Concealed questions without meta-meta-questions[1]

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Abstract. Sentences like *John knows the price that Fred knows* are ambiguous between 'Reading A' and 'Reading B'. When such sentences have a further embedding, existing analyses predict 'Reading C' that involves meta-meta-questions. This paper presents an analysis in which the escalating ambiguity disappears when the referent of concealed question DP has a proper name. I show that Reading C is reduced to a version of Reading B without meta-meta-questions. The proposal is based on the idea that questions are given different interpretations depending on the perspective taken to identify entities in the domain.

Keywords: concealed question, meta-question, conceptual cover, perspective, name, concept

1. Introduction

Concealed questions (CQ) are determiner phrases (DP) interpreted as questions (Q).

(1) John knows Mary's phone number.
→ John knows the answer to the question, "What is Mary's phone number?"

An intriguing question explored widely in the literature revolves around the ambiguity of (2).

(2) John knows the price that Fred knows. (Heim 1979)

Two different readings exist for (2), known since Romero (2005) as 'Reading A' and 'Reading B'.[2] These two readings differ in the question to which the matrix subject John knows the answer.

Context: The set of relevant questions consists of *questions* about prices.
{"what is the price of milk?", "what is the price of bread?", "what is the price of butter?" …}

Reading A
Fred knows the answer to the Q: what is the price of milk?
John knows the answer to the same Q: what is the price of milk?

Reading B
Fred knows the answer to the Q: what is the price of milk?
John knows the answer to the meta-Q: which of these Qs does Fred know the answer to?
But John might not know the answer to the Q: what is the price of milk?

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[2] This paper does not address predicational readings (or equivalently, set readings) pointed out in Roelofsen & Aloni (2008) and Frana (2010). It would suffice to note that these additional readings are understood as versions of existing reading types since the proposal is about reducing the number of reading types per se, which will be made clear as the argument unfolds.

The complexity of available readings is expected to increase when ambiguous sentences like (2) have a further embedding. Romero observes 'Reading C' for (3) below.

(3) John knows the price that Fred knows: the price announced yesterday morning.

Context: The set of relevant questions consists of *meta-questions* about prices.
{"which price was announced this morning?", "which price was announced yesterday morning?", "which price was announced the day before yesterday in the morning?" …}

Reading C
Fred knows the answer to the meta-Q: which price was announced yesterday morning?
John knows the answer to the meta-meta-Q: which meta-Q does Fred know the answer to?

The set of relevant questions for Reading C consists of meta-questions about prices, namely questions about questions about prices. They are meta-questions because what is being asked about is not the price value of some product, but the product itself whose price was announced at a certain time. For example, Fred knows that the price announced yesterday morning is not the price of bread but the price of milk, possibly without knowing how much milk costs. In other words, Fred knows the answer to the meta-question, "Which product's price was announced yesterday?" but does not know the answer to the question "What is the price of milk?". Since the question Fred can answer is already a meta-question, the question John can answer is a question about meta-questions, namely a meta-meta-question ("Which meta-question does Fred know the answer to?"). Among the relevant meta-questions, John knows that the second meta-question is the one whose answer is known to Fred (i.e., "Which price was announced yesterday morning?"). However, John does not necessarily know that the price announced yesterday morning is the price of milk (nor that it is $4).

This paper mainly concerns these three types of readings observed in existing proposals (Romero 2005, Nathan 2006, Frana 2013). I show that Reading C is reduced to a version of Reading B without meta-meta-questions if the semantics of questions takes into account the way in which objects in the domain are identified (Aloni 2001). The proposal applies explicitly to cases where the referents of CQ DPs have a proper name. Consider (4) below, whose structure is the same as that of (3) except that the head noun of the CQ DP is 'capital' instead of 'price'. Possible referents have a proper name, for example, London.

(4) John knows the capital that Fred knows: the capital whose mayor is Khan.

