

The *de re* Analysis of Concealed Questions

A Unified Approach to Definite and Indefinite Concealed Questions

Ilaria Frana

University of Massachusetts Amherst

1. Introduction

The underlined DPs in (1) are known in the literature (Baker 1968, Grimshaw 1979, Heim 1979, Romero 2005) as ‘concealed questions’ (CQs) because they can intuitively be paraphrased as the corresponding embedded questions in (2):¹

- (1) a. Meg has forgotten the capital of Italy.
b. Kim knows the governor of California.
c. They revealed the winner of the contest.
- (2) a. Meg has forgotten what the capital of Italy is.
b. Kim knows who the governor of California is.
c. They revealed who the winner of the contest was.

All the sentences in (1) are ambiguous between a CQ-reading (exemplified in 2a-c) and a reading in which the underlined DPs are not CQs. For example, (1a) can also mean that Meg has lost her personal memories of Rome; similarly, (1b) can mean that Kim is personally acquainted with Arnold Schwarzenegger. Perhaps a little less frequently, (1c) can mean that somebody has discovered the winner of the contest by physically removing whatever was covering him. The readings in which the DPs are not treated as CQs are not of interest in this paper.

In (2), I paraphrased the underlined DPs in (1) with embedded questions. Is this just a useful way to capture their meaning intuitively, or should we say that, although they surface as DPs, they are actually questions at some level of representation? If not, how can we account for their apparent question-meanings? In this paper, I provide arguments against the idea that DP-CQs denote questions. Instead, I propose an analysis that treats these DPs as denoting properties and I argue that their apparent question meaning is derived by independently-motivated semantic selection properties of the embedding predicates.

The paper is structured as follows. Section 2 reviews the hypothesis that CQs are indeed questions at some level of representation (the question-in-disguise

I would like to thank the members of my General Papers committee, Angelika Kratzer, Christopher Potts and Rajesh Bhatt, my friends and colleagues Jan Anderssen, Paula Menendez-Benito, Shai Cohen, Meredith Landman, Florian Schwarz and Anne-Michelle Tessier. I am also thankful to Irene Heim, Lance Nathan, Maribel Romero and to the audiences of UMass Semantics Reading Group, SALT 16 and WCCFL 25.

¹Examples in (1) and (2) are from Heim (1979).

approach) as argued for by Baker (1968) and Grimshaw (1979). Section 3 presents three arguments against the idea that CQs denote questions and discusses new data on indefinite CQs. Section 4 reviews Heim and Romero's individual concept approach as an alternative to the question-in-disguise approach, and argues that this account is not fully satisfactory either. Section 5 introduces a new analysis of CQs that I will call the *de re* analysis of CQs. Finally, Sections 6 and 7 discuss further issues and implementations of the *de re* analysis of CQs.

2. The Question-in-Disguise Approach

Baker (1968) argued that the underlined DPs in (1) are generated as questions and that the unpronounced material is deleted by some process of ellipsis, as shown in (3) below:

- (3) Kim knows [_{CP} ~~who~~ the governor of California is]

Baker's proposal can easily account for the question meanings exhibited by the underlined DPs in (1) under the assumption that the interpretation process applies to structures like (3) before the ellipsis takes place.

In saying that CQs are covert questions, this theory provides an interesting generalization regarding their distribution: CQs will only occur with predicates that select for *wh*-questions (Baker 1968). This generalization can explain the contrast between predicates like *know*, *forget* and *reveal* in (1a-c), which syntactically embed *wh*-questions and allow for CQ readings of their DP complements, and predicates like *believe*, *think* and *deny* which do neither, as shown in (4 a-c).

- (4) a. *Meg believed the capital of Italy.
 a'. *Meg believed what the capital of Italy is.
 b. *Kim thought the governor of California.
 b'. *Kim thought who the governor of California was.
 c. *John denied the winner of contest.
 c'. *John denied who the winner of the contest was.

Baker's approach has thus at least two advantages: it can easily account for the question meanings exhibited by DP-CQs, and it also makes an important prediction regarding their restricted distribution.

Grimshaw (1979) showed that CQs are not allowed with just any predicate that takes *wh*-questions. The following examples are from Grimshaw (1979: 302):

- (5) a. *I wonder the answer he gave.
 a'. I wonder what answer he gave.
 b. *John inquired the number of students in the class.
 b'. John inquired what the number of students in the class was
 c. *I don't care the height the plants grow to.

c'. I don't care what height the plants grow to.

In order to account for the facts in (5), Grimshaw proposed to distinguish between syntactic subcategorization and semantic selection features of the embedding verb. She argues, contra Baker, that CQs are syntactically DPs that are only semantically interpreted as questions (via a translation rule – Grimshaw's CQ Rule). From this, Grimshaw derives that only verbs that syntactically subcategorize for DPs and semantically select questions can embed CQs. The table in (6) illustrates the lexical entries of three classes of verbs in Grimshaw's system. As the table shows, only verbs of the *know*-class, which syntactically subcategorize for DPs and semantically select questions, can embed CQs. Verbs in the *believe*-class fail to embed CQs since they semantically do not select for question-type meanings, while verbs in the *wonder*-class fail to embed CQs because they don't subcategorize for DP arguments.²

(6)	<i>Syntactic subcategorization</i>	<i>Semantic selection</i>
Know	[DP,CP]	<Q,P>
Believe	[DP,CP]	<P>
Wonder	[CP]	<Q>

In this section, we saw two ways to implement what we can call the question-in-disguise approach. Grimshaw (1979) and Baker (1968) propose that at some level of linguistic representation DPs with CQ readings are treated as questions, either syntactically and semantically (Baker) or just semantically (Grimshaw). In the next sections, I present three arguments against this way of analyzing CQs.

