Concealed questions are structured individuals

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Key contrast to be explained

(1) a. John knows everyone’s age.
    b. *John knows everyone’s brick.

(2) John saw everyone’s brick.

Plan:

(1) Main ideas
(2) What do questions mean?
(3) A simple but incomplete theory of concealed questions
(4) A new constraint on concealed questions
(5) Implementation
(6) Conclusions
Main ideas, 1/2: Good and bad Concealed Questions

- Questions in natural language have a foreground and a background.
  
  (3) Who left? = \langle \text{person}, \text{left} \rangle 
  
  Foreground = the set of relevant people  
  Background = the set of leavers

- Concealed questions are DPs that can be interpreted as if they were questions
  
  (4) Ann found out Bill's age  
  (5) Ann found out what Bill's age is

- Only some DPs make good concealed questions
  
  (6) *Ann found out out the brick.  
  (7) *Ann found out Bill's brick.

Bumford (p.c.): With sortals, hard to know what's being asked.
Main ideas, 2/3: CQs need functional relational nominals

- DPs headed by functional relational DPs make the best concealed questions
- Löbner 1981 (paraphrasing): a concealed question must denote a ‘functional concept’ (*Fiunktionalbegriffe*). DPs denoting a functional relational concept naturally arise from DPs headed by functional nouns such as *temperature*, *president*, *wife*, and *price*, but not from DPs headed by sortal nouns (Löbner’s *Gattungsbegriffe*), including *linguist*, *rose*, and *brick*.
- Caponigro and Heller 2007:262: “We propose that it is functional nouns (in the sense of Vikner and Jensen 2002) that allow for concealed question interpretation, that is, nouns whose interpretation depend on an additional argument.”

Nathan 2006
Main ideas, 3/3: CQs must have F/B structure

- **But why?**
  Only relational DPs supply a foreground and a background.

  (8) Bill’s birthday
  Foreground = the set of days
  Background = the set of entities Bill was born on

  (9) the brick
  Foreground = the set of bricks
  Background = ??

- **But how?**
  Some DPs denote structured descriptions, just as expressions containing focus can denote a structured proposition consisting of a focused element and a background property.

  Instead of a structured proposition, we will have a structured individual.
Two indispensable perspectives on question meaning

- The **foreground/background** perspective: Krifka 2011:1757: “interrogatives are incomplete propositions, with the positions at which they are incomplete and the type of meanings that would make them complete specified by the wh-constituents.”

  (10) Who left? = \langle \text{person}, \text{left} \rangle

  (11) Who bought what? = \langle \text{person}, \langle \text{thing}, \text{bought} \rangle \rangle

- This perspective helps understand question/answer congruence:

  (12) **Bill** left.

  (13) *Bill left.

- And (relatedly) helps understand reduced (fragment) answers:

  (14) Bill

  (15) Bill, a book; Carl, a record
Second indispensible perspective: questions as partitions

• If a predicate embeds one kind of interrogative, it embeds them all:
  (16) a. I know who left.
  b. I know who bought what.

• Questions with different numbers of wh elements can be conjoined:
  (17) Ann knows whether it will rain, [yes/no]
  who called, and [single wh]
  who will arrive when. [multiple-wh]

• Need a semantic type for questions that is neutral across the different foreground/background types.
Questions as partitions (Groenendijk and Stokhof 1982)

(18) Who left?

* | * * | * | **
* * | * | * * | *
* | * | * | *
------- |-------|------|-------
Bill | Bill | Carl | no one
| & Carl |

- Each star is one possible situation (one “possible world”)
- Group together (partition) worlds that agree on the answer

More technically,
(a) Who left? \( \lambda_{ij}.\text{left}_i = \text{left}_j \)
(b) Who bought what? \( \lambda_{ij}.\text{buy}_i = \text{buy}_j \)
Both perspectives are essential

Krifka: we can compute partitions from foreground/backgrounds, but not vice-versa. In general:

\[
\llbracket \langle F, B \rangle \rrbracket^i = \{ \langle x, [B]^i(x) \rangle | x \in [F]^i \} \\
\llbracket \langle F, \langle F', B \rangle \rangle \rrbracket^i = \{ \langle x, \langle y, [B]^i(x)(y) \rangle \rangle : x \in [F]^i, y \in [F']^i \} \\
\]

For example: \( \llbracket \langle \text{person}, \text{left} \rangle \rrbracket^i = \{ \langle x, \text{left}_i(x) \rangle | x \in \text{person}_i \} \)

\[= \{ \langle a, \text{left}_i(a) \rangle, \langle b, \text{left}_i(b) \rangle \} \]

\[= \{ \langle a, \text{TRUE} \rangle, \langle b, \text{FALSE} \rangle \} \]

\[= \text{the set of people who left} \]

\( \llbracket \langle \text{person}, \langle \text{thing}, \text{buy} \rangle \rangle \rrbracket^i \)

\[= \{ \langle x, \langle y, \text{buy}_i y x \rangle \rangle | x \in \text{person}_i, y \in \text{thing}_i \} \]

\[= \{ \langle a, \langle c, \text{TRUE} \rangle \rangle, \langle a, \langle d, \text{FALSE} \rangle \rangle, \langle b, \langle c, \text{FALSE} \rangle \rangle, \langle b, \langle d, \text{TRUE} \rangle \rangle \} \]

\[= \text{the set of pairs of people and the things they bought} \]
Form a question meaning from a foreground/background pair by considering two possibilities (worlds) to be equivalent just in case they agree on the denotation of the foreground/background structure.