Once names are understood as individual concepts, precisely as constant functions denoting the same individual across indices, the questions Fred can answer in Reading B and Reading C are interpreted as having the same type. As a first step, these questions are both presented as *questions about concepts* that are expected to be answered using concepts, where names are treated just as definite descriptions except that their value does not vary across different possible worlds. Further, I show how questions about concepts are considered equivalent to *questions about the values of concepts* through a meta-reduction process. A desirable consequence of applying this two-step process is that Reading C is reduced to a mere variation on Reading B. The meta-meta-question that characterized Reading C is no longer a meta-meta-question but a meta-question, namely a question about questions about the values

of concepts. The analysis can be applied to even more complicated sentences where an additional embedding would introduce a new reading type with a meta-meta-meta-question in it. Under this analysis, the extra reading would remain an A-type or B-type reading, depending on whether meta-knowledge is involved or not. Therefore, no spiral of additional reading types or meta-questions is expected. In a system where knowledge is considered a primitive construct, the number of distinct reading types will correspond to the number of epistemic agents involved.

The parsimony argument in this paper is primarily motivated by the well-founded idea that identity questions are interpreted differently depending on the perspective taken to identify individuals in the domain (Aloni 2001). For example, the capital referred to by the CQ DP in (4) can be identified using different perspectives depending on the context. Possible options for identifying the objects include taking a name perspective, a country perspective, or a mayor perspective. In Aloni's theory, individuals in the domain under a certain perspective are formalized as a set of individual concepts, namely a conceptual cover. Not only definite descriptions but also proper names can form this set of individual concepts.

In the following section, I walk through each reading type for sentences like (4), focusing on how the three types of readings are described as different from one another in the existing proposals. Section 3 constructs the key idea of this paper. I show that the three-way ambiguity becomes two-way in terms of question types and reading types. In Section 4, the analysis is presented in a compositional setting, followed by relevant details of the formal apparatus adopted. Section 5 briefly addresses how the proposal relates to existing accounts of concealed questions.

2. Demystifying Reading C

Consider (4) repeated below, followed by three possible readings as sketched in Romero (2005: fn9). The bold question types characterize each reading.

(4) John knows the capital that Fred knows: the capital whose mayor is Khan.

For Reading A and B, the set of relevant questions consists of questions about capitals answered using names like 'London'. We assume a context that determines the following set:

{"which is the capital whose mayor is Khan?", "which is the capital whose mayor is Hidalgo?", "which is the capital whose mayor is Müller?" …}

Reading A
Fred knows the answer to the **Q**: which is the capital whose mayor is Khan?
John knows the answer to the same **Q**: which is the capital whose mayor is Khan?

Reading B
Fred knows the answer to the **Q**: which is the capital whose mayor is Khan?
John knows the answer to the **meta-Q**: which of these Qs does Fred know the answer to?
But John might not know the answer to the Q: which is the capital whose mayor is Khan?

For Reading C, we have the following set of relevant questions consisting of meta-questions about capitals that are answered using descriptions like ‘the capital of England’:

{“which capital’s mayor is Khan?”, “which capital’s mayor is Hidalgo?”, “which capital’s mayor is Müller?” …}

Reading C
Fred knows the answer to the **meta-Q**: which capital’s mayor is Khan?
John knows the answer to the **meta-meta-Q**: which meta-Q does Fred know the answer to?
But John might not know the answer to the meta-Q: which capital’s mayor is Khan?

Three points about these readings are to be clarified before moving onto the main analysis. First, why does Reading C have a different set of relevant questions? Note that the seeming difference does not come from assuming a whole different context but only from the question type. We uniformly assume a context where questions of some type are being asked using information about the mayor. In Reading A and Reading B, these questions are simple questions because they are answered using rigid values like names. On the other hand, the relevant questions for Reading C are answered using another set of descriptions like ‘the capital of England’. This difference, whether the expected answer is rigid or descriptive, is what makes these two sets of questions distinct in question types, one as a set of questions, the other as a set of meta-questions. It leads to introducing another reading type, namely Reading C that involves meta-questions for Fred and meta-meta-questions for John.

