

Copular Questions and Concealed Questions

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Abstract

This paper aims at explaining a contrast in meaning between CQs and embedded *wh*-questions. Greenberg (1977) observe that while a CQ-sentence like *John discovered the murderer of Smith* can only convey that John solved the question *who murdered Smith?*, the sentence *John discovered who the murderer of Smith is* has an additional reading, compatible with John not knowing about the murder, according to which he found out some essential fact about the person referred to as the murderer. In this paper, I argue that the ambiguity of embedded copular questions follows from the ambiguity of the copular clause they contain, which can have a *predicational* or a *specificational* interpretation (Higgins, 1973). On the other hand, assuming that CQs do not contain a copular clause at any level of representation, the ambiguity is not expected here.

1 Introduction

Concealed Questions (CQs) are DPs whose interpretation can be paraphrased by an embedded copular question, some examples in (1)a-b below.

- (1) a. I just found out the gender of my baby! (Google)
b. John knows the largest town in Italy. (Heim, 1979)
- (2) a. I just found out what the gender of my baby is!
b. John knows what the largest town in Italy is.

A reasonable hypothesis is that the underlined DPs in (1)a-b have the meanings paraphrased in (2)a-b above because they do, in fact, denote questions (for approaches along these lines see Grimshaw 1979; more recently, Aloni 2008, Roelofsen & Aloni 2008, Percus 2009).¹

¹Aside from its CQ-reading, the sentence in b can also have a reading according to which John is personally acquainted to the largest town in Italy. It is commonly assumed in the literature that these two readings are due to a lexical ambiguity of the English verb *know*, which is ambiguous between an epistemic and an acquaintance-based meaning. Evidence in favor of the lexical ambiguity hypothesis comes from languages like German and Italian, which lexicalize these as different words: *wissen* and *kennen* in German, *sapere* and *conoscere* in Italian. When *wissen* and *sapere* take a DP argument, the sentence cannot have an acquaintance reading. Thus (i) from German and (ii) from Italian can only have CQ-readings:

- (4) a. Susan is smart.
b. The winner of the prize is smart.

What these sentences express is that the individual picked out by the subject has the property denoted by the post-copular phrase. The copula, in these cases, is assumed to be semantically vacuous, or to denote an identity function, such as (5) below:

$$(5) \quad \llbracket \text{BE}_{\text{PRED}} \rrbracket = \lambda P_{\langle e, t \rangle}. [P]$$

The examples in (4) above involve a DP subject and an AdjP object; PRs, however, can also involve two DPs as in (6) below:

- (6) Susan is the winner of the prize.

Intuitively, (6) is not much different from (4)a-b in that it expresses that the individual picked out by the subject (Susan) has the property of being the winner of the prize. In order to accommodate predicative uses of definite descriptions, it is widely assumed that the referential definite DP undergoes a type-shifter operation and is assigned a property-type meaning. Partee (1986a) proposed the type-shifter in (7) below, which takes an individual and returns the property of being identical to that individual (8).

$$(7) \quad \llbracket \text{IDENT} \rrbracket = \lambda x_e. \lambda y_e. y = x \quad (\text{Partee 1986a})$$

$$(8) \quad \llbracket \text{IDENT}(\textit{the winner of the prize}) \rrbracket = \lambda y_e. y = \iota z_e [\textit{winner-of-the-prize}(z)]$$

2.2 Specificational sentences (SPs)

On the surface, specificational sentences (henceforth, SPs) look like inverted PRs. Some examples are given in (9) below.³

- (9) a. The winner of the prize is Susan.
b. The temperature in this room is 25C.
c. The number of planets is nine. (Higgins, 1973)

When comparing the SPs above with PRs like (6), it looks as if in (9) the referential and the predicative DPs have simply switched places. While in PRs, the subject-DP picks out an individual of whom it is claimed that the property denoted by the post-copular phrase holds, in (9) the predicational roles seem to be reversed (for an account of SPs as “inverted” PRs see Partee (1986b, 2000) and Mikkelsen (2004), among others).⁴

Another common analogy for SPs is with question-answer pairs. For instance, (9)a would be analogous to the question-answer pair in (10) below.

³ In this paper, I will only talk about “simple” or “noncleft” SPs, like the ones in , not pseudocleft like *What you need is a beer*, with a free relative in subject position.

⁴ Aside from this intuitive distinction, it has been shown that SPs are grammatically different from PRs, in that the former but not the latter exhibit connectivity effects (see Higgins 1973, Jacobson 1994, Heycock and Kroch 1999, Sharvit 1999, among others).

- (10) Q: Who is the winner of the prize?
A: Susan.

Several authors have pursued an analysis along these lines (Ross 1997, den Dikken et al. 2000, Schlenker 2003). Under this view, the subject of SPs is a question in disguise (a CQ) and the post-copular object provides the answer to that question.

Even though there is no agreement in the literature on what the best treatment of SPs is, most of the existing approaches agree on one point: the subject of a SPs is not referential, i.e. it does not denote an individual. Mikkelsen (2004) made this point quite clear by discussing the following pronominalisation contrast:

- (11) a. Susan is the winner of the prize. Isn't **she**/***it**? *PREDICATIONAL*
b. The winner of the prize is Susan. Isn't **it**/??**she**? *SPECIFICATIONAL*

Under the assumption that the pronoun in the tag refers back to the subject and that the use of a gendered pronoun, like *he* or *she*, pronominalises referential DPs (DPs of semantic type *e*), (11)a shows that the subject of PRs must be referential. In contrast, the preference for the gender-neuter pronoun *it* in (11)b, indicates a non-referential interpretation of the subject. A similar contrast can be seen in the question-answer pairs below, from Mikkelsen (2004: 7).