Note that the question operator ? is only defined when it combines with a foreground/background structure.

Strategy: define relational DPs in such a way that the question operator gives the right concealed-question meaning.

Then if only relational DPs give rise to foreground/background structures, only relational DPs will give rise to concealed questions.
Intensions...are meanings that vary with the situation.

(20) $[[\text{The President of the United States}]] = \begin{bmatrix} i \mapsto \text{Bush} \\ j \mapsto \text{Obama} \end{bmatrix}$

<table>
<thead>
<tr>
<th>Expression</th>
<th>Intension</th>
<th>Terminology</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>clause</td>
<td>$s \rightarrow t$</td>
<td>proposition</td>
<td>Ann left.</td>
</tr>
<tr>
<td>referential DP</td>
<td>$s \rightarrow e$</td>
<td>individual concept</td>
<td>the President</td>
</tr>
<tr>
<td>interrogative</td>
<td>$s \rightarrow (s \rightarrow t)$</td>
<td>relation over indicies</td>
<td>Who left?</td>
</tr>
</tbody>
</table>

Extensions are intensions applied to a specific situation.

(21) Ann pinched the President; The President is Obama; therefore, Ann pinched Obama.

(22) Ann seeks the President; The President is Obama; therefore, Ann seeks Obama.

Montague: intensions are available throughout the grammar.
Reducing knowing who to knowing that

- The extension of an interrogative is the same type as the intension of a (non-interrogative) clause.
- That’s supposed to be why verbs that embed interrogatives usually also embed non-interrogative clauses.

(23) a. Ann knows who left.
   b. Ann knows that Bill and Cam left.

(c) $\llbracket \text{Who left?} \rrbracket = \lambda i j. (\text{left}_i = \text{left}_j)$ type: $s \rightarrow (s \rightarrow t)$
(d) $\llbracket \text{Who left?} \rrbracket^i = \lambda j. (\text{left}_i = \text{left}_j)$ type: $s \rightarrow t$
   ‘the set of worlds in which the leavers are the same as in i’

(24) $\llbracket \text{that Bill and Cam left} \rrbracket = \lambda j. (\{\text{bill, cam}\} = \text{left}_j)$

wonder is intensional, like seek: *Ann wonders that Bill left
A simple but incomplete theory of concealed questions

- ? turns foreground/backgrounds into question meanings
- What about DPs? Quick answer: also ?!

Any function \( f : A \rightarrow B \) induces a partition on its domain \( A \).

\[ ?([\text{Bill's age}]) = \lambda i j. ([\text{Bill's age}]^i = [\text{Bill's age}]^j) \]

As long as DPs denote intensions (functions on the set of indices), ? can apply.
Why this simple theory is incomplete

Nathan 2006:28: [discussing a type-shifter like ?] “assigning question denotations to DPs is possible, and ... they adequately capture the meaning of CQs. However, ... this theory of CQ meanings must be supplemented with an explanation of CQ distribution.”

Overgeneration, syntactic:

(25) (26)*I know in the fridge ≠ I know what is in the fridge

(27)*I found out expensive ≠ I found out what is expensive

Overgeneration, the main contrast under study:

(28) a. Ann found out Bill’s age.
    b. *Ann found out Bill’s rose.
Relational versus sortal nouns

(29)

SORTAL    RELATIONAL

day        birthday
horse      steed
animal     pet
person     child

Transitive versus intransitive verbs:

(30) a. Ann dined (*the steak).
    b. Ann ate (the steak).
    c. John devoured *(the steak).

Transitive versus intransitive nouns:

(31) a. the stranger (*of Ann), *Ann’s stranger
    b. the child (of Ann), Ann’s child
    c. the sake *(of Ann), Ann’s sake

Le Bryun et al. 2013: all nouns sortal?
An operational test for relational nouns

Barker, Partee: in English, only relational nominals can take a postnominal *of* phrase with a possessive interpretation.

(32) $\begin{align*}
\text{SORTAL} & \quad \text{RELATIONAL} \\
*\text{the day of Ann} & \quad \text{the birthday of Ann} \\
*\text{the animal of Ann} & \quad \text{the pet of Ann} \\
*\text{the person of Ann} & \quad \text{the child of Ann}
\end{align*}$

Barker, Partee & Borschev: favorite turns a sortal into a relational nominal

(33) a. the favorite day of the policeman
    b. the favorite animal of John
    c. the favorite person of Ann
Concealed questions care about relationality

(34) a. the age of everyone (age is relational)
   b. Ann knows everyone’s age.