Another point is that these sets of relevant questions are not invariable because the context may allow other perspectives to be salient than the one provided explicitly by the CQ DP. For example, given the DP ‘the capital whose mayor is Khan’, I assumed a uniform perspective under which the objects in the domain are identified by their mayor. That is, information about the mayor provides the most natural set of relevant questions, roughly in the form of “Which is the capital whose mayor is _____?”. However, different contexts than the one provided by the DP could also contribute as far as the question types are matched. Depending on QUD, relevant questions for all three readings might take the form of “Which is the capital of _____?” where the blank is filled with information about the country.

The last point to mention concerns meta-knowledge. The distinction between Reading A and Reading B lies in whether John has knowledge about Fred’s knowledge. In Reading A, John and Fred might not even be aware of each other’s existence. On the other hand, what makes Reading C distinct from Reading B is not meta-knowledge because, in both readings, John has knowledge about what Fred knows. The major difference between Reading B and Reading C is in the type of questions that Fred can answer in each reading, which goes back to the first point that the two sets of relevant questions only differ in the question type. For Reading A and Reading B, the relevant questions are simple questions, meaning that Fred can answer them using rigid values such as capital names. For Reading C, the relevant questions are meta-questions to be answered by capital descriptions, and it is one of these meta-questions that Fred can answer. In the following section, I show that this difference between Reading B and Reading C is an illusion that can be dismantled by considering the way in which the objects in the domain are identified. However, the distinction between Reading A and Reading B will remain intact to capture the essential difference between knowing the

answer to a question and knowing which question's answer is known to someone else. This would amount to knowledge being assumed to be an implicit primitive.

To my knowledge, the nature of these readings described so far has not been demystified in the literature. This could partly be the reason why the fourth possible reading type has been passed over while the third reading was recognized. We might want to call it Reading D, where the matrix subject John and the embedded subject Fred both know the answer to the same meta-question expecting a descriptive answer. The set of relevant questions would be the same as in Reading C. Intuitively, however, this new reading has more in common with Reading A because John does not know what Fred knows, namely no meta-knowledge.

3. The main proposal

In this section, I show how complex CQ sentences like (4) can be interpreted in a way that simplifies a set of readings previously observed. The proposal reduces Reading C to Reading B (and Reading D to Reading A).

The previous section pointed out that questions which seem identical might actually differ in their type. Consider the following questions asking about the same object, "Which is the capital whose mayor is Khan?" and "Which capital's mayor is Khan?" In Reading A and Reading B, the former is a question about *capital names*, expecting a name as its answer. In Reading C, the latter is a question about *capital descriptions* looking for a descriptive answer like 'the capital of England'. Questions of the latter type are considered questions about questions, namely meta-questions, because the descriptive answers should already have been built out of simple questions about capitals that are answered using rigid values.

It would be easier to identify what is at stake in each reading type if we further disambiguate the question types by making a distinction (i) between questions about *names* and questions about *descriptions*, and (ii) between meta-questions to be answered using descriptions and meta-questions involving meta-knowledge. As a first step, I formulate below each reading for (4) in a way that its interpretation depends on which questions are resolved by the agent A's information state σ_A (σ_F for Fred's and σ_J for John's).[3] I set aside the issue of Reading D for now since it is a natural extension of reducing Reading C to Reading B.

(4) John knows the capital that Fred knows: the capital whose mayor is Khan.

Reading A
σ_F resolves the **Q about names**: which is the capital whose mayor is Khan?
σ_J resolves the **Q about names**: which is the capital whose mayor is Khan?

Reading B
σ_F resolves the **Q about names**: which is the capital whose mayor is Khan?
σ_J resolves the **Q about Qs about names**: which Q about names does σ_F resolve?

