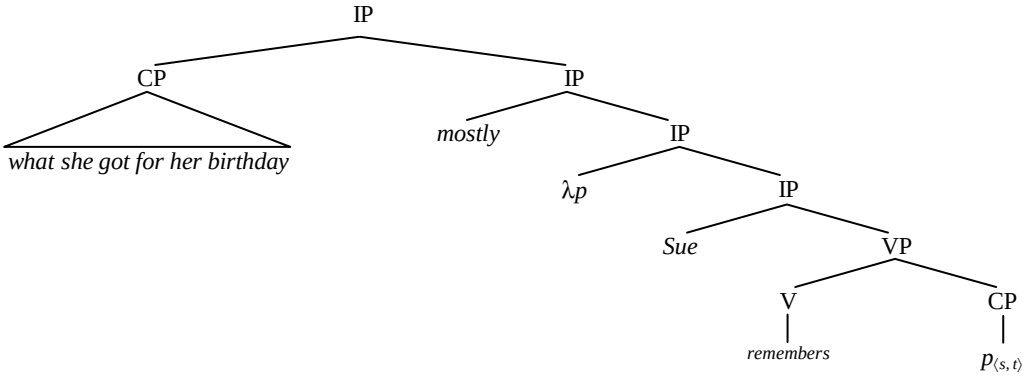
[12] Following Lahiri, I will discuss the semantic interpretation of questions in terms of movement and traces. Some semanticists (Jacobson 1999 *et alia*) adhere to theories of "direct compositionality," i.e. theories without movement. However, as Interrogative Raising is analogous to Quantifier Raising, and theories of direct compositionality simulate QR without using movement (typically with type-shifting operations), none of the

raised syntactic object has semantic type ⟨*st*, *t*⟩ (that is, the type of a question), and leaves behind a trace of type ⟨*s*, *t*⟩ (the type of a proposition). The IP of the original sentence is thus an open proposition with a variable over propositions, giving it the type ⟨*st*, *t*⟩ as well. The relation between the two sets of propositions (the raised question and the open proposition) is expressed by the quantificational adverb, which therefore has the type ⟨⟨*st*, *t*⟩, ⟨⟨*st*, *t*⟩, *t*⟩⟩, or perhaps more transparently ⟨P*t*, ⟨P*t*, *t*⟩⟩, where P is the proposition type ⟨*s*, *t*⟩: similar to a predicate of type ⟨*et*, ⟨*et*, *t*⟩⟩, it expresses a relationship between two sets of propositions.

The derivation of a sentence showing QVE such as (16a), repeated here as (41), will be something like the tree in (42).

(41) Sue mostly remembers what she got for her birthday.

(42)



Mostly expresses a relation between the sets of propositions λp . *Sue remembers p* and the denotation of *what she got for her birthday*.

In particular, Lahiri gives the sentence the meaning in (43).

(43) most(λp[*Ans*(*p*, [[*what she got for her birthday*]]) $\wedge$ C(*p*)])(λp[know(*p*)(sue)])

Ans(*p*, Q) is true if *p* is an answer to Q, following Lahiri's algebra but understandable in fairly intuitive terms. C is a contextual variable; in the case of *remember* or another factive verb, C will be λp . $^{\vee}p$, i.e. true iff *p* is true in the actual world. (Recall that using Hamblin semantics, if Sue got a sweater, a bicycle, and a puppy for her birthday, *Sue got a puppy for her birthday* will be an answer to *what Sue got for her birthday*, but *Sue got a pony for her birthday* will also be an answer. It should not be the case, however, that if Sue remembers what she got for her birthday, then Sue remembers that she got a pony for her birthday.) Other possibilities for C exist for other predicates. To determine the truth conditions for *John is certain (for the most part) about Q*, we cannot look at only the propositions that are true answers to Q—John can be certain about things that happen to be false. Instead, we look at the propositions that John considers likely or possible.[13]

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discussion of question interpretation and, later, CQ interpretation should be difficult to recast in a semantics without movement.

[13] In both cases discussed here, C is determined by the presuppositions of the predicate—*John remembers that X* presupposes that *X* is true; *John is certain that X* presupposes that John finds *X* possible or likely. Not all contextual variables can be determined solely from presuppositions; Lahiri discusses this issue in greater detail.

In the absence of an explicit quantifier such as *mostly*, sentences interpretable with IR contain an implicit adverbial. Lahiri correctly hesitates to adopt any analysis in which that adverbial is always universal quantification. That would assign the right meaning to *Sue remembers what she got for her birthday*, which should only be judged true if, for everything that she got for her birthday, she remembers that she got it. However, it will give the wrong truth conditions for *John knows where to get gas*, which is acceptable in situations where there is a place to get gas such that John knows one can get gas there, without it being necessary for John to know every such place. Overall, the quantifier is best left to be determined by context.

In Lahiri's theory, QVE readings derive from Interrogative Raising, and only predicates whose type is ⟨*st*, *et*⟩ receive interpretation via IR. Predicates with type ⟨⟨*st*, *t*⟩, *et*⟩ combine directly with questions of type ⟨*st*, *t*⟩ (and in fact Lahiri demonstrates that, not only is IR not required, it is not possible: raising the interrogative clause will create a type mismatch higher in the tree). Therefore, the QVE~Proposition correlation given in (20), "A predicate displays the Quantificational Variability effect if and only if it can take propositions as complements," is no accidental fact, but derives from the mechanisms of the grammar.

4.2 Counterexamples to the QVE~Proposition correlation

In Section 2.3, which postulated the QVE~Proposition correlation, we saw two apparent counterexamples. One is the set of proposition-taking predicates (e.g. *believe*) that do not take question complements at all, and thus certainly cannot take question complements when modified by an adverb like *mostly*.[14]

(44) * Sue (mostly) believes what she got for her birthday.

The other is *care*, which does take questions and propositions but does not show QVE.

(45) a. John cares that it is raining.
b. * John mostly cares who plays for the Red Sox (but doesn't care who plays first base).

Let us consider each in turn.

4.2.1 Counterexample one: believe

The problem posed by predicates such as *believe* is more fundamental than an inability to exhibit QVE. Because the mechanism of IR resolves a type mismatch between a predicate of type

[14] Kai von Fintel (p.c.) observed that *believe* does seem to take question complements when negated:

(i) Sue can't believe what she got for her birthday.

However, these complements are not questions but exclamations. On the one hand, these complements are only acceptable on the idiomatic "how amazing!" reading of *not believe*, which is factive: *I don't believe that Sue got a pony for her birthday* entails that she did indeed get a pony. On the other hand, negated *believe* doesn't take a question complement on its literal "fail to hold the belief" reading: *Mary doesn't believe what Sue got for her birthday* cannot mean that Sue got a pony but Mary doesn't hold the belief that Sue got a pony. I will continue to set aside issues concerning the syntax of exclamatives.

⟨*st*, *et*⟩ and a complement of type ⟨*st*, *t*⟩, it produces an interpretable structure for the sentence in (44), which has the meaning in (46).

(46) most(λ*p*[*Ans*(*p*, ⟦*what she got for her birthday*⟧) ∧ C(*p*)])(λ*p*[believe(*p*)(sue)])

Paraphrased, that meaning states: for most propositions that answer the question "What did Sue get for her birthday?", Sue believes that proposition. While well-formed, this meaning (or any other) is entirely missing from the sentence.

Lahiri recognizes this fact, and observes in footnote 10 of Lahiri (2000) that "[t]his is not an argument against the account developed here, but an independent question.... Some predicates can take proposition-denoting direct objects as well as question-denoting direct objects, some predicates can take only proposition-denoting direct objects. I assume that such information is present in the lexicon."