3. Why Concealed Questions Do Not Denote Questions

3.1. Why Only Identity Questions?

Nathan (2006) shows that CQs can only have the identity-question meanings *who X is* or *what X is*. Other questions, such as *where X is* or *when X is*, are not possible meanings for a CQ, even when they are made salient by the context. Consider, for instance, the following examples, from Nathan (2006: 6):

- (7)
- a. Leslie needed directions, so I told her where the capital of Vermont is.
 - b. #Leslie needed directions, so I told her the capital of Vermont.
 - c. Leslie was studying for a geography quiz, so I told her the capital of Vermont.
- (8)
- a. Alex wants to be on time, so I told him when the class he should attend is.
 - b. #Alex wants to be on time, so I told him the class he should attend.

²In the table, 'P' stands for the semantic type of propositions and 'Q' stands for the semantic type of questions

- c. Alex wants to learn semantics, so I told him the class he should attend.

This pattern is difficult to explain under the question-in-disguise approach. Under this approach, nothing seems to prevent (7b) from having an underlying representation like (9):

- (9) Leslie needed directions, so I told her [~~where~~ the capital of Vermont ~~is~~]

A possible way to explain these facts is to say that Grimshaw's CQ-Rule translates DP-CQs only as identity questions.³ In the following sections, we will see that even if we allow this possibility, the question-in-disguise approach will have to be rejected because CQs do not always have the same truth-conditions as the corresponding embedded identity-questions.

3.2. Greenberg's Contrast

Heim (1979) reports a discussion from B. Greenberg (1977) about the contrast between the CQ sentence (10a) and its identity-question paraphrase in (10b).

- (10) a. John found out the murderer of Smith.
b. John found out who the murderer of Smith was.

Following Greenberg, Heim observes that the embedded identity-question sentence in (10b) shows an ambiguity that is absent from its CQ-counterpart:

“[(10b)] cannot only be used to express that John solved the question who murdered Smith, but has a further reading which is perfectly compatible with John's being entirely ignorant about Smith's murder, and which only amounts to the claim that John found out some essential fact or other (e.g. that he was his brother) about the person referred to as “the murderer of Smith”. But this is not an available reading for [(10a)], which can only be used in the first-mentioned way.”

(Heim, 1979: 53)

The contrast in meaning between (10a) and (10b) shows that question paraphrases do not always correctly characterize the meaning of a sentence containing a CQ. This is clearly a problem for the question-in-disguise approach. Under this view, (10a) and (10b) should have identical representations at Logical Form. Therefore, their truth-conditions should not differ.

3.3. Indefinite CQs

Another serious challenge for the question-in-disguise approach is represented by indefinite descriptions with CQ readings. Some examples are provided in (11).

³Nathan (2006) explores this possibility. See Nathan (2006), pg. 17.

- (11) a. John knows a doctor that can treat your illness.
 b. Mary knows a detective in the Pioneer Valley.

Before seeing why indefinite descriptions are problematic for the question-in-disguise approach, we have to make sure that we are dealing with real CQs.

One way to argue that (11a-b) are real CQs, is to present evidence that these sentences are ambiguous in the same way (1a-c) are. Suppose the underlined DPs in (11a-c) did not have CQ-readings. If so, they should only have acquaintance readings similar, for instance, to the reading of (1b) in which Kim is personally acquainted with Arnold Schwarzenegger. However, this is not the only reading available for the sentences in (11): they also have CQ-readings. The two scenarios below serve to bring out the ambiguity for (11a).

Scenario 1 (acquaintance-know)

John is friends with Karl, who is a doctor in the Pioneer Valley specialized in migraines. I know that you have been suffering from migraines and I am telling you that John knows a doctor in the Pioneer Valley that can treat your illness.

In Scenario 1, the object DP in (11a) is not interpreted as a CQ and the sentence roughly means that John is personally acquainted with a particular doctor (Karl). Now, consider (11a) in a slightly different scenario:

Scenario 2 (CQ-embedding know)

John and I have been talking about your migraines and John told me that he has read in the Pioneer Valley medical gazette that Dr. Karl Mang has done outstanding research on the treatment of migraines.

In Scenario 2, (11a) can be paraphrased as (12):

- (12) John knows of a certain doctor (K. Mang) that he can treat your illness.

Under this reading, John doesn't need to be acquainted with Karl in the same way he was acquainted with him on the previous reading. To make this point even clearer, notice that the two readings differ with respect to certain entailments, originally used by Heim (1979) to point out the same ambiguity in definite CQs.

- (13) a. John knows a doctor that can treat your illness.
 b. Every doctor that can treat your illness is also a golf instructor.
 c. John knows a golf instructor.

The entailment in (13) goes through only under the acquaintance reading: if John is acquainted with a certain doctor that can treat your illness and that doctor happens to be a golf instructor, it follows that John is also acquainted with a golf instructor even though he might not be aware of it. Under the CQ-reading, on the other hand, if John knows that Karl is a doctor that can treat your illness and Karl

happens to be a golf instructor, we cannot infer that John knows that Karl is a golf instructor.

Further evidence for the existence of CQ-readings involving indefinite descriptions comes from languages like German and Italian that lexically distinguish two different predicates corresponding to English *know*: *wissen* and *kennen* in German; *sapere* and *conoscere* in Italian. When *wissen* and *sapere* take DP arguments, only the CQ-reading is available. This is shown for *sapere* in (14).

