Paul Hagstrom
Concerning
Reconstruction and the interpretation of which-phrases
Special Bonus Spring Break Seminar
Rullmann & Beck (1997)
3/18/99

Three main (and somewhat interrelated) claims:

Claim I: which-phrases are interpreted in situ.
Claim II: which-phrases are essentially definite descriptions.
Claim III: which-phrases can be analyzed as being non-quantificational.

Prologue: The de re/de dicto distinction

(1) John knows which students called.

De re
John’s knowledge of studentship is irrelevant. Students are who they are.
John knows who called ⇒ John knows which students called.

De dicto
John’s knowledge of studentship affects truth conditions.
John knows which students called only if he can identify a student.
If true, John knows of each student caller x
(a) that x called and (b) that x is a student.

Is student inside (de dicto) or outside (de re) the propositions the question denotes?

Overview of the plot

1. Existing accounts of de dicto entail strong exhaustivity, wrongly.
2. Attempt: Get de dicto by interpreting a question as ?x[x called and x is a student].
3. Problems: Doesn’t match intuitions embedded under want.
   Doesn’t work inside conditionals (Reinhart’s “Donald Duck” problem).
4. Properties of restriction match what we’d expect if it were presupposed (wrt projection).
   a. Definite descriptions (e.g. the student) have this kind of presupposition.
   b. Behavior with embedding verbs indicate restriction is interpreted low.
5. The denotation of a question can be derived without use of existential quantification.

1. Existing accounts of de dicto entail strong exhaustivity, wrongly.

As we recall...

if John knows who called
and Sue called.
then John knows that Sue called.

Exhaustivity (weak)

In fact, if John knows who called
and Mary did not call.
then John knows that Mary did not call.

Exhaustivity (strong)

(K) {x called for callers x}

We saw last week why (K) is weakly exhaustive but not strongly exhaustive...
If Sue, Bill, and Mary called, (K) = {that Sue called, that Mary called, that Bill called).
Neither that Pat called not that Pat did not call is in that set—either is compatible with knowing (K).

Deriving de dicto from strong exhaustivity (Heim 1994)—a sketch.

The Karttunen intension of which students called?

\[ Q_k = \lambda w \exists x [\text{student}(x)(w) \& p(x) \& p = w[\text{called}(x)(w)]] \]

Answer 1

\[ \text{answer}_1(w)(Q_k) = \cap \{Q_k(w) \} \]

A proposition consisting of the conjunction of the true(w) answers.

Answer 2

\[ \text{answer}_2(w)(Q_k) = \lambda w'[\text{answer}_1(w')(Q_k) = \text{answer}_1(w)(Q_k)] \]

The set of worlds w’ in which the conjunction of true(w’) matches the conjunction in w.

The proposition that the conjunction of the true answers is exactly those true in w.

Believe: A world w’ in which Mary called but is not a student, despite being a student in w,
will not qualify to be in answer2(w)(Q_k).

That is, answer2 turns out to entail de dicto.

Knowing the answer2 to which students called? also means knowing of the callers that they are students.

So, strong exhaustivity ⇒ de dicto, but does de dicto ⇒ strong exhaustivity?
They claim no. Here’s why:

(2) John knows (only) one answer to the question (of) which Dutch Olympic athletes won a medal.

• Clearly not claiming exhaustive knowledge, strong or weak.
• John either knows the relevant winner is Dutch (de dicto) or not (de re).
   (well, maybe…)

(3) Jonas and Ida agree on which European countries have a king.

• True even if Jonas and Ida (both) misidentify the European countries (de dicto)
• No issue of exhaustivity, because no set defined (in the actual world)

Two points made:
First, truth (in the actual world) of the members of a question denotation is not required.
Second, de dicto reading can be achieved without strong exhaustivity. (3)

2. The ‘naive de dicto approach’

Back to the drawing board; what is the intuition?

John knows which students called.

\[ \text{de re: } x \text{ is a student, John knows } x \text{ called.} \]

\[ \text{de dicto: } \text{John knows } [x \text{ is a student and } x \text{ called}.] \]

Beck & Rullmann 1996 ms.: the difference is in whether student is in the question nucleus.
Karttunen extension of a question (K) is \textit{de re}.

