CTF 2014
Concept Types and Frames in Language, Cognition, and Science
15:45 Tuesday, August 26th, 2014

Concealed questions are structured individuals

Chris Barker
New York University, Department of Linguistics

Version of August 26, 2014.

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? $= \langle$**person**, **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 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 indispensible 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? $= \langle$**person**, **left**$\rangle$

  (11) Who bought what? $= \langle$**person**, $\langle$**thing**, **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:

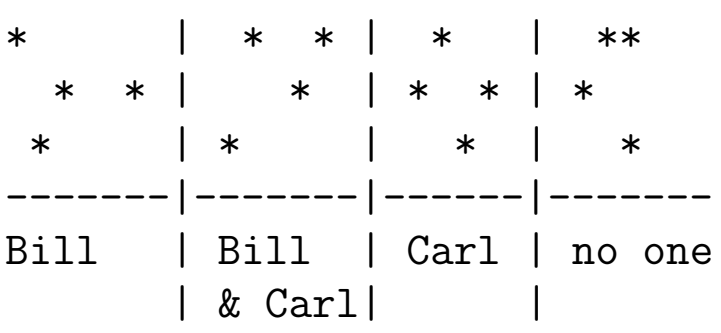
  (17)

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?



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

More technically,

(a) Who left? $\lambda ij.\mathbf{left}_i = \mathbf{left}_j$
(b) Who bought what? $\lambda ij.\mathbf{buy}_i = \mathbf{buy}_j$

Both perspectives are essential

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

$$[\![\langle F, B\rangle]\!]^i = \{\langle x, [\![B]\!]^i(x)\rangle | x \in [\![F]\!]^i\}$$

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

For example: $[\![\langle \textbf{person}, \textbf{left}\rangle]\!]^i = \{\langle x, \textbf{left}_i(x)\rangle | x \in \textbf{person}_i\}$

$= \{\langle a, \textbf{left}_i(a)\rangle, \langle b, \textbf{left}_i(b)\rangle\}$

$= \{\langle a, \textsc{true}\rangle, \langle b, \textsc{false}\rangle\}$

$=$ the set of people who left

$[\![\langle \textbf{person}, \langle \textbf{thing}, \textbf{buy}\rangle\rangle]\!]^i$

$= \{\langle x, \langle y, \textbf{buy}_i y\, x\rangle\rangle | x \in \textbf{person}_i, y \in \textbf{thing}_i\}$

$= \{\langle a, \langle c, \textsc{true}\rangle\rangle, \langle a, \langle d, \textsc{false}\rangle\rangle, \langle b, \langle c, \textsc{false}\rangle\rangle, \langle b, \langle d, \textsc{true}\rangle\rangle\}$

$=$ the set of pairs of people and the things they bought

Shifting foreground/background denotations into partitions

(19) $$[\![\textbf{?}\langle F, B\rangle]\!] = \lambda ij.([\![\langle F, B\rangle]\!]^i = [\![\langle F, B\rangle]\!]^j)$$

- 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) $[\![\textit{The President of the United States}]\!] = \begin{bmatrix} \mathtt{i} \mapsto \textbf{Bush} \\ \mathtt{j} \mapsto \textbf{Obama} \end{bmatrix}$

Expression	Intension	Terminology	Example
clause	$\mathtt{s} \rightarrow \mathtt{t}$	proposition	*Ann left.*
referential DP	$\mathtt{s} \rightarrow \mathtt{e}$	individual concept	*the President*
interrogative	$\mathtt{s} \rightarrow (\mathtt{s} \rightarrow \mathtt{t})$	relation over indicies	*Who left?*

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.

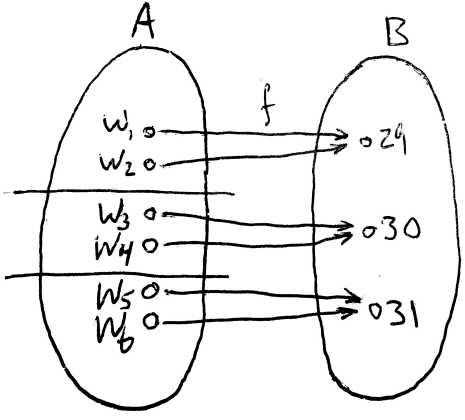
(c) $[\![\textit{Who left?}]\!] = \lambda \mathtt{i}\mathtt{j}.(\textbf{left}_{\mathtt{i}} = \textbf{left}_{\mathtt{j}})$ type: $\mathtt{s} \rightarrow (\mathtt{s} \rightarrow \mathtt{t})$
(d) $[\![\textit{Who left?}]\!]^{\mathtt{i}} = \lambda \mathtt{j}.(\textbf{left}_{\mathtt{i}} = \textbf{left}_{\mathtt{j}})$ type: $\mathtt{s} \rightarrow \mathtt{t}$
'the set of worlds in which the leavers are the same as in $\mathtt{i}$'

