Keeping Prices Low: an Answer to a Concealed Question *

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Abstract

I propose a novel theory of concealed questions that treats them as ascriptions of *de re*-belief. I adopt Aloni (2000)'s theory of conceptual covers and require that the context supplies a suitable identifier in addition to the one expressed by the argument DP of the concealed question predicate. The theory accounts for the core examples discussed in the literature and makes some interesting new predictions with respect to what DPs are acceptable as concealed questions.

1 Introduction

DPs in argument positions of certain predicates (e.g. object of *know*) can have the same truth-conditional impact as embedded interrogative clauses (cf. Barker, 1968; Heim, 1979). The phenomenon is dubbed **concealed questions** (henceforth, CQs).

(1) a. Cécile knows the capital of Norway.
≈ Cécile knows *what the capital of Norway is.*
b. John knows most of the prices in this supermarket.
≈ For most of the prices in this supermarket John knows *what they are.*

In the following, the DPs in questions will be called **CQ-DPs**, the embedding predicates **CQ-predicates**. $know_{CQ}$ differs from the acquaintance reading of *know*: First, acquaintance *know*, but not $know_{CQ}$ allow for substitution of co-extensional expressions:

(2) Cécile knows the capital of Norway.
The capital of Norway is the largest town in Norway.
[acquaintance: $\Rightarrow$, CQ: $\not\Rightarrow$] Cécile knows the largest town in Norway.

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(3) John knows a doctor that can treat your illness.
Every doctor that can treat your illness is also a golf instructor.
[acquaintance: ⇒, CQ: ⇏] John knows a golf instructor. Frana (2006)

Moreover, other languages may employ different lexical items for acquaintance and CQ knowledge (e.g. Italian, cf. Frana, 2006):[1]

(4) a. Gianni sa il presidente dell'Italia.
G. knows the president of Italy
'Gianni knows who the president of Italy is.' (only CQ)
b. Gianni conosce il presidente dell'Italia.
G. knows the president of Italy
'G. is (personally) acquainted with the president of Italy.' (no CQ)

The phenomenon raises many questions that have excited greater or lesser interest in previous research: How come a DP gets interpreted like a question? Why are CQs always identity questions? Which predicates embed CQs? Which noun phrases can occur within CQ-DPs? How do particular ambiguities come about (cf. 4.2)?

In answer, I propose an analysis that starts out from the observation that factivity is a crucial ingredient (cf. Frana, 2006). I argue that CQs constitute *de re*-belief reports, and I try to show that Aloni (2000)'s account of *de re*-belief offers a natural solution to the phenomenon under investigation. First, I briefly introduce the existing approaches to CQs. In section three, I discuss a problem with belief attribution that affects all of them and introduce a solution from the literature on *de re*-belief. In section four, I apply it to various subtypes of CQs. After a critical evaluation of the analysis that emerges, I conclude with a few remarks on further research.

2 Three Types of CQ-Theories

Theories of CQs are best grouped together according to what logical type they assign to CQ-predicates, that is, what semantic arguments correspond to the CQ-DP. Currently, the following three apporaches are considered most promising: type *e*-theory, individual concept theory, and propositional theory (cf. Romero, 2006, for detailed comparison).

type *e*-theories assume that $know_{CQ}$ takes two internal arguments, namely an individual u (type e) and a property P (type $P_{\langle s,et\rangle}$). Two variants have been proposed so far, which converge in that the belief subject knows of the individual u picked out by the CQ-DP that u has property P. They differ in where P comes from: Heim (1979) assumes that it is provided by the context, with a strong bias for the property mentioned

[1] Heim (1979) acknowledges the same contrast for German '*kennen* + DP' (only acquaintance) vs. '*wissen* + DP' (only CQ). All speakers I consulted (including myself) agree on *wissen* being limited to CQ readings, but both readings were judged acceptable for *kennen*. The restriction on *kennen* might corresponds to a regional variant.

in the CQ-DP (**pragmatic theory**). In contrast, Frana (2006) assumes that the CQ-DP simultaneously picks out the individual and contributes the property (***de re*-theory**).

individual concept theories (Heim, 1979; Janssen, 1984; Romero, 2005) propose that the CQ-DP denotes an individual concept (that is, a function from indices to individuals, type *se*). E.g., *the capital of Norway* is taken to denote the function that maps each index onto the city that is the capital of Norway at that index.

