Questions:
From embedded clauses to speech acts

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1 Introduction

- Semantics of questions,
  concentrating on embedded questions:

(1) a. *Sue knows what Max drank.*
    b. *Sue knows that Max drank whiskey.*

- Pragmatics of questions,
  investigated by considering answers to questions and their focus structure

(2) a. A: *What did Max drink?*
    B: *Max drank WHISKEY.*
    B′: *WHISKEY.*

    b. A: *Did Max drink whiskey?*
    B: *Max drank whiskey.*
    B′: *Yes. / No.*

Based on: Krifka, Manfred. 2011. Questions.
In: von Heusinger, Klaus, Claudia Maienborn & Paul Portner, (eds), *Semantics. An international handbook of natural language meaning*. Vol. 2. Berlin: Mouton de Gruyter, 1742-1785.

- Questioning as a speech act in a formal model of conversation (ongoing work)

2 Types of Questions

2.1 Constituent questions ("wh questions")

- Create an open proposition by leaving parts of the description unspecified

(3) Arguments:
a. *What did Max drink?*
b. *Who drank wine?*
Adjuncts:
c. *When did Max drink wine?*
d. *Where did Max drink wine?*
Proposition-related:
e. *Why did Max drink wine?*

(4) Multiple questions:
a. *Who drank what?* b. *Who drank what when where?*

- Extra-propositional elements cannot be questioned, e.g. speech-act / sentence adverbials:

(5) a. *Frankly, I don't like it.* b. *Unfortunately, we won't have time to eat.*

- Many languages have wh-in-situ, e.g. Chinese; an option in English (echo) questions.

(6) a. *Max hē-le shénme?* b. *Max drank WHAT?*

- Wh-movement of one constituent, leaving trace in original position, obeying island constraints

(7) a. *What*$_1$ *did* [*Max read* t_1]*?*
b. *Who*$_1$ [t_1 *read this book*]*?*
c. *Who*$_1$ [t_1 *read what*]*?*
d. [*Which book*]$_1$ *did* [*Max read* t_1]?
e. [*About what topic*]$_1$ *did* [*Max recommend a book* t_1]?
f. Romanian: *Cine ce a citit?*

- Root clause questions vs. embedded questions: No AUX, verb last in German.

(8) a. *Mary knows* [*what*$_1$ (**did*) [*Max read* t_1]]
b. *Mary wonders* [*what* (%*did*) [*Max read* t_1]]
c. *Was liest Max?*
d. *Maria weiß* [*was Max liest* / **was liest Max*]

- English does not have a question verb; Austronesian lg often do, e.g. Daakie (Vanuatu)

(9) *Ada-p maha ne vanten kiye?*
1.DU.INCL.-IRREAL do.what TRANS man that
'What should we do with that man?'

2.2 Polarity questions ("yes/no questions")

- Polarity questions request a decision on the truth of the proposition

(10) a. *Did Max drink whiskey?*
b. *Will Max drink whiskey?*

- Variety of polarity questions, expressing bias

(11) a. *Max drank whiskey?*
b. *Max drank whiskey, didn't he? / didn't he.*

- Embedded questions with complementizer *whether* / *if*

(12) *Sue knows* [*whether* / *if* [*Max drank whiskey*]].

- Marking strategy with question particle.

(13) a. [Japanese] *kono hon wa omoshiroi desu ka*
'Is this book interesting?'
b. [Swahili] *Je, Max amekisoma kitabu hiki?*
'Has Max read this book?'
c. [Latin] *Puer-ne bonus est?*
'Is the boy good?'

- Marking strategy with alternative construction:

(14) [Chinese] *Max hē pijiŭ bu hē pijiŭ*
Max drink beer NOT drink bear
'Will Max drink beer?'

- Marking as part of verb inflection, West Greenlandic (Sadock 1984):

(15) a. *neri-vu-q*
eat-INDIC-3sg
'He ate.'
b. *neri-va-∅*
eat-INTERR-3sg
'Did he eat?'
c. *su-mik neri-va-∅*
what-INSTR eat-INTERR-3sg
'What did he eat?'