Following Lahiri, I will also assume that some other independent factor prevents the *believe* class of predicates from taking question complements. This may well require a residual form of c-selection (not s-selection, as *know* and *believe* both have type ⟨*st*, *et*⟩), one which in particular distinguishes a CP with a question complementizer from a CP without a question complementizer; *know* can take either as a complement, *believe* only the latter. The theories in this paper which reduce most c-selection to s-selection will not eliminate this requirement.

4.2.2 Counterexample two: care

The same argument cannot work for *care*, which does take questions as complements. To understand why *care* does not exhibit QVE, let us look more carefully at the exact meaning of some question-taking verbs.

The entailments in (47) are fairly unsurprising, given that the theory of Interrogative Raising relates a question complement to the answers to the question, and given that *know* and *remember* are factive when taking propositions.

(47) a. Mary knows who left ∧ John left → Mary knows that John left
b. Mary remembers who left ∧ John left → Mary remembers that John left

Nor is it surprising that a similar entailment cannot be found for *wonder*, which does not take propositions as complements and which therefore will have no paraphrase with a proposition.

(48) Mary wonders who left ∧ John left → Mary wonders...?

What *is* surprising, in light of (47), is the fact in (49).

(49) Mary cares who left ∧ John left ↛ Mary cares that John left

Care, when it takes a proposition, is factive like *know* and *remember* (*Mary cares that John left* entails that John left). Nevertheless, the entailment in (49) does not hold: if Mary cares that John left, she must know that John left, which does not follow from the conjunction of *Mary cares who left* and *John left*.

The explanation for this fact lies at the heart of the insight behind IR. *Mary knows that John left* expresses a relation (the "know" relation) between Mary and a proposition, namely *that John left*. *Mary wonders who left* similarly expresses a relation (the "wonder" relation) between Mary and a question, namely *who left*. But *Mary knows who left* does not express a relationship between Mary and a question; rather, it expresses a relation between Mary and the *answer* to a question. By raising the question complements of proposition-taking verbs and leaving a propositional trace, Lahiri's theory of IR encodes these facts. *Wonder* combines directly with its question complement. *Know*, however, combines with a proposition which (because of the quantifier that relates the question to the rest of the sentence) is a member of the set denoted by the question complement—i.e., a proposition that is an answer to the question.

What about *care*? As with *know*, the sentence *Mary cares that John left* expresses a relation between Mary and the proposition *that John left*. *Mary cares who left*, however, is not analogous with *know* at all: as we saw in (49), the sentence does not relate Mary and the answer to the question *who left*. In fact, it relates *Mary* directly to the question *who left*. As Lahiri's explanation of QVE requires quantifying over the answers to the question complement, it makes sense that neither *wonder* nor *care* would allow QVE, as both relate their subjects directly to the question complement and not to that question's answers.

What remains is to reconcile the fact that *care* patterns with *know* in that it takes propositions but with *wonder* in that it does not allow quantification over its question complement. But the inconsistency is easily resolved by postulating an ambiguity: the ambiguity that Lahiri eliminates for most proposition-taking predicates is actually present in *care*. Because *care* does not undergo IR or demonstrate QVE, it must have the semantic type $\langle\langle st, t\rangle, et\rangle$ when it combines with questions; and because it takes propositions, it must also have the type $\langle st, et\rangle$. In this respect, *care* is not like *know* at all, but is in fact ambiguous between a predicate like *wonder*, which does not allow IR because it combines directly with questions, and a predicate like *believe*, which does not allow IR because it c-selects for non-question CPs.

4.3 Conclusion about QVE and propositions

We have seen how the generalization that predicates show QVE if and only if they take proposition-complements follows directly from the interpretation mechanism of Interrogative Raising, and how apparent counterexamples can be explained. Even so, of course, this correlation does not bear on the Autonomy Hypothesis, as some predicates still take propositions and not questions, some take questions and not propositions, and some take both; and nothing has been said about the connection of these facts to syntactic categories other than CPs.

For that, we must look at the CQ~QVE correlation. However, just as IR required an understanding of the semantics of questions, relying as it does on having a set of propositions whose elements can be quantified over, understanding this correlation will involve a digression into some of the complexities of CQs.

5. Concealed Questions

CQs have a number of restrictions, both semantic and syntactic. In comparison to clausal questions, CQs do not show the same range of meanings, and in comparison to non-question DPs, CQs do not show the same range of forms. This section examines both limitations.

5.1 The meaning of a CQ

At the beginning of the paper, we saw a handful of examples of CQs, repeated here.

(1) a. Kim knows *the governor of California*.
b. Leslie has forgotten *the capital of Texas.*
c. Sandy told me *the time of the meeting*.

These are useful as a first impression, but it is worthwhile to take a more careful look at the characteristics of CQs.

Concealed questions have two attributes in common. The first is a shared and relatively wide distribution. As we saw in section 2, not every question-taking predicate takes CQs; but there are a large number of predicates that do. While the details of the explanation remain to be seen, what is relevant for identifying CQs is that they share their distribution across these predicates.

The second common attribute is the meaning of the CQ. All of the CQs discussed in this paper have the same meaning: they are *identity questions*. Thus, the questions in (1) have paraphrases with full clausal question as seen in (50).

(50) a. Kim knows *who [the governor of California] is.*
b. Leslie has forgotten *what [the capital of Texas] is.*
c. Sandy told me *what [the time of the meeting] is.*

CQs are limited to these meanings, which is to say *who DP is* or *what DP is*. Other questions, whether with copulars such as *where DP is* or *when DP is* or with extraction from subject or object position of transitive verbs such as *what DP saw* or *who saw DP*, are not possible meanings of CQs.[15] (The latter might be expected because of the extra semantic material, but even a context which supplies that material does not make the CQ meaning available.)

(51) a. Leslie needed driving directions, so I told her *where the capital of Texas is*.
b. #Leslie needed driving directions, so I told her *the capital of Texas*.

(52) a. Alex has joined our department, so I told him *where the meeting he needs to attend is*.
b. #Alex has joined our department, so I told him *the meeting he needs to attend*.

[15] One apparent counterexample might be the sentence in (i).

(i) Tell me the last train to Boston.

At first glance, this seems to mean *Tell me when the last train to Boston is*, making it a *when* question and not an identity question. However, when speaking of trains (and other scheduled transportation), we habitually identify them by time: in fact, "8:10" is a less appropriate answer than "the 8:10" (and "the Northeast Direct," with no mention of a time, is an equally good answer). The question in (i) is therefore an identity question, *Tell me what the last train to Boston is.*

(53) a. Matt is compiling a list of who saw which movies, so I told him *who saw the movie directed by Orson Welles*.
b. #Matt is compiling a list of who saw which movies, so I told him *the movie directed by Orson Welles*.

In each of the (b) sentences in (51-53), the clause beginning *so I told...* has a grammatical reading (in a different context) with the DP acting as a CQ with the meaning of an identity question (*so I told her what the capital of Texas is*; *so I told him what the meeting he needs to attend is*; *so I told him what the movie directed by Orson Welles is*). Each is infelicitous, however, as a way of expressing the meaning of the corresponding (a) sentences, in which the questions are not identity questions.

In fact, a CQ is quite limited in what identity question it can represent—while *who DP is* and *what DP is* are possible meanings of a CQ, *which one DP is* is not.

(54) A: Three of these four puppies are male.
#B: Tell me the female.
(cf. *Tell me which one the female is.*)

The meaning of a CQ is the identity question *who/what X is* and not *which one X is*.[16, 17]

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[16] I am grateful to Rebecca Rabinowitz for this observation.