- (12) Q: What nationality is the recipient of this year's Nobel Peace Prize?
A: **She**/***It** is Iranian. *PREDICATIONAL*
- (13) Q: Who is the winner of this year's Nobel Peace Prize?
A: ??**She/It** is Shirin Ebadi. *SPECIFICATIONAL*

Interestingly, as Romero (2005) points out, CQs pattern with subjects of SPs when it comes to pronominalisation, as shown in (14) below, examples from Romero (2005: 720).

- (14) **PRs**: The winner of the Oscar for best actress walked in. **She**/***it** was wearing a red dress.
SPs: The girl who caused the trouble wasn't Mary. **It**/***she** was Jane.
CQ: John guessed the winner of the Oscar for best actress before I guessed **it**/***her**.

Summing up, the data on pronominalisation shows that SP-subjects and CQs are not referential, i.e. their denotation is not an individual of semantic type *e*. If these DPs do not denote individuals, what then do they denote? In this paper, I will adopt the view, defended by Romero (2005), that both SP-subjects and CQs denote individual concepts.

3. Romero's unified analysis of CQs and subjects of SPs

3.1 CQs as individual concepts

Heim (1979) suggests that a DP with a CQ-interpretation, like *the capital of Italy* in (15), denotes an individual concept (henceforth, IC), i.e. a function that maps a world *w* into the individual that is the capital of Italy at *w*. (16) could be an example of such a function.

(15) John knows the capital of Italy.

(16) $\llbracket \text{the capital of Italy} \rrbracket_{\langle s, e \rangle} := \left(\begin{array}{ll} w_0 \rightarrow \text{Rome} & w_2 \rightarrow \text{Salerno} \\ w_1 \rightarrow \text{Florence} & \dots \end{array} \right)$

Roughly speaking, knowing an IC construed as a function from possible worlds to individuals amounts to the following: if I know the individual concept f in w_0 , then f yields the same value at w_0 and at the worlds compatible with what I believe in w_0 .

Heim's analysis of CQs as denoting ICs was inspired by Montague (1973)'s analysis of the *temperature paradox*, attributed to Barbara Partee. Partee's observation is that in contrast to the valid argument in (17) below, the syllogism in (18) is intuitively invalid: by substitution, the first two sentences appear to lead to the invalid conclusion in (18)c.

(17) a. The mayor of Amherst is Ms Higgins.
b. The mayor of Amherst lives on Main St.
c. Ms Higgins lives on Main St.

(18) a. The temperature in this room is ninety.
b. The temperature in this room is rising.
c. Ninety is rising.

Montague's account of the contrast between the valid argument in (17) and the (invalid) temperature paradox in (18) consists of three major components. First, he argues that definite descriptions like *the mayor of Amherst* and *the temperature in this room* do not denote individual entities, but rather ICs, i.e. functions from indices (world/time pairs) to entities. These functions, as opposed to the constant functions denoted by proper names like *Ms Higgins* and *ninety*, can yield different values at different indices. Second, Montague assumes that equative *be*, as in *the temperature is 90* or *the mayor is Ms Higgins*, expresses extensional identity. Thus, as can be seen in (17') and (18') below, the first premise of both arguments does not assert that two ICs are identical, but rather that their extensions are the same at the index of evaluation. Finally, according to Montague, the significant difference between the valid argument in (17) and the temperature paradox lies in the kind of predication involved in the second premise. While in (17)b the extensional predicate **lives on Main Street** applies to the value of the function denoted by *the mayor of Amherst* (**f**) at the index of evaluation, in (18)b, the (temporally) intensional predicate **rise** applies to the function denoted by *the temperature in this room* (**g**), not to its value (intuitively, in order to establish whether the temperature is rising, one needs to look not just at the actual temperature value, but also at the values that the function yields at earlier and later indices):

(17')	a. The mayor of Amherst is Ms Higgins. f(i₀) = g(i₀)	<i>extensional identity</i>
	b. The mayor of Amherst lives on Main Street. lives-on-Main St (f(i₀))	<i>extensional predication</i>
	c. Ms Higgins lives on Main Street. lives-on-Main St. (g(i₀))	

(18')	a. The temperature in this room is ninety. $\mathbf{f'}(i_0) = \mathbf{g'}(i_0)$	<i>extensional identity</i>
	b. The temperature in this room is rising. $\mathbf{rise(f')(i_0)}$	<i>intensional predication</i>
	c. Ninety is rising $\mathbf{rise(g')(i_0)}$	

Heim (1979) suggests that definite descriptions with CQ-interpretations may be another example of DPs interpreted as denoting ICs. In analogy to the temperature paradox, she proposes the following invalid argument involving CQ-readings of the DPs in italics.

