PLING228 Semantics Research Seminar

Lecture 6: Functional Answers to Questions

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1 Functional answers

Groenendijk & Stokhof (1984:Ch.3) identify three types of answers:

(1) Which woman does every man love? (Groenendijk & Stokhof 1984:p. 168)
  a. Mary. (individual answer)
  b. John loves Mary, Bill loves Suzy, ... (pair-list answer)
  c. His mother. (**functional answer**)

The functional answer is so-called because it seems to specify a function, rather than a particular individual. In the case of (1c), the function is $[\lambda x_e.\ x$'s mother$]$, and the answer indicates that every man m loves $[\lambda x_e.\ x$'s mother$](m)$.

2 Groenendijk & Stokhof on functional vs. pair-list answers

It's easy to see that the individual answer is different from the other two:

(2) Which relative of his$_i$ does [every man]$_i$ love?
  a. #Mary. (individual answer)
  b. John loves his mother, Bill loves his father, ... (pair-list answer)
  c. His mother. (functional answer)

On the other hand, the distinction between pair-list answers and functional answers might not be very clear. Suppose the following son-mother relation:

(3)

son	mother
Andy	Ann
Ben	Beth
Charles	Christy
Dan	Dorothy

Suppose also that all these men love their mother. Then the following two answers seem to convey the exact same information.

(4) Which woman does every man love?
  a. Anthony loves Ann, Ben loves Beth, Charles loves Christy, and Dan loves Dorothy.
  b. His mother.

In fact, one can see the pair-list answer (4b) as the graph of the function specified by (4c), $[\lambda x_e.\ x$'s mother$]$, (with its domain restricted to the relevant men).

Of this issue, (Groenendijk & Stokhof 1984:p. 176f) remark as follows:

> With many others, we believed for a long time that answers like *his mother* to questions like [(4)] are just a kind of abbreviation, a more economic way of expressing pair-list answers. [...] But can functional answers and pair-list ones really always be equated? There seem to be several reasons to doubt this.

Groenendijk & Stokhof give three reasons that functional and pair-list answers are distinct 'readings', i.e. they should be captured as distinct semantic objects.

2.1

Someone who gives a functional answer might not be able to give a pair-list answer, and *vice versa* (see also Engdahl 1986, Heim 2012).

(5) John knows which woman every man loves.
  a. John knows that every man loves his mother, but doesn't know who is the mother of who. ⇒ Only the functional reading is TRUE
  b. John knows which man loves which woman, but doesn't know the fact that for each man, the woman he loves is his mother. ⇒ Only the pair-list reading is TRUE

I find this argument unconvincing. Maybe there is only one reading (i.e. one type of semantic object) that could be true in both of these situations? Notice that the same kind of 'ambiguity' obtains with individual answers.

(6) John knows which woman every Dutchman loves.
  a. John knows that every Dutchman loves Beatrix. He's unaware that she is the former Queen of the Netherlands.
  b. John knows that every Dutchman is crazy about the royal family and loves the former Queen of the Netherlands, but he cannot identify her.

Does this imply that there are two different individual-answer 'readings' of the embedded question? Not necessarily. Aloni (2001) points out that in some contexts not all extensionally equivalent individual answers are equally appropriate. Consider the following example from Aloni (2001:p. 9):

(7) *Your daughter Priscilla is doing her homework. She asks you:*
  Who is the president of Mali?
  a. Answer 1: *Konare*.
  b. Answer 2: You fly to Mali, kidnap Konare, bring him in your living room, and say *This guy*.

Answer 1 is appropriate, while Answer 2 is not really giving the information Priscilla asked for, despite the fact that both the name *Konare* and the demonstrative phrase *this guy* refer to the same individual! Similarly, *the president of Mali* is also an inappropriate answer to the question, although it also refers to the same guy.

Aloni's idea is that context may specify what kind of answer is appropriate. In (7) Priscilla is asking for the name that refers to the individual in question. In other situations, demonstratives become felicitous, e.g. at a party with lots of important figures, someone asks you to identify the president of Mali among the guests. Here, the proper name is inappropriate.

But this doesn't mean that there are two separate types of answers to be captured by different semantic objects. Rather, context decides which answers are appropriate answers.

Aloni furthermore observes that this consideration applies to embedded questions as well, as illustrated by the following examples taken from Aloni (2001:p. 11)

(8) a. *Someone killed Spiderman. You are at the Police department. you have just discovered that John Smith is the culprit. So you say*:
  John Smith did it. So I know who killed Spiderman.
  b. *You now want to arrest John Smith. He is attending a masked ball. You go there, but you don't know what he looks like. You say*:
  I don't know who killed Spiderman.

In (8a), you know the proper name of the individual who killed Spiderman, which entitles you to say that you know who killed Spiderman. In (8b), however, you have to be able to point to the individual, in order to say you know who killed Spiderman.