[3] Within a possible world framework, it would be σ_A^w, *A*'s information state in *w*, namely a set of worlds compatible with what *A* takes to be the case in *w*.

Reading C
σ_F resolves the **Q about descriptions**: which capital's mayor is Khan?
σ_J resolves the **Q about Qs about descriptions**: which Q about descriptions does σ_F resolve?

So far, we have assumed that questions about names and questions about descriptions are different types of questions because names like 'London' are rigid whereas descriptions like 'the capital of England' are not. Definite descriptions provide individual concepts, which can pick out different objects in different possible worlds. For example, the individual concept 'the capital of England' is a function from indices to individuals telling which is the capital of England at a given index. It might be London, Seoul, or Moscow, depending on which index the function is evaluated at. Once descriptions are modeled as denoting individual concepts, questions about descriptions are understood as *questions about concepts*, whereas questions about names tentatively as *questions about the values of concepts*. The difference led us to think that 'Q about descriptions' in Reading C is a meta-question. Note that this meta-question is distinct from 'Q about Qs about names' in Reading B, which is also a meta-question but for a different reason. Crucially, the question σ_J resolves in Reading B involves meta-knowledge.

Alternatively, names can also be understood as individual concepts, namely functions giving an extension at a given world. What is special about names is that they are constant functions whose value does not vary across indices. Therefore, I suggest that both questions about names and questions about descriptions be understood as *questions about concepts*, summarized as follows:

Reading A
σ_F resolves the **Q about concepts**: which capital's mayor is Khan?
σ_J resolves the **Q about concepts**: which capital's mayor is Khan?

Reading B
σ_F resolves the **Q about concepts**: which capital's mayor is Khan?
σ_J resolves the **Q about Qs about concepts**: which Q about concepts does σ_F resolve?

Reading C
σ_F resolves the **Q about concepts**: which capital's mayor is Khan?
σ_J resolves the **Q about Qs about concepts**: which Q about concepts does σ_F resolve?

A significant move taken right above is to see questions about names as having the same type as questions about descriptions, uniformly as 'Q about concepts'. Therefore, other than 'Q about concepts', we only have 'Q about Qs about concepts' to refer to those involving meta-knowledge, namely the questions σ_J resolves in Reading B and Reading C. Now the two readings look alike as intended. However, we are still not convinced that meta-meta-questions are successfully eliminated. What exactly is the 'Q about Qs about concepts'? Is it a meta-question or a meta-meta-question? It might appear that this move actually generalized to the worst case by modeling names as denoting concepts, thus elevating almost every question type involved.

I propose that all the questions about concepts in Reading A, B, and C be interpreted as *questions about the values of concepts*, which are identity questions in the sense of Aloni (2001). In Reading A and Reading B, Fred can state the identity relation between two concepts: a description and a name (the capital whose mayor is Khan = London). It means that Fred can identify the object whose mayor is Khan and whose name is London, and he knows that they are one and the same object. In this case, the object is identified by means of its name (London) and its mayor (Khan). Note that using names is not the only way of identifying objects. It can be any perspective that is mutually exclusive and collectively exhaustive enough to identify the objects in the domain. Names, in general, constitute one such perspective, naturally meeting the requirement for identification. Definite descriptions can also uniquely identify the objects if under a certain perspective. In Reading C, for example, Fred can state the identity relation between two descriptions (the capital whose mayor is Khan = the capital of England). Given the context, these concepts will formally denote the same object in every world compatible with what Fred takes to be the case. In other words, not only names but also descriptions under a perspective are allowed to be associated with a unique object as their referent. It is possible in Aloni's framework because interpreting identity questions involves quantifying over *individuals under a perspective*, overcoming both kinds of issues arising from quantifying over individuals and quantifying over individual concepts. This last step corresponds to a meta-reduction, ensuring that all the meta-meta-questions are eliminated from Reading A, B, and C.

