SynR and SemR

LING 252 · Ethan Poole · 1 April 2020

1 Preliminaries

1.1 Intensionality

- ***Basic assumptions***
  - Vanilla possible-world semantics
  - w_0 = @ = actual world / world of evaluation
- There are various conceivable compositional analyses to pair with a possible-world semantics. For simplicity, let us limit our attention to two representative cases.
- ***Scope theory***[1]
  - Intensional operators set the world at which the material in their logical scope is evaluated.
  - All elements have fully intensional denotations (à la Montague), e.g. determiners are type $\langle\langle e, \langle s, t\rangle\rangle, \langle\langle e, \langle s, t\rangle\rangle, \langle s, t\rangle\rangle\rangle$.

[1] Quine (1956); Montague (1973); Ogihara (1996); Keshet (2008, 2011)

- ***World-pronoun theory***[2]
  - There are indexed world variables, which are represented in the structure by world (or situation) pronouns.
  - Intensional operators are associated with a λ-operator that binds these pronouns.
  - Predicates are associated with a world pronoun, whose value sets the world at which the predicate is evaluated.

[2] Percus (2000); Schwarz (2012)

1.2 Interpreting traces

- ***Standard interpretation procedure***[3]
  1. The moved element is interpreted in its landing site.
  2. The launching site is replaced with a variable, typically of semantic type e.
  3. That variable is bound by a λ-operator inserted immediately below the landing site of movement.

[3] Beck (1996); Heim and Kratzer (1998); Sauerland (1998)

∗ ***Syntactic assumptions***
Following Heim and Kratzer (1998), let us assume that:
  - The index of the moved element is copied immediately below the moved element at LF—notated as λ_n.

    (1) LF: DP [λ_1 [. . . t_1 . . .]]

  - This copied index is translated into a λ-abstraction over that index via Predicate Abstraction:

(2) a. **Traces & Pronouns Rule**
$[\![t_i]\!]^g := g(i)$

b. **Predicate Abstraction**
$[\![[\ \lambda_i\ \phi\ ]]\!]^g := \lambda x\ .\ [\![\phi]\!]^{g[i \to x]}$

- Sometimes, it will be convenient (mainly for indicating types) to substitute copied-index notation with representations of the λ-abstractions that will eventually result:

(3) a. ***Actual under-the-hood syntax***
LF: [someone from Duluth] [λ_1 [is likely [t_1 to win the lottery]]]

b. ***Convenient shorthand***
LF: [someone from Duluth] [λx_e [is likely [x to win the lottery]]]

1.3 *Wh*-question semantics

- Remember that questions denote sets of answers:

(4) $[\![\text{which cat did Alex adopt}]\!](w_0) = \lambda p_{st}\ .\ \exists x[x \text{ is a cat} \wedge p = \lambda w\ .\ \text{Alex adopts } x \text{ in } w]$

- ***Classical compositional analysis***
With varying amounts of decomposition:

(5) $[\![\text{which}]\!] = \lambda P_{\langle e,st\rangle}\, \lambda Q_{\langle e,st\rangle}\, \lambda w\, \lambda p_{st}\ .\ \exists x[P(x)(w) \wedge p = Q(x)]$

⇒ ***A technical problem***

- Engrained in the classical analysis is the idea that the *wh*-phrase *must* move to [Spec, CP] to achieve the intended interpretation.

⇝ With respect to reconstruction, this assumption will end up being problematic on a purely technical level. We will not want to tie deriving the semantics of *wh*-questions to having the *wh*-phrase in a particular position at LF . . .

- Also, the *wh*-restrictor does not have to be rigid . . .

- Also, there are *wh*-in-situ languages . . .

∗ ***A simple mostly-agnostic analysis***
There is a question operator Q at the top of the structure, which, as part of its meaning, binds a variable introduced by the *wh*-phrase:[4]

[4] Baker (1970); Rullmann (1995); Rullmann and Beck (1998)

(6) a. $[\![Q_i\ \text{CP}]\!]^g = \lambda w\, \lambda p_{st}\ .\ \exists x[\,p = [\![\text{CP}]\!]^{g[i \to x]}]$

b. $[\![\text{which}_i\ \text{NP}]\!]^g = \iota x[x = g(i) \wedge [\![\text{NP}]\!](x)]$

- ***Choose your own semantics!***
Crucially, this analysis allows us to (more or less) abstract away from the question semantics. It is easy to assign Q denotations that correspond to the various more-developed analyses of *wh*-questions:

- Q is the *wh*-morpheme, which separates from the rest of the *wh*-phrase at LF, so that the two may scope separately (Romero 1998).