(24) $[\![\textit{that Bill and Cam left}]\!] = \lambda \mathtt{j}.(\{\textbf{bill}, \textbf{cam}\} = \textbf{left}_{\mathtt{j}})$

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.

$$\textbf{?}(\llbracket \textit{Bill's age} \rrbracket) = \lambda ij.(\llbracket \textit{Bill's age} \rrbracket^{i} = \llbracket \textit{Bill's age} \rrbracket^{j})$$

As long as DPs denote intensions (functions on the set of indicies), **?** 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 $\neq$ I know what is in the fridge

(27)*I found out expensive $\neq$ 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)

SORTAL	RELATIONAL
*the day of Ann	the birthday of Ann
*the animal of Ann	the pet of Ann
*the person of Ann	the child of Ann

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 backgro

- 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)
$[\![\textit{birthday}]\!] = \langle \textbf{day}, \textbf{born-on} \rangle$
$[\![\textit{birthplace}]\!] = \langle \textbf{location}, \textbf{born-at} \rangle$

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:

$$\begin{aligned}\text{Bill's birthday} \equiv\ & \text{the birthday of Bill} \equiv \\ & [\![\langle \textbf{\textit{day}}, \textbf{\textit{born-on}}(\textbf{\textit{bill}})\rangle]\!]^{i} \\ & = \{\langle a, fa\rangle | a \in \textbf{day}_i, f \in \textbf{born-on}_i(\textbf{bill}_i)\} \\ & = \{\langle \textbf{1-Jan}, \textsc{true}\rangle, \langle \textbf{2-Jan}, \textsc{false}\rangle, \ldots\}\end{aligned}$$

Shifted into a concealed question:

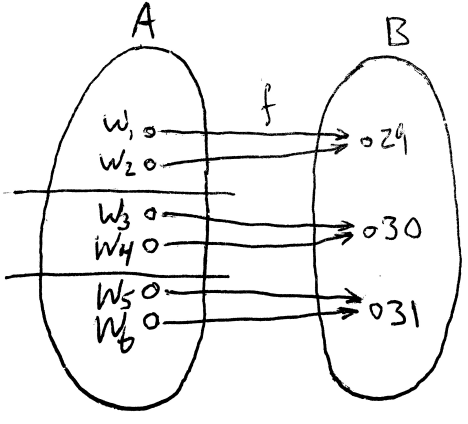
$$\text{Bill's birthday} \equiv \text{the birthday of Bill} \equiv [\![\textbf{\textit{?}}\langle \textbf{\textit{day}}, \textbf{\textit{born-on}}(\textbf{\textit{bill}})\rangle]\!]$$
$$= \lambda ij.([\![\langle \textbf{\textit{day}}, \textbf{\textit{born-on}}(\textbf{\textit{bill}})\rangle]\!]^{i} = [\![\langle \textbf{\textit{day}}, \textbf{\textit{born-on}}(\textbf{\textit{bill}})\rangle]\!]^{j})$$

How *favorite* saves a sortal:

$$[\![\textit{Bill's day}]\!] = \{x | \textbf{day}(x) \wedge \pi(\textbf{john})(x)\}$$
$$[\![\textit{favorite day}]\!] = [\![\langle \textbf{\textit{day}}, \textbf{\textit{favorite}}(\textbf{\textit{day}})\rangle]\!]$$
$$[\![\textit{Bill's favorite day}]\!] = [\![\langle \textbf{\textit{day}}, \textbf{\textit{favorite}}(\textbf{\textit{day}})(\textbf{\textit{bill}})\rangle]\!]$$

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)

$$\textsc{rel}([\![\textit{the restaurant is located on}]\!])([\![\textit{street}]\!]) = \langle \textbf{street}, \textbf{on}(\textbf{the-restaurant}) \rangle$$

- 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.

THANKS TO

Bert Le Bruyn
Dylan Bumford
Svetlana Godjevac
Jeremy Kuhn
Tim Leffel
Line Mikkelsen
Orin Percus
GLOW 2014

Key References

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

Aloni, Maria, and Floris Roelofsen. 2011. Resolving concealed questions. *Linguistics and Philosophy* **34**: 443–478.

Baker, C.L. 1968. *Indirect questions in English*. Doctoral dissertation, University of Illinois.

Barker, Chris. 1995. *Possessive descriptions*. Stanford: CSLI Publications.

Barker, Chris. 1998. Partitives, Double Genitives, and Anti-uniqueness. *NLLT* **16**:679–717.

Barker, Chris. 2011. Possessives and relational nouns. In von Heusinger, Maienborn, and Portner (eds). *Semantics: An International Handbook of Natural Language Meaning*. HSK 33.2. Berlin: de Gruyter. 1108-1129.