- (14) Giovanni **sa** il presidente del Congo. *acquaintance
 Giovanni knows the president of-the Congo.
 ‘Giovanni knows the president of Congo.’

Notice that both *sapere* and *wissen* can embed indefinite descriptions with CQ-meanings, as shown in (15) and (16) below.

- (15) *Italian “sapere”*
 a. **So** un posto dove possiamo nasconderci.
 know_(1st, SG) a place where can_(1st, PL) hide.
 ‘I know a place where we can hide.’
 b. Chi **sa** un programma per mixare e cambiare la voce?
 Who knows a program to mix and change the voice?
 ‘Who knows a program to mix and change voices?’ (Google)
- (16) *German “wissen”*
 a. Maria **weiß** ein Hotel, das noch zwei Zimmer frei hat.
 Maria knows a hotel that still two rooms free has.
 ‘Maria knows a hotel that still has two rooms available.’
 b. Ich **weiß** einen geheimen Weg.
 I know a secret path.
 ‘I know a secret path.’ (Google)

Now that we have established that indefinite descriptions can have CQ-readings, we can see why they are problematic for the question-in-disguise approach. Compare (11a) with its embedded-question counterpart (17):

- (17) John knows who is a doctor that can treat your illness.

It is clear that (11a) and (17) do not have the same truth-conditions. (17) implies that John knows the exhaustive list of doctors that can treat your illness. In contrast, in order for (11a) to be true, John simply needs to know one doctor that can treat your illness. Indefinite descriptions thus show that the readings we are trying to capture are not concealed questions in the literal sense.

4. The Individual Concept Approach

4.1. Heim (1979) and Romero (2005)

Heim (1979) explores the possibility that DPs with CQ interpretations denote individual concepts, i.e. functions of type $\langle s, e \rangle$ and that the CQ-embedding version of *know* (henceforth, $know_{CQ-DP}$) denotes a relation between an individual (the holder of the attitude) and an individual concept (the object DP-CQ).

“Intuitively, this represents the relation of knowing, as referred to in “John knows Bill’s telephone number”, as a relation between a person on one side and a certain function from points of reference into numbers on the other side. (...) Roughly characterized, this relation of knowing holds between X and Y at i iff X is at i able to identify the value Y(i) that Y yields when applied to i.”

(Heim, 1979: 56)

Consider (18) below:

(18) John knows the capital of Italy.

Under the individual concept approach (IC-approach), the DP *the capital of Italy* denotes a function from points of reference (pairs of worlds and times) into individuals that are capitals of Italy at that point of reference. (19) could be an example of such a function:

(19)
$$\left[\begin{array}{ll} [w_0, 2006] \rightarrow & \text{Rome} \\ [w_1, 2006] \rightarrow & \text{Florence} \end{array} \right. \quad \begin{array}{ll} [w_0, 1944] \rightarrow & \text{Salerno} \\ \dots & \end{array}$$

Intuitively, (18) is true at the actual world-time combination $[w_0, 2006]$ iff John is able to identify the value that the function denoted by *the capital of Italy* yields when applied to $[w_0, 2006]$. In other words, (18) is true at the point of reference $[w_0, 2006]$ iff John knows that Rome is the value of the function denoted by *the capital of Italy* at that point of reference. In (20) and (21), below, I show Romero’s implementation of Heim’s proposal:

(20) $\llbracket know_{CQNP} \rrbracket = \lambda y_{\langle s, e \rangle} \lambda x_e \lambda w. \forall w' \in \text{DOX}_x(w) [y(w') = y(w)]$

(21) $\llbracket \text{John knows the capital of Italy} \rrbracket = \lambda w. \forall w' \in \text{DOX}_j(w) [\iota x_e [\text{capital-of-Italy}(x, w')] = \iota x_e [\text{capital-of-Italy}(x, w)]]^4$

An important advantage of the IC-approach is that it does not resort to a question-type denotation for the DP-CQ. Thus, this approach does not need to explain the fact that only identity questions constitute good paraphrases for CQs and, even

⁴What the formula in (21) says is that “for all of John’s doxastic alternatives w' , the value of the relevant individual concept at w' is exactly what it is in the actual world w .” (Romero 2005: 6).

more importantly, it doesn't have to face the difficulty raised by differences in meaning between CQs and their corresponding identity questions paraphrases.

4.2. *Problems for the Individual Concept Approach*

4.2.1. *Indefinite CQs*

When considering indefinites, however, the parallel with individual concepts becomes much weaker. It is clear that (11a), for example, is compatible with a scenario in which there are several doctors that can treat your illness. All we need for (11a) to be true is that John knows one of them. Thus, the meaning of *a doctor that can treat your illness* cannot be described as having an individual concept denotation, i.e. as a function from points of reference into single individuals - since at the same point of reference there might be more than one individual that satisfies the description. One could enrich the inventory of DP-CQ denotations to include intensional properties (i.e. entities of type $\langle s \langle e, t \rangle \rangle$). Although this might represent a more suitable denotation for indefinite DPs, it's still not clear how we can predict the correct truth-conditions of (11a). If the indefinite DP in (11a) is of type $\langle s \langle e, t \rangle \rangle$, then its denotation will be a function that maps a world w into the set of individuals that are doctors that can treat your illness in w . Imagine that at the world of evaluation w_0 this set consists of Karl, Max and Sue; then (22) represents the extension of the function at w_0 :

$$(22) \quad w_0 \rightarrow \{\text{Karl, Max, Sue}\}$$

Following Heim's analysis, knowing the value of the function would amount to knowing of all the members in the set (Karl, Max and Sue) that they are the doctors that can treat your illness in w_0 . This, as we discussed before, correctly describes the meaning of the embedded question paraphrase 'John knows who is a doctor that can treat your illness', but not the meaning of (11a).⁵