2.3 Alternative questions

- Semantically like constituent questions, syntactically like polarity questions

(16) a. *Did /MAX or \SUE drink whiskey?* ‘Who drank whiskey, Max or Sue?’
  b. *Did Max drink /VODKA or WHISKEY\?* ‘What did Max drink, vodka or whiskey?’
  c. *Did Max drink /VODKA or did he drink WHISKEY?*

- Rising-Falling accent is essential:

(17) a. *Did /MAX or /SUE drink beer?*
  b. *Did Max drink /VODKA, or /WHISKEY?* – polarity questions, with focus.

- In contrast to constituent questions, no movement, no multiple questions.

(18) a. **/VODKA or \WHISKEY did Max drink?* – cf. *What did Max drink?*
  b. **/MAX or \SUE drank /VODKA or \WHISKEY?* – cf. *Who drank what?*
  c. **Who drank /VODKA or \WHISKEY?* – cf. *Who drank what?*

- Alternative questions can be embedded:

(19) a. *Sue knows* [*whether Max drinks /BEER or \WINE*].
  b. *Sue knows* [[*whether Max drinks /BEER*] or [*whether Max drinks \WINE*]]

3 Questions as Semantic Objects

3.1 The semantic representation language

- Example for representation of a proposition:

(1) $[\![$*Max met Sue*$]\!]$
  $= \lambda i[\text{Max met Sue in } i]$, where i: an index (world/time or situation)
  $= \lambda i[i{<}now \wedge met_i(Sue_i)(Max_i)]$
  a function from indices i into the truth value 1, if Max (in i) met (in i) Sue (in i);
  met_i: lexical meaning of *met* at index i

- Compositional derivation of this meaning:

(2) General rule for (extensional) functional composition:
  $[\![[\alpha\ \beta]]\!] = ([\![\alpha]\!], [\![\beta]\!]) = \lambda i[[\![\alpha]\!](i)([\![\beta]\!](i))]$ or $\lambda i[[\![\beta]\!](i)([\![\alpha]\!](i))]$, whichever possible

(3) $[\![[$*Max* $[$*met Sue*$]]]\!]$
  $= \lambda i[[\![[met\ Sue]]\!](i)([\![Max]\!](i))]$
  $= \lambda i[\lambda i'[[\![met]\!](i')([\![Sue]\!](i'))](i)([\![Max]\!](i))]$
  $= \lambda i[\lambda i'[\lambda i''\lambda y\lambda x[i''{<}now \wedge met_{i''}(y)(x)](i')(\lambda i''[Sue_{i''}](i'))](i)(\lambda i'[Max_{i'}](i))]$
  $= \lambda i[\lambda i'[\lambda y\lambda x[i'{<}now \wedge met_{i'}(y)(x)](Sue_{i'})](i)](Max_i)]$
  $= \lambda i[\lambda y\lambda x[i{<}now \wedge met_i(y)(x)](Sue_i)](Max_i)]$
  $= \lambda i[\lambda x[i{<}now \wedge met_i(Sue_i)(x)](Max_i)]$
  $= \lambda i[i{<}now \wedge met_i(Sue_i)(Max_i)]$

3.2 The functional (categorical) representation of question meanings

Ajdukiewicz (1928), Tichy (1978), Hausser & Zaefferer (1979), Ginzburg (1992), ...

- Question as open proposition; example: constituent question.

(4) ⟦*who met Sue*⟧ = λi[x met Sue in i]

- Question as propositional function, two options:

(5) a. λx:person λi[x met Sue in i]
b. λi λx:person$_i$ [x met Sue in i]

- Some other questions meanings

(6) a. ⟦*who Max met*⟧ = λiλy:person$_i$ [Max met y in i]
b. ⟦*which woman Max met*⟧ = λiλy:woman$_i$ [Max met y in i]
c. ⟦*which man met which woman*⟧ = λiλx:man$_i$ λy:woman$_i$ [x met y in i]

- Answers are semantic meanings that, when question meaning is applied, lead to a proposition.