(5) $$f_{the-capital-of-Norway} := \begin{bmatrix} w_1 & \mapsto & \text{Oslo} \\ w_2 & \mapsto & \text{Paris} \\ w_3 & \mapsto & \text{Vienna} \\ & \dots & \end{bmatrix}$$

a knows x_{se} expresses that the belief subject a knows the correct value of individual concept x_{se} (all indices that constitute doxastic alternatives of the subject agree with the actual world on the value of x). E.g., for Cécile to CQ-know the capital of Norway means that at all worlds that according to her could be the actual one, the capital of Norway is the city that is the capital of Norway in the actual world (Oslo, in our case).

propositional theories of CQs (Nathan, 2006; Romero, 2006, 2007) assume that CQ-DPs quantify over a set of (true) propositions arising as identity predications from the CQ-DP. E.g. *capital of Norway* gives rise to the set $Q = \{u \text{ is capital of Norway} | \ u \in D_e\}$. Depending on the determiner of the CQ-DP, it is expressed that exactly one/at least one/most/every/...element(s) of Q are true at all of the belief subject's doxastic alternatives.

3 A Problem with *de re*-Belief

Apart from Frana (2006), factivity is not treated as essential to the theory of CQs. Moreover, CQs are analyzed in terms of beliefs about individuals simpliciter. The following scenario elucidates that this is highly problematic:

(6) scenario: *John gives you name and address of Dr. Maria Bloom (the individual DMB) who is indeed a doctor who can help you. That same night, John and DMB happen to be at the same party and she is introduced to him as "Mary". They start chatting and, since she is a sparetime semanticist, she entertains him with some classical puzzles of mistaken identity. John is very fascinated and ends up thinking she must be some sort of philosopher (or maybe, philologist?). It does not even occur to him that she might be a doctor.*

Intuitively, both (7-a) and (7-b) can be understood as true in the given scenario:

(7) a. John knows a doctor who can help you.
b. John thinks the person he is currently talking to is not a doctor.

In our scenario, DMB is the individual that verifies (7-a). Yet, DMB is John's interlocutor. Nevertheless, John does not seem entirely unreasonable to us. Hence, John's beliefs cannot be about an individual simpliciter, but have to be about an individual in a particular guise. This problem is not taken into account by the analyses of CQs that have been proposed so far. For (7-a), they derive belief of a singular proposition:[2]

(8) Frana (2006):
$\exists u_e[\text{doctor}(w)(u) \wedge \text{can-help-you}(w)(u) \wedge$
$\forall w' \in Dox_{john}(w)[\text{doctor}(w')(u) \wedge \text{can-help-you}(w')(u)]]$
There is an individual u which is actually a doctor who can help you, and John believes of that individual that he/she is a doctor who can help you.
($\Rightarrow$ John excludes that u is not a doctor)

(9) Nathan (2006):
$\exists p_{st} \exists u_e[p = \lambda w_1.[\text{doctor}(w_1)(u) \wedge \text{can-help-you}(w_1)(u)] \wedge p(w) \wedge$
$\forall w' \in Dox_{john}(w)[p(w')]]$
There is a true proposition that, for some individual u, is of the form "u is a doctor who can help you", and John believes that proposition
($\Rightarrow$ John excludes that u is not a doctor)

The puzzle we have encountered is an instance of Quine (1953)'s **double vision problem**. Similar problems with individual variables arise with cross-identification tasks. Granted that each individual is identical only to him-/herself, (10) would be trivial if *who* were interpreted as running over individuals of type e. Nevertheless, questions of cross-identification can be informative as bringing together e.g. names and persons identifiable by their position in the room.

(10) A: Who is who? - B: The person right next to you is Hans-Christian, the person closest to the window is Monika,. . . .

To solve these issues, it is generally assumed that questioning and belief attribution do not target individuals simpliciter, but only in certain guises. This can be implemented by letting variables range over individual concepts, and we obtain a **contingent identity theory**. Kaplan (1969) points out that we obtain counter-intuitive results if all individual concepts are taken into account.[3] Aloni (2000, 2005) argues that the set of suitable individual concepts depends on the perspective taken on the (relevant) individuals in a particular utterance context.

[2]Romero (2006) only spells out an analysis for an indefinite CQ-DP with *price* as the head noun. *price* is treated as being of type $\langle se, st\rangle$. It is not clear if *doctor* is to be treated likewise. If so, I would expect it to correspond to a set of constant individual concepts. But then, the problem of singular propositions arises again.

[3]The problem has become known as **the shortest spy problem**.