Coming back to functional vs. pair-list answers, I think the following story is not at all far-fetched. In some contexts, a pair-list answer is appropriate, in other contexts, a functional answer is appropriate.

They identify the same list, but in different ways, just like a proper name and a demonstrative can identify the same individual but in different ways. This difference persists in embedded questions, giving rise to two different truth-conditions. But this doesn't necessitate two distinct kinds of semantic objects for pair-list and functional answers.

2.2

Groenendijk & Stokhof's (1984) second argument is that a complete pair-list answer and a complete functional answer can be different. E.g. Suppose John loves his mother Mary, Bill loves his mother Suzy and John's mother Mary, and Peter loves his mother Jane.

(9) Which woman does every man love?
   a. Partial pair-list answer: John loves Mary, Bill loves Suzy, and Peter loves Jane.
   b. Complete functional answer: His mother.

Groenendijk & Stokhof claim that there's a sense in which (9a) is a partial answer but (9b) sounds like a complete answer, although they convey the same amount of information.

One confound: Is the singular marking on *woman* compatible with the complete pair-list answer? To control for this, let's make everything plural. Suppose that there are three Dutch men, Jeroen, Martin, and Adriaan. They are all married, and love their wife. They also love their mother. Jeroen and Martin love the former Queen Beatrix, but Adriaan doesn't.

(10) Which women does every Dutch man love?
   a. Jeroen loves his wife Jenny and his mother Ineke, Martin loves his wife Maartje and his mother Maaike, and Adriaan loves his wife Anne and his mother Abby.
   b. His wife and mother.

(10a) is a partial answer (doesn't mention Beatrix!), but (10b) sounds like a complete answer in this context. I think this is good evidence that functional and pair-list answers should be given distinct semantic treatments.

2.3

Certain quantifiers do not allow pair-list answers, while allowing functional answers.

(11) $$\text{Which woman does} \left\{ \begin{array}{l} \text{no man} \\ \text{few men} \\ \text{many men} \\ \text{a man} \\ \text{some men} \\ \text{most men} \\ \text{at least one man} \\ \text{exactly one man} \end{array} \right\} \text{love?}$$
   a. Mary.
   b. *John loves Mary, Bill loves Suzy, ...
   c. *John doesn't love Mary, Bill doesn't love Suzy, ...
   d. His/Their mother.

In fact, only universal quantifiers and *wh*-phrases allow pair-list readings.

2.4

One more argument from Preuss (2001): pair-list readings show *quantificational variability effects*, but functional readings don't.

(12) a. John knows for the most part which boy likes which girl.

b. John knows for the most part which girl every boy likes.
c. #John knows for the most part which girl no boy likes.

2.5 Summary

Pair-list and functional answers should be given different analyses. I will put aside how to account for pair-list readings (hopefully Patrick has solved this problem by now).
Agenda:

- We want to account for the fact that the functional answer in (11d) cannot be paraphrased by (11b) or (11c), even if they are extensionally equivalent.
- We want to account for the fact that *His wife and mother* is a complete functional answer in (10).

3 How to Derive Functional Answers

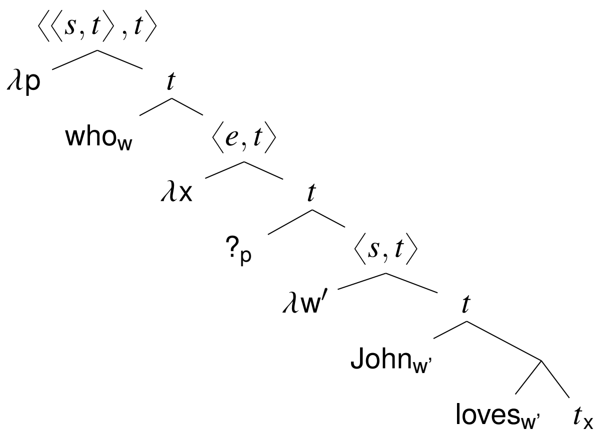
3.1 A quick review of the Hamblin-Karttunen Semantics

The original Karttunen-style semantics only derives the individual answer. Here is a version of it.

(13) a. $[\![?_{\mathsf{p}}]\!]^g = [\lambda q_{\langle s,t\rangle}.\ g(\mathsf{p}) = q]$
b. $[\![\mathsf{who}_{\mathsf{w}}]\!]^g = [\lambda P_{\langle e,t\rangle}.\ \exists x_e[\mathbf{person}_{g(\mathsf{w})}(x) \wedge P(x)]]$

We assume that lexical item is associated with an intensional pronoun w denoting a possible world (we omit ones on world-insensitive items, e.g. $?_{\mathsf{p}}$). When free, intensional pronouns denote the actual world @.