(7) *who met Sue? – Max.* λi[λx:person$_i$[x met Sue in i](Max$_i$)]
= λi[Max$_i$ met Sue$_i$], provided that Max$_i$ is a person in i.

- Compositional interpretation, wh-movement results in lambda abstraction:

(8) ⟦[[*which woman*]$_1$ [*Max met* t$_1$]]⟧ = λi[λx$_1$:⟦*woman*⟧(i) ⟦[*Max met* t$_1$]⟧(i)]
= λi[λx$_1$:woman$_i$ λi′[met$_{i'}$(x$_1$)(Max$_{i'}$)](i)]
= λi[λx$_1$:woman$_i$ [met$_i$(x$_1$)(Max$_i$)]]

- Interpretation of polarity question, answers: affirmation / negation of truth value:

(9) ⟦*whether* [*Max met Sue*]⟧ = λi λf∈{λt[t], λt[¬t]}[f([Max met Sue in i])]

- Alternative questions: Intended interpretation; derivation unclear (*whether*, no wh-movement)

(10) ⟦*whether Max met /SUE or \JILL*⟧ = λiλx∈{Sue$_i$, Jill$_i$} [Max met x in i]

3.3 The proposition set representation of questions

Hamblin (1958, 1973), Rooth (1992), Karttunen (1977): Set of true propositions.

- Question as a set of propositions

(11) ⟦*who met Sue*⟧ = {λi[Max met$_i$ Sue in i], λi[Bill met Sue in i], …}
= {λi[x met Sue in i] | x:person} (notice: person independent of s)

- Other question meanings

(12) a. ⟦*which woman Max met*⟧ = {λi[Max met y] | y:woman}
b. ⟦*which man met which woman*⟧ = {λi[x met y] | x:man, y:woman}

- Compositional interpretation: Generation of alternatives
  – wh-words denote set of alternative meanings, other words: singular sets of regular meanings
  – alternatives are projected through semantic composition

(13) General rule for meaning composition, assuming alternatives:
⟦[α β]⟧ = {(X Y) | X∈⟦*α*⟧, Y∈⟦*β*⟧}, = {λi[X(i)(Y(i)) | X∈⟦*α*⟧, Y∈⟦*β*⟧} or {λi[Y(i)(X(i)) | X∈⟦*α*⟧, Y∈⟦*β*⟧}

(14) a. ⟦*who*⟧ = {x | person(x)}, = {λi′[Max$_{i'}$], λi′[Bill$_{i'}$], λi′[Sue$_{i'}$]...}
b. ⟦*met*⟧ = {λi′λyλx[met$_{i'}$(y)(x)]}, a singleton set, disregarding tense
c. ⟦[*met who*]⟧ = {(X,Y) | X∈⟦*met*⟧, Y∈⟦*who*⟧}
= {λi[λi′λyλx[met$_{i'}$(y)(x)](i)(Y(i)) | Y∈ {λi′[Max$_{i'}$], λi′[Bill$_{i'}$], λi′[Sue$_{i'}$]...}}
= {λiλx[met$_i$(Y(i))(x)] | Y∈ {λi′[Max$_{i'}$], λi′[Bill$_{i'}$], λi′[Sue$_{i'}$]...}}
= {λiλx[met$_i$(Max$_i$)(x)], λiλx[met$_i$(Bill$_i$)(x)], λiλx[met$_i$(Sue$_i$)(x)], …}, = ①
d. ⟦[*Max* [*met who*]]⟧ = {(X, Y) | X∈⟦*Max*⟧, Y∈⟦[*met who*]⟧}
= {λi[Y(i)(X(i)) | X∈{λi′[Max$_{i'}$]}, Y∈①}
= {λi[met$_i$(Y(i))(λi′[Max$_{i'}$])] | Y∈ {λi′[Max$_{i'}$], λi′[Bill$_{i'}$], λi′[Sue$_{i'}$]...}}
= {λiλx[met$_i$(Max$_i$)(Max$_i$)], λiλx[met$_i$(Bill$_i$)(Max$_i$)], λiλx[met$_i$(Sue$_i$)(Max$_i$)], …}