- (19) a. The capital of Italy is the largest town in Italy.
 b. John knows *the capital of Italy*.
 c. John knows *the largest town in Italy*. (Heim 1979:54)

The entailment in (19) does not go through if we assume that the DPs in italics are interpreted as CQs. Intuitively, knowing what the capital of Italy is does not entail knowing what the largest town in Italy is, despite the fact that the two DPs are co-referential at the actual world/time index. As Heim points out, the lack of entailment is expected if the DP-CQs in (19) denote ICs and *know_{CQ}* is a predicate selecting for ICs. On a par with Montague’s analysis of the temperature paradox, (19) can be analyzed as in (20) below.

(20)	a. The capital of Italy is the largest town in Italy. $\mathbf{f'}(i_0) = \mathbf{g'}(i_0)$	<i>extensional identity</i>
	b. John knows <i>the capital of Italy</i> . $\mathbf{know(f')(john)(i_0)}$	<i>intensional predication</i>
	c. John knows <i>the largest town in Italy</i> . $\mathbf{know(g')(john)(i_0)}$	

Setting aside the semantic interpretation of *know* for the moment, the failure of entailment can be explained by assuming that equating the value of two concepts at the actual index ((20)a) is not enough to guarantee identity across indices. Therefore, the conclusion in (20)c does not follow from the premises of the argument.

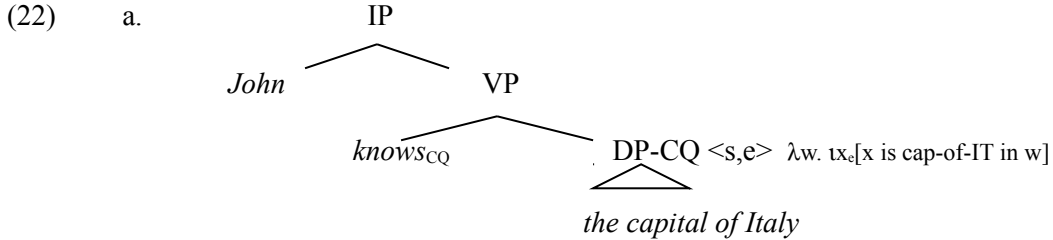
3.2 Romero (2005) on CQs and SP-subjects

Building on Heim (1979), Romero (2005) develops a more detailed analysis of CQs embedded under *know*. The denotation she proposes for *know_{CQ}* as a predicate selecting for ICs is given in (21) below (where *Dox_x(w)* stands for the set of worlds compatible with what the attitude holder *x* believes in world *w*, i.e. the set of *x*’s doxastic alternatives to *w*).⁵

$$(21) \quad \llbracket know_{CQ} \rrbracket^w = \lambda f_{\langle s, e \rangle} \lambda x_e. \forall w' \in Dox_x(w) [f(w') = f(w)]$$

⁵ For simplicity, Romero ignores the factivity of *know* and other considerations about the justification of the subject’s belief. I will also ignore these issues here.

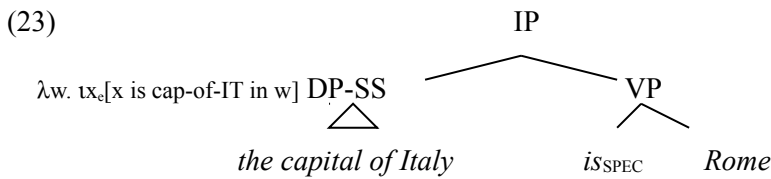
Under this view, a simple CQ-sentence such as *John knows the capital of Italy* is analyzed as shown in (22) below.



- b. $\llbracket \text{John knows the capital of Italy} \rrbracket^w = 1$ iff
 $\forall w' \in \text{Dox}_J(w) [\iota x_e [x \text{ is cap-of-IT in } w'] = \iota x_e [x \text{ is cap-of-IT in } w]]$

According to (22)b, *John knows the capital of Italy* is true at the world w iff the IC “capital of Italy” yields the same value at w as it does at John’s doxastic alternatives to w .

Turning now to copular sentences, Romero assumes that the copula in English is not always semantically vacuous (as in the case of PRs), but it can denote a special copula of identity, or specification, which requires that its second argument denote an IC. Thus, a simple SPs such as *The capital of Italy is Rome* is analyzed as in (23) below.⁶



- (24) $\llbracket \text{BE}_{\text{SPEC}} \rrbracket^w = \lambda z_e \lambda f_{\langle s,e \rangle} . [f(w) = z]$

- (25) $\llbracket \text{The capital of Italy is}_{\text{SPEC}} \text{ Rome} \rrbracket^w = 1$ iff $\iota x_e [x \text{ is cap-of-IT in } w] = \text{Rome}$

Summing up, three types of sentences have been discussed: PRs (*Rome is pretty/the capital of Italy*), SPs (*The capital of Italy is Rome*) and CQ-sentences (*John knows the capital of Italy*). PRs are just-run-of-the-mill predicative clauses with a referential subject, a predicative object and a semantically vacuous copula. SPs are a special kind of equative statements, with an IC-denoting subject, a referential object and Romero’s copula of specification (BE_{SPEC}). Finally, following Heim (1979) and Romero (2005), CQs denote ICs and CQ-embedding predicates require a separate lexical entry that selects for ICs. These assumptions are summarized in (26) below.