(14)

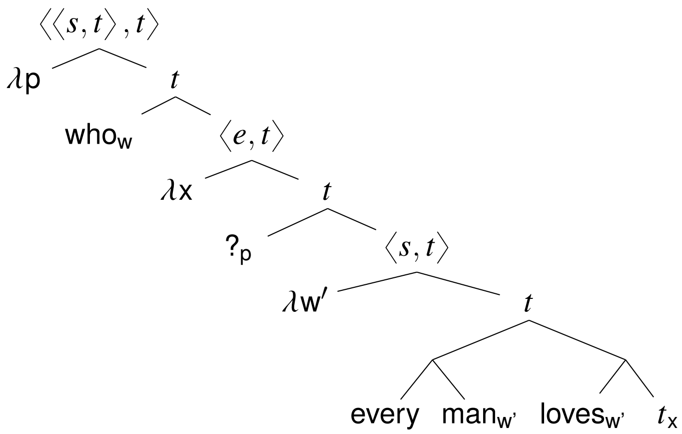


This denotes:

$$[\lambda p_{\langle s,t\rangle}.\ \exists x_e[\mathbf{person}_{@}(x) \wedge p = [\lambda w'_s.\ \mathbf{love}_{w'}(j,x)]]]$$
$$\approx \{\, [\lambda w'_s.\ \mathbf{saw}_{w'}(j,x)] \mid \mathbf{person}_{@}(x) \,\}$$

Replacing *John* with a universal quantifier, we derive an individual answer:

(15)



(15) denotes:

$$\lambda p_{\langle s,t\rangle}.\ \exists x_e[\mathbf{person}_{@}(x) \wedge p = [\lambda w'_s.\ \forall y_e[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y,x)]]$$
$$\approx \{\ [\lambda w'_s.\ \forall y_e[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y,x)]] \mid \mathbf{person}_{@}(x)\ \}$$

Each proposition is about every man loving the same person.

3.2 Asking about functions

Engdahl's (1986) and Groenendijk & Stokhof's (1984) idea:

(16) *Individual answer*
Who does every man love? $\approx$ Which x_e is such that every man loves x?
— Mary

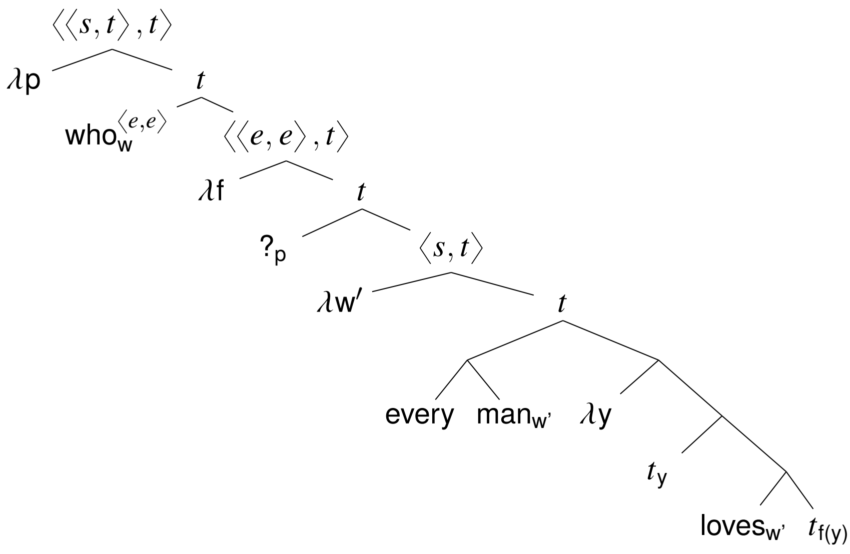
(17) *Functional answer*
Who does every man love? $\approx$ Which $f_{\langle e,e\rangle}$ is such that every man x loves $f(x)$?
—His mother. $\approx [\lambda x_e.\ x$'s mother$]$

I will not discuss Groenendijk & Stokhof's (1984) compositional semantics today.

Heim (2012) translates Engdahl's (1986) semantics into a modern system with some changes. In order to account for functional answers, Heim postulates a second meaning to *who*.

(18) $$\left[\!\left[\text{who}_\text{w}^{\langle e,e\rangle}\right]\!\right]^g = [\lambda P_{\langle\langle e,e\rangle,t\rangle}.\ \exists f_{\langle e,e\rangle}[\forall x_e[\mathbf{person}_{g(\text{w})}(f(x))] \wedge P(f)]]$$

(19)



Here the trace is a complex one, which is interpreted as follows (This is slightly different from what Heim says in the end):

(20) $[\![t_{\mathsf{f(y)}}]\!]^g = g(\mathsf{f})(g(\mathsf{y}))$

(19) yields a functional reading:

$$\lambda p_{\langle s,t\rangle}.\ \exists f_{\langle e,e\rangle}\forall x_e[\mathbf{person}_@(f(x)) \wedge p = [\lambda w'_s.\ \forall y_e[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, f(y))]]$$
$$\approx \{\, [\lambda w'_s.\ \forall y_e[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, f(y))]] \mid \forall x_e[\mathbf{person}_@(f(x))] \,\}$$