(K) \[ \lambda p \exists x [\text{student}(x)(w) \land p(w) \land p=\lambda w[\text{called}(x)(w')]] \]

(The set of propositions like \(x\) called for those \(x\) which are both students and callers, \(x\) is a student is not part of the proposition, the “question nucleus” (underlined))

(B&R) \[ \lambda p \exists x [p(w) \land p=\lambda w[\text{student}(x)(w') \land \text{called}(x)(w')]] \]

\textit{de dicto (?)}

(Set of propositions \(x\) is a student and \(x\) called for \(x\) both students and callers)

The Beck & Rullmann (1996) proposal (formalizing the intuition)

\textbf{De dicto:} \hspace{1cm} (B&R) as-is, student with bound world variable \(w’\) (student in the caller world).

\textbf{(B&R)} \[ \lambda p \exists x [p(w) \land p=\lambda w[\text{student}(x)(w') \land \text{called}(x)(w')]] \]

(Set of propositions \(x\) is a student and \(x\) called for \(x\) both students and callers)

\textbf{De re:} \hspace{1cm} (B&R’), with \textit{student} taking the actual world \(w\) (student in the real world).

\textbf{(B&R’)} \[ \lambda p \exists x [p(w) \land p=\lambda w[\text{student}(x)(w) \land \text{called}(x)(w)]] \]

(Set of propositions \(x\) is a student in the real world and \(x\) called for \(x\) both students and callers)

This (B&R’) is going to be the same as (K).

(\(B&R’\)) \[ = \lambda p \exists x [p(w) \land p=\lambda w[\text{student}(x)(w) \land \text{called}(x)(w)]] \]

(\(K\)) \[ = \lambda p \exists x [p(w) \land \text{student}(x)(w) \land p=\lambda w[\text{called}(x)(w)]] \]

In defense of allowing \textit{student} to pick its own world:

\begin{itemize}
  \item (4) Maria wants a hat like mine. \hspace{1cm} (attrib. by Irene Heim to Janet Fodor)
  \begin{itemize}
    \item Maria wants \textit{[a world in which her hat} is like mine]. \hspace{1cm} (Maria makes it her goal to imitate me)
    \item Maria wants \textit{[a world in which her hat} is like mine]. \hspace{1cm} (Maria may not know me or care in the slightest what kind of hat I have in her want-world).
  \end{itemize}
  \item (5) In John’s dream, every unicorn was chasing a secretary of mine.
  \begin{itemize}
    \item \textit{John dreams of unicorns and elephants.}
    \item \textit{Each elephant in John’s dream corresponds to a secretary of mine in the real world.}
    \item \textit{In John’s dream-world, for every unicorn \(x\) there was an elephant \(y\) such that \(x\) chased \(y\).}
    \item \textit{So, every unicorn\textsubscript{\textit{dream}} was chasing a secretary\textsubscript{\textit{real}}.}
    \item every unicorn has scope over a secretary; so the domain of dream-world includes both.
  \end{itemize}
  \item Conclusion (attrib. Enç Madison diss. 1981) world variable can be assigned to a secretary by means other than QR’ing out of dream scope.
\end{itemize}

\textbf{How many} questions can show similar properties.

(6) How many alligators does Mary want to catch?

One dimension of ambiguity:

\begin{itemize}
  \item for which \(n\) there are \(n\) alligators that Mary wants to catch?
  \item Mary wants the cardinality of set of alligators Mary catches to be \(n\)?
\end{itemize}

Another dimension of ambiguity:

\begin{itemize}
  \item alligators = alligators in the real world (regardless of Mary’s beliefs & knowledge)
  \item alligators in Mary’s view (regardless of their real-world status)
\end{itemize}

All four options are available, including want > \(\exists n\) yet alligator only in the actual world.

(Mary thinks those things are crocodiles, though we know they’re alligators. Any four will do, so long as it’s four.)

The point:

What world an N is interpreted with respect to is not correlated with its syntactic scope. Suggesting that an N is assigned an “interpretation world” independently.

So the “naive de dicto approach” involved in (B&R) and (B&R’) isn’t so naive.

\section{Problems with the naive de dicto approach}

(7) Which unicorn does Bill want to catch?

Bill wants \textit{[to catch \textit{which} unicorn]}? Propositions of the form \(x\) is a unicorn and \(x\) so said.

\textit{Not in the question which unicorn does \textit{B} want to catch? he doesn’t. [but just asserted…?]}

(8) Which linguist read every book by which philosopher?