Reading A
σ_F resolves the **question about the values of concepts**: what is the value of the concept 'the capital whose mayor is Khan'?
So does σ_J.

Reading B
σ_F resolves the **question about the values of concepts**: what is the value of the concept 'the capital whose mayor is Khan'?
σ_J resolves the **question about questions about the values of concepts**: for which concept C does σ_F resolve the question about the values of concepts, "what is the value of C?"

Reading C identical to Reading B

The advantage of applying the two-step process to complex CQ sentences is that the expected readings are neatly simplified, reducing Reading C to a version of Reading B.[4] The question that σ_F resolves in Reading B has the same type as the corresponding one in Reading C, once names are modeled as denoting individual concepts. I also provided a conceptual explanation of why a question about questions about concepts is not a meta-meta-question but to be a meta-question. This is because following Aloni (2001), the questions about concepts in Reading B and C can both be understood as questions about the values of concepts, i.e., identity questions asking about the same object under different perspectives, which will be elaborated in the following section. Therefore, two achievements in order: matching the

[4] It follows that the tentative Reading D (in which Fred and John can answer the same meta-question and no meta-knowledge is involved) collapses into Reading A. In the proposed analysis, the meta-questions in Reading D are questions about descriptions, namely questions about concepts, which are then meta-reduced to questions about the values of concepts.

question types between Reading B and Reading C and eliminating meta-meta-questions through a meta-reduction. The same process can simplify even more complicated sentences. Potential reading types predicted to involve meta-…meta-questions collapse into either Reading A or B, depending on whether the matrix subject has knowledge about the embedded subject's knowledge (B-type) or not (A-type).[5]

4. Meta-reduction under conceptual cover

I present conceptual cover (Aloni 2001), the formal apparatus that accounts for the proposal in the previous section, which formalizes the idea of identifying individuals in the domain under different perspectives. Building on its application to concealed questions (Aloni 2008), it will be shown in a compositional setting that Reading C is a variation on Reading B.

4.1. Conceptual cover

To illustrate the idea that the interpretation of identity questions depends on perspectives, Aloni provides an example where two cards are placed face down on the table: one is the Ace of Spades, and the other is the Ace of Hearts. You do not know which one is the Ace of Spades, the card that will make you win. In this situation, the following question can be interpreted in two different ways.

"Which is the winning card?"

If this question is interpreted as asking about the rule, the cards will be identified by suit: 'the Ace of Spades' or 'the Ace of Hearts'. Now, if it is your turn to venture a guess as a participant of the game, the cards will be identified by position: 'the card on the left' or 'the card on the right' (you could also point at one of them). In the latter context, 'the Ace of Spades' will not count as a felicitous answer. The possible answers in each case comprise a set as follows:

Cards identified by suit: {the Ace of Spades, the Ace of Hearts}
Cards identified by position: {the card on the left, the card on the right}

The perspective-sensitivity illustrated in this example shows that what counts as a possible answer varies depending on the perspective taken to identify the objects in the domain. Each set of possible answers under a certain perspective provides a set of individual concepts, namely a conceptual cover. A conceptual cover (CC) is formally defined as a set of functions from worlds (W) to individuals (D) such that

$\forall w \in W : \forall d \in D : \exists! c \in CC : c(w)=d$

[5] The proposal applies well to cases that involve rigid values. What if the objects do not have a name? For example, 'the price of milk' at a given world is likely to turn a numerical value, say $4, which can hardly be conceptualized and be uniquely picked out unless supported by the context. To account for these cases, Aloni & Roelofsen (2011) introduce a derived cover.