4.2.2. *The Distribution of CQs*

It is also not clear how the IC-approach can account for the restricted distribution of CQs. The underlined DPs in (4a-c) and (5a-c) from Section 2 can all be analyzed as individual concepts but the examples are ungrammatical. In order to account for the ungrammaticality of (4a-c) and (5a-c), the IC-approach will presumably have to resort to some independent syntactic explanation along the lines of Grimshaw and say that (4a-c) and (5a-c) are ungrammatical because the verbs occurring in these sentences do not have arguments of the required kind.

However, notice that even when syntactic subcategorization is satisfied, a CQ-reading is not always available. This is shown in (23a-c).

⁵This is, of course, the simplest attempt to extend the IC-approach to the case of indefinites. There could be other ways to account for the indefinite cases. Romero (2005), for example, makes use of a 'mention-some' Answer operator. I will leave this point open and let the proponents of the IC-approach find the best account for the challenging case represented by indefinites.

- (23) a. I wondered about the price of the car.
 b. John inquired about the winner of the contest.
 c. Kim doesn't care about the president of the US.

The most natural reading of (23c) is that Kim doesn't care about the person referred to as 'the president of the US', rather than Kim doesn't care about the identity of the president of the US.⁶ The examples in (23) are, therefore, a problem for any account that resorts to an explanation à la Grimshaw.

In this section, I have explored the IC-approach to CQs and argued that this theory isn't completely satisfying for two reasons: first, it does not directly apply to the case of indefinite CQs, and second, it does not directly account for the restricted distribution of CQs. In the following section, I will introduce a new analysis of CQs. I will argue that CQs are *de re* belief ascriptions (in the sense of Quine 1956 and Lewis 1979) and that they only appear with factive verbs because of independently-motivated semantic selection properties of these verbs (Kratzer 1990, 2002). This proposal, I argue, has the advantage of capturing the right truth-conditions for both definite and indefinite DPs with CQ readings and at the same time, accounting for their restricted distribution.

5. The *de re* Analysis of CQs

5.1. *Factivity and the Semantics of know*

Consider a sentence in which *know* takes a propositional complement, like (24):

- (24) Jan knows that the GLSA manager is blond.

What does it mean to know the proposition that the GLSA manager is blond? One hypothesis might be that to know the proposition expressed by this sentence is the same thing as to be in a world in which that proposition is true and to believe that it is so. However, things are not this easy.⁷ Imagine a scenario in which the GLSA manager in the actual world is Matt and Matt is blond. Jan, however, mistakenly thinks that his officemate Monica, who also happens to be blond, is the GLSA manager. According to the hypothesis in which knowledge corresponds to true

⁶Maybe a better way to put it is to say that sentences (23a-c) are somewhat vague. There are many situations that you can describe by saying that I wondered about the price of the car. For example, I might have wondered whether it was a good or fair price, whether I could afford it, etc. A reading similar to the CQ meaning 'I wondered what the price of the car was' might also be available as a result of some inference process from this vague meaning. This is particularly the case with definite descriptions that denote numbers, like *the price*, *the height*, *the distance*, etc. In these cases, the CQ-meaning might become more prominent since it is harder to imagine a way in which a person can be acquainted with a number apart from wondering/knowing what that number is.

⁷The following example is not original. Similar examples have been extensively discussed in the philosophical literature since Russell (1912). See also Gettier (1963).

belief, we can conclude that (24) is true, since Jan believes a true proposition, namely that the GLSA manager - whoever that happens to be - is blond. In this scenario, however, (24) would still be false. Kratzer (1990, 2002) proposes a semantics for factive verbs that takes care of cases like these. She argues that sentences of the type in (24) have the truth-conditions in (25):

- (25) S knows p in w if and only if there is some fact s that exemplifies p in w and S believes p *de re* of s .^{8,9}

According to (25), (24) is true if and only if Jan believes that the GLSA manager is blond *de re* of an actual fact exemplifying the proposition denoted by (24). In our scenario, the actual fact exemplifying the proposition that the GLSA manager is blond is the fact that Matt is blond. But, that fact is not a fact that Jan has a *de re* belief about. (25), thus, correctly predicts (24) to be false, given Jan's beliefs.

According to Kratzer, factive verbs are special in the sense that they select for an argument that characterizes both the external (the fact of which the belief is about, i.e. the *res*) and the internal content of the attitude (the information content of the belief ascription). When *know* takes a propositional complement, the *that*-clause helps identify both the external and the internal content of the attitude:

“In knowledge ascriptions, the ‘that’-clause seems to have a double function. One is to characterize the information content of the belief ascribed. The other one is to characterize a fact that the belief ascribed is a belief of. That is, the ‘that’-clause also helps pick out the *res* of the belief. This *res* is not a proposition. It is a worldly thing, a situation.”

(Kratzer, 2002: 659)

In the next section, I show how Kratzer's analysis of factive verbs can be extended to account for CQs with minimal modifications.