- Interpretation of polarity questions:

(15) ⟦*whether Max met Sue*⟧ = {λi[Max met Sue in i], λi¬[Max met Sue in i]}

- Interpretation of alternative questions:

(16) ⟦*wether Max met /SUE or \JILL*⟧ = {λi[Max met Sue in i], λi[Max met Jill in i]}

- Proposition set interpretation can be derived from functional interpretation (not vice versa)

(17) ⟦*who Max met*⟧

a. functional: λiλx:person[Max met x at i], = ① (assuming person not dependent on i)

b. propositional: {λi[Max met x at i] | person(x)}, = ②

c. ② = {p | ∃x[p=λi[①(i)(x)]]}

3.4 The partition interpretation of questions

Higginbotham & May (1981), Groenendijk & Stokhof (1982, 1984)

- Questions as equivalence relations between indices:

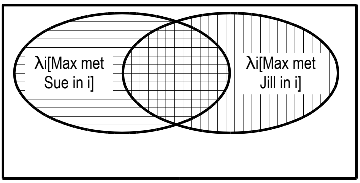
(18) ⟦*which woman Max met*⟧ = $\lambda j\lambda i[\lambda y{:}woman_i[\text{Max met } y \text{ in } i] = \lambda y{:}woman_j[\text{Max met } y \text{ in } j]]$, = ①

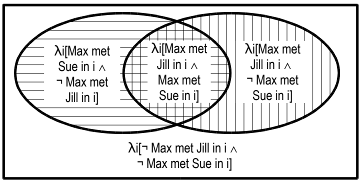
(19) ⟦*which woman Max met*⟧(i*) = $\lambda i[\lambda y{:}woman_i[\text{Max met } y \text{ in } i] = \lambda y{:}woman_j[\text{Max met } y \text{ in } i^*]]$,
the set of worlds i that do not differ from the world i* for the answers of *which woman Max met*.

- Equivalence relation defines a partition:

(20) {p | ∀i,j[p(i) ∧ p(j) ↔ ①(j)(i)}

- Comparison proposition set interpretation / partition interpretation (if Sue, Jill are the only women):





- Compositional derivation from the functional meaning:
Assume $\lambda i\lambda x_1{:}woman_i\,[met_i(x_1)(Max_i)]$ = ②, relational meaning: λjλi[②(i) = ②(j)]

- Other question meanings, including polarity question

(21) a. ⟦*which man met which woman*⟧
= $\lambda j\lambda i[\lambda x{:}man_i\lambda y{:}woman_i[x \text{ met } y \text{ in } i] = \lambda x{:}man_j\lambda x{:}woman_j[x \text{ met } y \text{ in } j]]$

b. ⟦*whether Max met Sue*⟧ = $\lambda j\lambda i[[Max_i \text{ met } Sue_i \text{ in } i] = [Max_j \text{ met } Jill_j \text{ in } j]]$

- Relation to exhaustivity of answers:
  – Proposition set interpretation: question is not exhaustive.
  – Partitional interpretation: question is exhaustive

(22) A: *Where can I buy the New York Times?*
B: *At the train station.*
B: *At the train station, the post office, the kiosk in the park, the grocery store, ….*

- Partitional interpretation develops notion of "partial answer" as a special case.
  Proposition set interpretation develops notion of "total answer" as a special case.
- Not clear what is the "basic" meaning of a question:

(23) a. *Where all can I buy the NYT?* – Marked exhaustivity
b. *Where, for example, can I buy the NYT?* – Marked de-exhaustivity.

- A side issue, worth to be mentioned here (cf. Ginzburg):
  Fine-grainedness of alternatives

(24) A: *Where am I?*
B: *At Schützenstrasse 18.* / *In Berlin Mitte.* / *In Berlin.* / *In Germany.* / *On planet Earth.*

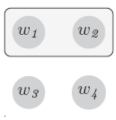
3.5 The relational interpretation (inquisitive semantics)

Groenendijk & Roelofsen (2009), see https://sites.google.com/site/inquisitivesemantics/,
for introduction see lecture notes of Ciardelli, Groenendijk & Roelofsen 2012

- Question meanings as relations between indices that is reflexive and symmetric,
  but not transitive – hence not an equivalence relation as in partition representation
- Question formation is achieved with **disjunction** forming **sets** of propositions.