[17] Chris Barker (p.c.) observed that other nouns seem to act as questions. For instance:

(i) a. Teach me French. ≈ Teach me how to speak French.
b. Teach me the tango. ≈ Teach me how to dance the tango.

In Karttunen's taxonomy, *teach* falls into the same category as *tell*, i.e. communication of information, and takes propositions and questions (but unlike *tell*, not exclamations).

(ii) a. I taught John that the capital of France is Paris.
b. I taught John what the capital of France is.
c. *I taught John what an incredible idiot he was.

(*Teach* sets other restrictions on its complement—e.g. that the complement must be some sufficiently complex or obscure fact: #*I taught John what time it was*—which are not relevant here.)

If these nouns are indeed questions—and they may be merely DPs denoting individuals, which in this case are pieces of information—they are at the very least not the sort of concealed questions considered in the rest of this paper. In addition to not having the same meanings as CQs, being questions of information rather than identity, they cannot occur productively with other CQ-taking verbs.

(iii) a. *I discovered French. (cf. *I discovered how to speak French*)
b. *Tell me the tango. (cf. *Tell me how to dance the tango*)

Unlike the CQs discussed here, pronouns with antecedents of type *e* can stand in for them (note that pronouns can have CQ meanings if their antecedents are CQs: *I know the capital of France. I suspect you know it too*).

(iv) a. I love the tango! Let me teach it to you.
b. I love the capital of France! #Let me teach it to you.

(Thanks to Ben Russell for this observation.) Also, contexts such as *taught* do not show QVE.

(iv) #Kim mostly taught me how to tango. (≠ *Kim taught me how to dance most of the tango*.)

What differentiates *what the capital of Texas is* from the other questions—*where the capital of Texas is, who saw the movie directed by Orson Welles,* and *which one the female is*? The first question can be represented by the CQ *the capital of Texas* because each answer to the question asserts that some individual is a capital of Texas (along with the uniqueness presupposition that the definite article provides), as in (55). The same is not true of the others: answers to *where the capital of Texas is* do not assert that any individual is a capital of Texas, but instead assert that an individual (i.e. a location) is the location of a presupposed (unique) capital of Texas, as in (56). Consequently, *the capital of Texas* cannot represent this question. A similar explanation holds for the Orson Welles question.

The last question is trickier, as it is an identity question like the first. However, by asking *which one*, the answers do not merely assert that a given individual is the female, but instead assert that a given individual is a puppy[18] and that this individual is identical to a presupposed unique female.

(55) $[\![$*what the capital of Texas is*$]\!]$ =
$\{p : \exists x \,.\, p = \lambda w \,.\, [\text{capital-of-Texas}(w)(x) \wedge \forall y \,.\, [\text{capital-of-Texas}(w)(y) \rightarrow y = x]]\} \equiv$

{that Austin is a capital of Texas (and anything else that is, is identical to Austin),
that Dallas is a capital of Texas (and anything else that is, is identical to Dallas),
that Houston is a capital of Texas (and anything else that is, is identical to Houston)...}

(56) $[\![$*where the capital of Texas is*$]\!]$ =
$\{p : \exists z \,.\, p = \lambda w \,.\, \exists x \,.\, [\text{capital-of-Texas}(w)(x) \wedge \forall y \,.\, [\text{capital-of-Texas}(w)(y) \rightarrow y = x]$
$\wedge\ \text{is-the-location-of}(w)(x)(z)]\} \equiv$

{that 30°30′N, 97°75′W is the location of x (x is the capital of Texas),
that 29°58′N, 95°21′W is the location of x (x is the capital of Texas),
that 32°51′N, 96°51′W is the location of x (x is the capital of Texas)...}

Finally, Kai von Fintel pointed out to me that the paraphrases in (i), which suggest that nouns like *the tango* are approximately the same as questions like *how to dance the tango,* are not entirely accurate: full questions such as *how to dance the tango* apparently denote mere information, whereas infinitives such as *to dance the tango* or nouns such as *the tango* additionally entail ability:

(v) a. John taught me how to dance the tango, but I can't actually perform it.
b. *John taught me to dance the tango, but I can't actually perform it.
c. *John taught me the tango, but I can't actually perform it.

All in all, DPs like those in (i) are sufficiently different from the objects commonly called "concealed questions" in the literature that I would not expect a single explanation to cover both, and will not consider them further in this paper.

[18] If *one* is a sort of pronoun whose antecedent is the property *puppy*. Otherwise the assertion is that the individual is a "one"—i.e., is an individual.

(57) ⟦*which one/puppy the female is*⟧ =
$\{p : \exists z \,.\, p = \lambda w \,.\, [\text{puppy}(w)(z) \wedge \exists x \,.\, [\text{female}(w)(x) \wedge \forall y \,.\, [\text{female}(w)(y) \rightarrow y = x] \wedge x = z]]\} \equiv$

{*that Rosebud the basset hound is x (x is the female),*
that Mitzi the toy poodle is x (x is the female)...}

In other words, the question denoted by a DP acting as a CQ is retrievable entirely from the NP (e.g. *capital of Texas*); if any additional information must be added (about locations, movie viewings, or puppies) to get an intended meaning, the CQ cannot have that meaning.

5.2 The form of a CQ

Of the determiner phrases that can be the sort of concealed question that goes by that name in the literature, some contain only a head noun (and possibly a complement) in the NP, but require no adjunct. A partial list, based on Caponigro and Heller (2003):

(58) Tell me...
- a. the governor of California
- b. the winner of last year's Pulitzer Prize
- c. the outcome of the trial
- d. the capital of France
- e. the location of the meeting
- f. the color of my eyes
- g. your shoe size
- h. your height
- i. her age
- j. the time of the meeting
- k. the temperature of the water
- l. Bill's telephone number
- m. the square root of 49
- n. the sum of 8 and 9

Caponigro and Heller, following Heim (1977), categorize these as "functional" nouns, nouns that are functions from individuals to individuals. *Capital* is a function from countries (or states, etc.) to cities, *sum* from number-pairs to numbers, *governor* from states to people, and so forth. I will call these CQs "lexical," as it is a lexical property of the noun that allows it to receive a CQ meaning.[19]

Other nouns, however, don't appear as CQs with nearly the same ease. Even with a context establishing the uniqueness of the referent, *the city* is infelicitous as a CQ whereas *the capital* is fine.

[19] It is not clear whether *all* functional nouns are lexical CQs. *Tell me his mother* sounds very odd to me; even when the mother is someone famous or relevant, e.g. *I know Liza Minelli's mother—it's Judy Garland*, I find the sentence strange at best. This is a question I will put off for this paper.

(59) The island nation of Nauru—unlike, say, South Africa, which has three capital cities—has only one capital.

a. Let me tell you the capital of Nauru.

The island nation of Nauru—unlike, say, South Africa, which has many cities—has only one city.

b. *Let me tell you {the city/the city of Nauru/Nauru's city}.[20]

Non-functional nouns such as *city* and *semanticist*, unlike functional nouns, do not readily act as CQs, as the ungrammaticality of the sentences in (60) indicates. In the sentences in (61), however, these nouns are acceptable as CQs.

(60) a. *Tell me Nauru's city.
b. *Tell me a city in France.
c. *Tell me Brown's semanticist.

(61) a. Tell me the largest city in France.
b. Tell me a city you visited last month.
c. Tell me the semanticist I should consult

I will call CQs like those in (61) "coerced." There seems to be some process that turns an ordinary determiner phrase into a coerced CQ, a process that depends on modification of some sort. Let us consider some of them.

