On Concealed Questions and Specificational Subjects

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Concealed Questions

- Paradigmatic example of knowledge attributions:

  (1) S knows that *p*.

- But sentences used to express knowledge often take a different form:

  (2) Philip knows who denounced Catiline. [**embedded question**]
  (3) Meno knows the way to Larissa. [**concealed question**]

- Intuitively (2) and (3) are true iff Philip and Meno know the true answer to the **direct questions** (4) and (5) respectively:

  (4) Who denounced Catiline?
  (5) What is the way to Larissa?

- Goal 1: present a uniform analysis of the meaning of direct questions, embedded questions and concealed questions
- **Proposal**: concealed questions are semantically questions (Aloni08); and questions denote propositions (Groenendijk & Stokhof 84)

Specificational Subjects

- GOAL 2: Extend the analysis to subjects in specificational sentences
- Taxonomy of copular sentences (Higgins, 1979):

(6) The director of *Kill Bill* is fat (isn't he?) **[predicational]**
Who I met was fat.

(7) The director of *Kill Bill* is Tarantino$_F$ (isn't it?) **[specificational]**
Who I met was Tarantino$_F$.

(8) (Philip believes that) Cicero is Tully. **[equative]**

- 'Metaphysically loaded' statements like (9) arguably examples of specificational sentences:

(9) The number of Jupiter's moons is four. (Frege, 1884)
The number of planets is eight.

- Moltmann's (2011) argument: [see Fenka 2014 for argument based on *F*]

(10) Die Zahl der Planeten ist acht. Früher dachte man, es/*sie wären neun.
'The number of planets (fem) is eight. Before it was thought that it (neut) was nine.'

(11) Maria ist nicht Susanne, ?sie/*es ist Anna.
'Mary is not Sue, she /*it is Ann.'

Frege, 1884

Now our concern here is to arrive at a concept of number usable for the purposes of science; we should not, therefore, be deterred by the fact that in the language of everyday life number appears also in attributive constructions. That can always be got round. For example, the proposition "Jupiter has four moons" can be converted into "the number of Jupiter's moons is four". Here the word "is" should not be taken as mere copula, as in the proposition "the sky is blue". This is shown by the fact that we can say: "the number of Jupiter's moons is the number four, or 4". Here "is" has the sense of "is identical with" or "is the same as". So that what we have is an identity, stating that the expression "the number of Jupiter's moon" signifies the same object as the word "four".

[*Frege, The Foundation of Arithmetics, 1884, par. 57*]

Number words and ontological commitment

- Different ontological commitments of (12) and (13):

(12) Jupiter has four moons.

(13) The number of Jupiter's moons is four.

- Frege: (12) can be converted into (13), which should be analysed as an equative, which commit us to the existence of numbers:

(14) a. The number of Jupiter's moons is four.
b. The number of Jupiter's moons = four

- Anti-Realists: (13) should be converted into (12), in which no reference to numbers is made. E.g. Moltmann (2011):

(15) a. The number of Jupiter's moons is four.
b. How many moons has Jupiter? Jupiter has four moons.

- **My proposal**: Specificational subjects are semantically questions (concealed questions), but Fregean denotations will be assumed:

(16) a. The number of Jupiter's moons is four.
b. What is the number of Jupiter's moons? Four.

Outline

- Background
  - Concealed questions: basic data
  - Existing linguistic analyses of concealed questions
  - Groenendijk & Stokhof (1984) on questions and knowledge
  - Quantification under conceptual covers (Aloni 2001)
- Proposals
  - Concealed questions under cover (Aloni 08, Aloni & Roelofsen 11)
  - Specificational subjects as concealed questions

References

Maria Aloni. Concealed questions under cover. In Franck Lihoreau (ed.), *Knowledge and Questions. Grazer Philosophische Studien*, 77, 2008, pp. 191–216.

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Concealed Questions (CQs)

Concealed questions are nominals naturally read as identity questions

Some examples

(17) a. Meno knows the way to Larissa. (Plato, *Meno*)
b. John knows the price of milk. (Heim 1979)
c. (I know that) Peter knows the password. (cf. McCarthy 1979)
d. They revealed the winner of the contest.
e. Mary discovered the murderer of Smith.
f. Ann told me the time of the meeting.