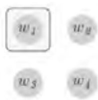
(25) a. ⟦*whether Max met Sue*⟧ = $?\lambda i[\text{Max met Sue in } i] = \{\lambda i[\text{Max met Sue in } i], \lambda i\neg[\text{Max met Sue in } i]\}$
b. ⟦*which woman Max met*⟧ = $\forall x{:}\text{woman } ?\lambda i[\text{Max met } x \text{ in } i] = ?\lambda i[\text{M met S in } i] \Cap ?\lambda i[\text{M met J in } i]$

- Illustration of **non-inquisitive** "**information states"** and of **inquisitive "issues"**
  relative to four possible worlds, where in w_1, w_2: Max met Sue, in w_1, w_3: Max met Jill



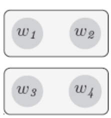
Max met Sue

Max met Sue or Jill



Max met Sue and Jill

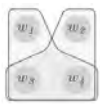
no type distinction between
information states and issues,
both sets of sets of possible worlds,
information states: singleton sets



whether Max met Sue

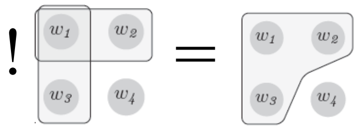
whether Max met
/SUE or \JILL

which woman
Max met



whether Max met Jill,
if he met Sue

- Inquisitive semantics has an operation ! to form an information state from an inquisitive state, by forming set union over all propositions:



- This can be used to capture a relation between wh-words and indefinites in many languages, e.g. German *wer* 'who' and *irgendwer* 'someone',
  English *where* and *somewhere*

(26) ⟦*Max met someone*⟧ = ! ⟦*who Max met*⟧
Notice that the indefinite pronoun always is derived from the question word, cf. Bhat 2000.

4 Embedding Questions

Karttunen 1977, Spector & Égré 2012

(1) a. *Bill knows which woman Max met.* — cf. *be aware, remember, forget; learn, notice,*
b. *Bill knows that Max met Sue.* — *find out; guess, predict; tell, say; be certain*

(2) a. *Bill wonders which woman Max met.* — inquisitive verbs: ask, investigate, be interested in
b. **Bill wonders that Max met Sue.* — dependency verbs: *depends on*

(3) a. **Bill believes which woman Max met.*
b. *Bill believes that Max met Sue.*

- Embedding behavior of *know* in **propositional** interpretation of questions:

(4) a. Basic meaning: proposition-embedding.
⟦*Bill knows*$_p$ [*that Max met Sue*]⟧ = $\lambda i[\text{know}_i(⟦$*Max met Sue*$⟧)(\text{Bill})]$
= $\lambda i[\text{know}_i(\lambda i'[\text{Max met Sue in } i'])(\text{Bill})]$

b. Derived meaning: question-embedding.
⟦*Bill knows*$_q$ [*who Max met*]⟧ = $\lambda i[\forall p{\in}⟦$*who Max met*$⟧[p(i) \leftrightarrow \text{know}_i(p)(\text{Bill})]$
= $\lambda i[\forall p{\in}\{\lambda i'[\text{Max met x in i}] \mid \text{person}(x)\}[p(i) \leftrightarrow \text{know}_i(p)(\text{Bill})]$

- Factivity effects
  – Meaning postulate requires $[p(i) \leftrightarrow \ldots]$, i.e. restricted to propositions p that are true at i.
  – we expect: restriction to **factive** predicates

(5) **Bill believes who Max met.* — *believe* same meaning as *know* except factive presupposition violates "Maximize presupposition!"