5.2.1 Postnominal adjectives

Bolinger (1967) discovered a difference between prenominal and postnominal adjectives. The following scenario illustrates a striking example of the contrast.

(62) Kim and Sandy are working on a project together, under the direction of Sam. Kim is a fine, upstanding person who never forgets deadlines and is wholly reliable. Sandy is much more absent-minded and prone to carelessness. While walking together to their office, Sandy tripped and spilled a box of papers, which got wet, torn, and generally mutilated. Gathering up the papers, they continued to the office and left the papers on a table, where Sam saw them. At which point...

a. Sam yelled at the responsible person.
b. Sam yelled at the person responsible.

The sentence in (62a) asserts that Sam yelled at Kim, who is the *responsible person*. On the other hand, the sentence in (62b) asserts that Sam yelled at Sandy, who is the *person*

[20] That is, neither the strict minimal pair *the city of Nauru* nor any more natural variation is grammatical. Incidentally, Nauru, at 21 sq km, is too small to have any cities at all. Its government is simply headquartered in one of its fourteen districts.

responsible.[21] There is an unquestionable difference between an adjective used prenominally and the same adjective used postnominally.

The sentences in (62) are part of a more general paradigm, in which an adjective used prenominally expresses, informally speaking, a permanent property, and one used postnominally expresses a temporary property. Thus, being responsible is a long-term fact about Kim, whereas being responsible is true of Sandy only in this particular situation. Similarly, the determiner phrase in (63a) refers to the rivers that one can, generally speaking, navigate (and when it is the subject of *include the Volga*, the proposition asserts that the Volga is such a river); the determiner phrase in (63b) denotes those rivers that can be navigated *at the moment*—those that are generally navigable and are also not currently flooded, frozen over, etc.

(63) a. the rivers navigable (include the Volga)
b. the navigable rivers (include the Volga)

Bolinger's categorization correctly predicts that (64a), with a stage-level adjective after the noun, will be fine, whereas (64b), with an individual-level adjective after the noun, will be anomalous.

(64) a. the children sick
b. #the children tall

It also predicts that (65a) will be felicitous and (65b) will not. The former denotes the subset of "navigable rivers," rivers that are generally navigable, which cannot currently be navigated. The latter denotes the subset of "unnavigable rivers," those that cannot be navigated, which one can currently navigate: the empty set, as no unnavigable rivers will ever be temporarily navigable.

(65) a. the navigable rivers unnavigable
b. #the unnavigable rivers navigable

Larson (1999) further observes that when adjectives describing temporary states can come before the noun, they precede those describing permanent states.

(66) a. the unnavigable navigable rivers
b. #the navigable unnavigable rivers

The felicity of (66a) and infelicity of (66b) follows in the same way as the determiner phrases in (65) do.[22]

The rough schema in (67) represents the structure of noun phrases with respect to the positions of adjectives. There is a single slot (in actuality, one that is likely iterable) preceding the noun, into which adjectives with "permanent" meanings go, here labeled ψ in order to remain

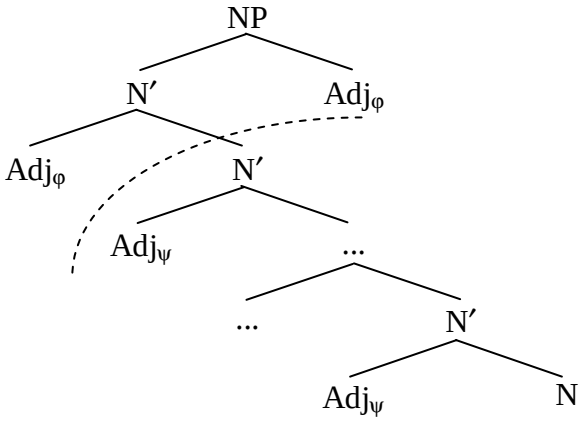
[21] To some degree, (62a) has a reading on which *the responsible person* refers to Sandy. The availability of this reading will be explained within the next page.

[22] For this reason, *the responsible person* has, to some extent, a reading on which *responsible* has a temporary meaning, i.e. on which it is synonymous with the only reading of *the person responsible*. The availability of that reading depends on *responsible* going into the first adjective slot, and the second slot, the one closer to the noun, remaining empty. For the sake of explication, I will use prenominal adjectives only on their "permanent" readings.

neutral for the moment on the question of what exactly categorizes these adjectives. Higher in the tree (in a sense, farther from the head noun) are slots before and after the resulting N′, into which adjectives with "temporary" meanings go, here labeled φ. The dashed curve in the tree indicates the "cutoff point"—a point below which adjectives must be of the ψ sort, and above which they must be of the φ sort. (See Larson 1999 for a discussion of how to generate all adjectives in the same place and move them to the appropriate points in the tree.)

(67) a. $[_{NP}$ _____$_{\varphi}$ $[_{N'}$ _____$_{\psi}$ N] _____$_{\varphi}$]

b.



What does distinguish φ adjectives from ψ adjectives, the distinction called "temporary" and "permanent" above? Bolinger refers to the former, the ones that come after the noun (and before the noun but farther than the other sort), as having an "accidental" or an "occasional" meaning, and the latter as having an "essential" or "characteristic" meaning. In terms that postdate Bolinger, these can perhaps be seen as stage-level and individual-level, respectively. Larson takes a different view: φ-adjectives are those that contain an event, e.g. *the children sick* contains an event *e* at which the children are sick, *the rivers navigable* contains an event *e* at which the rivers are navigable, and so forth. For Larson, the dotted line in the tree in (67) is the point at which the events are bound by a generic operator.

The exact details will not be crucial to the theories presented in this paper. What is relevant is that a distinction exists between pre- and postnominal modification—relevant because one but not the other will turn a non-lexical CQ noun into a coerced CQ.

(68) a. * Sam wanted to know the responsible person.
b. Sam wanted to know the person responsible.

Following the scenario above, (68a) cannot be used to mean "Sam wanted to know who the responsible person was (and it was Kim)." However, (68b) can and does mean that "Sam wanted to know who the person responsible was (and it was Sandy)." Postnominal modification with an adjective is one way to turn a non-functional noun into a CQ.

5.2.2 Other methods

Postnominal adjectives are not the only way to coerce non-functional nouns into CQs. Relative clauses can as well. Note that in (69), the relative clause adds much the same meaning as a bare

adjective: *person who is responsible* is the intersection of the set denoted by *person* and the set denoted by *responsible*. Adding *always so* disambiguates the adjective so that it has only a individual-level meaning and not the stage-level meaning of *person responsible*, suggesting that the postnominal adjective and the relative clause are different constructions.

(69) Sam wanted to know the person who's (always so) responsible.

Prepositional phrases, though they also appear postnominally, do not turn NPs into coerced CQs.

(70) * Sam wanted to know the responsible person in the department.

As always, the comparable sentence with a full clausal question, *Sam wanted to know who the responsible person in the department is*, is syntactically and semantically well-formed.

As we saw in the previous subsection, prenominal adjectives do not transform nouns in this manner. Superlatives appearing prenominally, however, do:

(71) Sam wanted to know the most responsible person.

To compare superlatives to simple prenominal individual-level predicates, consider the following contrast.

(72) I saw your students heading into class the other day—the fifteen five-foot-two students and the one who's six-foot-six.
   a. * I need to know the tall person in your class.
   b. I need to know the tallest person in your class.

While (72a) has the irrelevant reading of my needing to become acquainted with the six-foot-six student in your class, it has no CQ meaning (again, regardless of the context helping establish a unique tall person). With the superlative in (72b), the CQ meaning is possible.