⁶Romero’s analysis of simple SPs is very similar to Montague’s treatment of identity statements like *The temperature is ninety*. However, while in Montague’s analysis the *be* of identity equates the value of two ICs at the actual world, the post-copular one being a rigid concept, Romero’s BE_{SPEC} is asymmetric, requiring only its second argument to denote an IC. Presumably, Romero’s analysis will have to rely on a third lexical entry for the copula (aside from BE_{PRED} and BE_{SPEC}), to account for identity statements such as *Cicero is Tully*. Perhaps then, a cross-categorial denotation of Montague’s copula of identity ($\text{BE}_{\text{ID}}: \lambda x_t. \lambda y_t. y = x$) would be a more economical choice, since it could account for both SPs and true identity statements. However, the resolution of this issue does not have an impact on the account proposed here. As long as SP-subjects denote non-rigid ICs, the issue of whether the post-copular DP denotes a constant concept or an individual, and whether we should adopt Romero’s BE_{SP} or Montague’s BE_{ID} does not really matter here.

(26)

PRs:	X: <i>e</i>	i _{SPRED}	Y: < <i>e,t</i> >
SPs:	X:< <i>s,e</i> >	i _{SPEC}	Y: <i>e</i>
CQs:	X: <i>e</i>	knows _{CQ}	Y:< <i>s,e</i> >

4. Recasting Greenberg’s ambiguity

Let’s now return to our original task, which was to explain why a sentence containing an embedded *wh*-question such as (27)a is ambiguous while its CQ-counterpart in (27)b is not ambiguous in the same way.

- (27) a. The Dean discovered who our favorite candidate (for the job) is.
 b. The Dean discovered our favorite candidate (for the job).

Before providing an account of the contrast between (27)a-b, I’d like to suggest that the ambiguity of embedded copular questions discussed by Greenberg is an ambiguity of the specificational/predicational kind and that the PR-variant only is compatible with a transparent reading of the subject of the copular clause (*our favorite candidate*). The scenario below brings out the SP-reading of (27)a.

(28) **Scenario 1 (SPECIFICATIONAL)**

We are having a job search and our favorite candidate for the job is Dr. Brown. However, since the issue is not fully set yet, we do not want to inform the Dean yet. Suppose rumors spread and the Dean finds out that our favorite candidate for the job is Brown.

- (29) a. The Dean discovered who our favorite candidate is (**It/#He** is Brown).
 b. Intended reading (**SP**): The Dean discovered that our favorite candidate is Brown.

Under the SP-reading, the expression *our favorite candidate* is obligatorily opaque, in the sense that the Dean must know that our actual favorite candidate is our favorite candidate. However, as Heim and Greenberg point out, a sentence like (27)a has an additional reading, according to which the Dean has simply found out some essential fact about the person referred to as our favorite candidate (without knowing that he is our favorite candidate). To bring out this reading, we need a more complex scenario, like the one given in (30) below.

(30) **Scenario 2 (PREDICATIONAL-TRANSPARENT)**

Our top candidate for the job is Brown. Brown is secretly the chief editor of a paper that has frequently attacked the Dean. The committee members know about this and don’t care, but hope that the Dean would not find out about Brown’s secret identity. The second job-candidate on the shortlist (Smith) works with Brown at the paper and knows that he is the editor responsible for the articles against the Dean. Suppose Smith finds out that Brown is the first person on the shortlist and since he wants the job terribly, starts scheming against him. So, he arranges to have somebody go tell the Dean that the secret editor of the paper is Brown. In this way, he is certain that when the Dean would hear that Brown is the top candidate for the professorship, he would refuse to give him the job. Suppose that this has just happened: the Dean has

been informed that Brown is the secret editor, but he still does not know anything about the short-list or the job-candidates.

Given the scenario above, one member of the committee could utter (31)a to another member, with the intention of expressing what (31)b says.

- (31) a. Unfortunately, the Dean found out/discovered who our top candidate is.
b. Intended reading (**PR**): The Dean found out that Brown is the secret editor.

Under the PR-reading, the DP *our favorite candidate* can be read transparently (in the sense that the Dean does not have to know that our favorite candidate is our favorite candidate) and, in fact, is read transparently in the above scenario.⁷ Notice that CQs cannot have this reading: none of the sentences in (32) are appropriate in the PR-Transparent scenario.

- (32) a. Unfortunately, the Dean discovered/found out our top candidate.
b. Unfortunately, somebody revealed to the Dean our top candidate.
c. Unavailable reading (***PR**): The Dean discovered that Brown is the secret editor.
- (33) *Summary of the readings*
a. A discovered/found out who B is.
b. **SP**-reading: A discovered which person is B. **It** is x.
c. **PR**-reading: A discovered something crucial about the person B refers to. **He** is P.

5. The Account

5.1 Outline of the proposal

I propose that the ambiguity of embedded copular questions such as (3)b and (27)a follows from the fact that these questions contain a copular clause [_{IP} DP is t_i], which can have a specificational or a predicational representation, as illustrated in (34) below.