- Q existentially binds the choice function introduced by the *wh*-phrase (Engdahl 1980, 1986; Reinhart 1997).

- Q 'catches' the focus alternatives that percolate up from the *wh*-phrase (Beck 2006; Beck and Kim 2006; Cable 2007, 2010; Kotek 2014, 2019).

2 SynR

⁎ ***Syntax-centric approach (SynR)***
Reconstruction effects are derived by placing the moved element back in its premovement position at LF.

- ***Two SynR mechanisms***
  - ***LF-Lowering***[5]
    At LF, the moved element is actually *lowered* into its premovement position:

    (7) LF: ___ is likely [[someone from Duluth] to win the lottery]

  - ***Selective copy interpretation***[6]
    Assuming copy-theoretic movement, the lower copy is interpreted, and the higher copy is ignored:

    (8) LF: ~~[someone from Duluth]~~ is likely [[someone from Duluth] to win the lottery]

[5] Chomsky (1976); May (1977, 1985); Cinque (1990)

[6] Chomsky (1993, 1995)

2.1 Scope reconstruction

- Let us consider a scopally-ambiguous *how many* question:

(9) [**How many books**]$_1$ *should* Alex read ___$_1$ this summer?

a. **Surface-scope reading** how many ≫ should
For what number n: There are n-many (particular) books x such that Alex should read x this summer.

b. **Reconstructed-scope reading** should ≫ how many
For what number n: It is necessary for there to be n-many books x such that Alex reads x this summer.

- ***Surface-scope derivation (both SynR and SemR)***

(10) LF: Q_n [how$_n$ many books] [λ_1 [should [Alex read t_1]]]

a. $[\![\text{how}_n \text{ many books}]\!] = \lambda \mathrm{P}_{\langle e,t\rangle} \,.\, \exists x[\#x = n \wedge {}^*\textsc{book}(x) \wedge \mathrm{P}(x)]$

b. $[\![[\ \lambda_1 \ [\text{ should } [\text{ Alex read } t_1 \ ]]]]\!] = \lambda y_e \,.\, \textsc{should}(\text{Alex reads } y)$

c. $[\![\text{how}_n \text{ many books}]\!]([\![[\ \lambda_1 \ [\text{ should } [\text{ Alex read } t_1 \ ]]]]\!])$
$= \exists x[\#x = n \wedge {}^*\textsc{book}(x) \wedge [\lambda y_e \,.\, \textsc{should}(\text{Alex reads } y)](x)]$
$= \exists x[\#x = n \wedge {}^*\textsc{book}(x) \wedge \textsc{should}(\text{Alex reads } x)]$

∗ ***Reconstructed-scope derivation***

(11) LF: Q_n ~~[how$_n$ many books]~~ [should [Alex read [how$_n$ many books]]]

a. $[\![\text{how}_n \text{ many books}]\!] = \lambda P_{\langle e,t \rangle} \,.\, \exists x[\#x = n \wedge {}^{*}\textsc{book}(x) \wedge P(x)]$

b. $[\![\text{Alex read [how}_n \text{ many books]}]\!] = \exists x[\#x = n \wedge {}^{*}\textsc{book}(x) \wedge \text{Alex reads } x]$

c. $[\![\text{should}]\!]\,([\![\text{Alex read [how}_n \text{ many books]}]\!])$
$= \textsc{should}\big(\exists x[\#x = n \wedge {}^{*}\textsc{book}(x) \wedge \text{Alex reads } x]\big)$

- ***Note on GQs in nonsubject positions***
  - Here, I am abstracting over the common assumption that GQs cannot semantically compose in nonsubject positions because the semantic types do not match.
  - Under such an assumption, *how many books* would need to undergo a short step of intermediate movement purely for type purposes.
  - To derive the reconstructed-scope reading then, *how many books* would reconstruct to this intermediate position:

(12) LF: Q_n ~~[how$_n$ many books]~~ [should [[how$_n$ many books] [λ_1 [Alex read t_1]]]]

  - This short movement step does not significantly change the derivation, and it would be required on SemR as well.