3.1 Conceptual Covers

The perspective taken on the (relevant) individuals in the utterance context corresponds to the concepts the interlocutors would employ to refer to these individuals. Aloni (2000, 2005) models such a perspective as a **conceptual cover**, a set of individual concepts that fulfills two requirements:

(11) Given a set of possible worlds W and a universe of individuals D, a **conceptual cover CC** based on (W, D) is a set of functions $W \rightarrow D$ such that:
$(\forall w \in W)(\forall d \in D)(\exists! c \in CC)[c(w) = d]$

A conceptual cover is therefore a set of individual concepts that meets the requirements of **existence** (at each index, all individuals are picked out), and of **uniqueness** (at each index, each individual is picked out by only one individual concept). What particular conceptual cover is salient determines for example what counts as an appropriate answer to an identity question. Consider *Who is the president of Mali?*:

(12) a. Amadou Toumani Touré. *at a history exam*
b. Him! (pointing at someone) *at a cocktail reception*

According to Groenendijk and Stokhof (1984), a question induces a partition on a set of possible worlds. An answer is relevant if it rules out some or, ideally, all but one of the resulting cells. The difference in relevance of (12-a) vs. (12-b) can be captured, if the partition dependends on what contextual cover is salient. An answer like (12-a) is helpful if the partition is induced with respect to (13), (12-b) is helpful if it is induced with respect to (14).

(13) NC $= \{\lambda w.\iota x[x \text{ is called } a \text{ in } w] \mid a \in K\}$ **naming cover**
partition induced: {*that George W. Bush is the president of Mali, that Amadou Toumani Touré is the president of Mali, that Hilary Clinton is the president of Mali,...*)

(14) RC $= \{\lambda w.d \mid d \in D\}$ **rigid cover**, used in pointing
partition induced: {*that this guy* (pointing at person at the bar) *is the president of Mali*, *that that guy* (pointing at a person close to the entrance) *is the president of Mali,...*}

For a cross-identification question as in (10), two conceptual covers have to be salient.

Moreover, conceptual covers provide the relevant restriction on the guises in which entities can be known *de re*. Following Kaplan, we assume that, e.g., if John believes *de re* of the individual DMB that she is a doctor, there has to be an individual concept x_{se} that (i) picks out DMB in the actual world, and (ii) at each of John's doxastic alternatives picks out an individual that is a doctor, and (iii) not any individual concept would do. Kaplan points out that the third requirement is crucial to avoid things like (15-a) come

out as true *de re*-knowledge, just because Mary is indeed the richest doctor in Germany, and John is reasonable enough to be aware that the richest doctor in Germany is a doctor, while not knowing anything about Mary. Instead of Kaplan's original proposal for (iii), I adopt Aloni (2000)'s theory that suitable individual concepts have to be part of a contextually salient conceptual cover F. The truth conditions for (15-a) can now be rendered as in (15-b).

(15) a. John believes that Mary is a doctor.
b. $\exists^F x[x(w) = \text{DMB} \wedge \forall w' \in Dox_{john}(w)[\text{doctor}(x(w'))]]$

Aloni (2000, 2005) proposes that the principles of Relevance, Informativity, Consistency, and Parsimony (her 'Avoid Accommodation!') jointly govern which conceptual cover is salient in an utterance context. She implements this in bi-directional OT. The first three constraints are inviolable and require respectively that the proposition expressed is relevant to the current task of the conversation, non-trivial and consistent with respect to the current state of information. The violable constraint of Parsimony prohibits to accommodate conceptual covers elements of which are not expressed explicitly. I assume that accommodating a naming cover (NC) is less costly than accommodating any other conceptual cover.

For (15-a), Informativity rules out a value for F that contains "the richest doctor in Germany"; Consistency rules out "the person John has just been introduced to" (we have described the scenario is saying that he does not consider her a doctor). Given that an element of the informal naming cover, "the person called Mary", is used explicitly, the sentence is considered false as a *de re*-report, even if an element from the standard naming cover ("the person called Dr. Maria Bloom") would make it true.

We can now proceed to extend the approach to concealed questions.

4 CQs under Conceptual Covers

4.1 The Basic Idea

For a start, I assume that $know_{CQ}$ takes an individual concept as its internal argument (this will be revised in (28), section 4.3):

(16) $[\![know_{CQ}]\!]^w = \lambda x_{se} \lambda u_e . \exists^F y[y(w) = x(w) \wedge \forall w' \in Dox_u(w)[x(w') = y(w')]]$

According to (16), the subject u *CQ*-knows individual concept x iff

- u has an **identifier** (another individual concept y) for the actual referent of x and
- u knows that x and y pick out the same individual (whichever that is)
- there are pragmatic constraints on what are possible identifiers (y has to come from a conceptual cover F that is contextually salient according to Informativity,

Relevance, Consistency and Parsimony).