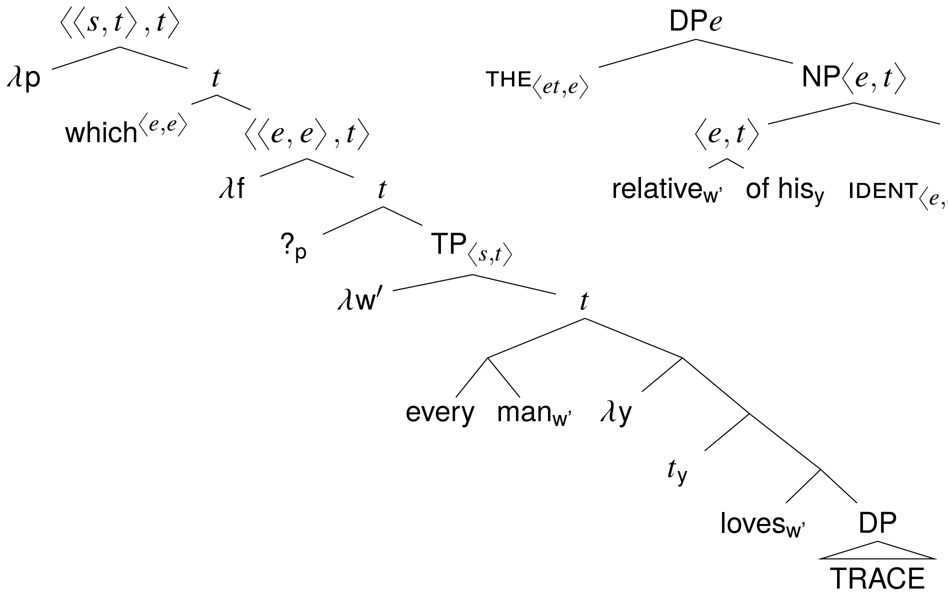
3.3 *Which*-Phrases

So far so good, but notice that we can have a bound pronoun within the moved *wh*-phrase, which can be answered with a functional answer.[1]

(21) a. Which relative of his$_i$ does [every man]$_i$ love?
b. Which picture of himself does no man like?

To account for such cases, Heim assumes that the NP part of a *which*-phrase can *reconstruct*, i.e. be interpreted in the base-generated position. She adopts Fox's (2000) Trace Conversion which turns traces into definite descriptions:

(22)



THE and IDENT have world-independent denotations:

(23) a. $[\![\textsc{the}]\!]^g = \lambda P_{\langle e,t\rangle}\!:\ \exists! x_e[P(x)].\ \iota x[P(x)]$
b. $[\![\textsc{ident}]\!]^g = \lambda x_e.\lambda y_e.\ x = y$

Then the NP in (22) is interpreted as follows:

(24) $[\![\mathsf{relative_w\ of\ his_y}\ \textsc{ident}\ \mathsf{f\ y}]\!]^g = \lambda x_e.\ \mathbf{relative}_{g(\mathsf{w})}(x, g(\mathsf{y})) \wedge x = g(\mathsf{f})(g(\mathsf{y}))$

THE introduces a uniqueness presupposition:

(25) a. $\mathsf{DP} \in \mathrm{dom}([\![\ ]\!]^g)$ iff $\exists! x[\mathbf{relative}_{g(\mathsf{w'})}(x, g(\mathsf{y})) \wedge x = g(\mathsf{f})(g(\mathsf{y}))]$
b. Whenever defined, $[\![\mathsf{DP}]\!]^g = \iota x[\mathbf{relative}_{g(\mathsf{w'})}(x, g(\mathsf{y})) \wedge x = g(\mathsf{f})(g(\mathsf{y}))]$

This presupposition universally projects through *every man*, giving rise to the presupposition that for every man y in w', there is exactly one relative of y's that is identical to $g(\mathsf{f})(y)$.

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[1] Preuss (2001) shows with the following example that such questions can be answered by individual answers.

(i) Q: Which of his (blood-)relatives does every man (in our family) love?
A: Aunt Mary. (Preuss 2001:p. 40)

This can be captured easily under Heim's analysis in two ways. One way is to use the version of *which* that quantifies over type-*e* elements. Another is to assume that rigid designators are in the domain, e.g. λx_e. Aunt Mary. Assuming that the latter strategy is always available, we can assume that *which* always quantifies over type-$\langle e, e\rangle$ functions.