2.2 Pronominal-binding reconstruction

- Under (classical) Binding Theory, a pronoun can only be bound if it is c–commanded by its binder:

(13) a. [Every child]$_1$ likes their$_{1/2}$ mother.

b. Her$_{*1/2}$ child likes [every mother]$_1$.

- On SynR, this constraint is preserved. Interpreting only the lower copy puts the pronoun in the c–command domain of its binder:

(14) LF: Q_n ~~[which$_n$ of their$_1$ friends]~~ [[every child]$_1$ [λ_1 [t_1 see [which$_n$ of their$_1$ friends]]]

2.3 Referential-opacity reconstruction

- ***On the scope theory of intensionality***
  - Interpreting only the lower copy puts the moved element in the (logical) scope of the intensional operator at LF.
  - Because intensional operators determine the evaluation world for the material in their scope, the moved element will be evaluated w.r.t. that intensional operator.
- ***On the world-pronoun theory of intensionality***
  Interpreting only the lower copy puts the world pronoun in the scope of the intensional operator at LF and thus allows it to be bound by the associated λ-operator:

(15) LF: $\mathrm{Q}_n\ \lambda w_0$ ~~[which$_n$ criminal]~~ [Alex want [$\underline{\underline{\lambda w_1}}$ to date [which$_n$ criminal$_{w_0/\underline{\underline{w_1}}}$]]]

- Note that on the scope theory, SynR only yields an opaque reading, while on the world-pronoun theory, SynR allows both transparent and opaque readings.

3 SemR

⁎ ***Semantics-centric approach (SemR)***
Reconstruction effects are derived using traces of higher-semantic types.

- It is important to recognize that what matters for SemR is just that a higher-type-trace analysis is in principle *possible* for each reconstruction effect. The specific details will depend a lot on one's underlying assumptions about semantics, so do not hung up on what the "correct" analysis is.

3.1 Scope reconstruction

- On SemR, scope reconstruction is achieved by using traces of type $\langle et, t\rangle$ (GQs):

(16) LF: Q_n [how$_n$ many books] [λ_1 [should [Alex read t_1]]]

a. $[\![\text{how}_n \text{ many books}]\!] = \lambda \mathrm{P}_{\langle e,t\rangle}\ .\ \exists x[\#x = n \wedge {}^*\textsc{book}(x) \wedge \mathrm{P}(x)]$

b. $[\![[\ \lambda_1\ [\text{ should } [\text{ Alex read } t_1\ ]]]]\!] = \lambda \mathcal{Q}_{\langle et,t\rangle}\ .\ \textsc{should}(\mathcal{Q}(\lambda z_e\ .\ \text{Alex reads } z))$

c. $[\![[\ \lambda_1\ [\text{ should } [\text{ Alex read } t_1\ ]]]]\!]\,([\![\text{how}_n \text{ many books}]\!])$
$= \textsc{should}\big([\lambda \mathrm{P}_{\langle e,t\rangle}\ .\ \exists x[\#x = n \wedge {}^*\textsc{book}(x) \wedge \mathrm{P}(x)]](\lambda z_e\ .\ \text{Alex reads } z)\big)$
$= \textsc{should}\big(\exists x[\#x = n \wedge {}^*\textsc{book}(x) \wedge [\lambda z_e\ .\ \text{Alex reads } z](x)]\big)$
$= \textsc{should}\big(\exists x[\#x = n \wedge {}^*\textsc{book}(x) \wedge \text{Alex reads } x]\big)$

- The crucial step of the derivation to take note of is when the moved element combines with the λ-abstraction created by movement (16c).
  - Ordinarily, with a type-e trace, the moved quantificational element takes as argument the λ-abstraction.
  - However, with a type-$\langle et, t\rangle$ trace, it is vice versa: the λ-abstraction takes as argument the moved quantificational element.