For (17-a), I interpret *the capital of Italy* as a definite description of type e and assume that we are allowed to take its intension to avoid a type-mismatch (cf. Lasersohn, 2005).

(17) a. John knows the capital of Italy.
b. $[\![\text{the capital of Italy}]\!]^w$ = Rome
c. $[\![\text{the capital of Italy}]\!] = \lambda w.\iota u_e[\text{capital}(w)(\text{Italy})(u)]$
d. $[\![\text{(17-a)}]\!]^w = 1$ iff $\exists^F x[x(w) = \iota u_e[\text{capital})(w)(\text{Italy})]$
$\wedge\ \forall w' \in Dox_{john}(w)[x(w') = \iota u_e[\text{capital}(w')(\text{Italy})]]$

So, (17-a) is true at the actual world w iff, within the salient conceptual cover, there is an individual concept x which at w picks out the capital of Italy at w and, at all of John's doxastic alternatives also picks out whatever is the capital of Italy there. The information conveyed depends crucially on what conceptual cover F is salient: Because of Informativity, F cannot contain *the capital of Italy*. So, by Parsimony, F is the naming cover, which means that x can only be "the unique object called Rome" ($\lambda w.\iota u[u$ is called "Rome" at $w]$).

In order for other quantifiers to be interpretable, I adopt Nathan (2006)'s type shifts that map relational nouns[4] like *capital* (type $\langle s, \langle e, et\rangle\rangle$) to either sets of individuals (**Shift1**), or sets of individual concepts (**Shift2**).[5]

(18) a. from $\langle s, \langle e, et\rangle\rangle$ to a set of individuals $\langle s, et\rangle$:
$\lambda R_{\langle s,\langle e,et\rangle\rangle}\lambda w\lambda u_e.\exists v_e[R(w)(v)(u)]$ **Shift1**
b. from $\langle s, \langle e, et\rangle\rangle$ to a set of individual concepts $\langle se, e\rangle$:
$\lambda R_{\langle s,\langle e,et\rangle\rangle}\lambda x_{se}.\exists u_e[\forall w[R(w)(u)(x(w))]$ **Shift2**

With cross-categorial entries of quantificational determiners, we obtain quantifiers of type $\langle\langle se, t\rangle, \langle\langle se, t\rangle, t\rangle\rangle$. QR-ing them leaves a trace of type se.[6]

(19) a. John knows most European capitals.
b. [[most European capitals]$_i$ John knows t_i]
c. $[\![\textbf{Shift2}(\text{capitals})]\!]^w = \lambda x_{se}.\exists u_e[\forall w[\text{capital}(w)(u)(x(w))]$
d. Most$(\lambda x_{se}.\text{capital}_{\langle se,t\rangle}(x) \wedge \text{European}(x))$
$(\lambda x_{se}.\exists^F y[y(w) = x(w) \wedge \forall w' \in Dox_{john}(w)[y(w') = x(w')]])$

[4]In the sense of Partee and Borschev (2003), relational nouns are understood as nouns that characterize sets of individuals only with respect to one or more relational arguments, e.g. *capital of x*.

[5]The result of **Shift2** is not world dependent, this avoids Gupta's problem, cf. Dowty et al. (1981); Lasersohn (2005). Floris Roelofsen (p.c.) has pointed out to me that the resulting theory is maybe too restricted. For the moment, I will leave the issue aside.

[6]If *the* shall be treated as a quantifier, too, we need a further type-shift from $\langle s, \langle e, et\rangle\rangle$ to $\langle e, \langle se, t\rangle\rangle$:

(i) $\lambda R\lambda u_e\lambda x_{se}.\forall w[R(w)(u)(x(w))]$ **Shift2b**

Modulo uniqueness presuppositions, the results are the same for relational nouns, but no definite CQ-DPs could be derived from non-relational nouns. Cf. section 5 for discussion.

4.2 Reading A and B

The solution in terms of identifiers depending on contextually salient conceptual covers allows an interesting solution to a puzzling ambiguity observed first in Heim (1979). (20) is ambiguous between reading A (John and Fred have knowledge of the same kind), and reading B (John knows something about Fred's knowledge):

(20) John knows the capital Fred knows.

Reading A For exactly one country u, Fred can tell you what u's capital is, and John can also tell you what u's capital is. (John need not know anything about Fred.)