(6) a. *Bill told Jill that Max met Sue.* — non-factive *tell*, Bill might have told something false
b. *Bill told Jill who Max met.* — factive *tell*, Bill told the truth
c. *Bill told Jill whether Max met Sue.* Bill told the truth (observation: Karttunen 1977)

(7) *Bill guessed which horse won* [past: factive]./*… would win*. [relative future: factive in Bill's world]

- Embedding behavior of *know* in **partitional** interpretation of questions:
  know takes the extension of the question as argument, reduces to a proposition

(8) $[\![$*Bill knows* [*who Max met*]$]\!]$
$= \lambda i[\text{know}_i([\![\textit{who Max met}]\!](i))(\text{Bill})]$
$= \lambda i[\text{know}_i(\lambda j'\lambda j[\lambda y{:}\text{person}_j[\text{Max met y in j}] = \lambda y{:}\text{person}_{j'}[\text{Max met y in j}']](i)])(\text{Bill})]$
$= \lambda i[\text{know}_i(\lambda j[\lambda y{:}\text{person}_j[\text{Max met y in j}] = \lambda y{:}\text{person}_i[\text{Max met y in i}]])(\text{Bill})]$
If Max met Sue and didn't meet Jill, equivalent to $\lambda j[\text{Max met Sue in j} \wedge \neg\text{Max met Jill in j}]$

- Embedding behavior of *wonder*: does not select for propositions, hence **wonder that...*
  – In proposition set interpretation: no meaning postulate reducing question to proposition
  – In partitional interpretation: *wonder* selects for the intension of a question meaning.

(9) $[\![$*Bill wonders* [*who Max met*]$]\!] = \lambda i[\text{wonder}_i([\![\textit{who Max met}]\!])(\text{Bill})]$

- Quantification over "amounts" of questions (Lahiri 1991)

(10) *Bill knew for the most part* [*who Max met*]: $\text{MOST}p{\in}[\![\text{who Max met}]\!][p(i) \rightarrow \text{know}_i(p)(\text{Bill})]$

- Concealed questions: Functional nominal expressions with question-like meaning.

(11) *Bill asked / knew the time* (≈ *what the time was*): $[\![\textit{the time}]\!] = \lambda i\lambda x[x = \text{time of i}]$

- Wh-exclamatives:

(12) *Bill was amazed how many people Max met.*
– abstraction over degree: $\lambda i\lambda n[\text{Max met n-many people at i}]$
– Bill did not expect the degree n that yields a true proposition is as high as it is:
$\lambda i[\forall p{\in}[\![\textit{how many people Max met}]\!][p(i) \rightarrow \neg\text{expect}_i(p)(\text{Bill})]$, notice: factivity

(13) *Bill did not believe how many people Max met.*
Notice: *believe* does not allow for question complements, *cannot* **believe** does; factivity!
$\lambda i[\forall p{\in}[\![\textit{how many people Max met}]\!][p(i) \rightarrow \neg\text{believe}_i(p)(\text{Bill})]]$

5 Multiple questions and boolean combinations of questions

5.1 Multiple questions

- Multiple questions

(1) *The NSA knows who called whom when.*

- Representation of question in functional interpretation and proposition-set interpretation:

(2) a. $\lambda i\lambda x{:}\text{person}_i\lambda y{:}\text{person}_i\lambda z{:}\text{time}_i[\text{x called y at time z in i}]$
b. $\{\lambda i[\text{x called y at time z in i}] \mid \text{person(x), person(y), time(i)}\}$

- But the wh-elements are asymmetric:

(3) a. *The phone book tells you which person has which phone number.* (true)
b. *The phone book tells you which phone number belongs to which person.* (not quite)
– Kuno 1972: the first wh-element acts as a sorting key
– Higginbotham & May 1981: function formation by "absorption";
notice that function formation can be defined for functional interpretation,
not for proposition set interpretation (cf. Krifka 2001).

(4) a. $\lambda i\lambda x{:}\text{person}_i\lambda y{:}\text{number}_i[\text{x has y in i}]$
b. $\lambda i\lambda f{:}[\text{person} \rightarrow \text{number}]\forall x{\in}\text{DOM}(f)[\text{x has f(x)}]$
– for proper functions: #(DOM(f)) > 1, hence multiple answer tuples expecte ("matching question")

- Conjoined wh-questions, also called "quiz questions" (cf. Comorovski 1996):
  – in contrast to "matching questions" (above), do not expect more than one answer tuple.