5.2.3 Determiners other than the

The above discussion has concentrated on details about the noun phrase, and in each case the CQ had the form *the NP*. In this section, we will see that the choice of determiner does not affect a DP's ability to be a CQ.

CQs are often most natural with the definite determiner *the*. In some cases *the* is practically obligatory. Superlatives and functional nouns sound odd with other determiners regardless of whether they appear as individual-denoting DPs or CQs, because the use of a superlative presupposes uniqueness, as do many functional nouns: *#every/no/many/at least three/both tallest student(s), #every/no/many/at least three/both outcome(s) of the trial*.

Not all functional nouns have this restriction, and for those that do not, and for coerced CQs, these other determiners are possible.

(73) a. John told me every/no/at least three/both phone number(s) of Bill's.
b. John told me every/no/at least three/both student(s) responsible.

The determiners contribute to the meaning of the CQ only their usual quantifier meanings. Combined with the rest of this section, this fact suggests that the determiner plays no role in whether a given DP can be a CQ; only the NP does.

5.3 Summary: the form and meaning of a CQ

In this section we have observed more generalizations than explanations. I very much leave open the question of *why* some DPs and not others can serve as CQs, both in terms of which nouns are lexical CQs (why functional nouns?) and which modifications turn a DP into a coerced CQ (why postnominal adjectives, relative clauses, and superlatives?). Among the possibilities for the latter raised by the observations in this section:

- A DP can be a coerced CQ if the NP contains stage-level modification
  (Superlatives are, in a way, stage-level: being the "tallest" depends on the particular circumstances of e.g. who else is around, rather than being an inherent property.)

- A DP can be a coerced CQ if the NP contains an event
  (Superlatives can be seen as containing events, depending on the murky details of events.)

- A DP can be a coerced CQ if the NP does not "denote a single property" by means of containing a nominalized modifier
  (Following Dayal (1995), who finds a similar distinction in NPs with non-negative, non-modal *any*; prenominal adjectives are predicate modifiers and thus do not nominalize, making nouns with prenominal adjectives equivalent to unmodified nouns.[23])

Of course, how these relate modified nouns that act as CQs to functional nouns, or whether they should, remains mysterious.

For the sake of determining which predicates can take CQs as complements, it is not crucial which of these explanations, if any, is correct. The relevant facts from this section are that CQs have the meanings of identity questions based on the meaning of the noun phrase, and

[23] Some illustrative sentences:

(i) a. John punished any person responsible.
b. # John punished any responsible person.

Postnominal modification by a relative clause also makes an NP acceptable with *any*:

(2) John talked to any politician who is powerful. (=Dayal's 33b)

Dayal's ultimate conclusion is necessarily different from the one drawn in this paper—her theory involves the possibility of emptiness of the referent of the NP, which is well-suited to the particular effect of *any* but not to CQs, which commonly occur with *the* and thus have no possibility of an empty set denoted by the NP. (For similar reasons, NPs modified by superlatives, which work as CQs, cannot work with *any*: #*John talked to any most powerful politician at the party.*) Nevertheless, the similarity is noteworthy.

that something about the noun phrase, independent of the determiner, specifies whether a DP can act as a CQ. With this in mind, we can consider how to interpret CQs.

6. Quantificational Variability Effects and Concealed Questions

Section 2.2 noted the correlation between predicates that show QVE and those that take concealed questions. In this section, we will see that, working from Lahiri's theory of IR, we can develop a theory of CQ interpretation such that this correlation is also not accidental.

6.1 Interpreting CQs: shifting and quantifier raising

Lahiri's theory of Interrogative Raising was formed on analogy with Quantifier Raising, which raises DPs to resolve type mismatches. We can turn this theory back around and use QR to resolve the type mismatch between CQs and the predicates that take them.

QR gives a sentence like (74) the meaning seen below it.[24] The quantifier *every* expresses a relationship between the set denoted by its complement, the NP *person responsible*, and the set denoted by the sentence after the DP has been extracted, λx . *Sam likes x*. (There is also a contextual variable C which limits the domain of individuals to only the ones relevant to the context.)

(74) Sam likes every person responsible.
every$_x$ [[[*person responsible*]](x) $\wedge$ C(x)][Sam likes x]

In (75a), based on Lahiri's idea of IR, we would want a similar meaning: the determiner *every* relates two sets, but instead of sets of individuals they are sets of propositions. One set of propositions is the NP part of the concealed question, *person responsible*, which therefore needs to shift into a question meaning. The other set is, as in (74), the set denoted by the sentence after the DP has been extracted; instead of the DP leaving a trace that denotes an individual, i.e. a trace of type *e*, so that λ-abstraction over the trace gives a set of individuals, the DP leaves a trace that denotes a proposition, i.e. a trace of type $\langle s, t \rangle$, so that λ-abstraction over the trace gives a set of propositions. Specifically, *every* will relate the set of propositions that (a) assert that x is a person responsible (for some x) and (b) fit some contextual variable, and the set of propositions that Sam knows.

(75) a. Sam knows every person responsible.
every$_p$ [($\exists x_e$. $p = \lambda w_s$. [[*person responsible*]](w)(x)) $\wedge$ C(p)][Sam knows that p]

b. Sam knows the person responsible.
the$_p$ [($\exists x_e$. $p = \lambda w_s$. [[*person responsible*]](w)(x)) $\wedge$ C(p)][Sam knows that p]

Extending this to (75b), with a CQ with *the* as the determiner, requires taking *the* to be a quantifier that relates two sets rather than an operator that returns the unique individual from a

[24] I will use [[*person responsible*]] rather than spelling out the meaning of the noun phrase, to avoid the distraction of the details discussed in the previous section concerning the stage-level nature of the predicate.

set, but this is not a difficult move to make. The sense that *the* in (75b) identifies a unique individual (namely, the unique person responsible) comes from the fact that it identifies a unique proposition *p* such that *p* is a true proposition that *x* is a person responsible. Since the proposition *p* is unique, there is only one true proposition that *x* is a person responsible, and thus there is only one *x* of whom the predicate *person responsible* holds: that is, there is a unique individual who is the person responsible.

As the QR mechanism exists independently in the grammar, using it to interpret CQs requires only mechanisms that derive the correct semantic types for the NP and the determiner. In particular, the NP in a CQ must shift from $\langle e, t\rangle$, a set of individuals, to $\langle st, t\rangle$, a set of propositions, and the determiner, generally treated as having type $\langle et, \langle et, t\rangle\rangle$, a relation between two sets of individuals, must instead have type $\langle\langle st, t\rangle, \langle\langle st, t\rangle, t\rangle\rangle$, a relation between two sets of propositions.

Neither mechanism is complicated.[25] A shifter for the former appears in (76); its relation to the sentences in (75) is fairly clear. It turns an expression denoting a property into the set of propositions that assert that some individual has that property.

(76) $\langle e, t\rangle \rightarrow \langle st, t\rangle$
$\lambda P_{\langle e, t\rangle} . \lambda p_{\langle s, t\rangle} . [\exists x_e . p = \lambda w_s . P(w)(x)]$

If this is the only typeshifter available, CQs will necessarily have identity question meanings, as it will not be possible to work any more information into the proposition beyond the one present in the shifter, i.e. that the property denoted by the NP holds of some individual. The unavailable question meanings discussed in Section 5.1 are unavailable because the extra semantic information (e.g. *z is the location of x* or *z is a puppy*) is not part of the meaning of the NP and thus cannot be incorporated into the meaning of the question.