(26) $[\![\mathsf{TP}]\!]^g = \lambda w'_s \colon \forall y[\mathbf{man}_{w'}(y) \rightarrow \exists! x[\mathbf{relative}_{w'}(x,y) \wedge x = g(\mathsf{f})(y)]].\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, \iota x[\mathbf{relative}_{w'}(x,y) \wedge x = g(\mathsf{f})(y)])$

Then the sister to *which* denotes the following function:

(27) $\lambda f_{\langle e,e\rangle}.\ g(\mathsf{p}) = \lambda w' \colon \forall y[\mathbf{man}_{w'}(y) \rightarrow \exists! x[\mathbf{relative}_{w'}(x,y) \wedge x = f(y)]].\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, \iota x[\mathbf{relative}_{w'}(x,y) \wedge x = f(y)])]$

Which has a world-independent existential meaning (Heim generalizes this to all types):

(28) a. $[\![\mathsf{which}]\!]^g = \lambda P_{\langle e,t\rangle}.\ \exists x_e[P(x)]$

b. $[\![\mathsf{which}^{\langle e,e\rangle}]\!]^g = \lambda P_{\langle\langle e,e\rangle,t\rangle}.\ \exists f_{\langle e,e\rangle}[P(f)]$

The overall meaning will be a functional reading, as desired:

$$\lambda p.\ \exists f_{\langle e,e\rangle}\left[p = \lambda w' \begin{array}{l} \colon \forall y[\mathbf{man}_{w'}(y) \rightarrow \exists! x[\mathbf{relative}_{w'}(x,y) \wedge x = f(y)]] \\ .\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, \iota x[\mathbf{relative}_{w'}(x,y) \wedge x = f(y)])] \end{array}\right]$$

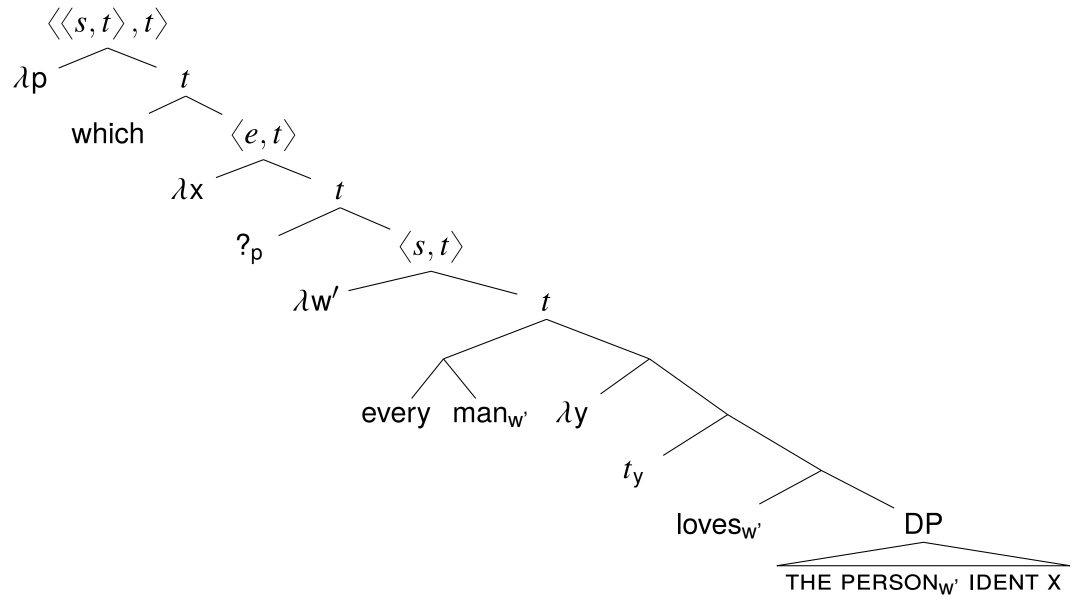
Since the uniqueness is vacuous here, we can simplify this to:

$$\lambda p.\ \exists f_{\langle e,e\rangle}\left[p = \lambda w' \colon \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{relative}_{w'}(f(y),y)].\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, f(y))]\right]$$

We can reanalyze *who* as *which* + PERSON (disregarding the issue of number):

(29) Who does every man love?