5.2. The *de re* Analysis of CQs - Some Examples

In analogy with Kratzer's analysis of factive verbs that embed propositions, we can characterize (1b) as describing a *de re* belief about a particular individual of which the property *being the governor of California* holds in the actual world. The example in (1b) can thus be paraphrased as (1b'):

- (1) b. Kim knows the governor of California.
b'. Kim knows of *A. Schwarzenegger* that he is the governor of California

⁸In Kratzer's system, facts are situations. A speaker S believes p *de re* of a situation s iff the following conditions are met (from Kratzer, 2004):

- there is an acquaintance relation R that S bears to s , and only s in the actual world and
- all of S 's doxastic alternatives are part of situations where the unique situation they bear R to is one where p is true.

⁹For the definition of *fact that exemplifies a proposition*, see Kratzer (2002).

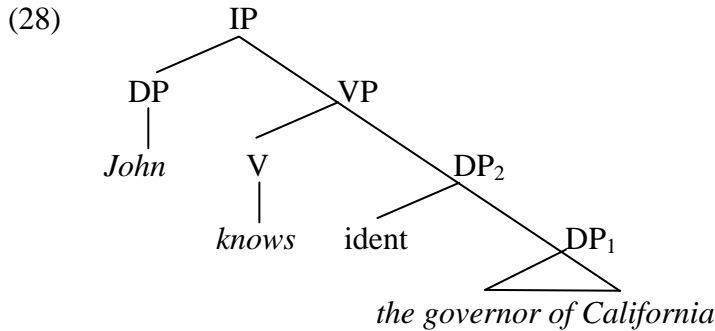
In the case of CQs, it is the DP that has a double role. On the one hand, it helps pick out the *res* argument of which the belief is about, i.e. the individual of which the property holds in the actual world (the *external content* of the attitude); on the other hand, it provides the property that is ascribed to the *res* argument (the *internal content* of the attitude).

The denotation for $know_{DP-CQ}$ and the schematic truth-conditions for a CQ-sentence are given in (26) and (27) below.

$$(26) \quad \llbracket know_{DP-CQ} \rrbracket = \lambda P_{\langle e, \langle s, t \rangle \rangle} . \lambda x_e . \lambda w . \exists y_e [P(y)(w) \ \& \ \forall w' (Dox_{(x)}(w)(w') \rightarrow P(y)(w'))]$$

(27) x knows P in w if and only if there is some individual y of which P holds in w and x believes P *de re* of y .

This account assumes that definite descriptions can denote properties. This has been previously argued for in the literature (see Heim 1982, Partee 1986, Mikkelsen 2004).¹⁰ For the formal implementation of the analysis, I will follow Partee (1986) and assume that the type shifter *ident* is responsible for shifting the denotation of the definite description into a property.¹¹ The derivation of a sentence containing a definite DP-CQ is shown in (28) below.



1. $\llbracket the \ governor \ of \ California \rrbracket = \lambda w . \iota y_e [\text{governor-of-CA}(y)(w)] \quad \langle s, e \rangle$
2. $\llbracket ident \rrbracket = \lambda I_{\langle s, e \rangle} \lambda x_e \lambda w . x = I(w) \quad \langle \langle s, e \rangle, \langle e, st \rangle \rangle$
3. $\llbracket DP_2 \rrbracket = \lambda x_e \lambda w . [x = \iota y_e [\text{governor-of-CA}(y)(w)]] \quad \langle e, st \rangle$
4. $\llbracket John \ knows \ the \ governor \ of \ California \rrbracket (w_0) = \exists x_e [x = \iota y_e [\text{governor-of-CA}(y)(w_0)] \ \& \ \forall w (Dox_f(w_0)(w) \rightarrow x = \iota y_e [\text{governor-of-CA}(y)(w)])]$ ¹²

¹⁰Mikkelsen (2004) argued that subjects of specificational clauses denote properties. In contrast to (i), which has a referential subject, the use of ‘it’ in (ii) indicates a property interpretation for the definite description. Interestingly, this carries over to the CQ in (iii):

- i. The winner of the contest is Iranian. Isn’t she/ *it? (PREDICATIONAL)
- ii. The winner of the contest is Susan. Isn’t it/ *she? (SPECIFICATIONAL)
- iii. I know the winner of the contest. It’s Susan/ *She is Susan. (CQ)

¹¹To be more precise, I am using an intensional version of Partee’s type shifter *ident*.

¹²For simplicity, I am assuming that a given individual can exist in more than one world. However, all these formulas can be translated in a Lewis-style counterpart system.

This analysis can also be easily extended to the case of plural definite descriptions. Assuming Link's σ -operator, the simplified truth-conditions of (29a) are given in (29c) below:

- (29) a. Susie knows the colors of the US flag.
 b. $\llbracket \textit{the colors of the US flag} \rrbracket = \lambda x \lambda w. (x = \sigma y [\textit{colors-US-flag}(y)(w)])$
 c. $\llbracket \textit{Susie knows the colors of the US flag} \rrbracket (w_0) =$
 $\exists x [x = \sigma y [\textit{colors-US-flag}(y)(w_0)] \ \& \ \forall w (Dox_s(w_0)(w) \rightarrow$
 $x = \sigma y [\textit{colors-US-flag}(y)(w)])]$

The *de re* analysis has the advantage of easily accounting for indefinite CQs. Assuming that an indefinite does not have independent quantificational force (see Heim 1982), its denotation is a simple property that can combine directly with the denotation of $know_{DP-CQ}$ given in (26). An example is shown in (30) below:

- (30) a. Pat knows a shortcut to UMASS.
 b. $\llbracket \textit{a shortcut to UMASS} \rrbracket = \lambda x_e \lambda w. (\textit{shortcut-to-UM}(x)(w))$
 c. $\llbracket \textit{Pat knows a shortcut to UMASS} \rrbracket (w_0) =$
 $\exists y [\textit{shortcut-to-UM}(y)(w_0) \ \& \ \forall w' (Dox_p(w_0)(w) \rightarrow$
 $\textit{shortcut-to-UM}(y)(w))]$

The analysis can also be easily extended to account for bound variable interpretations of indefinites, as shown in (31):

- (31) a. Every nurse at the hospital knows a doctor in the Pioneer Valley.
 b. $\llbracket \textit{Every nurse at the hospital knows a doctor in the Pioneer V.} \rrbracket (w_0) =$
 $\forall x [\textit{nurse-in-hospital}(x)(w_0) \rightarrow \exists y [\textit{doctor-in-PV}(y)(w_0) \ \& \ \forall w (Dox_x(w_0)(w) \rightarrow \textit{doctor-in-PV}(y)(w))]]]$

To conclude, the *de re* analysis of CQs provides a uniform account of definite and indefinite CQs by simply resorting to independently-motivated assumptions regarding the nature of the verbs and DPs occurring in these constructions.

5.3. The Distribution of CQs

The *de re* analysis predicts that CQs will only be available with factive verbs, since only factive verbs select for an argument that characterizes both the external (*res*) and the internal content of the attitude. This proposal provides an account of the restricted distribution of CQs alternative to Grimshaw's. According to Grimshaw, the availability of CQ-readings depends on the syntactic and semantic selection properties encoded in the lexical entry of the verb. Only verbs of the *know*-class - those that syntactically subcategorize for DPs and that semantically select questions- admit CQ-readings of their complement DP. In Section 4.2.2, however, we saw that examples (23a-c) satisfy syntactic subcategorization and are grammatical, but they do not have CQ-readings. The *de re* analysis of CQs offers an account of those cases. Under this view, the reason for which examples (23a-

c), together with (4a-c) and (5a-c), do not have CQ-readings is that none of the verbs involved in these examples are factive.

To sum up, the *de re* analysis has at least two advantages on its competitors. On the one hand, it offers a unified account of both definite and indefinite CQs. On the other hand, it provides an alternative to Grimshaw's account of the restricted distribution of CQs that can predict the unavailability of CQ-readings in (23a-c). In the next section, I will return to the contrast in meaning between CQs and their embedded question-counterparts (Section 3.2) and I will propose an account of it based on world-variable binding constraints.

6. Accounting for Greenberg's Contrast

As discussed in Section 3.2, CQs and their embedded-question counterparts can differ in meaning (10a-b, repeated below). The embedded-question sentence (10b) has a reading that is absent in (10a): while (10a) can only mean that John found out the identity of the murderer of Smith, (10b) can also mean that John found out something about the person referred to as 'the murderer of Smith'.

- (10) a. John found out the murderer of Smith.
b. John found out who the murderer of Smith was.

I will argue that the contrast between CQs and their question counterparts can be explained in terms of binding principles for world variables and the way these principles apply to the different structures projected by CQs and embedded questions. Following Percus (2000), I will assume that:

1. Syntactic structures contain silent pronouns that denote variables ranging over possible worlds (indexed items of the form w_1, w_2, w_3) and variable abstractors (indexed items of the form $\lambda, \lambda_2, \lambda_3$).¹³
2. Verbs project a structure that includes a world variable.
3. Intensional verbs trigger the introduction of a world variable binder λ_i adjoined to the maximal projection of their internal argument.¹⁴
4. Definite descriptions also contain a world variable.

With these assumptions in mind, we can restate the contrast between (10a) and (10b) in this way. Suppose that the murderer of Smith in the actual world is Bill. Then, what (10a) says is that John has a *de re* belief about Bill. The internal content of this belief is that Bill has the property of being identical to the person that *the murderer of Smith* refers to in John's belief worlds (this is traditionally called an *opaque* reading of the definite description). On the other hand, (10b) is

¹³Percus uses situation variables. For the purpose of our discussion, the choice between world and situation variables is irrelevant.

¹⁴Percus does not specify exactly what is responsible for the introduction of a world variable binder into the syntactic structure, but in the cases at hand, we could imagine it happens to create arguments of the right type, or because of lexical information encoded in the intensional verb.

ambiguous: apart from the opaque reading, it has a reading in which John found out something else about Bill, but he is ignorant about the murder. In this case, *the murderer of Smith* is used to refer to the murderer in the actual world rather than in John's belief worlds (the definite description, in this case, is said to have a *transparent* use). Structurally, the two readings correspond to different syntactic representations. The opaque reading corresponds to a structure in which the world variable inside the definite description is bound by the λ introduced by the intensional operator. In contrast, the transparent reading corresponds to a structure in which the world variable inside the definite description is anchored to the actual world.

The problem is now reduced to understanding why in (10a) the world variable inside the definite description has to be bound by the world binder introduced by the intensional verb, while in (10b) it can be free. I will suggest that a constraint against vacuous binding will do the work. The following one is adapted from Kratzer (1999):

- (32) *Constraint against vacuous binding*: A world binder λ must bind the world variable selected by the lexical head of its extended projection.