- (34) **SP** ... λ1 [_{IP} our favorite candidate is_{SPEC} t_i]
DP1:<s,e> DP2:e
- PR** ... λ1 [_{IP} our favorite candidate is_{PRED} t_{1<s,e>}] (via IDENTIFY)
DP1:e DP2:<s,<e,t>>

The SP-structure corresponds to the resolution of the question “Which x is our favorite candidate?”. Here, *who* ranges over individuals and the copula is Romero’s BE_{SPEC}. The PR-structure corresponds to the resolution of the question “Which identifying property does our favorite candidate have?”. Here, *who* ranges over ICs instead of over individuals and the copula is BE_{PRED}. Since BE_{PRED} selects for a property-argument, the trace gets shifted into an identifying property by the type-shifter IDENTIFY, which is just a categorial variant of Partee’s type shifter IDENT.⁸ Because in the PR-structure, the definite description (*our favorite candidate*) is used referentially, this LF is compatible with a transparent reading of

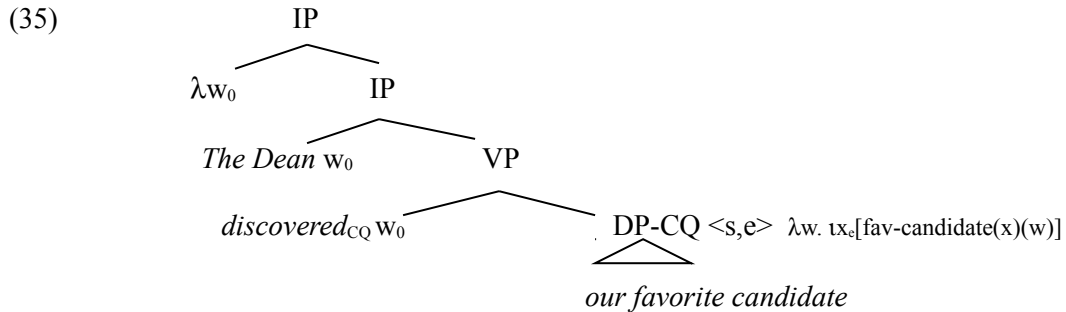
⁷ One may be wondering whether a third reading (PR-opaque) exists. As a matter of fact it does, even though Greenberg and Heim did not talk about it. I will return to this reading in section 5.4.

the subject of the copular clause (DP1), hence the Dean does not have to know of our actual favorite candidate that he is our favorite candidate. Finally, following Heim and Romero’s proposal that CQs are just individual concept-denoting DPs, we expect them to lack the ambiguity caused by the copula in their full-fledged question counterparts.

Before spelling out the account, let me briefly point out that the syntactic structures I will employ contain silent pronouns that denote variables ranging over possible worlds (indexed items of the form w_1, w_2 , etc.) and variable abstractors over world variables (indexed items of the form $\lambda w_1, \lambda w_2$, etc.). Following Percus (2000), I assume that world pronouns obey strict locality conditions, i.e. they must be bound by a matrix binder or a closer binder when available. I also assume that world pronouns are generated as sisters to all lexical predicates (von Stechow & Heim 2008).⁹

5.2 Unambiguous CQs

As anticipated, the lack of ambiguity for CQ-sentences follows from the fact that these sentences are structurally unambiguous. The LF of (27)b would then be (35) below. Following standard rules of semantic composition, and ignoring the semantic contribution of the past tense, we arrive at the truth-conditions in (36) below. The formula in (36) expresses the SP-reading, according to which the Dean now knows which person is our favorite candidate. Here, I am assuming that the meaning of *discover*_{CQ} is the same as *know*_{CQ} with the additional presupposition that the subject did not know the value of the concept at a time t preceding the utterance time, (for simplicity, time variables are not represented at LF).¹⁰



⁸ One may be wondering why I did not assume that *who* in the PR-structure ranges over properties directly. The reason is that there is independent evidence for allowing *who* to range over ICs, as shown by the fact that we can sometimes answer a *who*-question with an IC-denoting expression, as in (i) below. On the other hand, in order to argue that *who* can also range over properties, we would have to provide an explanation of why it is not possible to answer a *who*-question with a predicate, as in (i)b. However, assuming we find a satisfying answer to this question, the account can be easily amended.

- (i) a. Who will win next election?
 b. The candidate with the biggest campaign budget (whoever that will be). (Engdahl 1986)
- (ii) a. Who will win next election?
 b. #Smart
 c. A smart person.

⁹ The reason why I am turning now to a system with overt world variable in the syntax is that it provides a handy way of discussing transparent/opaque ambiguities.

¹⁰ Romero’s denotation of *know*_{CQ} would then be relativized to a temporal parameter as well.

$$(36) \quad \llbracket \textit{The Dean discovered our favorite candidate} \rrbracket (w_0) = 1 \text{ iff} \\ \forall w' \in \text{Dox}_j(w_0) [\iota x_e [x \text{ is fav-candidate in } w'] = \iota x_e [x \text{ is fav-candidate in } w_0]]$$