Paraphrases

(18) a. Meno knows what the way to Larissa is.
b. John knows what the price of milk is.
c. (I know that) Peter knows what the password is.
d. They revealed who the winner of the contest was.
e. Mary discovered who the murderer of Smith is.
f. Ann told me what the time of the meeting is.

Acquaintance (ACQ) *vs* concealed question (CQ) readings

(19) Mary knows the capital of Italy.

a. ACQ: She is acquainted with Rome.
b. CQ: She knows what the capital of Italy is.

(20) Mary knows the price of milk.

a. ?ACQ: She is acquainted with 1,60 euro.
b. CQ: She knows what the price of milk is.

In many languages epistemic 'know' and acquaintance 'know' are lexically distinct

(21)
a. German: *wissen*$_{\text{EPI}}$+ NP (only CQ) vs. *kennen*$_{\text{ACQ}}$ (Heim 1979)
b. Italian: *sapere*$_{\text{EPI}}$ + NP (only CQ) vs. *conoscere*$_{\text{ACQ}}$ (Frana 2007)
c. Dutch: *weten*$_{\text{EPI}}$ + NP (only CQ) vs. *kennen*$_{\text{ACQ}}$

(22) Maria sa la capitale dell'Italia.
Mary knows$_{\text{EPI}}$ the capital of-the-Italy
'Mary knows what the capital of Italy is' [CQ/#ACQ]

Basic Data (Heim 1979)

Definite CQs

(23) John knows the price of milk.

Quantified CQs

(24) John knows every European capital.

CQ-containing CQs (CCQs) (aka Heim's Ambiguity)

(25) John knows the capital that Fred knows.

Reading A: Fred and John know the same capital
There is exactly one country x such that Fred can name x's capital; and John can name x's capital as well

Reading B: John knows which capital Fred knows
John knows which country x is such that Fred can name x's capital (although John may be unable to name x's capital himself)

Recent Approaches

	[–perspective]	[+perspective]
Questions / Propositions	Nathan, 2006 Romero, 2007	**Aloni, 2008** **Aloni & Roelofsen, 2011**
Properties	Brogaard, 2008	Schwager, 2007
Individual concepts	Romero, 2005 Frana, 2010	Schwager, 2007

Main features of our proposals

- Type dimension: CQs denote question extensions, i.e. propositions;
- Their interpretation depends on the particular perspective that is taken on the individuals in the domain.

Illustration: Romero 2005

- CQs denote individual concepts.

(26) a. John knows$_{\mathrm{CQ1}}$ the capital of Italy.
b. $\lambda w.\forall w' \in Dox_j(w) : \iota x[\text{C-of-I}(x, w')] = \iota x[\text{C-of-I}(x, w)]$

- Heim's ambiguity captured by allowing 'know' to take the extension and the intension of the CQ.

(27) John knows the capital Fred knows.

a. Reading A: know$_{\mathrm{CQ1}}$ + extension CQ: $\lambda w.\forall w' \in Dox_j(w)$:
$\iota \mathbf{x}[\mathrm{C}(\mathbf{x}, w) \wedge \forall w'' \in Dox_f(w) : \mathbf{x}(w) = \mathbf{x}(w'')](w') =$
$\iota \mathbf{x}[\mathrm{C}(\mathbf{x}, w) \wedge \forall w'' \in Dox_f(w) : \mathbf{x}(w) = \mathbf{x}(w'')](w)$

b. Reading B: know$_{\mathrm{CQ2}}$ + intension CQ: $\lambda w.\forall w' \in Dox_j(w)$:
$\lambda w^*.\iota \mathbf{x}[\mathrm{C}(\mathbf{x}, w^*) \wedge \forall w'' \in Dox_f(w^*) : \mathbf{x}(w^*) = \mathbf{x}(w'')](w') =$
$\lambda w^*.\iota \mathbf{x}[\mathrm{C}(\mathbf{x}, w^*) \wedge \forall w'' \in Dox_f(w^*) : \mathbf{x}(w^*) = \mathbf{x}(w'')](w)$