A conceptual cover's defining property can be stated as the existence and uniqueness condition that each individual in a given world is identified by only one individual concept in the cover. The condition guarantees that conceptual covers represent the domain of individuals exclusively and exhaustively. As a result, different conceptual covers correspond to different ways to cover the same domain. It prevents the following set of concepts from forming a conceptual cover because the objects referred to by these concepts fail to cover the domain in such a way:

{the card on the left, the Ace of Spades}

In the conceptual cover framework, variables range over the elements of conceptual cover. However, the denotation of variables in a given world is not an individual concept but an individual, namely the value of the concept in that world. The domain of quantification consists of *individuals under a perspective*.

Aloni adopts the partition semantics (Groenendijk & Stokhof 1984), according to which the intension of questions is a partition, i.e., a set of propositions.[6] A partition is composed of non-overlapping cells, each of which collects the worlds that agree on what the answer is, and the union of which equals every possible world in the domain. Consider the following question, "Who came to the party?". If the individuals who came to the party are the same in w_1 and w_2, these two worlds will belong to the same cell of the partition. Each set of worlds collected this way comprises a cell representing a possible answer to the question, which is equivalent to a proposition that contains every world in that cell. The partition as a whole is then a set of propositions.

In the partition approach, the extension of questions in a given world is the true exhaustive answer, i.e., a proposition. This proposition contains a set of worlds in which the set of individuals who came to the party is the same as in the evaluation world. For simplicity, we only look at single-*wh* questions. The extension of "Who came?" in w is given below.

$\lambda w'[\lambda x.\mathsf{came}(w')(x) = \lambda x.\mathsf{came}(w)(x)]$

As we consider perspective-sensitivity, interpreting questions involves quantification over the elements of the conceptual cover determined by the context, rather than bare individuals. The meaning of questions under cover is thus a partition in which each cell collects the worlds that agree on which concepts identify the individuals who came to the party. For example, in w_1 and w_2, if the individuals who came to the party are covered by the same concepts (i.e., by the same elements in the cover), these two worlds will belong to the same cell of the partition. The extension of "Who came?" in w under cover is then a set of worlds in which the unique individual who came is identified by the same element of the contextually determined cover CC as follows:

$\lambda w'[\forall c \in CC\ [c(w') = \lambda x.\mathsf{came}(w')(x) \leftrightarrow c(w) = \lambda x.\mathsf{came}(w)(x)]]$

[6] Aloni (2001) shows that conceptual covers are also compatible with other theories of questions, including Karttunen (1977), Ginzburg (1995a, 1995b), and Krifka (1999).

4.2. Concealed questions under conceptual cover

Concealed questions are DPs interpreted as questions. To resolve the mismatch, Aloni (2008) introduces an operator ↑ that shifts an individual-denoting expression into a question, namely a proposition of type <*s,t*> as in the partition approach.

Type-shifter ↑[7]
$\lambda x_e.\ \lambda w'.\forall c \in CC : c(w') = x \leftrightarrow c(w) = x$

A simplified meaning for *know* is given below, which takes a proposition as an argument.[8]

$[\![\text{know}]\!]^w = \lambda p_{<s,t>}.\lambda y_e.\sigma_y^w \subseteq p$

Going back to the card game situation in the previous subsection, we derive the following CQ sentence *Mary knows the winning card*. Given the two different contexts where the cards are identified either by suit or by position, two conceptual covers are assumed as follows:

CC_1 = {the Ace of Spades, the Ace of Hearts}
CC_2 = {the card on the left, the card on the right}

What is type-shifted is the individual-denoting description 'the winning card' whose extension is a unique individual written as winning card. In the context where the cards are identified by position, CC_2 is salient.

$[\![\uparrow \text{the winning card}]\!]^w = \lambda w'.\forall c \in \boldsymbol{CC_2} : c(w') = \text{winning card} \leftrightarrow c(w) = \text{winning card}$

$[\![\text{Mary knows the winning card}]\!]^w = 1$ iff
$\sigma_M^w \subseteq \{w' : \forall c \in CC_2\,[c(w') = \text{winning card} \leftrightarrow c(w) = \text{winning card}]\}$

4.3. Reading C as a variation on Reading B

The goal of this subsection is to show that the distinction between Reading B and Reading C can be captured only by cover resolutions, therefore trivial under cover. For expository purposes, we only engage with Fred's information state, which is relevant to this goal.