Determiners will not be able to shift type, because quantification over individuals is written into the typical meaning of a determiner. A few such meanings appear in (77).

(77) $[\![every]\!] = \lambda P_{\langle e, t\rangle} . \lambda Q_{\langle e, t\rangle} . \forall x_e [(P(x) \wedge C(x)) \rightarrow Q(x)]$
$[\![some]\!] = \lambda P_{\langle e, t\rangle} . \lambda Q_{\langle e, t\rangle} . \exists x_e [(P(x) \wedge C(x)) \wedge Q(x)]$
$[\![the]\!] = \lambda P_{\langle e, t\rangle} . \lambda Q_{\langle e, t\rangle} . \exists x_e [[\forall y_e [(P(y) \wedge C(y)) \leftrightarrow y{=}x]] \wedge Q(x)]$[26]

Instead, as has been argued for other operators (e.g. *and* in Partee and Rooth (19xx)), determiners need to be treated as neutral with respect to type. The lexical entries for the determiners in (77) instead look like the templates in (78), where σ is a semantic type such as e, in which case the determiners are identical to those in (77), or $\langle s, t\rangle$, in which case the determiners give concealed questions. In other words, determiners express relations between two sets, which may be sets of individuals, sets of propositions, or any other sets.[27]

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[25] Indeed, if a proposition is a kind of individual, of type *e* instead of type $\langle s, t\rangle$, then the NP and Det need not shift at all.

[26] Or, of course, your favorite meaning for the definite determiner—as long as *the* is a generalized quantifier, not an operator that returns an individual.

[27] For instance, Irene Heim (p.c.) suggests that adverbs such as *always* may be related to determiners, expressing relations between sets of situations. Certainly the adverb *mostly* in QVE sentences seems to serve the same set-comparison function that the determiner *most* does.

(78) $[\![\textit{every}]\!] = \lambda P_{\langle \sigma, t \rangle} . \lambda Q_{\langle \sigma, t \rangle} . \forall x_{\sigma} [(P(x) \wedge C(x)) \rightarrow Q(x)]$
$[\![\textit{some}]\!] = \lambda P_{\langle \sigma, t \rangle} . \lambda Q_{\langle \sigma, t \rangle} . \exists x_{\sigma} [(P(x) \wedge C(x)) \wedge Q(x)]$
$[\![\textit{the}]\!] = \lambda P_{\langle \sigma, t \rangle} . \lambda Q_{\langle \sigma, t \rangle} . \exists x_{\sigma} [[\forall y_{\sigma} [(P(y) \wedge C(y)) \leftrightarrow y{=}x]] \wedge Q(x)]$

Note that the Lahiri's contextual variable C is already part of the meaning of determiners and does not need to be part of the operation that shifts the NP.

A direct consequence of this theory is that, because concealed questions are interpreted in the same way as interrogatives that raise, they will have the same distribution. That is to say, there is in fact a direct correlation between the ability to take CQs, the ability to exhibit QVE, and the ability to take a propositional complement. Additionally, interpreting CQs via QR encodes the conclusion of the previous section, that the possibility of a DP acting as a CQ depends entirely upon the NP. The theory presented here does not answer the question of why the typeshifter in (76) can apply only to certain NPs—those that contain events, or those that do not denote a single property, or the like—but it does suggest an explanation of how it happens, namely that the typeshifter is restricted in its domain to certain NPs. A theory in which the entire DP shifts in meaning (or in which the predicate shifts to take an object with DP meaning) will not be able to restrict the shifting based on the form of the NP.

6.2 Cleaning up the details

A few loose ends remain. One is the interaction between QVE and CQs; the others are the counterexamples *be certain* and *ask*.

6.2.1 Simultaneous QVE and CQ

The last section explained the correlation between predicates that exhibit QVE and predicates that can take CQs as objects. However, the methods for interpretation conflict: with QVE, the adverb (or an implicit adverb) expresses the relation between the question complement and the rest of the sentence; with a CQ, the determiner expresses that relation. What happens when a verb has both a concealed question complement and a quantificational adverb?

It turns out that such sentences are ungrammatical.

(79) *John mostly knows every/no person responsible.

If such sentences had an interpretation—for instance, if *John mostly knows no person responsible* could mean "John knows who one or two of the people responsible are, but for the most part he doesn't know who they are"—the theory presented in this paper would have trouble explaining them. Fortunately, these sentences do not.

It is possible to use a quantificational adverb with a concealed question, but only when the CQ is a plural noun.

(80) John mostly knows the people responsible.

In such cases, the adverb is not, properly speaking, quantifying over answers to questions at all. Instead, *the* expresses the quantificational relation—in particular, that there is a single answer to the question *who are the people responsible?*, which is a plural entity—and *mostly* quantifies

over that plural entity. The details are the concern of theories of plurality, not theories of concealed questions or QVE with questions.

6.2.2 Counterexample one: be certain

Recall from Section 2.2 that the set of predicates that take CQs is the same as the set of predicates that show QVE, with two apparent exceptions. First, let us examine Dor's (1992) assertion that *be certain* and *be convinced* are non-CQ-taking predicates, based on contrasts like the one in (81).

(81) a. * John was certain the winner of the Nobel Peace Prize.
b. John was mostly certain who plays for the Red Sox. (but wasn't certain who plays first base).

The discussion of Case Theory in Section 3.2 had the welcome prediction that, as adjectives do not assign case, they will never take CQ complements. On the other hand, since prepositional phrases do not require case, a PP headed by *about* can be the complement of the adjective, though as Abney observed, *about* is not a dummy preposition inserted for mere Case reasons without semantic contribution. The example given in the Case Theory discussion above is the sentence *John asked about the time*, which can mean that John asked not for the name of a time but for information about a time.

In light of the discussion about the meaning of a CQ, this observation can be recast. In the sentence *John asked about the time*, John's question is not necessarily the identity question *What is the time?* but may be a more complicated question such as *Why is the time of the meeting 10:00 and not noon?*. The prepositional phrase *about DP*, when embedded under a question-taking verb like *ask*, may denote a question, but it is not in fact a CQ (since CQs must be identity questions), nor does the DP itself denote a question. This same fact can be seen with a variety of question-taking predicates: *Mary knows about the time* may mean that Mary knows the answer to the question *Why is the time of the meeting 10:00 and not noon?* and need not be an identity question. And, of course, the same is true of *about DP* as the complement to an adjective like *certain* or *convinced*: the preposition is not a mere case marker and the complement is not a CQ.

However, while it is true that *about* is not a dummy preposition, it is not the case that no such preposition exists. In particular, consider *of*, which is often used as a mere Case marker (for instance, in nominalization and certain gerunds: *Caesar's destruction **of** the city*, *John's eating **of** the cake*).

(82) a. Sam is certain of the time of the meeting.
b. * Sam is certain {by/at/to/with/from...} the time of the meeting.
c. Sam is certain about the time of the meeting.

The adjective *certain* can take as its complement a prepositional phrase headed by *of*. Other than *about DP*, which can denote a question due to the semantic contribution of *about*, no other preposition can head the PP complement. Does *of* make any semantic contribution in (82a)? In fact, it does not. The sentence in (82c) can be used to express the fact that Sam is certain that the time of the meeting is before noon, or that it's too late in the day for her to attend, or many other facts about the time. In contrast, (82a) cannot mean that Sam is certain of any fact about the time

of the meeting *except for its identity*. In other words, when it is the complement of *certain*, *of DP* has exactly the meaning of a CQ, which suggests that the DP is a CQ and the preposition is exactly what *about* cannot be: a semantically empty preposition inserted for Case requirements.