- Special purpose lexical items know$_{\mathrm{CQ1}}$, know$_{\mathrm{CQ2}}$ introduced:

(28) a. know$_{\mathrm{CQ1}}$ $\mapsto \lambda \mathbf{y}_{(s,e)}.\lambda x_e.\lambda w.\forall w' \in Dox_x(w) : \mathbf{y}(w') = \mathbf{y}(w)$
b. know$_{\mathrm{CQ2}}$ $\mapsto \lambda \mathbf{y}_{(s,(s,e))}.\lambda x_e.\lambda w.\forall w' \in Dox_x(w) : \mathbf{y}(w') = \mathbf{y}(w)$

Arguments along the TYPE dimension

Coordination

(29) They knew the winner of the contest and that the President of the association would hand out the prize in person.

(30) I only knew the price of milk and who won the World Series in 1981.

Parsimony

- We'd rather not assume special purpose lexical items know$_{\text{CQ1}}$, know$_{\text{CQ2}}$ besides know$_{\text{ACQ}}$ and know$_{\text{EPI}}$.

  (31) John knows$_{\text{ACQ}}$ Barack Obama.

  (32) John knows$_{\text{EPI}}$ what is the capital of Italy and that it is a very old town.

  (33) John knows$_{?}$ the price that Fred knows.

  a. Individual concept approach: know$_{\text{CQ1}}$, know$_{\text{CQ2}}$
  b. Proposition/question approaches: know$_{\text{EPI}}$

Groenendijk & Stokhof on questions and knowledge

Questions

Questions denote their true exhaustive answers (propositions):

(34) a. What is the capital of Italy?
b. $?y.\ y = \iota x.\text{CAPITAL-OF-ITALY}(x)$
c. $\lambda w.[\![\iota x.\text{CAPITAL-OF-ITALY}(x)]\!]_w = [\![\iota x.\text{CAPITAL-OF-ITALY}(x)]\!]_{w_0}$
d. λw. Rome is the capital of Italy in w

Knowledge

John knows$_{\text{EPI}}$ α ($K_j\alpha$) iff John's information state $\subseteq$ the denotation of α

Applications

(35) John knows what is the capital of Italy and that it is a very old town.

(36) Rome is the capital of Italy & John knows what the capital of Italy is
$\Rightarrow$ John knows that Rome is the capital of Italy

(37) Mary knows that John knows what the capital of Italy is
$\not\Rightarrow$ Mary knows what the capital of Italy is

Recent Approaches

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Main features of our proposals

- TYPE dimension: CQs denote question extensions, i.e. propositions;
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Arguments along the PERSPECTIVE dimension

Perspective-related ambiguities (cf. Schwager 07 & Harris 07)

Two face-down cards, the ace of hearts and the ace of spades. You know that the winning card is the ace of hearts, but you don't know whether it's the card on the left or the one on the right.

(38) a. You know the winning card.
b. You know which card is the winning card.

True or false?

Intuitive analysis

Two salient ways to identify the cards:

1. By their position: the card on the left, the card on the right
2. By their suit: the ace of hearts, the ace of spades

Whether (38-a,b) are judged true or false depends on which of these perspectives is adopted.

Conceptual Covers (Aloni 2001)

- Identification methods can be formalized as *conceptual covers*:

(39) A conceptual cover *CC* is a set of concepts such that in each world, each individual instantiates exactly one concept in *CC*

In each world each individual is identified by at least one concept (existence); in no world is an individual identified twice (uniqueness)

- In the cards scenario, 3 salient covers/ways of identifying the cards:

(40)
a. {on-the-left, on-the-right} [ostension]
b. {ace-of-spades, ace-of-hearts} [naming]
c. {the-winning-card, the-losing-card} [description]
d. #{on-the-left, ace-of-spades}

- Evaluation of (41) depends on which of these covers is adopted:

(41)
a. Anna knows which$_n$ card is the winning card.
b. $K_a(?y_n.\ y_n = \iota x.\textsc{winning-card}(x))$

(42)
a. False, if $n \mapsto$ {on-the-left, on-the-right}
b. True, if $n \mapsto$ {ace-of-spades, ace-of-hearts}
c. Trivial, if $n \mapsto$ {the-winning-card, the-losing-card}

$\mapsto$ CC-indices *n* added to logical form, their value is contextually supplied

Concealed questions under cover (Aloni 2008)

Main idea: CQs as embedded identity questions

(43) a. John knows the capital of Italy.
b. John knows what the capital of Italy is.