(35) a. *the brick of everyone (brick is sortal)
   b. *Ann knows everyone’s brick

Prediction: if favorite turns sortals into relational nominals, and relational nominals make good CQs, then favorite should rescue sortal concealed questions.

(36) a. *Ann knows Bill’s brick.
   b. Ann knows Bill’s favorite brick.

(37) a. *Ann found out Bill’s person.
   b. Ann found out Bill’s favorite person.
Main hypothesis

questions must be articulated into a foreground and a background

- If so, relational DPs must deliver foreground/background structures
  - The sortal requirements on the DP referent give the foreground
  - The relational requirements give the background

(38)

\[
[birthday] = \langle \text{day, born-on} \rangle \\
[birthplace] = \langle \text{location, born-at} \rangle
\]

Löbner 1981:486: [regarding the meaning of a relational concealed question] “the range of alternative referents or possible function values is naturally included in a functional noun, just as a question determines the range of possible answers.”

Sortals: just not enough material to work with—all foreground
Still need the partition view of question meaning

Concealed questions can be conjoined with interrogatives:

(39) Ann found out Bill’s phone number and where he lives.

(40) Our accountant needs to know everyone’s budget and who bought what.

The ? type-shifter will shift a concealed question into an appropriate denotation for coordination purposes.
Some details

Ordinary relational nominal denotation:

Bill’s birthday ≡ the birthday of Bill ≡

\[ \llbracket \langle \text{day}, \text{born-on}(\text{bill}) \rangle \rrbracket^i \]
\[ = \{ \langle a, f a \rangle | a \in \text{day}_i, f \in \text{born-on}_i(\text{bill}_i) \} \]
\[ = \{ \langle 1\text{-Jan}, \text{TRUE} \rangle, \langle 2\text{-Jan}, \text{FALSE} \rangle, ... \} \]

Shifted into a concealed question:

Bill’s birthday ≡ the birthday of Bill ≡ \[ \llbracket ?\langle \text{day}, \text{born-on}(\text{bill}) \rangle \rrbracket \]
\[ = \lambda ij. (\llbracket \langle \text{day}, \text{born-on}(\text{bill}) \rangle \rrbracket^i = \llbracket \langle \text{day}, \text{born-on}(\text{bill}) \rangle \rrbracket^j) \]

How favorite saves a sortal:

\[ \llbracket \text{Bill’s day} \rrbracket = \{ x | \text{day}(x) \wedge \pi(\text{john})(x) \} \]
\[ \llbracket \text{favorite day} \rrbracket = \llbracket \langle \text{day}, \text{favorite}(\text{day}) \rangle \rrbracket \]
\[ \llbracket \text{Bill’s favorite day} \rrbracket = \llbracket \langle \text{day}, \text{favorite}(\text{day})(\text{bill}) \rangle \rrbracket \]
Deriving the restriction to *functional* relational nominals

The ? type-shifter only induces a partition if it acts on a function.

See also discussion in Percus 2014
A caution on paraphrases

(41) Ann knows the capital of Italy.
(42) Ann knows which city is the capital of Italy.

• Close, but the official paraphrase is closer to this:

(43) Ann is able to characterize the set of worlds in which the capital of Italy is the same as it is in the actual world.

• The special discourse properties of which are misleading
Relative clauses

The syntax of relative clauses is like that of wh-interrogatives:

(44) a. Ann knows [the street the restaurant is located on].
    b. Ann knows [which street the restaurant is located on].

Idiom licensing, quantificational binding, and more argue the head nominal (sometimes?) moves from inside the relative clause, creating a foreground/background structure:

(45) \[
    \text{REL}([\text{the restaurant is located on}])([\text{street}]) \\
    = \langle \text{street, on(} \text{the-restaurant}) \rangle
\]

- Foreground: the set of streets
- Background: the set of places the restaurant is located at
Pronouns and names make lousy concealed questions
No surprise, but predicted by the account here.

(46)*Ann found out him.
(47)*Ann found out Bill.
Some relational nominals are better CQs than others

(48) *Ann found out the truck’s carburetor.

M. Kaufmann 2008: objects that don’t have descriptions independent of their classifying nominal?

- Good: age, speed, winner, capital
- Not so good: nose, mother

Mysteries remain, but at least the foreground/background theory allows for lexical gaps.
Conclusions

- Questions denote functions over the set of possible answers.
- This naturally creates a foreground/background structure:
  - The foreground characterizes the set of possible answers.
  - The background evaluates the possible answers.
- A typeshifter $?\,$ unifies various types of questions.
- $?\,$ gives the right result for concealed question DPs.
- If $?\,$ is restricted to foreground/background structures.
- ...and as long as only some DPs give rise to F/B structures, including DPs containing (some) relational nouns, favorite, and relative clauses.
- We have an explanation for why only some DPs make good concealed questions.
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