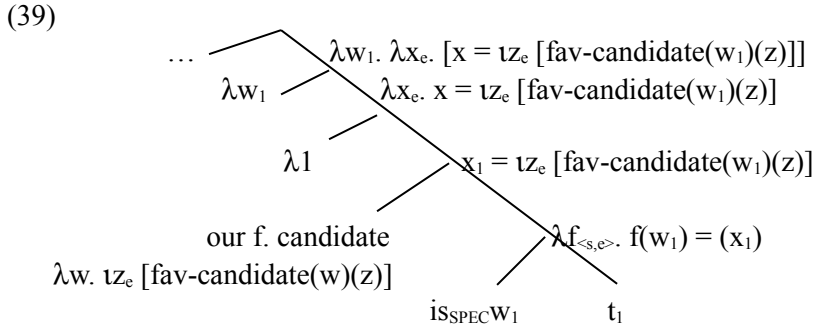
$$(37) \quad \llbracket \textit{discover}_{\text{CQ}} \rrbracket = \lambda w. \lambda t. \lambda f_{\langle s, e \rangle} \lambda x_e: [\exists t' [t' < t] \& \\ \neg \llbracket \textit{know}_{\text{CQ}} \rrbracket (w)(t')(f)(x)]. \llbracket \textit{know}_{\text{CQ}} \rrbracket (w)(t)(f)(x)$$

5.3 Specificational wh-Q

Our hypothesis is that the SP-reading of (27)a, repeated below, derives from an LF in which the copular clause inside the embedded question has a SP-structure.

- (38) a. The Dean discovered who our favorite candidate is.
b. Intended reading (**SP**): The Dean discovered which person is our favorite candidate.

The LF for (38)a is provided in (39) below, only relevant parts included. In this LF, the copula is Romero's BE_{SPEC} , the DP in subject position denotes an IC and the trace is a bound variable of type e . Following standard assumptions (Heim & Kratzer 1998), movement of the *wh*-pronoun triggers the insertion of a λ -binder, which binds the trace at the bottom of the chain (for simplicity, *who* does not have semantic content here). Assuming a semantic analysis of questions à la Groenendijk & Stokhof (1982), the question operator in (40) applies to the predicate derived by abstraction to yield the question intension in (41).



$$(40) \quad \llbracket ? \rrbracket = \lambda w. \lambda w'. \lambda P_{\langle s, \langle e, t \rangle \rangle}. [P(w') = P(w)] \quad (\text{Groenendijk \& Stokhof, 1982})$$

$$(41) \quad \llbracket \text{Q}_{\text{INT}} \rrbracket = \lambda w. \lambda w'. [\lambda x_e. [x = \iota z_e [f\text{-candidate}(w')(z)]]] = \lambda x_e. [x = \iota z_e [f\text{-candidate}(w)(z)]]$$

The question intension in (41) creates a partition that groups together worlds in which the individual who is our favorite candidate is the same. Following Groenendijk & Stokhof again, I assume that the proposition-embedding verb *discover*, applies to the extension of Q_{INT} (a proposition). The resulting truth-conditions are given in (43) below.

$$(42) \quad \llbracket \text{Q}_{\text{EXT}} \rrbracket = \llbracket \text{Q}_{\text{INT}} \rrbracket (w_0) = \\ \lambda w'. [\lambda x_e [x = \iota z_e [f\text{-candidate}(w')(z)]]] = \lambda x_e [x = \iota z_e [f\text{-candidate}(w_0)(z)]]$$

$$(43) \quad \llbracket \textit{The Dean discovered who our favorite candidate is} \rrbracket (w_0) = 1 \text{ iff} \\ \forall w' \in \text{Dox}_D(w_0) ([\lambda x. [x = \iota z [f\text{-candidate}(w')(z)]]] = \lambda x. [x = \iota z [f\text{-candidate}(w_0)(z)]])$$

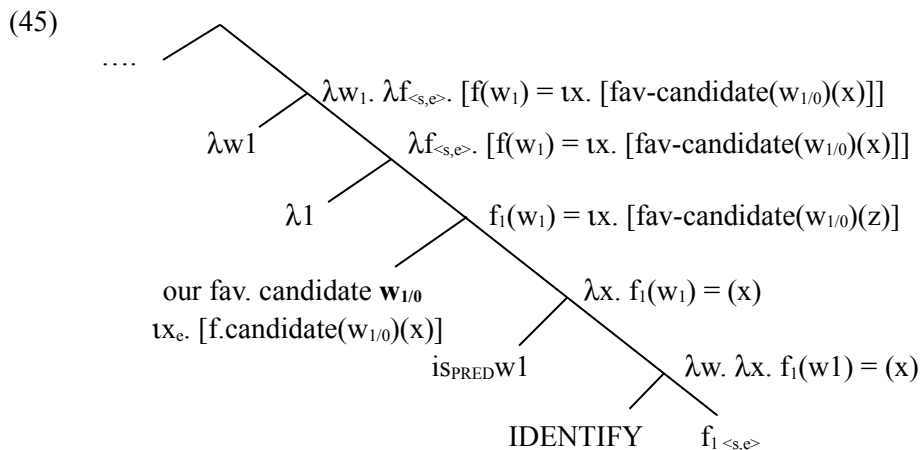
What (43) above expresses is that the individual who is our favorite candidate in the actual world and the individual who is our favorite candidate in the Dean’s belief worlds are one and the same individual. Hence, the Dean knows that Brown is our favorite candidate (the meaning component having to do with the Dean’s discovery of the fact is encoded as a presupposition in the lexical entry of *discover*).¹¹ As the reader can see, the meaning just derived is equivalent to the meaning of the CQ-sentence.

5.4 Predicational wh-Qs

Let’s turn now to the PR-reading of (27)a, repeated below. Our hypothesis is that the reading paraphrased in (44)b derives from an LF in which the copular clause inside the embedded question has a PR-structure and the subject of the clause is interpreted transparently.