Type Shift

(44) $\uparrow_n \alpha \ =_{\text{def}} \ ?x_n.\ x_n = \alpha$

$\uparrow_n$ transforms an entity-denoting expression α into the identity question 'who$_n$/what$_n$ is α?', where n is a pragmatically determined conceptual cover

Illustration

(45) a. John knows the capital of Italy.
b. $K_j(\uparrow_n \iota x.\text{CAPITAL-OF-ITALY}(x))$
c. $K_j(?x_n.\ x_n = \iota x.\text{CAPITAL-OF-ITALY}(x))$

where x_n ranges over {Berlin, Rome, Paris, ...}

fct1 Rome is the capital of Italy & John knows the capital of Italy $\models$ John knows that Rome is the capital of Italy

fct1′ Mary knows that John knows the capital of Italy $\not\models$ Mary knows the capital of Italy

More illustrations

Cards

(46) a. Anna knows the winning card.
b. $K_a(\uparrow_n \iota x.\text{WINNING-CARD}(x))$
c. $K_a(?x_n.\ x_n = \iota x.\text{WINNING-CARD}(x))$

with x_n ranging either over {left, right} or over {spades, hearts}.

Quantified CQs

(47) a. John knows every European capital.
b. $\forall x_n(\text{EUROPEAN-CAPITAL}(x_n) \rightarrow K_j(\uparrow_m x_n))$

where:

- x_n ranges over {the capital of Germany, the capital of Italy, . . . }
- x_m ranges over {Berlin, Rome, . . . }

——— ——— ——— ——— ———

fct2 Berlin is the capital of Germany & Germany is in Europe & John knows every European capital $\models$ John knows that Berlin is the capital of Germany

More illustrations

Heim's Ambiguity (definite CCQ)

(48) John knows the capital that Fred knows.

a. Reading A: John and Fred know the same capital

$\exists x_n(x_n = \iota x_n[C(x_n) \wedge K_f(\uparrow_m x_n)] \wedge K_j(\uparrow_m x_n))$ (*de re*)

b. Reading B: John knows which capital Fred knows

$K_j(\uparrow_n \iota x_n[C(x_n) \wedge K_f(\uparrow_m x_n)])$ (*de dicto*)

where:

- x_n ranges over {the capital of Germany, the capital of Italy, ...}
- x_m ranges over {Berlin, Rome, ...}

—— —— —— —— ——

fct3 Fred knows that the capital of Italy is Rome & John knows the capital that Fred knows [Reading A] $\models$ John knows that the capital of Italy is Rome

fct4 Fred knows that the capital of Italy is Rome & John knows the capital that Fred knows [Reading B] $\not\models$ John knows that the capital of Italy is Rome

Interim conclusions on Concealed Questions

- Conceptual covers: useful tool for perspicuous representations of CQ meanings (perspective-related ambiguities, quantified CQs, Heim's ambiguity);
- Conceptual and empirical advantages wrt previous accounts, e.g. Romero (2005):
  - No multiple entries know$_{CQ1}$, know$_{CQ2}$, ... needed;
  - Coordination facts easily accounted for;
  - Analysis easily extendable to represent (49) (Aloni & Roelofsen 11)

(49) a. John knows the price known to Fred that Bill knows.
b. John knows every price that Fred knows.

NEXT: extend analysis to Specificational Subjetcs

- Specificational subjects as concealed questions under cover:
  1. Pronominalisation and focus effects explained
  2. Analysis compatible to 'Question plus deletion' accounts to connectivity effects
  3. Pragmatic account of Romero's A and B Reading examples:

(50) The price Fred thought was 2 euros was in fact 1 euro.

(51) The price Fred thought was 2 euros was the price of milk.