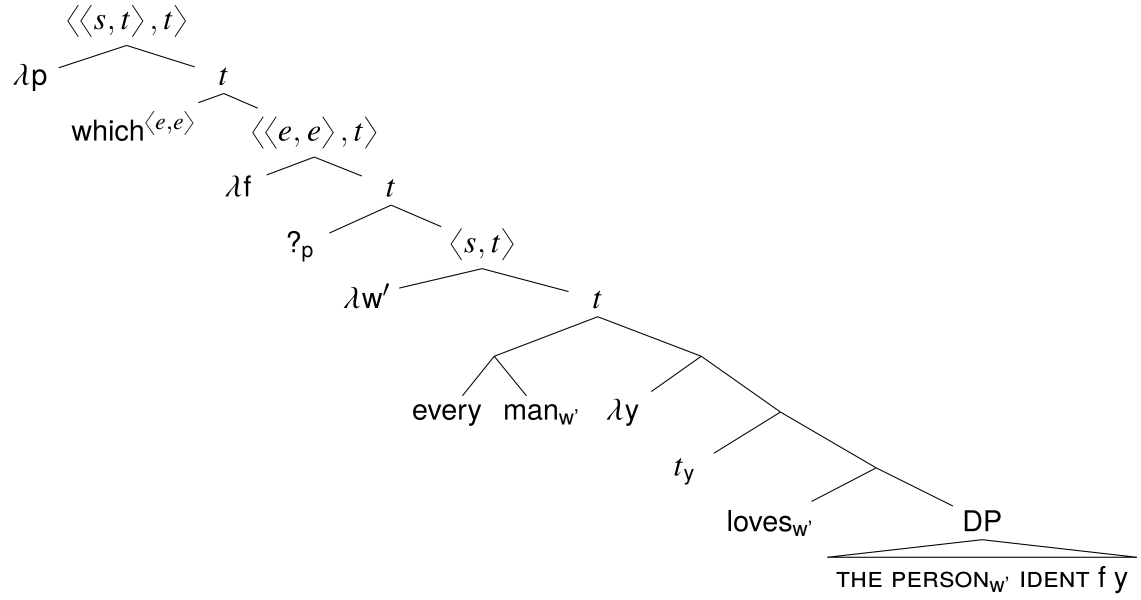
(30) *Individual Reading*



$$\lambda p.\ \exists x\left[p = \lambda w' \colon \exists! z[\mathbf{person}_{w'}(z) \wedge z = x].\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, \iota z[\mathbf{person}_{w'}(z) \wedge x = z])]\right]$$

$$= \lambda p.\ \exists x[p = \lambda w' \colon \mathbf{person}_{w'}(x).\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, x)]]$$

(31) *Functional Reading*



$$\lambda p.\ \exists f_{\langle e,e\rangle}\left[p = \lambda w' \begin{array}{l} :\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \exists! x[\mathbf{person}_{w'}(x) \wedge x = f(y)]] \\ .\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, \iota x[\mathbf{person}_{w'}(x) \wedge x = f(y)])] \end{array}\right]$$

$$= \lambda p.\ \exists f_{\langle e,e\rangle}[p = \lambda w' :\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{person}_{w'}(f(y))].\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, f(y))]]$$

Note: If y in the trace is replaced by a free variable, e.g. z, in (31), it yields an assignment-dependent individual reading.

$$\lambda p.\ \exists f_{\langle e,e\rangle}\left[p = \lambda w' \begin{array}{l} :\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \exists! x[\mathbf{person}_{w'}(x) \wedge x = f(g(\mathsf{z}))]] \\ .\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, \iota x[\mathbf{person}_{w'}(x) \wedge x = f(g(\mathsf{z}))])] \end{array}\right]$$

Assuming that there are men in each world (which is presupposed but not represented here), this is identical to:

$$\lambda p.\ \exists f_{\langle e,e\rangle}[p = \lambda w' :\ \mathbf{person}_{w'}(f(g(\mathsf{z}))).\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{love}_{w'}(y, (f(g(\mathsf{z}))))]]$$

3.4 Intensionality

According to the analysis so far, the functions are extensional. But we actually need to intensionalize it. To see this, consider:

(32) Q: Which book did every man read?
A: His favorite book.

The question (32Q) denotes:

(33) $\lambda p. \exists f_{\langle e,e\rangle}[p = \lambda w' :\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{book}_{w'}(f(y))]. \forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{read}_{w'}(y, f(y))]]$

The proposition (32A) expresses is:

(34) $\lambda w'_s \begin{array}{l} :\ \forall y[\mathbf{man}_{w'}(y) \rightarrow \exists! x[\mathbf{favorite.book}_{w'}(x, y)]] \\ .\forall y[\mathbf{man}_{w'}(y) \rightarrow \mathbf{read}_{w'}(y, \iota x[\mathbf{favorite.book}_{w'}(x, y)])] \end{array}$

The function here is intensional: for each man x, his favorite book might be different in different possible worlds.

$$\lambda y_e.\lambda w'_s.\ \iota x[\mathbf{favorite.book}_{w'}(x, y)]$$

Suppose there are three men m_1, m_2, m_3 and two books b_1, b_2. The question denotation (33) as a set will contain eight propositions, depending on which man is mapped to which book.

(35)

read	p_1	p_2	p_3	p_4	p_5	p_6	p_7	p_8
m_1	b_1	b_1	b_1	b_2	b_2	b_2	b_1	b_2
m_2	b_1	b_1	b_2	b_1	b_2	b_1	b_2	b_2
m_3	b_1	b_2	b_1	b_1	b_1	b_2	b_2	b_2

Now consider the answer proposition (34). There are eight types of possible worlds with respect to which man likes which book.

(36)

fovorite.book	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8
m_1	b_1	b_1	b_1	b_2	b_2	b_2	b_1	b_2
m_2	b_1	b_1	b_2	b_1	b_2	b_1	b_2	b_2
m_3	b_1	b_2	b_1	b_1	b_1	b_2	b_2	b_2

Which books the men read and which books they like are independent considerations. But then, the answer proposition is not really answering the question, as it is compatible with every possible answer p_i in (35).