(5) a. $[\![\textit{when Max saw Sue where}]\!] = \lambda i\lambda f{:}[\text{time} \rightarrow \text{location}]\ \forall l{\in}\text{DOM}(f)[\text{Max saw Sue at l at f(l) in i}]$
b. $[\![\textit{when and where Max saw Sue}]\!] = \lambda i\lambda t{:}\text{time}\ \lambda l{:}\text{location}\ [\text{Max saw Sue at l at t in i}]$

5.2 Conjunction of questions

◆ Questions can be conjoined

(6) *Bill knows* [*who Max met and whether he drank whiskey*]

◆ Treatment in partition interpretation by intersection of partitions (also, inquisitive semantics)

(7) a. ⟦*who Max met*⟧
= λjλi[λx[Max met x in i] = λx[Max met x in j]], = ①
b. ⟦*whether Max drank whiskey*⟧
= λjλi[λy[Max drank whiskey in i] = λy[Max drank whiskey in j]], = ②
c. ⟦[*who Max met*] *and* [*whether Max drank whiskey*]⟧
= λjλi[①(j)(i) ∧ ②(j)(i)],
forms an equivalence relation that defines a partition

◆ Universal quantification into questions:

(8) a. *Jill knows* [*which woman every man met*]
b. Universal quantifier as generalized conjunction:
which woman Max met and which woman Bill met and …

◆ Treatment in functional interpretation: unclear, as questions may be of different type

(9) *Bill knows* [*who Max met and whether he drank whiskey*]
a. ⟦*who Max met*⟧ = λiλx:person$_i$[Max met x in i], = ①
b. ⟦*whether Max drank whiskey*⟧ = λiλf∈{λt[t], λt.[¬t]}[f([Max drank whiskey in i])], = ②
c. unclear how to conjoin ① and ②
d. solution (Krifka 2001): lifting to embedding predicate conjunction, λP[P(①) ∧ P(②)],
know [*who Max met and whether he drank whiskey*]
⇔ [*know* [*who Max met*]] *and* [*know* [*whether Max drank whiskey*]]

6 Answers to questions

6.1 Answers to constituent questions: The role of focus

◆ Question-answer focus congruence (Herman Paul, 1880)

(1) a. *Who did Max meet?* *Max met SUE$_F$.*
b. *Who met Sue?* *MAX$_F$ met Sue.*

◆ Interpretation of focus feature in answer corresponds to question

◆ Focus in function interpretation of question, cf. von Stechow 1991:Background-Focus pairs

(2) a. ⟦*Max met SUE$_F$*⟧ = ⟨λiλx[Max met x in i], Sue⟩
b. ⟦*MAX$_F$ met Sue*⟧ = ⟨λiλx[x met Sue in i], Max⟩

The interpretation of the question must be a **restriction of the background**,
term answers: background is deleted, only focus is represented.

c. ⟦*who did Max meet*⟧ = λiλx:person[Max met x in i]
d. ⟦*who met Max*⟧ = λiλx:person[x met Sue in i]

◆ Focus in proposition set interpretation of question, cf. Rooth 1992:
Regular interpretation and focus interpretation (set of alternatives)

(3) a. ⟦*Max met SUE$_F$*⟧ = λi[Max met Sue in i]
⟦*Max met SUE$_F$*⟧^{f} = {λi[Max met x in i] | x:entity}
b. ⟦*MAX$_F$ met Sue*⟧ = λi[Max met Sue in i]
⟦*MAX$_F$ met Sue*⟧^{f} = {λi[x met Sue in i] | x:entity}

The interpretation of the question must be a **subset of the focus meaning of the answer**.

c. ⟦*who did Max meet*⟧ = {λi[Max met x in i] | x:person}
d. ⟦*who met Sue*⟧ = {λi[x met Sue in i] | x:person}

Additional pragmatic principle (Schwarzschild 1999): Avoid focus if possible, don't over-focus!