- As with SynR, an intermediate step of movement might be needed for type purposes, but this does not significantly change the derivation:

(17) LF: Q_n [how$_n$ many books] [$\lambda \mathcal{Q}_{\langle et,t\rangle}$ [should [$\mathcal{Q}$ [λx_e [Alex read x]]]]]

3.2 Pronominal-binding reconstruction

- For the purposes of illustration, let us focus on functional readings.

- Following Engdahl (1980, 1986), let us assume that these readings have meanings like the following:

(18) $[\![$which picture of herself did no woman submit?$]\!]$
$= \lambda p_{st} \,.\, \exists f_{\langle e,e \rangle}[\forall x[\textsc{picture-of}_{@}(f(x))(x)] \wedge p = \lambda w \,.\, \neg\exists y[\textsc{woman}_{@}(y) \wedge \textsc{submit}_{w}(f(x))(x)]]$

- The LF that would derive this meaning:

(19) Q_f [which$_f$ picture of herself] [$\lambda g_{\langle e,e\rangle}$ [no woman [λx_e [x submit $g(x)$]]]]

(20) $[\![$which$_f$ picture of herself$]\!] = f$, where $\forall x[\textsc{picture-of}_{@}(f(x))(x)]$

- This meaning is arguably too strong (see Heim 2012), but it serves to illustrate the basic idea.

- ***Layered traces***
  - Traces can be 'layered', i.e. have some internal content that facilitates function–argument interpretation:

    (21) $[\![[\ t_1\ pro_2\ ]]\!]^g = g(1)(g(2))$

  - Note that something equivalent to a layered trace is required even on a SynR approach, because functional readings are possible in the absence of overt bound pronouns or anaphora:

    (22) a. Which picture did no person submit?

    b. their first picture, their favorite picture, their prom picture

  - The SemR approach, however, has trouble capturing that bound pronouns force a functional (or pair-list) reading.

3.3 Referential-opacity reconstruction

- ***On the scope theory of intensionality***

(23) [$\text{DP}_{\langle\langle e,\langle s,t\rangle\rangle,\langle s,t\rangle\rangle}$ [$\lambda \mathcal{Q}_{\langle\langle e,\langle s,t\rangle\rangle,\langle s,t\rangle\rangle}$ [... think [... [$\text{V}_{\langle e,\langle s,t\rangle\rangle}$ $\mathcal{Q}$] ...]]]]

a. $[\![\text{D}]\!] = \lambda \text{P}_{\langle e,\langle s,t\rangle\rangle}\, \lambda \text{Q}_{\langle e,\langle s,t\rangle\rangle}\, \lambda s_s\, .\, \text{D}(\lambda x\, .\, \text{P}(x)(s))(\lambda x\, .\, \text{Q}(x)(s))$

b. $[\![\text{every}]\!] = \lambda \text{P}_{\langle e,\langle s,t\rangle\rangle}\, \lambda \text{Q}_{\langle e,\langle s,t\rangle\rangle}\, \lambda s_s\, .\, \forall x[\text{P}(x)(s) \rightarrow \text{Q}(x)(s)]$

c. $[\![\text{think}]\!] = \lambda p_{\langle s,t\rangle}\, \lambda x_e\, \lambda s_s\, .\, \forall s'[s' \in \textsc{acc}_x(s) \rightarrow p(s')]$

- ***On the world-pronoun theory of intensionality***

(24) [$\text{DP}_{\langle s,\langle et,t\rangle\rangle}$ [$\lambda \mathcal{Q}_{\langle s,\langle et,t\rangle\rangle}$ [... think [$\lambda s'$ [... $\mathcal{Q}(s')$ ...]]]]]

a. $[\![\text{D}]\!] = \lambda \text{P}_{\langle e,t\rangle}\, \lambda \text{Q}_{\langle e,t\rangle}\, .\, \text{D}(\text{P})(\text{Q})$

b. [$_{\text{DP}}$ λs [D [NP s]]]

References

Baker, Carl Lee. 1970. Notes on the description of English questions: The role of an abstract question morpheme. *Foundations of Language* 6:197–219.

Beck, Sigrid. 1996. *Wh*-constructions and transparent Logical Form. Ph.D. dissertation, Universität Tübingen, Tübingen.