To fix this, Engdahl (1986) and Heim (2012) intensionalize the functions that *which* quantifies over (see also Preuss 2001). The above question denotation (33) becomes:

(37) $\lambda p.\, \exists f_{\langle e,se\rangle}[p = \lambda w' \colon \forall y[\mathbf{man}_{w'}(y) \to \mathbf{book}_{w'}(f(y)(w'))].\, \forall y[\mathbf{man}_{w'}(y) \to \mathbf{read}_{w'}(y, f(y)(w'))]]$

One of the propositions here is $\bigcup p_i \cap W_i$ with $f = \lambda y_e.\lambda w_s.\ \iota x[\mathbf{favorite.book}_w(x, y)]$. This is exactly what the answer *his favorite book* expresses.

Intensionalization of functions captures possible readings of examples like (38), which involve another layer of intensionality.

(38) a. Which book does John expect every man to recommend?
— His favorite book.
b. Which professor does John think that no student wants to work with?
— His or her supervisor.

I'm not go into the details here, but these answers have both *de re* and *de dicto* readings. Type-$\langle e, se\rangle$ functions may capture them, depending on which intensional variable they combine with.

4 Functional Answers and Their Extensional Paraphrases

One might think that on the assumption that functional readings of questions always quantify over intensional functions, one could account for why extensional paraphrases are not admissible.

(39) a. Which book did no man read?
b. #m_1 didn't read b_1, m_2 didn't read b_2, and m_3 didn't read b_1.
c. (No man read) his favorite book.

In fact, from an extensional list, you can't uniquely identify a function of type $\langle e, se\rangle$. So (39b) and (39c) don't carry the same information, even if they are extensionally identical.

However, this alone doesn't give us a solution to the puzzle why pair-list answers are inappropriate for functional readings. If *which* quantifies over all functions of type $\langle e, se\rangle$, the question denotation includes a rigid function like the following:

(40) $$f = \begin{bmatrix} m_1 & \mapsto & [\lambda w'.\, b_1] \\ m_2 & \mapsto & [\lambda w'.\, b_2] \\ m_3 & \mapsto & [\lambda w'.\, b_1] \\ \dots & \dots & \dots \end{bmatrix}$$

Then, this answer is identified by (39b).

So Heim's (and others') semantics doesn't really capture the fact that pair-list answers are inadmissible. To this end, Groenendijk & Stokhof (1984:p. 199) suggest that f should be restricted to a subset of functions:

> Somehow quantification over functions is restricted. It would seem that functions that are allowed, must be either conventional in some sense (such as the mother-function,the wife-function, etc.) and thus in some sense computable, or they must be made computable by the context. [...] The exact principle, or principles, underlying this restriction are not entirely clear to us, but that something like this is going on seems quite likely.

So maybe functions like (40) are not in the domain of quantification. But notice that generally, rigid functions seem to be available.

(41) Q: Who does no Dutchman love?
A: (No Dutchman loves) himself.

(41A) identifies the proposition in the question denotation obtained with the following function:

(42) $$\begin{bmatrix} \text{John} & \mapsto & [\lambda w'.\ \text{John}] \\ \text{Bill} & \mapsto & [\lambda w'.\ \text{Bill}] \\ \text{Peter} & \mapsto & [\lambda w'.\ \text{Peter}] \\ \dots & \dots & \dots \end{bmatrix}$$

Maybe proper names cannot be used in functional answers? Yes, they can:

(43) Q: Who does no Dutchman love?
A: His father and Elizabeth.

(44) $$\begin{bmatrix} \text{John} & \mapsto & [\lambda w'.\ \text{John's mother in } w' \oplus \text{Elizabeth}] \\ \text{Bill} & \mapsto & [\lambda w'.\ \text{Bill's mother in } w' \oplus \text{Elizabeth}] \\ \text{Peter} & \mapsto & [\lambda w'.\ \text{Peter's mother in } w' \oplus \text{Elizabeth}] \\ \dots & \dots & \dots \end{bmatrix}$$

If this is allowed, why not (45)?

(45) Q: Who does no Dutchman love?
A: #John doesn't love his mother, Bill doesn't love Beatrix, Peter doesn't love Elizabeth, ...

(45A:) identifies the proposition in the question denotation that's obtained with the following function:

(46) $$\begin{bmatrix} \text{John} & \mapsto & [\lambda w'.\ \text{John's mother in } w'] \\ \text{Bill} & \mapsto & [\lambda w'.\ \text{Beatrix}] \\ \text{Peter} & \mapsto & [\lambda w'.\ \text{Elizabeth}] \\ \dots & \dots & \dots \end{bmatrix}$$

5 Complete Functional Answers

5.1 Answerhood

Heim's system is a version of Hamblin-Karttunen semantics. As Heim (2012:fn.11) notes, one can construct the Groenendijk & Stokhof denotation using the following equivalence relation:

(47) For any question denotation Q,
$w \sim_Q w'$ iff $\forall p[Q(p) \rightarrow [[w \in \text{dom}(p) \wedge p(w)] \leftrightarrow [w' \in \text{dom}(p) \wedge p(w')]]]$

(48) For any world w, the cell of the partition induced by $\sim_Q$ (i.e. $\{\, w' \mid w \sim_Q w' \,\}$) is referred to as $[w]_{\sim_Q}$.