The same facts hold for other adjectives that take questions as complements and for other phrases such as *have an idea* that do not assign Case directly, as well as certain verbs (though verbs may select for particular prepositions).

(83) a. Sam is aware of the time of the meeting.
b. Sam has an idea of the time of the meeting.
c. Sam and Jesse agreed on the time of the meeting.

All of these would be grammatical with *about* (in which case the DP would not be not a CQ), would not be grammatical with any other preposition, and have only an identity-question denotation for the DP.

In summary, Dor was too quick to categorize predicates of opinion as not taking CQs. In fact, they do take CQ complements, and as they also exhibit QVE, they are not a counterexample to the CQ~QVE correlation.[28]

6.2.3 Counterexample two: ask

[28] This is as good a point as any to mention the verb *inform*, which is on Karttunen's list of question-embedding predicates. *Inform* is undeniably bad with concealed questions.

(i) *Kim informed Sandy the time of the meeting.

However, *inform* does take propositions (*Kim informed Sandy that she was leaving*), and therefore seems to be another counterexample.

My first instinct, upon realizing this, was that *inform* did not belong on Karttunen's list at all—that it does not embed questions. The judgment of every English speaker I asked about (ii) corresponded to my own.

(ii) *John informed me who left.

On the other hand, some further thought suggested that other questions were grammatical: *John informed me where the documents were* is much better than (ii), though a similar sentence with a concealed question, **John informed me the location of the documents*, is still bad.

What's going on here? As a hypothesis, *inform* may have an odd selectional restriction that it cannot embed *who*- or *what*-questions; *John informed me what the location of the documents was* sounds quite odd to me, much more so than the truth-conditional equivalent with *where*. Since all concealed questions are *who*- or *what*-questions, *inform*'s inability to embed CQs could well result from its inability to embed questions with CQ meanings.

The reason I mention this here is that *inform* differs from most other predicates (and its cousin *told* in particular) in that sentences with *inform* often improve when the complement is *of Q* instead of just a question, and this is true with both full phrasal questions and, interestingly, concealed questions.

(iii) a. John informed me of who left.
b. John informed me of the time of the meeting.

(A particularly natural use of this construction is in imperatives such as *Keep me informed of who leaves*; cf. **Keep me informed who leaves.*) The entire question of *inform* remains mysterious to me, but it seems plausible that, as with adjectives, there is some restriction, perhaps a Case restriction, that *of* can fix.

The remaining counterexample to the correlations of Section 2 is *ask*, the thorn in the side of semantic theories of CQs.

Sentences with *ask + CQ* are among the most cited uses of concealed questions.

(84) Sam asked the time of the meeting.

Indeed, many explanations of the distribution of CQs have focused in particular on the difference between *ask*, which takes CQs, and *wonder*, which does not (e.g. Dor 1992, as discussed above). With *ask*, unlike with *be certain*, Case cannot be of any help; *ask* is not excluded from taking propositions because of Case requirements, insofar as it can take question-CPs as complements but not proposition-CPs. And because the theory just discussed postulates a direct connection between a predicate's ability to take propositions and the grammar's ability to interpret a CQ complement of the predicate, *ask* is more problematic than ever. A QR approach with the NP shifted to a question meaning cannot interpret *ask + CQ*, because *ask* cannot compose with a $\langle s, t \rangle$ trace. So how can *ask* take CQs?

The short answer to this question is that *ask*, contrary to appearances, cannot take CQs. More properly, *ask* does not take as its complement the full range of CQs discussed in the previous section. To elucidate, consider (85).

(85) a. * Sam asked the person responsible.
b. * Sam asked the city I visited last month.
c. * Sam asked the tallest person in my class.

The difference between the sentence in (84) and those in (85) is the kind of CQ that appears in each. The latter sentences contain a coerced CQ, of the sort discussed in subsections 5.2.1 and 5.2.2. The former, on the other hand, contains a lexical CQ.

This brings us back to the difference between the two kinds of noun. One conceivable difference between the two is that functional nouns such as *time*, *height*, *age*, *color*, and so on denote sets not of individuals but of *individual concepts* of semantic type $\langle s, e \rangle$. More precisely, because they are "functional" nouns, such nouns are functions from individuals to sets of individual concepts, i.e. predicates of type $\langle e, \langle se, t \rangle \rangle$. The first argument is what the noun is "of" (and is typically expressed with an *of* PP or a possessive): *time of the meeting*, *Bill's height*, and so on.

We still do not want the DP to denote a question, lest we find ourselves once again unable to distinguish *ask* from *wonder*—predicates like the latter cannot take even lexical CQs. The mechanism must be built into *ask* but not into *wonder*, but not in such a way that *ask* can combine with coerced CQs. The difference in type provides a way for *ask* to distinguish between the CQs it can take and those it can't simply by giving *ask* the type $\langle se, et \rangle$ in addition to $\langle \langle st, t \rangle, et \rangle$. The two meanings appear in (86).[29]

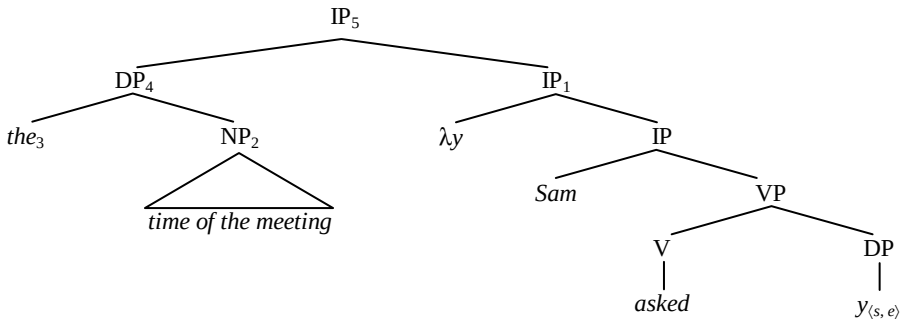
[29] This may be an ambiguity which is a quirk about *ask*. Alternately, the ambiguity may be avoided with a type-shifting operation that turns (86a) into (86b), but this does not avoid the need for *ask* to be treated specially, as the shifter cannot apply to *wonder*, *inquire*, *investigate*, and so forth.

(86) a. $[\![ask]\!]^w = \lambda q_{\langle st,\, t\rangle} . \lambda x_e . [x \text{ asks the question } q \text{ in } w]$

b. $[\![ask]\!]^w = \lambda y_{\langle s,\, e\rangle} . \lambda x_e . [x \text{ asks the question } \lambda p_{\langle s,\, t\rangle} [\exists z_e . p = \lambda w' . [z = y(w')]] \text{ in } w]$

Using the latter meaning, the sentence in (84) receives the following interpretation via QR.

(87)



$[\![1]\!]^w = \lambda y_{\langle s,\, e\rangle} .$ Sam asked the question $\lambda p_{\langle s,\, t\rangle} [\exists z_e . p = \lambda w' . [z = y(w')]]$ in w

$[\![2]\!]^w = \lambda y_{\langle s,\, e\rangle} . y(w)$ is a time at which the meeting occurred

$[\![3]\!]^w = \lambda P_{\langle se,\, t\rangle} . \lambda Q_{\langle se,\, t\rangle} . \exists x_{\langle s,\, e\rangle} [[\forall y_{\langle s,\, e\rangle} [(P(y) \wedge C(y)) \leftrightarrow y{=}x]] \wedge Q(x)]$

$[\![4]\!]^w = [\![3]\!]([\![2]\!]) = \lambda Q_{\langle se,\, t\rangle} . \exists x_{\langle s,\, e\rangle} [[\forall y_{\langle s,\, e\rangle} [(y(w)$ is a time at which the meeting occurred $\wedge C(y)) \leftrightarrow y{=}x]] \wedge Q(x)]$

$[\![5]\!]^w = [\![4]\!]([\![1]\!]) =$

$\exists x_{\langle s,\, e\rangle} [[\forall y_{\langle s,\, e\rangle} [(y(w)$ is a time at which the meeting occurred $\wedge C(y)) \leftrightarrow y{=}x]]$
$\wedge$ Sam asked the question $\lambda p_{\langle s,\, t\rangle} [\exists z_e . p = \lambda w' . [z = x(w')]]$ in $w]$

In other words, there is one individual concept which is the time of the meeting, and Sam asked for its identity.