\textit{Propositions of the form} Bill wants \textit{[}a world in which her hat is like mine\textit{]}.

Failure on \textit{y is a philosopher} bestows truth upon the consequent (cf. Reinhart).

We do not want \textit{John read every book by Howard Stern} to be among the propositions contained in the denotation of (8), assuming with R&B that HS isn’t a philosopher.
Presupposition projection as a function of the embedding verb (Karttunen TL 1974).

\[ p \text{ presupposes } q. \]

\[ x \text{ wants that } p \text{ presupposes } x \text{ believes that } q. \]

\[ x \text{ thinks that } p \text{ presupposes } x \text{ believes that } q. \]

\[ x \text{ knows that } p \text{ presupposes } q. \]

(9) Patrick saw the unicorn.  \text{(presupp: unicorns exist)}
#Unicorns do not exist.
Patrick is confident that unicorns do not exist (but could be mistaken).

(10) Patrick wants to catch the unicorn.  \text{(presupp: unicorns exist, projects to belief)}
Unicorns do not exist.
#Patrick is confident that unicorns do not exist.

(11) Patrick thinks that the unicorn left.  \text{(presupp: unicorns exist, projects to belief)}
Unicorns do not exist.
#Patrick is confident that unicorns do not exist.

(12) Patrick knows that the unicorn left.  \text{(presupp: unicorns exist, projects to matrix presup)}
#Unicorns do not exist.
Patrick is confident that unicorns do not exist (but could be mistaken).

Look: Which-phrases act like they presuppose their restriction, by the above diagnostics.

Bill believes he saw two unicorns, a green one and a blue one.  \text{(Although we know that they were painted rocks.)}

(13) Which unicorn does Bill want to catch?
(14) Which unicorn does Bill think he will see again?
   Fine if unicorns don’t exist as long as Bill believes unicorns exist.
(15) Which unicorn does Bill know he will see again?
   Not so good if unicorns don’t exist, regardless of Bill’s beliefs.

It appears: The which-phrase introduces a presupposition in its base position clause.
\text{(i.e. below want, think, know, …)}
(Despite having moved overtly, the restriction appears to be interpreted in situ).

And we saw that definite descriptions (like the unicorn) introduce the same kind of presupposition.
Idea: Interpret which N’ as the N’wh, which presupposes that wh is an N’.

(16) Which man did Meg see?
   not (B&R)  \{ Meg saw Sam and Sam is a man,  
   Meg saw Ian and Ian is a man, ... \}
   but rather \{ Meg saw the man Sam,  
   Meg saw the man Ian, ... \}
   Where the man Sam is defined iff Sam is a man.  \text{(i.e. presupposes Sam is a man)}

(17) The man Sam left.
   This is true in worlds in which Sam is a man and left.
   This is false in worlds in which Sam is a man and did not leave.
   This has no truth value in worlds in which Sam is not a man.

This presupposition-based account solves the “Donald Duck” problem—
   (didn’t Reinhart say it wouldn’t?)

(18) Which linguist read every book by which philosopher?
   Will not contain the proposition John read every book by Howard Stern because the philosopher Howard Stern is undefined (not false).

Side issue about presupposition projection:
Which unicorn does Bill want to catch?
   sounds iffy assuming unicorns don’t exist.
Suggestion: It is a misleading intuition.
   It is easier to accommodate a presupposition to the world than to Bill’s beliefs as distinct from the world.

A potential conflict?  Who wants to marry which millionaire?
   which is supposed to only be about millionaires in the real world not in “who’s” belief-world.
   Who wants to catch which unicorn?
   Which unicorn does Bill know he will see again?

Why can’t these unicorns exist only in the belief worlds of the who subjects?
   (Discussed anywhere?)

Which kid wants to meet which of Santa’s reindeer?

Conclusions so far (Part I of the paper)

• The basic question denotation should be (K), which yields de re reading.
  \[ \lambda p \exists x [p(x) & \text{student}(x)(w) & p=\text{called}(x)(w')] \]
• The de dicto reading should come from interpreting which N’ as the N’wh inside the question nucleus.
• The which-phrase (at least the the N’part) should be interpreted in its base position.

Part II: The syntax-semantics interface and flexible functional application

(K)  \[ \lambda p \exists x [p(x) & \text{student}(x)(w) & p=\text{called}(x)(w')] \]

The set denoted by (K) involves \exists quantification. Where does that \exists come from?