Once we adopt this constraint, we can explain the contrast. In (10b), the intensional binder binds the world variable introduced by the VP. This satisfies the constraint against vacuous binding and hence, the world variable in the complement DP can remain free (i.e. it can get the same index of the intensional binder or be anchored to the actual world). This generates two possible structures:

- (33)
 a. [IP... John [VP knows ... λ_1 [CP who [IP ...[VP w_1 [DP the murderer... w_1] ... is]]]]
 b. [IP... John [VP knows ... λ_1 [CP who [IP ...[VP w_1 [DP the murderer... w_0] ... is]]]]

In (10a), on the other hand, there is no VP introducing a world variable that can be bound by the intensional operator and, consequently, the variable inside the definite description has to be bound by the intensional binder to satisfy the constraint against vacuous binding. This leaves the opaque reading of the definite description as the only option:

- (34) [IP... John [VP knows ... λ_1 [DP ... the murderer... w_1]]

7. Further Issues and Open Remarks

7.1. More Complex *res* Arguments

So far we have considered cases in which the *res* argument of the belief ascription is an individual that satisfies the extension of the property in the actual world (or the maximal individual, in the case of plurals). Cresswell and von Stechov (1982),

however, argued that *de re* beliefs can involve more complex *res* arguments.¹⁵ In what follows, I will argue that relational nouns with unsaturated arguments are examples of CQs involving more complex *res* arguments.

Imagine a context in which the price of several objects is at issue. Imagine that Susie knows the price of one of those objects. She knows, for example, that a bottle of milk costs \$1.29. In this context, an utterance of (35a) is not felicitously paraphrased by (35b):

- (35) a. Susie knows a price.
b. Susie knows of \$1.29 that it is a price

However, (35b) is the only meaning we predict for (35a). If *price* denotes a property of individual objects, then the *de re* analysis predicts that (35a) is true if there is a particular price (i.e. a particular dollar amount) in the actual world of which Susie knows it is a price. However, these truth-conditions are too weak. We can imagine a scenario in which Susie is aware of the fact that \$1.29 is a price without being aware that it is the price of milk, or the price of anything at all.

Following previous analyses of relational nouns (Barker 2001, Nathan 2006), I assume that these nouns denote a relation that holds of pairs of objects rather than a property of single individuals. Under this view, the lexical entry of *price*, in its relational sense, would look like (36):

- (36) $\llbracket price \rrbracket = \lambda x \lambda y \lambda w. \text{price of } (x, y) \text{ in } w \quad \langle e \langle e, st \rangle \rangle$

The reading of (35a) in the above scenario (35b) can be derived as shown below:

- (37) a. Susie knows of $\langle \$1.29, \text{milk} \rangle$ that they are in the *price of* relation.
b. $\llbracket Susie \text{ knows a price} \rrbracket (w_0) =$
 $\exists x \exists y [\text{price-of } (x)(y)(w_0) \ \& \ \forall w (\text{Dox}_S(w_0)(w) \rightarrow \text{price-of } (x)(y)(w))]$

To conclude, when *price* is used in its relational sense, the *res* argument is not simply an individual that satisfies the property in the actual world (i.e. a dollar amount), but rather a pair of individuals that are in the relation denoted by the noun in the actual world.^{16,17}

¹⁵In the simplest case a *de re* belief involves ascribing a one-place property to an individual but “there is no reason why a many-place property cannot be ascribed to things other than individuals.” (Cresswell and von Stechov, 1982: 505).

¹⁶Of course, *price* can also be used in a non-relational sense, as exemplified by (i) below:

(i) The cashier knew the price that John paid. It was \$ 66.

¹⁷Things, however, can get even more complicated. Consider example (iia) from Heim (1979) and its intended reading in (iib):

(ii) a. John knows the price that Fred knows.
b. John knows the price Fred knows. It’s the price of the new iBook (but John doesn’t know how much the iBook costs).

In order to capture reading (iib), we do not want a *res* argument corresponding to a specific dollar amount, nor to a pair consisting of an object and its actual price. Neither of these *res* arguments would give us the right truth conditions of (iib). What I would like to suggest is that, in this case, the *res* argument is the whole individual concept corresponding to the function *the price*

7.2. CQs and Relational Nouns

It has been noted in the literature (Caponigro and Heller 2003, Nathan 2006) that the typical examples of definite CQs involve relational nouns, ‘nouns whose interpretation depend on an additional argument’ (Caponigro & Heller 2003: 26).¹⁸ Plain non-relational nouns can hardly be interpreted as CQs, as shown by (38) and (39):

- (38) #Sue knows the shoes.
 (39) #Fabio knows the carburetor.

The oddness of (38) and (39) is quite unexpected under the *de re* analyses of CQs. According to this proposal, any property-denoting DP should be able to be interpreted as a CQ when embedded under a factive verb. However, the contrast between (38)-(39) and (1a-c) suggests that more than this might be going on. Based on examples like (38)-(39), Nathan (2006) suggested that CQs can only be derived from relational nouns by special type-shifting operations. However, the notion of relational noun is not a simple one to work with. First of all, what prevents us from considering *shoes* and *carburetor* as relational? Why can’t we describe them as denoting functions from shoes to shoes’ brands or from shoes to shoes’ owners? Second, there are several examples involving relational nouns that sound as odd as (38)-(39). Some examples are shown in (40):

- (40) #Mary knows/found out the father/the sister/the leg/the home.

Third, as Caponigro and Heller pointed out, as soon as non-relational DPs are modified in some way (by adding a relative clause, a superlative etc), the CQ-reading becomes accessible. Compare (38)-(39) with (41):

- (41) a. Sue knows the shoes *that will be fashionable next season*.
 b. Fabio knows *the best carburetor on the market*.