6.2 Answers to polarity questions

- Grammaticalized answers: *yes, no*; *ja, nein, doch*
  Do not exist in all languages – lacking e.g. in Welsh (cf. Bob Moris Jones 1999)
- Not only answers to polarity questions, but also reactions to assertions:

(4) a. A: *Did Max meet Sue?* B: *Yes. / No.*
 b. A: *Max met Sue.* B: *Yes. / No.*

- Complex situation if the antecendent clause is negated:

(5) a. A: *Did Max not meet Sue?* B: ***No, he didn't.*** *Yes, he didn't.*
 b. A: *Max did not meet Sue.* *No, he did!* ***Yes, he did!*** (G: *doch*)

- Often observed: Differences between lg, e.g. Chinese, Japanese; agreement/disagreement
- New models: Farkas & Roelofsen (t.a.), "Polar initiatives and polar particle responses..."
  Here: Krifka (2013), "Response particles as propositional anaphors"
- Clauses introduce propositional discourse referents that can be picked up by anaphoric elements

(6) *Max met Sue. Jill is aware of that.*
 ↪p: 'Max met Sue' ↑p

- Sentential negation is a clause-level operator, hence two propositional DRs are introduced.

(7) *Two plus two isn't four.* *Everyone knows that.* / *That would be a contradiction.*
 ↪q: ¬p ↪p: '2+2=4' ↑q ↑p

- Response particles pick up propositional DR and assert it (*yes*) or its negation (*no*).

(8) A: *Max met Sue.* B: *Yes.* B: *No.*
 Did Max meet Sue? ↑p ↑p
 ↪ p: 'Max met Sue' ASSERT(p) ASERT(¬p)

(9) A: *Max did not meet Sue.* B: *Yes.* B: *No.*
 Did Max not meet Sue? ↑**p** / ↑q ↑**p** / ↑q
 ↪q: ¬p, ↪p: 'Max met Sue' **ASSERT(p)** **ASSERT(¬p)**, = ASSERT(q)
 ASSERT(q) ASSERT(¬q), = ASSERT(p)

- Additional optimization processes for anaphor resolution explain preferential answers, e.g. p is more salient in most contexts as p was likely salient before the antecedent clause, but not always.

(10) A: *Mount Cotopoxi is difficult to climb.*
 B: *I know. Reinhold Messner did not climb it.*
 A: *No*. (preference for: He did not climb it.)

(11) A: *Here is a list of mountains. Which mountains on this list did Reinhold Messner NOT climb?*
 B: *Wait... he did not climb Mount Cotopaxi.*
 A: *No*. (preference for: He did climb it.)

7 Which question interpretation?

- Frameworks considered:
  – Functional interpretation
  – Proposition set interpretation
  – Equivalence relation / partitional interpretation
  – Relational interpretation of inquisitive semantics
- From functional interpretation, others can be derived
  (also, proposition set ⇒ partitional interpretation by intersection of all the proposition).
- Functional interpretation is particularly attractive for questions involving wh-movement,
  as this movement creates functional expressions
- For functional interpretation:
  ✓ functional reading of multiple questions
  ✓ straigtforward interpretation of term answers
  ✓ restrictions of wh-items dependent on index i of interpretation
- For a hybrid interpretation (Krifka 2006, Association with focus phrases): syntactic island effects:

(1) A: *[the dissertation by which of Bill's students] [t received a price]?*
B: *[the dissertation by Molly]* / **["Questions and Answers"]*

(2) Suggested representation:
$\lambda i[\lambda x{\in}\{\text{dissertation}_i \text{ by } y \mid y{:}\text{student}_i \text{ of Bill}\}[x \text{ received a price in } i]$
|---------------- alternative semantics -------------|
|-------------------------------- functional interpretation ------------------------|

- Similar island effects in in-situ-languages like Japanese: wh-movement on LF?
- Alternative semantics for alternative questions, which do not allow for multiple questions

(3) * *Did /MAX or \SUE drink /BEER or \WINE?*