First, we assume the following covers for (4) repeated below.

(4) John knows the capital that Fred knows: the capital whose mayor is Khan.

Capitals identified by name: CC_1 = {London, Paris, Berlin, …}
Capitals identified by country: CC_2 = {the capital of England, the capital of France, …}

[7] See also (35) in Uegaki (2016) for a precise compositional formulation.

[8] In the partition view, the extension of questions in a given world is a proposition. It allows *know*, whether it embeds questions or propositions, to have a uniform compositional meaning.

In Reading A, John identifies the unique capital whose mayor is Khan by its name. So does Fred. Therefore, the questions to which Fred and John know the answer can both be interpreted under cover, meaning that these questions can be understood as questions about the values of concepts. The context determines the name cover CC_1 as the domain of quantification.[9]

In Reading B and Reading C, the questions John can answer are meta-questions. It was also shown that the difference between Reading B and Reading C lies in under which cover Fred can identify the capital whose mayor is Khan. In Reading B, Fred can identify the object by its name as in Reading A. On the other hand, in Reading C, Fred can identify it by its country. This difference between Reading B and Reading C is captured by cover resolutions: CC_1 and CC_2. Suppose that the extension of 'the capital whose mayor is khan' is a unique object written as capital-khan.

Reading B (Fred can identify capital-khan by its name, i.e., under CC_1)
$\sigma^w_F \subseteq \{w' : \forall c \in \boldsymbol{CC_1}\ [c(w') = \text{capital-khan} \leftrightarrow c(w) = \text{capital-khan}]]$

Reading C (Fred can identify capital-khan by its country, i.e., under CC_2)
$\sigma^w_F \subseteq \{w' : \forall c \in \boldsymbol{CC_2}\ [c(w') = \text{capital-khan} \leftrightarrow c(w) = \text{capital-khan}]]$

Once the questions that Fred can answer in each reading are both interpreted as simple questions under cover that do not make use of the notion of meta-questions, the questions that John can answer in Reading B and Reading C are both interpreted as a meta-question, roughly "which question's answer is known to Fred?". Interpreting questions without considering perspective-sensitivity led to the illusion that Reading B and Reading C belong to separate reading types. In the framework taking into account perspectives, by contrast, the distinction between Reading B and Reading C is trivial not only conceptually but also formally under cover. The sketch above illustrates that they are just different versions within the same reading type, which only differ in their cover resolution.

5. Perspective-sensitivity in concealed questions

I conclude by briefly addressing how the proposal relates to existing accounts of CQ.

There are mainly three types of analyses in terms of what concealed questions denote: the proposition analysis (Nathan 2006, Romero 2007, Aloni 2008, Aloni & Roelofsen 2011, Barker 2016), the individual concept analysis (Romero 2005, Romero 2010, Frana 2010, Frana 2013), and the property analysis (Heim 1979, Frana 2006, Schwager 2008). This paper does not provide novel evidence that advances the debate. Rather, the main issue relevant to this paper is the domain of quantification in deriving the A/B/C ambiguity. This can be addressed separately from the larger issue of what CQ DPs denote in the end. In other words, it is not the final semantic type assigned to CQ DPs that decides whether or not a proposal

[9] As mentioned in Section 2, different cover resolutions will be possible depending on the context. For example, in Reading D, Fred and John know the answer to the same meta-question (though it is not a meta-question anymore in this proposal, leading Reading D to collapse into Reading A). In this case, the context could provide CC_2 instead of CC_1.

can benefit from this paper's parsimony account. Focusing on the A/B/C/… ambiguity and contextually determined domains of quantification, it might be beneficial to group together the proposals that consider perspective-sensitivity as suggested in Aloni & Roelofsen (2011) and call them the *individual under a perspective* analysis. In the conceptual cover framework, the formal apparatus allows questions about *concepts* to be interpreted as questions about the *values of concepts*, i.e., individuals, without quantifying directly over bare individuals.