Barker, Chris and Chung-chieh Shan. 2014. *Continuations and Natural Language*. Oxford: Oxford University Press.

Büring, Daniel. 2004. Crossover situations. *Natural Language Semantics* **12.1**: 23–62.

Caponigro, Ivano, and Daphna Heller. 2007. The non-concealed nature of free relatives: Implications for connectivity in specificational sentences. In C. Barker and P. Jacobson (eds): 237–263.

Le Bruyn, B., de Swart, H. & Zwarts, J. 2013. Establishing relations. SALT 23.

Frana, Illaria. 2006. The de re analysis of concealed questions. *SALT 16*.

Frana, Illaria. 2013. Quantified concealed questions. *NLS* **21**: 179–218.

Groenendijk, Jeroen. 2008. Inquisitive semantics: Conditionals, questions, and disjunction. In: T. Friedman & S. Ito (eds.) Proceedings of Semantics and Linguistics Theory (= SALT) XVIII, Ithaca, NY: Cornell University, 729–746.

Groenendijk, Jeroen & Floris Roelofsen. 2009. Inquisitive semantics and pragmatics. Ms., University of Amsterdam.

Groenendijk, Jeroen & Martin Stokhof. 1982. Semantic analysis of WH-complements. *Linguistics & Philosophy* **5**:175–233.
Hamblin, Charles Leonard. 1973. Questions in Montague English. *Foundations of Language* **10**: 41–53.
Heim, Irene. 1979. Concealed questions. In R. Baüerle, U. Egli, and A. von Stechov, (eds). *Semantics from different points of view*, 51–60. Berlin: Springer.
Heim, Irene, and Angelika Kratzer. 1998. *Semantics in generative grammar*. Oxford: Blackwell.
Karttunen, Lauri. 1977. Syntax and semantics of questions. *Linguistics & Philosophy* **1**: 3–44.
King, Jeffrey C. 2007. *The nature and structure of content*. Oxford: Oxford University Press.
Krifka, Manfred. 2011. Questions. In Heusinger, Klaus von, Claudia Maienborn & Paul Portner (eds.), *Semantics. An international handbook of Natural Language Meaning*, Vol. 2, 1742–1785. Berlin: Mouton de Gruyter.
Langacker, Ronald W. 1993. Reference-point constructions. *Cognitive Linguistics* **4.1**:1–38. Berlin, Boston: De Gruyter Mouton.
Löbner, Sebastian. 1981. Intensional verbs and functional concepts: more on the 'rising temperature' problem. *Linguistic Inquiry* **12**: 471–477.
Löbner, Sebastian. 2011. Concept Types and Determination. *Journal of Semantics***28**: 279–333.
Löbner, Sebastian. Ms. Functional Concepts and Frames. semanticsarchive.net.
Mikkelsen, Line. 2011. Copular clauses. *Semantics: An international handbook of natural language meaning*, Vol. 2: 1805–1829.
Montague, Richard. 1974. The proper treatment of quantification in ordinary English. In Richmond Thomason (ed). *Formal philosophy: Selected papers of Richard Montague*, 247–70.

Nathan, Lance. 2006. *On the interpretation of concealed questions*. PhD diss., MIT.

Partee, Barbara. 1997[1982]. Uniformity vs. versatility: The genitive, a case study. *The handbook of logic and language*. 464–470.

Partee, Barbara H., and Vladimir Borschev. 1999. Possessives, favorite, and coercion. In Rebecca Daly and Anastasia Riehl (eds.), *ESCOL 99 Proceedings*. Ithaca: CLC Publications.

Percus, Orin. 2014. What concealed questions might conceal. Ms., University of Nantes.

Romero, Maribel. 2005. Concealed questions and specificational subjects. *Linguistics and Philosophy* **28**: 687–737.

Romero, Maribel. 2006. On concealed questions. In M. Gibson and J. Howell (eds). *Proceedings of SALT XVI*. Ithaca, NY: Cornell University. 208–227.

Romero, Maribel. 2010. Concealed Questions with Quantifiers. In M. Aloni et al. (eds). *Proceedings of the Amsterdam Colloquium 2009*, LNAI 6042. Berlin: Springer-Verlag. 21–31.

Schwager, Magdalena. 2007. Bodyguards under cover: The status of individual concepts. *SALT 17*. 246–263.

Schwager, Magdalena. 2008. Keeping prices low: An answer to a concealed question. *Sinn und Bedeutung 12*. 582–596.

Soames, Scott. 2014. Why the traditional conceptions of propositions cant be correct. In Jeff King, Scott Soames, Jeff Speaks (eds). *New thinking about propositions*. Oxford: Oxford University Press. 25–45.

Vikner, Carl, and Per Anker Jensen. 2002. A semantic analysis of the English genitive. Interaction of lexical and formal semantics. *Studia Linguistica* **56.2**: 191–226.