Specificational subjects under cover

Main idea: specificational subjects as CQs

(52) a. The number of planets is eight$_F$.
b. What is the number of planets? Eight$_F$.

Pronominalisation and focus effects explained

Implementation

(53) a. α is β
b. $\uparrow_n \alpha = {}^\wedge\phi(\beta)$

Main ingredients (cf. Schlenker 2003):

1. $\uparrow_n \alpha$ is a concealed question, i.e. a proposition denoting expression
2. ${}^\wedge\phi(\beta)$ stands for a propositional answer to the question
3. 'is' is identity: $\lambda x_a.\lambda y_a.x = y$, for any type a

Illustration

(54) a. The number of planets is eight.
b. $\uparrow_n \iota x.\text{NUMBER-OF-PLANETS}(x) = {}^\wedge\phi(8)$
c. $(?x_n.\ x_n = \iota x.\text{NUMBER-OF-PLANETS}(x)) = {}^\wedge\phi(8)$

where x_n ranges over $\{\text{one, two, } \ldots\}$

Post-copular elements as full sentences

- Question: How to go from β to $^\wedge\phi(\beta)$?

(55) a. α is β
b. $\uparrow_n \alpha = {}^\wedge\phi(\beta)$

- Most plausible answer: syntactic reconstruction
  - The post-copular element is a full sentence containing elided material
    1. Pre-copular element α is syntactically a nominal but semantically a question/proposition
    2. Post-copular element is semantically and syntactically a sentence
- Two arguments syntactic reconstruction:
  - Mismatch between category pre- and post-copular element is what triggers the application of $\uparrow_n$
  - Connectivity effects in specificational sentences

Connectivity effects in specificational sentences

- Principle A of Binding Theory: reflexive pronouns should be c-commanded locally by their antecedents.

(56) a. John$_i$ likes himself$_i$.
b. #John$_i$'s mother likes himself$_i$.

- Apparent violation in specificational clauses:

(57) What John$_i$ likes is himself$_i$.

Questions plus deletion account (Ross 1972, Schlenker 2003)

- Main ingredients:
  (i) the pre-copular element in a specificational clause is a question;
  (ii) the post-copular element is a full IP which contains an elided subject which licenses the reflexive locally:

  (58) What does John$_i$ like is [$_{IP}$ ~~he$_i$ likes~~ himself$_i$].

- Evidence for (ii):

(59) What I did then was [I called the grocer]. (Ross 1972)

Back to Frege example

- Frege: committed to existence of numbers

(60) a. The number of Jupiter's moons is four.
b. The number of Jupiter's moons = four

- Anti-Realists: not committed to existence of numbers

(61) a. The number of Jupiter's moons is four.
b. How many moons has Jupiter? Jupiter has four moons.

- My proposal: two possible analyses (depending on how ϕ is syntactically reconstructed)

(62) The number of Jupiter's moons is four.
$\uparrow_n \iota x.\textsc{number-of-J-moons}(x) = {}^\wedge\phi(4)$
a. What is the number of Jupiter's moons? The number of Jupiter's moon is four.
b. What is the number of Jupiter's moons? Jupiter has four moons.

Both analyses committed to existence of numbers

Reading A and B of specificational subjects (SS)

- Romero (2005) examples:

(63) The price Fred thought was 2E was in fact 1E. (Reading A)

(64) The price Fred thought was 2E was the price of milk. (Readng B)

- Romero's analysis:
  - Specificational subjects denote individual concepts.
  - Reading A and Reading B sentences captured by allowing 'be' to take the extension and the intension of the NP, respectively.

(65) a. $\text{be}_{1,spec} \mapsto \lambda x_e \lambda \mathbf{y}_{(s,e)} \lambda w_s . \mathbf{y}(w) = x$

b. $\text{be}_{2,spec} \mapsto \lambda \mathbf{x}_{(s,e)} \lambda \mathbf{y}_{(s,(s,e))} . \lambda w_s . \mathbf{y}(w) = \mathbf{x}$

- Our analysis: No multiple entries for 'be' needed, question expressed by the SS interpreted under different covers in the two examples:

(66) What is the price Fred thought was 2 euros?

a. Possible answers under A: 1 euro, 2 euros, ...

b. Possible answers under B: the price of milk, ...