Reading B For exactly one country u, Fred can tell you what u's capital is, and John can tell you what country u that is. (John knows something about Fred; John need not know what the capital of u is).

A situation that verifies reading B, but not reading A can be described as follows:

(21) *The capital of Italy is Rome.*
Fred knows (≈ believes for good reasons): The capital of Italy is Rome. Fred does not know what any other country's capital is.
John holds possible:
The capital of Italy is Rome and Fred knows: The capital of Italy is Rome.
The capital of Italy is Paris and Fred knows: The capital of Italy is Paris.
The capital of Italy is LA and Fred knows: The capital of Italy is LA.
...

My proposal requires neither cross-cateogrial types of CQ-predicates (cf. Romero, 2006) nor a particular type shift (cf. Nathan, 2006). The ambiguity falls out from what conceptual covers are salient, and, therefore, what identifiers the two belief subjects have for what they are claimed to CQ-know.

(22) a. [John knows [the [[**Shift2**(capital) Fred knows]]]]
b. $[\![$the capital Fred knows$]\!]^w =$
$\iota x_{se}[\text{capital}_{\langle se,t\rangle}(x) \wedge \exists^F y[y(w) = x(w) \wedge \forall w' \in Dox_{fred}(w)[y(w') = x(w')]]$

(23) $[\![$(22-a)$]\!]^w = 1$ iff
$\exists^K z_{se}[z(w) = \iota x_{se}[\text{capital}_{\langle se,t\rangle}(x) \wedge \exists^F y[y(w) = x(w) \wedge$
$\forall w' \in Dox_{fred}(w)[y(w') = x(w')]]](w)$
$\wedge \forall w' \in Dox_{john}(w)[z(w') =$
$\iota x_{se}[\text{capital}_{\langle se,t\rangle}(w)(x) \wedge \exists y[y(w) = x(w) \wedge \forall w' \in Dox_{fred}(w)[y(w') = x(w')]]](w')$

]]

Assume that Fred can identify the capital of Italy as the city called Rome; so, $y =$ "the city called Rome" ($=\lambda w.\iota u_e$.called-Rome$(w)(u)$). This is highly likely because of

INFORMATIVITY and PARSIMONY. Now, either John has the same knowledge (reading A), then $z = y =$ "the city called Rome"; or John knows something about Fred (reading B), namely, that Fred can answer the question what the capital of Italy is (in that case, z is the individual concept that maps every index to the city that at w' is the city-individual u which is the capital of some country v and Fred knows at w' that capital$(w')(v)(u)$).

(24) reading A: $z = y = \lambda w.\iota u[\text{called-Rome}(w)(u)]$
reading B: z is "the capital Fred knows", interpreted as follows:
$z = \lambda w.\iota u[\exists v[\text{capital}(w)(v)(u) \wedge \forall w' \in Dox_{fred}(w)[\text{capital}(w')(v)(u)]]]$
($z =$ the individual concept that maps every index w' to the city that at w' is the city-individual u which is the capital of some country v and Fred knows at w' that u is the capital of v)

Note that, in our scenario, $\iota x.\text{capital}_{\langle se,t\rangle}(x) \wedge \exists y[y(w) = x(w) \wedge \forall w' \in Dox_{fred}(w)[y(w) = x(w)]$ (the interpretation of the relative clause) is $\lambda w.\iota u_e.\text{capital}(w)(\text{Italy})(u)$. Hence, it is not a possible value for z because it would attribute trivial knowledge to John. The identifier used at the pragmatic level can also be described as "the capital Fred knows". Yet it differs from how the definite description (which is responsible for the identifier to become available!) is interpreted in the course of the semantic computation. This requires closer investigation. As a working hypothesis, I assume that a definite description renders salient as an identifier the intension of its type e-denotation (in the sense of Lasersohn, 2005); - even if the noun is shifted to a set of individual concepts in the course of the semantic computation.

Irene Heim (p.c.) points out a possible problem with disambiguated variants of (20):

(25) a. John knows the same price Fred knows.
b. John knows the price Fred knows, too.

In both cases, only Reading A survives. I think the explanation is that the identifier needed for Reading B (*the price Fred knows*) is no longer expressed overtly (hence, via PARSIMONY), we are stuck with Reading A. [7]

[7] Matters become more complicated though, if presuppositions of additive particles are taken into account. In the following German variant of Heim's examples, as well as its English translation, the ambiguity arises again:

(i) Auch Frank kennt den Preis, den Fred kennt.
also F. knows the price that R. knows
'Frank also knows the price Fred knows.'