A different determiner will give a similarly quantified meaning. With *every*, for example, the sentence would express the proposition that for every individual concept which is the time of the meeting, Sam asked for its identity. Pragmatically, of course, this is infelicitous with times, but with a different noun *every* is felicitous and the quantifier meaning correct. That is, a quantifier in the DP complement of *ask* is quantifying over questions (though indirectly; it does so by quantifying over individual concepts that serve as a basis for the question in the meaning of *ask*). Confirming this fact is the contrast in (88). With *every color of the rainbow*, there is only a single question being asked (i.e. the question *What is a color of the rainbow?*), whereas *every phone number* is a number of different questions (namely *What is the phone number of <individual>* for a number of different contextually-restricted individuals—students, for instance, or bookstores).

(88) a. * Sam asked every color of the rainbow.

b. Sam asked every phone number.

In contrast, *Sam knew every color of the rainbow*, where there is a single question (*What is a color of the rainbow?*) with multiple answers, is felicitous, because with *know* answers and not questions are being quantified.

7. Conclusions

This paper presented a descriptive correlation among three facts about predicates—taking concealed question complements, taking propositional complements, and exhibiting quantificational variability effects with adverbs—and demonstrated that, with the correct semantic types and interpretation mechanisms, the correlation follows from the structure of the grammar.

Using Quantifier Raising coupled with appropriate typeshifting operations does not require predicates to be marked as DP-taking predicates or as non-DP-taking predicates. Instead, a predicate's ability to take a CQ follows directly from the semantic type of the predicate, which any compositional theory of semantics will need to lexically specify for each predicate. Autonomy Theory requires both c-selection and s-selection, two independent processes, to categorize the syntactic and semantic distribution of complements. Case Theory requires Case marking and s-selection, also two independent processes. The theories presented here, however, correlate the syntactic distribution of CQs with the semantic facts about the complements of predicates, leaving only a single set of predicates, those like *believe*, still requiring any form of c-selection.

(89) a. Autonomy Theory

believe	[___ CP][30]	< ___ P> ≡ ⟨*st*, *et*⟩
know	[___ CP, DP]	< ___ P, Q> ≡ ⟨*st*, *et*⟩, ⟨⟨*st*, *t*⟩, *et*⟩
wonder	[___ CP]	< ___ Q> ≡ ⟨⟨*st*, *t*⟩, *et*⟩
ask	[___ CP, DP]	< ___ Q> ≡ ⟨⟨*st*, *t*⟩, *et*⟩
care	[___ CP]	< ___ P, Q> ≡ ⟨*st*, *et*⟩, ⟨⟨*st*, *t*⟩, *et*⟩

b. Case Theory

believe	[∅-case]	< ___ P> ≡ ⟨*st*, *et*⟩
know		< ___ P, Q> ≡ ⟨*st*, *et*⟩, ⟨⟨*st*, *t*⟩, *et*⟩
wonder	[∅-case]	< ___ Q> ≡ ⟨⟨*st*, *t*⟩, *et*⟩
ask		< ___ Q> ≡ ⟨⟨*st*, *t*⟩, *et*⟩
care	[∅-case]	< ___ P, Q> ≡ ⟨*st*, *et*⟩, ⟨⟨*st*, *t*⟩, *et*⟩

c. Interrogative Raising + Quantifier Raising

believe	⟨*st*, *et*⟩	(plus a c-selectional restriction against Qs)
know	⟨*st*, *et*⟩	
wonder	⟨⟨*st*, *t*⟩, *et*⟩	
ask	⟨⟨*st*, *t*⟩, *et*⟩, ⟨*se*, *et*⟩	
care	⟨*st*, *et*⟩, ⟨⟨*st*, *t*⟩, *et*⟩	

Predicates must have lexical entries that include a semantic type which, for each predicate, specifies what semantic expressions it can combine with (making semantic type an expression of

[30] *Believe* can take DP objects: *I believe this theory*. But even *wonder* can take certain kinds of DPs: *I've always wondered that, myself.* The relevant fact here is that *believe* cannot take a "concealed proposition"—*I believe John is intelligent* vs. **I believe John's intelligence*.

Grimshaw's s-selection). Using IR and QR to interpret questions and concealed questions eliminates the need to specify what syntactic expressions a predicate can combine with.

7.1 Unanswered questions and future directions

A number of questions set aside over the course of this paper remain open for further investigation. One is the interpretation of CQs in subject position and whether they correlate in any way with propositions or quantificational adverbs (if, indeed, quantificational adverbs can quantify over questions in subject position). Another is the exact feature which allows some NPs but not others to become CQs—an event, a variable over stages of a stage-level predicates, some sort of nominalization—as well as how that requirement interacts with the typeshifter from $\langle e, t \rangle$ to $\langle st, t \rangle$.

Additionally, nothing has been said in this paper about concealed questions across languages, not because there is too little to say about cross-linguistic facts but because there is too much to fit neatly into the scope of this paper. For instance, Svetlana Godjevac (p.c.) observed that Serbo-Croatian has only a subset of the lexical CQs in English, and no coerced CQs at all. Some nouns (e.g. *time*, *location*, *color*, *height*, *size*, *age*) can be CQs, but not *winner (of the prize)*, *capital (of France)*, or *chair (of the department)*. It's not difficult to hypothesize what might account for these facts. The distinction between nouns like *time* and nouns like *winner* may center around the former being inherent properties of things (every event has a time, every object has spacial coordinates and dimensions as well as a color, and so forth) and the latter being more like actual functions. Godjevac suggested that the lack of coerced CQs might relate to the lack of overt articles in Serbo-Croatian. But both of these hypotheses are only rough sketches of theories that require more investigation and detail.

Romero (2003) relates concealed questions to subjects of specificational copular sentences. Based on data presented in Caponigro and Heller (2003), Romero[31] postulated a typology of which languages have specificational subjects with a copular (*The number of planets is nine*) and which languages have concealed questions. On a rough first pass, the typology ran as follows.

(90)

Language	**Spec. Subj + *be*?**	***know* + CQ?**
Spanish, Catalan	✓	✓
Hebrew, Wolof, Hungarian	✓	✓NPs, *Free Relatives
English	✓	✓some NPs, *other NPs
Macedonian	✓	*
[Greek?]	*	*

The correlation, if any, between concealed questions and specificational subjects of copulars is certainly worth exploring, but this typology also serves as a starting point to explore the presence of, and restrictions on, concealed questions in languages other than English. The theory presented in this paper predicts a cross-linguistic correlation, all other things being equal, between allowing CQs (at least, CQs that are not individual concepts) and allowing quantifier raising. Exploring this prediction is a logical next step. I have confidence that further exploration of these topics will help refine the theory presented in this paper.

[31] In her commentary on the talk (Workshop on Direct Compositionality, Brown University, 2003).

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