A: Some part of which (e.g., wh-) denotes \exists (and moves to C).
B: \exists is provided by default (\exists-closure).
C: There is no true quantificational \exists in a wh-construction.

Options A & B are fairly common views, and therefore are less interesting to think about.
(A) \[
\text{Which student} \] called \[
\text{which student}
\]

(B) = (A) except with \(\exists\)-closure catching \(x\) (instead of \(wh\))

\[ \exists x \{ \ldots \text{called(}\text{the student } x\text{)} \ldots \} \]

No argument against (B).

The only argument against (A) is that it requires that LF-mmt be insensitive to islands. But (C) is interesting in its differentness, so let’s consider that.

- There is no quantifier-variable structure in which-constructions.
- Alternatives are introduced directly into the semantics by the which-phrase.

\[ \text{Roughly, } [\text{who}] = \text{the set of (contextually relevant) individuals.} \]

Immediate issue: How does the semantics handle sets of individuals as well as individuals?

Rullmann & Beck’s answer: flexible functional application (19)—as we’ve discussed before.

\[ f((a)) =
\]

(i) \( f(a) \)

(ii) \( \{ m : \exists x a : m = f(x) \} \)

(iii) \( \{ m : \exists g f : m = g(a) \} \)

(iv) \( \{ m : \exists x a : \exists g f : m = g(x) \} \)

whichever is defined.

(20) Who saw what?

\[ \{ p | p = \text{that } x \text{ saw } y \text{ for } x \text{ people, } y \text{ things } \} \]

You might characterize that set like this:

\[ \lambda p \exists x \exists y [\text{who-member}(x) \& \text{what-member}(y) \& p = \lambda w [x \text{ saw } y \text{ in } w]] \]

And that’s the same thing Karttunen would have assigned, with his \(\exists\) quantifiers and everything.

By allowing \(wh\)-words to denote a set on their own, we’ve derived the same meaning as we had when we posited a \(\exists\) operator as part of the \(wh\)-construction.

**Big-picturing**

- Wh-movement is not done for semantic interpretation.
  (In fact, if you do move the \(wh\)-phrase, it must be put back for interpretation)
- Wh-in-situ can in general stay in situ.
  (though which-phrases, interpreted as the \(N\) \(wh\) act like quantifiers as much as
  the \(N\) phrases do normally—i.e. they may QR, but they don’t \(wh\)-move).

But what about \(wh\)-scope? Which clause is a \(wh\)-phrase associated with?

Either

- Who knows where we bought which book?

Or

- John knows where we bought which book...

They wave at multiple focus:

(21) We only introduced, Marilyn to John.

We also, only, introduced, Marilyn to Bobby.

which is a similar problem; Rooth (NaLS 1992) semantics of focus contained a “closure” statement that ensures a focus is bound by the closest ~. Wold (SALT VI 1996) proposes indexation and multiple evaluation of focus values. Rooth (Lappin handbook, 1996) concludes the argument against movement in such cases is not conclusive.

So, if we explained the Donald Duck examples with presuppositions, are choice functions redundant? (Since R proposed them to account for the same thing) It’s even possible that the presupposition projection facts support the R&B approach against the R approach, since which millionaire is so unclear.

We have presupposition projection evidence that the restriction is low, but binding suggests other options are available (Lebeaux, via Danny Fox)

\[ \text{Which paper that he gave to Bresnan did every student hope that } [\ldots] \text{ she will read?} \]

he has to be below every student but Bresnan has to be above she.

That’s not in situ. [Though R&B did allow for which \(N\) to QR like the \(N\), right?]

\[ \text{Which paper that every student gave to Bresnan did he hope that she will read?} \]

I think that’s no good. Probably moot—every can’t scope out of the relative clause]

Food for thought—we’ve probably run out of time anyway.

**Answer equivalences**

- Some time is spent reconciling the “naïve approach” of a previous paper with current.
  (“Naïve approach”: which \(N\) \(P\)? has propositions like \(x\) is an \(N\) and \(x\) has property \(P\)—
  current approach: \(\text{which } N\ \text{P}\)? has propositions like \(\text{the } N\ x\ \text{has property } P\).)
- Certain complications with “partial propositions” arise… (e.g., defining conjunction, …)

[A partial proposition \(p\) is such that, for each \(w\), \(p(w)\) is either true, false, or undefined]