In these cases, the identifier is expressed explicitly. Nevertheless, problems arise if the presupposition of further price-knowledge is anchored not to a third belief subject, but to Fred's knowledge as mentioned in the relative clause. I will leave the issue for further research.

4.3 Indefinites

Let us now take a look at indefinites as in (26):

(26) a. John knows a doctor who can help you.
b. John knows a European capital.

In principle, we could treat them as *se*-quantifiers just like *every* and *most*. But it seems highly unintuitive to shift *doctors who can help you* to a set of individual concepts. Intuitively, (26-a) says that John has a means to identify for you a person who (actually and to him) is a doctor who can help you. This is exactly what Frana (2006) aims at.

(27) $\exists^F x[x(w) \in \text{doctor-who-can-help-you}(w) \wedge \forall w' \in Dox_{john}(w)[x(w') \in \text{doctor-who-can-help-you}(w')]$

But this requires a different lexical entry for *know* (type $\langle\langle s,et\rangle,et\rangle$):

(28) $[\![know_{CQ}]\!]^w = \lambda P_{\langle s,et\rangle}\lambda u_e.\exists^F x[x(w) \in P(w) \wedge \forall w' \in Dox_u(w)[x(w') \in P(w')]]$

Assuming that indefinites can be interpreted as properties (cf. Zimmermann, 1993), we immediately obtain (27) for (26-a). If we allow for a typeshift from *se* to $\langle s,et\rangle$ (**Shift 3**), we can give up the original entry for $know_{CQ}$, (16), and use (28) for definite descriptions and quantifiers as well. The result for the simple definite description is given in (30). For any u_e, x_{se}, w_s: $[u \in (\lambda v.v = x(w))]$ is equivalent to $[u = x(w)]$, so it is equivalent to the original (17-d).

(29) $\lambda x_{se}\lambda w\lambda u_e.u = x(w)$ **Shift 3**

(30) $[\![\text{John knows the capital of Italy.}]\!]^w = 1$ iff $\exists^F x[x(w) \in (\lambda u_e.u = \iota v[\text{capital}(w)(\text{Italy})(v)]) \wedge \forall w' \in Dox_{john}(w)[x(w') \in (\lambda u_e.u = \iota v[\text{capital}(w')(\text{Italy})(v)])]]$

If indefinites can be both quantifiers and properties, the framework offers two possibilities of dealing with indefinite CQs: *doctor (who can help you)* does not normally shift to a set of individual concepts, hence, (26-a) is interpreted with the indefinite in situ denoting a property (cf. (27)). But *capital* can undergo both **Shift1** (to a set of cities that are capital of some country or other) and **Shift2** (to a set of individual concepts recording some country's capital each); thus, we predict the following two construals for (26-b):

(31) [John knows [a Euorpean **Shift1**(capital)]]
$\exists^F x[x(w) \in \text{European-capital}_{\langle s,et\rangle}(w) \wedge \forall w' \in Dox_{john}(w)[x(w') \in \text{European-capital}_{\langle s,et\rangle}(w')]$

(32) [[a European-**Shift2**(capital)]$_i$ John knows t_i]
$\text{A}(\lambda x_{se}.\text{European-capital}_{\langle se,t\rangle}(x))$

$$(\lambda x_{se}.\exists^F y[y(w) = x(w) \wedge \forall w' \in Dox_{john}(w)[y(w') = x(w')]])$$

Let us first see what these construals correspond to. (26-b) can be interpreted as saying e.g. that John can name one city of which he knows that this is a Euorpean capital (without knowing which country's capital that is) (then (31) is true, but (32) is false). But (26-b) can also be understood as saying that John could answer only one question out of "What is the capital of the European country x?" (with x ranging over a contextually relevant set of European countries). Indeed this has been suggested as the only kind of reading available for (at least, abstract) relational nouns (cf. Frana, 2006).[8]

(33) John knows a price (in this supermarket).
e.g.: *John knows that the butter costs 1.30.*
and not: *John knows that 1.30 is a price (of some object or other).*

But is this an independent reading which corresponds to (32), or is it just a stronger interpretation of (31)? The following scenario indicates that (32) constitutes an independent reading:

(34) *Peter takes part in a quiz and has to answer questions i-iv about American capitals and v-viii about European capitals:*
(i) *What is the capital of Massachusetts?*
(ii) *What is the capital of Vermont?*
(iii) *What is the capital of Texas?*
(iv) *What is the capital of California?*
(v) *What is the capital of Norway?*
(vi) *What is the capital of Italy?*
(vii) *What is the capital of Austria?*
(viii) *What is the capital of Germany?*

Peter answers most of the questions correctly. After the quiz, John (the quizmaster), has to report which questions each candidate could answer. John himself has no clue what the correct answers are, and he isn't even very good at remem-

[8] Heim (1979) (p.60) describes a scenario in which a noun *phone number*, usually also associated with the stronger knowledge "knowing a phone number as someone's phone number", is just known to fall under the existentially closed predicate **Shift1**(phone number). She considers (i) in the scenario described below.