Groenendijk & Stokhof (1984:Part V) define complete and partial answers as follows.

(49) a. ϕ is a complete answer to Q iff for some w, $\phi = [w]_{\sim_Q}$.
b. ϕ gives a complete answer to Q iff $\phi \neq \varnothing$ and for some w, $\phi \subseteq [w]_{\sim_Q}$.

(50) a. ϕ is a partial answer to Q iff $\phi \neq \varnothing$ and for some set W of possible worlds, $\phi = \bigcup_{w \in W} [w]_{\sim Q}$.
b. ϕ gives a partial answer to Q iff $\phi \neq \varnothing$ and for some set W of possible worlds, $\phi \subseteq \bigcup_{w \in W} [w]_{\sim Q}$.

(51) ϕ is a true complete/partial answer to Q iff ϕ is a complete/partial answer to Q and $@ \in \bigcup \{ [w]_{\sim Q} \mid [w]_{\sim Q} \cap \phi \neq \varnothing \}$.

This allows ϕ itself to be false. Here's an example of such a case:

(52) Q: Is Groenendjik a linguist?
A: Yes, he's a phonologist.

5.2 Puzzle

The following data are as expected:

(53) [Context: *Every man loves his wife and his mother and nobody else.*]
Q: Who/Which women does every man love?
A: His wife. (true partial answer)
A: His wife and his mother. (with exh, true complete answer)

(54) [Context: *Every man loves everybody except his wife and his mother.*]
Q: Who/Which women does no man love?
A: His wife. (true partial answer)
A: His wife and his mother. (with exh, true complete answer)

Consider the Heimian denotation for (54Q):

(55) $\{ \lambda w'\colon\ \forall y[\mathbf{man}_{w'}(y) \to \mathbf{women}(f(y)(w'))].\ \neg\exists y[\mathbf{man}_{w'}(y) \wedge \mathbf{love}_{w'}(y, f(y)(w')) \mid f \in D_{\langle e,se \rangle} \}$

This induces a partition that looks like:

(56) For any w_s, $[w]_{(56)} = \{ w' \mid \forall p \in (56)[w \in \mathrm{dom}(p) \wedge p(w)] \leftrightarrow [w' \in \mathrm{dom}(p) \wedge p(w')] \}$

$[@]_{(56)}$ in the above context is the proposition that every man is such that he loves everyone except for his wife and his mother. Understanding the answer with exh, the answer expresses this proposition. Note that disjunctive answers are possible:

(57) [Context: *Half the men love their wife and no one else, the other half love their mother and no one else*]
Q: Who/Which woman does every man love?
A: His wife or his mother.

(58) [Context: *Half the men don't love their wife, the other half don't love their mother*]
Q: Who/Which woman does no man love?
A: His wife or his mother.

Now consider (59):

(59) [Context: *There are three men and each men loves exactly three women. Every man loves his mother and his wife.* m_1 *loves his daughter Sophie.* m_2 *loves his sister Claire.* m_3 *loves his aunt Jessica.*]
Q: Who/Which women does every man love?
A: His mother and his wife.

(59A) sounds like a complete answer in this situation. But (59A) should not be interpreted with exh, because that would entail that every man only loves two women, which is false in this context. But then it fails to identify a cell in the partition.

Furthermore, there's a properly stronger answer like:

(60) His mother, his wife, and [his daughter or his sister or his aunt].

6 More Stuff to Think About

Groenendijk & Stokhof (1984) observe that functional readings arise with ordinary quantifiers too.

(61) Every man loves a woman...
  a. namely, Mary.
  b. namely, John loves Mary, Bill loves Suzy, ...
  c. namely, his mother.

(62) There is a woman that every man loves...
  a. namely, Mary.
  b. *namely, John loves Mary, Bill loves Suzy, ...
  c. namely, his mother.

(63) There is a woman that no man loves...
  a. namely, Mary.
  b. *namely, John loves Mary, Bill loves Suzy, ...
  c. namely, his mother.

G&S suggest that the same mechanism as functional answers to questions is at play here.

However, disjunctive functions are not admissible here. Consider the contrast below:

(64) [Context: *Every man loves his wife*]
There is a woman that every man loves. (TRUE)

(65) [Context: *No man loves his wife*]
There is a woman that no man loves. (TRUE)

(66) [Context: *Some men only love their wife, the rest of men only love their mother*] There is a woman that every man loves. (FALSE)

(67) [Context: *Some men don't love their wife, the rest of men don't love their mother*] There is a woman that no man loves. (FALSE)

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