- (44) a. The Dean discovered who our favorite candidate is.
- b. Intended reading (**PR**): The Dean discovered something crucial about the person referred to as “our favorite candidate” (i.e. that he is the secret editor).

The LF for (44)a is provided in (45) below, only relevant parts included. In this LF, the copula is the intensional BE_{PRED} in (46), the DP in subject position is referential and the trace is a bound variable of type <s,e>. Since BE_{PRED} needs to combine with a property, the trace must be shifted into a property of individuals via IDENTIFY ((46)). Like before, movement of the *wh*-pronoun triggers the insertion of a λ -binder, which binds the trace at the bottom of the chain. The PR-structure has some crucial consequences with respect to the indexing of the world variables. Following Percus (2000), I assume that only the world variable selected by the verb must be bound by the most local binder (Generalization X), while the world variable in the DP subject (*our favorite candidate*) could be bound either locally, or by a higher binder. Because of these two possible co-indexations, an application of the (categorial variant of) Groenendijk & Stokhof’s question operator in (48) will yield two possible question intensions, as shown in (49).



¹¹ Here too, I assume that proposition-embedding *discover* is just like *know* with the additional presupposition that the attitude holder did not know the proposition expressed by Q_{EXT} at a time *t* preceding the utterance time. For simplicity, reference to the time variables is left implicit in the formulae.

- (46) $\llbracket \text{BE}_{\text{PRED}} \rrbracket = \lambda w. \lambda P_{\langle s, \langle e, t \rangle \rangle}. P(w)$
 (47) $\llbracket \text{IDENTIFY} \rrbracket = \lambda f_{\langle s, e \rangle}. \lambda w. \lambda x_e. f(w) = x$
 (48) $\llbracket ? \rrbracket = \lambda w. \lambda w'. \lambda P_{\langle s, \langle se, t \rangle \rangle}. [P(w') = P(w)]$
 (49) $\llbracket \text{Q}_{\text{INT}} \rrbracket = \lambda w. \lambda w'. [\lambda f_{\langle s, e \rangle} [f(w') = \iota x_e [\text{our-favorite-candidate}(w/w')(x)] = \lambda f_{\langle s, e \rangle} [f(w) = \iota x_e [\text{our-favorite-candidate}(w)(x)]]]$

Depending on the choice of the λw -binder, two question extensions are possible. Choosing the most local binder yields the question extension in (50), which I will call PR-opaque:

- (50) **Q_{EXT1} (PR-opaque)**
 $\llbracket \text{Q}_{\text{EXT1}} \rrbracket = \lambda w'. [\lambda f_{\langle s, e \rangle} [f(w') = \iota x_e [\text{our-favorite-candidate}(w')(x)] = \lambda f_{\langle s, e \rangle} [f(w_0) = \iota x_e [\text{our-favorite-candidate}(w_0)(x)]]]$

Intuitively, Q_{EXT1} picks out the set of worlds in which the individual who is our favorite candidate in those worlds fits exactly the same descriptions that he fits in the actual world (“descriptions” is just an intuitive way of referring to ICs). To illustrate the kind of partition induced by Q_{EXT1} , consider the toy model in (51), consisting of three concepts/descriptions and four possible worlds, w_0 being the actual world.

- | | | | |
|------|----------------------------|---------------------|-----------------------|
| (51) | f1: our favorite candidate | f2: the mean editor | f3: the Dean’s nephew |
| | w0 b | w0 b | w0 c |
| | w1 b | w1 b | w1 b |
| | w2 b | w2 b | w2 a |
| | w3 a | w3 a | w3 c |

Given the circumstances described in (51), Q_{EXT1} picks out the set of worlds $\{w_0, w_2, w_3\}$. w_1 is out because the individual who is our favorite candidate in this world (b) fits a description he does not actually fit in w_0 (i.e. he is also the Dean’s nephew), w_2 is in because our favorite candidate in this world (b) fits all and only the descriptions he actually fits in w_0 ; finally, w_3 is also in because the individual who is our favorite candidate in this world (c) fits all and only the descriptions that our actual favorite candidate fits in w_0 . Thus, as the truth-conditions in (52) below show, (44)a would be true in our toy model iff the set of worlds consisting of the Dean’s doxastic alternatives to w_0 is a subset of $\{w_0, w_2, w_3\}$. Notice, that these truth-conditions do not produce the reading that we were after, instead they yield another possible PR-reading that we hadn’t noticed before. According to (52), our sentence is predicted to be true if, for example, the Dean found out that our favorite candidate (whoever that is) is the mean editor (whoever that is).

- (52) $\llbracket \text{The Dean discovered who our favorite candidate is} \rrbracket (w_0) = 1$ iff
 $\forall w' \in \text{Dox}_D(w_0) (\lambda f_{\langle s, e \rangle} [f(w') = \iota x_e [\text{our-favorite-candidate}(w')(x)] = \lambda f_{\langle s, e \rangle} [f(w_0) = \iota x_e [\text{our-favorite-candidate}(w_0)(x)]]]$

- (53) Reading with Q_{EXT1} (**PR-opaque**): The Dean discovered that our favorite candidate and the mean editor are the same person, but he does not know which person.