(i) John knows every phone number.

Suppose, John's task is to assign to a new phone a number which is not yet taken by any other phone. Then he needs to "know every phone number", not in the sense of knowing which number is whose, however, but merely in the sense of knowing which numbers are somebody's at all. This reading seems to involve quantification over phone numbers as individuals and should come out roughly as in (ii).

(ii) $\textsc{Every}(\lambda u.\text{phone-number}_{\langle s,et\rangle}(w)(u))$
$(\lambda u.\exists^F x[x(w) = u \wedge \forall w' \in Dox_j(w)[x(w') \in \text{phone-number}_{\langle s,et\rangle}(w')]])$

It remains to be worked out how this reading can be generated in a systematic way.

bering which questions the candidates could answer. Eventualy, John remembers that Peter got the capital of Austria right. So, John knows a European capital.

I think that scenario makes (26-b) true on a non-trivial reading, that is not captured by (31). The construal in (31) would hold true in the scenario, if we interpreted (26-b) as saying that (without thinking of Peter), John managed to remember that Austria was a European country (hence, "the capital of Austria" (whatever it is), would be some European capital). But in the given scenario, this is not the reading we are after: we report John as knowing something about Peter's performance, namely, which European capital-question he could answer. This is obtained from (26-b) if y is "the capital Peter identified correctly" (John himself neither has to know that this is Vienna nor that Austria is a European country). In the given context, (26-b) amounts to:

(35) there is an x_{se} which describes the capital of some European country (namely, $\lambda w.\iota u_e[\text{capital}(w)(\text{Austria})(u)]$), such that
John can identify it (by y = "the capital Peter identified correctly")

5 Evaluating the analysis

My proposal combines insights of type e-theories and individual concept theories. Type theoretically, it constitutes a new type of analysis: $know_{CQ}$ combines with a property P (type $\langle s, et\rangle$). Definite, indefinite and quantificational CQ-DPs are captured correctly, including ambiguities as arising from relative clause modification (readings A/B) as well as lesser investigated phenomena arising with indefinite CQ-DPs. A full-fledged theory of *de re*-belief is incorporated, which avoids incorrect belief ascriptions of knowledge about naked individuals (singular propositions). My analysis offers no new insights w.r.t. what are possible CQ-predicates. Despite Nathan (2006)'s careful study in favor of propositional embedding predicates, the class remains somewhat mysterious and seems to be influenced by purely lexical factors, especially when investigated cross-linguistically. For the moment, I follow Frana (2006) in rendering essential the one property common to all CQ-predicates, namely factivity.

Both type e-theories and individual concept theories have been criticized for their incorrect predictions with respect to **coordination**. Neither argument positions with type e nor with *se* can be coordinated with concealed questions:

(36) a. #John told me, and Mary visited, the capital of Norway. e-failure
b. #The price of milk fell last week and is known to John. *se*-failure

In contrast, the predictions of the property analysis are quite favorable. If Zimmermann (1993) is correct, opaque verbs like *suchen/look for* take property type arguments. German (37) and its English translation may not be perfect, but they are judged considerably better than coordinations involving e and *se* positions. (Note that *weiss*+DP can only have a CQ-reading, cf. footnote 1.)

(37) ?Hans sucht und Maria weiss einen Arzt, der Krebs heilen kann.
H. looks.for and Mary knows a doctor who cancer cure can
'?Hans is looking for, and Mary knows a doctor who can cure cancer.'

So far, only Nathan (2006) tries to answer the question of what are possible **head-nouns of CQ-DPs**. He presents a strictly type-logical analysis that constrains simple CQs to relational nouns. Only relational nouns can be shifted to a set of propositions as required for his CQ-analysis. Nathan (2006) observes that certain modifiers, in particular postnominal adjective and restrictive relative clauses can help to achieve acceptable CQs. He relates this to their inherent clausal make-up and devises special type shifters. Romero (2006) discusses some compositionality problems that arise if CQs are made to depend on the internal make up of the CQ-DP. But apart from that, Nathan (2006)'s notion of relationality is ad hoc (cf. his footnote 3, p.87). E.g., *picture* is claimed to be non-relational. As acknowledged by Nathan himself, this does not conform to any independent test of relationality (cf. Barker, 1995; Partee and Borschev, 2003). E.g., in English, only relational nouns allow for postnominal genitives (*of Peter*, cf. (38-a) vs. (38-c)). Contextually given relations holding with respect to non-relational nouns or non-inherent readings for relational nouns are expressed by 'double genitives' (e.g. *of Peter's*).