Another analysis that uses conceptual cover is Schwager (2008), where Kaufmann models concealed questions as denoting properties. The parsimony proposal of the present paper could also be achieved in Kaufmann's property account extended to Reading C. In all three readings, Fred knows the answer to the same type of questions, which only differ in cover resolutions. What distinguishes Kaufmann's cover-based account from the approach adopted in this paper is that in Kaufmann's analysis, cover resolutions account for not only the B/C ambiguity but also the A/B ambiguity. Specifically, the question *John* can answer in Reading B, which involves meta-knowledge, is also interpreted under cover, meaning that the difference between the questions John can answer in Reading A and Reading B is explained as a difference in cover resolutions. In the context of the present paper, it amounts to meta-reducing all reading types to A-type, eliminating every meta-question from the scene.

However, the A/B ambiguity seems to deserve a different treatment than that of the B/C ambiguity because knowing the value of a concept is substantially different from knowing which concept someone has knowledge about. Compare what σ_J resolves in Reading B to what σ_J resolves in Reading A. The reason why only the latter is interpreted under cover in this paper is because Reading A does not involve meta-knowledge, whereas, in Reading B, John has knowledge about Fred's knowledge. Although Kaufmann's analysis achieves simplification to a greater extent in terms of meta-questions and reading types, knowledge being an implicit primitive, and therefore meta-knowledge not forming a perspective for identification, can directly model the difference between Reading A and B.

The individual concept analysis has been pointed out to suffer from inflating the types of relevant entries (as hinted in Aloni 2008, Frana 2013: fn 24). In Romero (2005), the A/B ambiguity is explained as whether $know_{CQ}$ combines with the extension of CQ DP or the intension of CQ DP. In Reading A, the extension is a non-rigid intensional argument of type $\langle s,e \rangle$ saturating $know_{CQ}$ that behaves similarly to intensional transitive verbs. The intension of CQ DP in Reading B then denotes a concept of individual concept, which has type $\langle s,se \rangle$. As the sentence gets more complicated, it would have to introduce, ultimately, an infinite number of entries for $know_{CQ}$ that combine with different types of arguments. The consequence is the escalating number of meta-questions and the corresponding reading types.

A possible counterargument to this point would be that multiple lexical entries for *know* are "pure crosscategorial variants" of one other, as rightly pointed out in Romero (2005). In this regard, the present proposal does not directly aim to deny specific accounts of CQ. It rather empirically supports the need to consider perspectives in the semantics, which can simplify how sentence meaning and ambiguity are understood especially in attitude reporting sentences. I presented one straightforward case by applying such formal theory to complex CQ sentences. An analysis in a kindred spirit is the concept-generator analysis of *de se* attitudes (Percus & Saulerland 2003). Concept-generators are defined as functions mapping

de se individuals to the relevant *de re* concepts. One option considered there is quantifying over acquaintance-based individual concepts in the same spirit as in the conceptual cover theory. [10] A semantic analysis considering perspective-sensitivity can simplify our understanding of a set of readings or patterns, which is more than just a matter of the number of entries and/or operators used to account for a set of data.

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[10] For example, ⟦*thinks that Mary is happy*⟧ = λ*x*.λ*w*.∃*c*: for all <*y*,*w'*> in Dox_x^w, *c(w')* is happy in *w'* (20' in Percus & Sauerland 2003). *y* is the individual in *w'* whom *x* identifies as themselves in *w*. *c* is an acquaintance-based Mary-concept for *x* in *w* if there exists an acquaintance relation *R* s.t. *x* bears *R* uniquely to Mary in *w*.

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