(67) a. Cover A: {1 euro, 2 euro, ...}

b. Cover B: {the price of milk, the price of butter, ...}

Analysis A and B examples

(68) The price Fred thought was 2 euros was in fact 1 euro.

a. What$_A$ is the price Fred thought was 2 euros? 1 euro.

b. $\uparrow_A \iota x_B[P(x) \wedge \Box_f x = 2] = {}^\wedge(\iota x_B[P(x) \wedge \Box_f x = 2] = 1)$

(69) The price Fred thought was 2 euros was the price of milk.

a. What$_B$ is the price Fred thought was 2 euros? The price of milk.

b. $\uparrow_B \iota x_B[P(x) \wedge \Box_f x = 2] = {}^\wedge(\iota x_B[P(x) \wedge \Box_f x = 2] = m)$

(70)

	milk	butter	Dox$_f$	the price Fred thought was 2
w_0	1	2	$\{w_1\}$	1
w_1	2	1	$\{w_0\}$	1

(71) a. What is the price that Fred thought was 2 euros?

b. $?y_{A/B}.y = \iota x_B[P(x) \wedge \Box_f x = 2]$

under A :

w_0 w_1

under B :

w_0
w_1

(72) a. Cover A: {1 euro, 2 euro, ...}

b. Cover B: {the price of milk, the price of butter, ...}

Conclusions

Summary

- Conceptual covers: useful tool for perspicuous representations of concealed questions
- Analysis easily extendable to capture Reading A and Reading B specificational sentences.

Future concealed questions

- Which syntactic reconstruction of elided material in post-copular position?
- Open problem concerning derived covers (see appendix): anti-realists strike back?
- Distribution of CQs: know CQ, #believe CQ, ask CQ, #wonder CQ
- ...

Selected References

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An open problem: prices, temperatures, . . .

- Sentence (73-a) involves quantification over set (73-b):

(73) a. John knows the price that Fred knows.
b. {the price of milk, the price of butter, . . . }

- In a conceptual cover:
  - in each world each individual is identified by at least one concept (existence);
  - in no world is an individual identified twice (uniqueness).
- But (73-b) need not be a conceptual cover:
  - Milk and butter might have the same price (no uniqueness)
  - 1 euro need not be the price of anything (no existence)
  - The price of milk might have not been fixed yet (no total functions)
- Same problem with temperatures, dates of birth, etc.

A possible solution

Distinction between basic and derived covers

- Only basic covers must satisfy the original requirements of uniqueness and existence;
- Derived covers are obtained from basic covers C and functions $f_{\langle s,\langle e,e\rangle\rangle}$ as:

  (74) $\{c \mid \exists c' \in C.\forall w.\ c(w) = f(w)(c'(w))\}$

Examples of derived covers

(75) {the capital of Italy, the capital of Germany,...}
based on {Italy, Germany,...} and the capital-of function

(76) {the price of milk, the price of butter, ...}
based on {milk, butter, ...} and the price-of function

Problems with *de dicto* representations of definite CCQs

- Once we allow overlapping concepts, problems arise for *de dicto* representations of definite CCQs:

(77) a. John knows the price that Fred knows.
b. $K_j(\uparrow_n \iota x_n(Px_n \wedge K_f(\uparrow_m x_n)))$

- While sentence (77-a) is intuitively false in scenario (78), analysis (77-b) under resolution (79) predicts it to be true.

(78) Scenario: (a) Milk and butter both cost 2E. John does not know how much the milk or butter costs, but he knows that they cost the same. (b) Fred knows that the price of milk is 2E, but he does not know what the price of butter is. (c) John is aware that the price that Fred knows is either the price of milk, or the price of butter, but cannot determine which one of those two it is.

(79) a. $n \mapsto \{$the price of milk, the price of butter, $\dots\}$
b. $m \mapsto \{1E, 2E, 3E, \dots\}$

- Possible solutions: (i) Ban *de dicto* readings; (ii) more structure in notion of derived cover: we need to be able to distinguish the price of milk from the price of butter, even though they happen to have the same value in the relevant worlds.