In which sense are the examples in (41) relational? And why do these types of nominal modifications affect the availability of CQs? To my knowledge, there exists no definitive answer to this question in the literature.¹⁹

of the new iBook. For a more detailed discussion of this example, see Romero (2005) and Nathan (2006).

¹⁸Caponigro and Heller use the expression ‘functional nouns’. However, since NPs in general denote functions, I will use the expression ‘relational nouns’ to avoid confusion.

¹⁹One might make the following conjecture. Maybe the reason why (41a) is better than (38) is that the relative clause in (41) provides an informative property that was missing in (38). Intuitively, (38) might be unacceptable because in normal circumstances, the statement *I know of this entity that it is shoes* might sound odd and uninformative. It is hard to imagine a situation in which someone might be acquainted with shoes without knowing that they are shoes. By adding a relative clause in (41), on the other hand, we are contributing an informative property (being the shoes that will be fashionable next season) and turning the statement into an informative one. However, this explanation doesn’t work so well for (39). In this case, knowing what a carburetor is, being able to identify it among other parts of your car, is a much less trivial fact than knowing

Moreover, notice that getting a CQ-reading from examples in (35)-(36) might be hard, but crucially not impossible. Consider the following scenario:

The guessing game

Imagine you are involved in the following game: you have been presented with a series of objects: a pair of shoes, a carburetor and a pair of scissors. Your challenge is to look at the objects for 3 minutes and memorize the way they look. After that, you will be shown only little parts of them and you will have to tell what they are. Imagine you were only successful with the shoes. Then, you can report that by saying: “I didn’t win. I only knew the shoes”.

To conclude, definite CQs are easier when the object DP contains a relational noun, other property-denoting NPs need more contextual support and seem harder to get. However, they are still possible, as the *de re* analysis predicts.

8. Conclusions

In this paper, I discussed three approaches to DP-CQs: the question-in-disguise approach, the individual concept approach and the *de re* analysis. In Section 3, I presented three arguments against the question-in-disguise approach and concluded that CQs do not denote questions. In Section 4, I briefly reviewed Heim and Romero’s individual concept approach and concluded that, although it doesn’t face the same difficulties of the question-in-disguise approach, it still doesn’t provide an independent account of the restricted distribution of CQs nor does it easily apply to indefinite CQs. As an alternative, I proposed the *de re* analysis of CQs and I showed that this solution captures the restricted distribution of CQs, and it correctly characterizes the truth-conditions of both definite and indefinite CQs.

References

- Baker, Carl L.: 1968, *Indirect Questions in English*. Doctoral Dissertation, University of Illinois, Urbana.
- Barker, Christopher: 1991, *Possessive Descriptions*. Doctoral Dissertation, University of California, Santa Cruz.
- Caponigro, Ivano and Daphna Heller: 2003, ‘The Non Concealed Nature of Free Relatives: Implications for Connectivity’, in C. Barker and P. Jacobson (eds.) *Direct Compositionality*, Oxford University Press, Oxford; New York, 237-263.

of a pair of shoes that they are shoes. However, (39) is as odd as (38). Therefore, a purely pragmatic explanation might not be on the right track (thanks to C. Potts and L. Nathan for discussing this last point with me).

- Cresswell, Max J. and Arnim von Stechow: 1982, 'De Re Belief Generalized', *Linguistics and Philosophy* **5**, 503-535.
- Gettier, Edmund: 1963, 'Is Justified True Belief Knowledge?', *Analysis* **23**, 121-123.
- Greenberg, Bill: 1977, 'A Semantic Account of Relative Clauses with Embedded Question Interpretations', Ms., UCLA.
- Grimshaw, Jane: 1979, 'Complement Selection and the Lexicon', *Linguistics Inquiry* **10**, 279-326.
- Heim, Irene: 1979, 'Concealed Questions', in R. Bäuerle, U. Egli and A. von Stechow (eds.) *Semantics from Different Points of View*, Springer-Verlag, Berlin; New York, 51-60.
- Kratzer, Angelika: 1990, 'How Specific is a Fact?', in Proceedings of the Conference on Theories of Partial Information, Center of Cognitive Science, University of Texas at Austin, January 25-27.
- Kratzer, Angelika: 1999, 'Tutorial on Attitude Ascriptions', Lecture notes.
- Kratzer, Angelika: 2002, 'Facts: Particulars or Information Units?', *Linguistics and Philosophy* **25**, 655-670.
- Kratzer, Angelika : 2004, Lecture notes.
- Lewis, David K. : 1979, 'Attitudes *de dicto* and *de se*', *Philosophical Review* **88**.
- Mikkelsen, Line: 2004, 'Specificational subjects- a formal characterization and some consequences', *Acta Linguistica Hafniensia* **36**.
- Nathan, Lance: 2006, *On the Interpretation of Concealed Questions*. Doctoral Dissertation, MIT.
- Partee, Barbara: 1986, 'Noun Phrase Interpretation and Type-Shifting Principles', in P. Portner and B. Partee (eds.) *Formal Semantics: the Essential Readings*, Blackwell, Oxford; Malden, MA, 357-381.
- Percus, Orin: 2000, 'Constraints on Some Other Variables in Syntax', *Natural Language Semantics* **8**, 173-229.
- Quine, Willard V.: 1956, 'Quantifiers and Propositional Attitudes', *The Journal of Philosophy* **53**, 177-187.
- Romero, Maribel: 2005, 'Concealed Questions and Specificational Subjects', *Linguistics and Philosophy* **28**.
- Russell, Bertrand: 1912, *The Problems of Philosophy*, H. Holt and Company, New York.