(38) a. the picture of Peter
b. the picture of Peter's
c. the horse of Peter/*Peter's

The type-logical restriction does not offer any explanation why in the absence of independent semantic reflexes, non-relational nouns can be understood as relational in certain contexts, suddenly allowing for the formation of CQs. In particular, no account is offered why just about any head noun can occur as an acceptable CQ-DP when reporting someone's performance on a quiz show (cf. Frana, 2006).

For these reasons, I consider a genuinely pragmatic solution to the restrictions more promising. The analysis I have proposed here, solely in virtue of relying on conceptual covers, predicts at least some of the restrictions observed on CQ-DPs. According to my theory, *CQ*-knowledge requires that there be a salient conceptual cover (of some set of relevant individuals) that does not contain the interpretation of the CQ-DP: the identifier crucial for CQ-knowledge cannot correspond to the interpretation of the CQ-DP because this would attribute trivial knowledge and would thus violate INFORMATIVITY. This immediately explains the contrast between (39-a) and (39-b), recognized as problematic for her pragmatic proposal in Heim (1979). Given that the naming cover is available for free (cf. PARSIMONY), for (39-a), it is easy to come up with a conceptual cover that does not contain the interpretation of *the capital of Italy*. For (39-b), of course C = $\{\lambda w.\iota u[u$ is the capital of $x \mid x$ is a country$\}$ would be an appropriate conceptual cover. Nevertheless, it is not rendered salient explicitly and thus violates PARSIMONY.[9]

[9]Spelling out in more detail Aloni (2000)'s bi-directional account, (39-b) should simply be blocked by (39-a).

(39) a. I know the capital of Italy.
b. #I know Rome.

It is also predicted that objects without proper names do not make for good concealed questions. While *carburetor (of the engine)* is clearly relational, (40) is reportedly infelicitous (cf. Nathan, 2006).

(40) #I know the carburetor.

Normally, carburetors do not have names; hence, we lack a conceptual cover that would contain an alternative identifier for the carburetor of my car.[10] Note, that quite in general, pointing (hence, the rigid cover), does not seem to be a valid method of identification for CQs. Excluding the rigid cover (maybe because of interference with acquaintance knowledge), we can also explain why CQs cannot be understood as *which*-questions (Nathan, 2006). E.g. in reply to *Three of these four puppies are male*:

(41) Tell me *which one the female is./#the female.*

Frana (2006) observes that, when reporting the outcome of a quiz where people have to recognize pictures, even CQs like (40) become acceptable. I think the theory in terms of conceptual covers offers a nice explanation for this fact: a quiz of that type immediately renders acceptable a conceptual cover like PictureC = {the object presented on picture one, the object presented on picture two,...}; analogously for other quiz forms.[11]

6 Conclusion

I have outlined a novel analysis of CQs that relies on a property type for the CQ-DP (or its trace). CQs are treated as ascriptions of *de re*-belief, analyzed along the lines of Aloni (2000, 2005). CQs thus depend on the perspective taken on the relevant individuals in the context of the conversation (conceptual covers). This accounts for standard examples with all type of CQ-DPs as well as various types of ambiguities, and it makes interesting predictions with respect to what are possible CQ-DPs. Further study is required w.r.t. the implications of the property type, and in particular the pragmatic factors involved in what constitute salient conceptual covers.

[10] For German, Hans-Christian Schmitz (p.c.) reports that the translation of (40) becomes grammatical when wondering about the particular type of carburetor - which, again, has a standard name.

[11] Past tense tends to refer to events of identification and can thus help to establish particular conceptual covers. This pertains also to an example Nathan (2006) (p.55) attributes to Kai von Fintel (p.c.) and qualifies as marginally possible:

(i) (I asked John the capital of Italy, and Peter the capital of Germany.)
John knew Rome but Peter didn't know Berlin.

Here, informative identifiers could be 'the capital I asked John/Peter', avoiding competition with the unmarked *John knew the capital of Italy, but Peter didn't know the capital of Germany.*

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