Beck, Sigrid. 2006. Intervention effects follow from focus interpretation. *Natural Language Semantics* 14:1–56.

Beck, Sigrid, and Shin-Sook Kim. 2006. Intervention effects in alternative questions. *Journal of Comparative Germanic Linguistics* 9:165–208.

Cable, Seth. 2007. The grammar of Q: Q-particles and the nature of *wh*-fronting, as revealed by the *wh*-questions of Tlingit. Ph.D. dissertation, MIT, Cambridge, MA.

Cable, Seth. 2010. *The Grammar of Q: Q-Particles, Wh-Movement and Pied-Piping*. Oxford: Oxford University Press.

Chomsky, Noam. 1976. Conditions on rules of grammar. *Linguistic Analysis* 2:303–351.

Chomsky, Noam. 1993. A minimalist program for linguistic theory. In *The View from Building 20: Essays in Linguistics in Honor of Sylvain Bromberger*, eds. Kenneth Hale and Samuel Jay Keyser, 1–52. Cambridge, MA: MIT Press.

Chomsky, Noam. 1995. *The Minimalist Program.* Cambridge, MA: MIT Press.

Cinque, Guglielmo. 1990. *Types of* A'*-dependencies.* Cambridge, MA: MIT Press.

Engdahl, Elisabet. 1980. The syntax and semantics of questions in Swedish. Ph.D. dissertation, University of Massachusetts, Amherst, MA.

Engdahl, Elisabet. 1986. *Constituent Questions.* Dordrecht: D. Reidel Publishing Company.

Heim, Irene. 2012. Functional readings without type-shifted noun phrases. Ms., MIT.

Heim, Irene, and Angelika Kratzer. 1998. *Semantics in Generative Grammar*. Oxford: Blackwell.

Keshet, Ezra. 2008. Good intensions: Paving two roads to a theory of the *De re/De dicto* distinction. Ph.D. dissertation, MIT, Cambridge, MA.

Keshet, Ezra. 2011. Split intensionality: A new scope theory of *de re* and *de dicto*. *Linguistics and Philosophy* 33:251–283.

Kotek, Hadas. 2014. Composing questions. Ph.D. dissertation, MIT, Cambridge, MA.

Kotek, Hadas. 2019. *Composing questions.* Cambridge, MA: MIT Press.

May, Robert. 1977. The grammar of quantification. Ph.D. dissertation, MIT, Cambridge, MA.

May, Robert. 1985. *Logical Form: Its structure and derivation.* Cambridge, MA: MIT Press.

Montague, Richard. 1973. The proper treatment of quantification in ordinary English. In *Approaches to Natural Language*, eds. Jaako Hintikka, Julius Moravcsik, and Patrick Suppes, 221–242. Dordrecht: Dordrecht.

Ogihara, Toshiyuki. 1996. *Tense, attitudes, and scope.* Dordrecht: Kluwer.

Percus, Orin. 2000. Constraints on some other variables in syntax. *Natural Language Semantics* 8:173–229.

Quine, W. V. 1956. Quantifiers and propositional attitudes. *Journal of Philosophy* 53:177–187.

Reinhart, Tanya. 1997. Quantifier scope: How labor is divided between QR and choice functions. *Linguistics and Philosophy* 20:335–397.

Romero, Maribel. 1998. Focus and reconstruction effects in *wh*-phrases. Ph.D. dissertation, University of Massachusetts, Amherst, MA.

Rullmann, Hotze. 1995. Maximality in the semantics of *wh*-constructions. Ph.D. dissertation, University of Massachusetts, Amherst, MA.

Rullmann, Hotze, and Sigrid Beck. 1998. Presupposition projection and the interpretation of *which*-questions. In *Proceedings of Semantics and Linguistic Theory 8 (SALT 8)*, eds. Devon Strolovitch and Aaron Lawson, 215–232. Ithaca, NY: CLC Publications.

Sauerland, Uli. 1998. The meaning of chains. Ph.D. dissertation, MIT, Cambridge, MA.

Schwarz, Florian. 2012. Situation pronouns in determiner phrases. *Natural Language Semantics* 20:431–475.