The other question extension obtains by co-indexing the world variable inside the DP-subject with the top-most binder, I will call this question extension PR-transparent:

(54) **Q_{EXT2} (PR-transparent)**

$$\llbracket Q_{EXT2} \rrbracket = \lambda w'. [\lambda f_{\langle s, e \rangle} [f(w') = \iota x_e [\text{our-favorite-candidate}(w_0)(x)]] = \lambda f_{\langle s, e \rangle} [f(w_0) = \iota x_e [\text{our-favorite-candidate}(w_0)(x)]]]$$

Intuitively, Q_{EXT2} picks out the set of worlds in which the set of descriptions that our actual favorite candidate fits in those worlds are exactly the same that he fits in w₀. Assuming the toy model from before, it is easy to see that Q_{EXT2} picks out a different the set of worlds, namely the set {w₀, w₂}. Indeed, this time, we are only looking at our actual favorite candidate (Brown = b) and collect those worlds in which Brown fits exactly the same descriptions he fits in w₀. So, w₁ is out because, in this world, Brown is also the Dean's nephew (a description he doesn't actually fit), w₂ is in because Brown fits exactly the same descriptions he fits in w₀, whereas w₃ is out because Brown does not even exist in this world. Now, if the set of worlds consisting of the Dean's doxastic alternatives to w₀ is a subset of {w₀, w₂}, i.e. if he believes the proposition expressed by Q_{EXT2}, the sentence should be true. According to our hypothesis, this should give us the PR- reading that we were after. Is that so? Not quite. Take a look at the predicted truth-conditions in (55) below:

$$(55) \quad \llbracket \textit{The Dean discovered who our favorite candidate is} \rrbracket (w_0) = 1 \text{ iff} \\ \forall w' \in \text{Dox}_D(w_0) (\lambda f_{\langle s, e \rangle} [f(w') = \iota x_e [\text{our-favorite-candidate}(w_0)(x)]] = \lambda f_{\langle s, e \rangle} [f(w_0) = \iota x_e [\text{our-favorite-candidate}(w_0)(x)]]]$$

According to the truth-conditions in (55), (44)a is true iff the Dean found out that Brown (our actual favorite candidate) has all the descriptions he actually has, including the description of being our favorite candidate! This is clearly not the reading paraphrased in (44)b. The reading we want to predict, instead, is a reading according to which the Dean found out about Brown that he fits a description he actually fits. Which one? The one that the Dean was not supposed to find out (in our PR-scenario, the description “the mean editor”).

It seems to me that the problem we found is more general and may not turn out to be a problem just for this particular analysis. Consider the following scenario:

(56) John and Mary recently split up and are avoiding each other. Suppose I know this, but I nevertheless, decide to invite them both to my party. Now, suppose that the following dialogue takes place between my friend A and me.

A: John said he is not coming to your party.

Me: Why?

A: Cause he found out *who is coming*.

It is clear that for the sentence *he found out who is coming (to the party)* to be true in this context, John does not need to know of all the people who are coming to my party that they are coming, which is what (57) would require. Instead, what A's sentence conveys is that John found out that Mary is coming.

$$(57) \quad \llbracket \textit{John found out who is coming to the party} \rrbracket (w_0) = 1 \text{ iff} \\ \forall w' \in \text{Dox}_J(w_0) (\lambda x. [\text{coming-to-party}(w')(x)]] = \lambda x. [\text{coming-to-party}(w_0)(x)])$$

Now the question to ask is the following. In order to capture the PR-transparent reading in (44)b, would it be possible to restrict the domain of ICs to include just the relevant concept (*the mean editor*) in the same way that, in the party scenario, we restrict the domain of salient individuals to contain just Mary? If one can do that, then the truth-conditions in (55) correctly characterize the PR-transparent reading paraphrased in (44)b.

To wrap up, I proposed to derive the ambiguity of embedded copular questions discussed by Heim (1979) and Greenberg (1977) from the independently motivated ambiguity of copular clauses, which can have either a specificational or a predicational interpretation. Under the view adopted here, PRs and SPs project different structures with different binding possibilities for the world variables at LF. In particular, it follows from the analysis that the PR-structure only is compatible with a transparent reading of the subject of the copular clause (*our favorite candidate*). Whereas, assuming that both SP-subjects and CQs denote ICs, a (completely) transparent interpretation of these DPs is ruled out.

6. Conclusions

In this paper, I proposed an account for a truth-conditional contrast between CQs and their full-fledged question counterparts, known as Greenberg's observation. Greenberg (1977) points out that a sentence containing a copular question, such as *John discovered who the murderer of Smith is*, has a reading which is absent from its CQ counterpart *John discovered the murderer of Smith*: while the CQ-sentence can only mean that John found out the identity of the murderer of Smith, the sentence with the embedded question can also mean that John discovered something crucial about the person the speaker refers to as *the murderer of Smith*. My proposal is that the ambiguity of embedded questions of the type *who DP is* derives from the fact that the copular clause [_{IP} DP is t_i] can have either a specificational or a predicational representation and that only the predicational variant is compatible with a transparent reading of the subject. On the other hand, following Heim (1979) and Romero (2005)'s proposals that CQs are just individual concept-denoting DPs, the analysis predicts them to lack the ambiguity caused by the copular clause in their full-fledged counterparts.

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