GIVENNESS, compositionally and dynamically[*]

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Constituents that aren't in focus must be *given*. Schwarzschild 1999 accounts for this by positing a GIVENNESS constraint that elevates the first sentence of this note to a principle of grammar.

Schwarzschild's GIVENNESS seems at odds with compositionality: whether an expression satisfies it can't, in general, be known on the basis of its meaning and the meanings of its siblings alone (cf., e.g., Jacobson to appear). Fortunately, Rooth 1992 defines a compositional *focus interpretation operator* which can be repurposed to do the job. This operator is notated '~' and characterized in Definition 1, where '#' means undefinedness, and '$\langle\!\langle \gamma \rangle\!\rangle^g$' names γ's *focus value* (given an assignment g) — the set of all and only the meanings obtainable by varying any F-marked things in γ.[1]

Definition 1 (Focus interpretation, à la Rooth 1992).

$$[\![\gamma_{\sim n}]\!]^g = \textbf{if } g_n \in \langle\!\langle \gamma \rangle\!\rangle^g \textbf{ then } [\![\gamma]\!]^g \\ \textbf{else } \#$$

If every node in every tree must either be F- or ~- marked, GIVENNESS follows, and in a compositional way. Take (1) (ignoring any F- or ~- marking in the first conjunct). The second occurrence of *John* trivially counts as given since $[\![\text{John}]\!]^g \in \langle\!\langle \text{John} \rangle\!\rangle^g$, the second VP counts as given since $[\![\text{likes John}]\!]^g \in \langle\!\langle \text{HATES}_F \text{ John} \rangle\!\rangle^g$, and the second S counts as given since $[\![\text{Mary likes John}]\!]^g \in \langle\!\langle \text{SUE}_F \text{ HATES}_F \text{ John} \rangle\!\rangle^g$.

(1) $[\text{Mary } [\text{likes John}_1]_2]_3$ but $[\text{SUE}_F\ [\text{HATES}_F \text{ John}_{\sim 1}]_{\sim 2}]_{\sim 3}$

GIVENNESS can thus be cashed out compositionally in terms of *anaphora*: $\sim n$ results in undefinedness unless the utterance context supplies an appropriate value for n.

A subtlety lurks. Following Rooth, the discussion here assumes that the relationship between $\sim n$ and its "antecedent" is to be modeled in terms of simple coreference. However, there are reasons to think that $\sim n$ can be *bound*. Consider the following LF (we'll only pay attention to the outermost ~ to keep the discussion manageable):

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[1] Rooth's formulation additionally requires there to be an element of $\langle\!\langle \gamma \rangle\!\rangle^g$ distinct from g_n. If ~ is used to mark GIVENNESS, this contrast condition must be dropped (cf. Schwarzschild 1999: 164).

(2) Every boy$_1$ claimed that [Mary likes him$_1$]$_4$ and [SUE$_F$ HATES$_F$ him$_1$]$_{\sim 4}$

The problem is this: though *SUE$_F$ HATES$_F$ him$_1$* should count as given, there's no way to satisfy the demands of ~4 unless there's just one boy. Suppose there are two: boy_1 and boy_2. As *every boy* plows through its domain, two focus values for *SUE$_F$ HATES$_F$ him$_1$* will be activated — see (3). In general, these two sets are disjoint, in which case it's *a fortiori* impossible for the context to serve up a single value for 4 that's in both.

(3)
$$\begin{array}{l} \mathsf{boy}_1 \dashrightarrow \{R(x, \mathsf{boy}_1) \mid x_e \wedge R_{(e \times e) \to s \to t}\} \\ \mathsf{boy}_2 \dashrightarrow \{R(x, \mathsf{boy}_2) \mid x_e \wedge R_{(e \times e) \to s \to t}\} \end{array}$$

Near as I can tell, this argument is independent of any particular assumptions about how *every boy* and ~4 interact. For example, we might try to "locally accommodate" the definedness condition imposed by ~4 (e.g., Heim 1983), but in that case we predict that (2) is necessarily false (rather than necessarily undefined).[2]

It seems clear enough what's going on here. As the value of *Mary likes him$_1$* varies boy-by-boy, so should the value against which ~ is checked. A straightforward way to secure this result is to allow *Mary likes him$_1$* to **bind** ~4.

In fact, since *Mary likes him$_1$* c-commands ~4 in (2), it's easy to establish the requisite binding relationship. But other examples suggest that ~-binding needs to transcend c-command, even LF c-command (cf. Rooth 1992: 87, fn. 8). Take (4) and (5). The problem they pose is analogous to that posed by (2): absent binding, there's no way for context to value the index on ~ that can secure a defined result. Moreover, unlike (2), appealing to in-scope binding won't help here: in (4) and (5), the troublemakers are *donkey* pronouns (resp., *him$_6$* and *it$_7$*). This suggests that not only must we allow ~ to be bound — we must allow it to be *dynamically* bound.

(4) If [Mary likes a boy$_6$]$_5$ you can bet that [SUE$_F$ HATES$_F$ him$_6$]$_{\sim 5}$

(5) Whenever [you use [the copier or the fax]$_7$]$_8$ [I$_F$ CAN'T$_F$ use it$_7$]$_{\sim 8}$

Here's a sketch of how this might go (see the Appendix for a more formal presentation). Statically conceived, sentence meanings are assignment-relative propositions,

[2] Two comments. First, the situation here is reminiscent of an issue pointed out by Heim 2011 for theories that assign the following semantics to definite determiners: $[\![\text{the}_n]\!]^g = \lambda P.\, \textbf{if}\ P(g_n)\ \textbf{then}\ g_n\ \textbf{else}\ \#$. The problem comes from examples like (i) (Heim's ex. 23): unless every cat caught the same mouse, the definedness condition imposed by *the$_8$* can't be satisfied.

(i) Every cat$_3$ ate the$_8$ mouse it$_3$ caught.

Second, one might object that the puzzle for (2) is an artifact of using assignments to value pronouns. For the variable-free semanticist (e.g., Jacobson 1999), $[\![\text{Mary likes him}]\!] = \lambda x.\, \mathsf{likes}(m, x)$, which is a member of $\langle\!\langle \text{SUE}_F\ \text{HATES}_F\ \text{him} \rangle\!\rangle = \{\lambda x.\, R(y, x) \mid y_e \wedge R_{(e \times e) \to s \to t}\}$. But that tack seems to predict, problematically, that *Bill likes her, and JOHN$_F$ HATES$_F$ her* will be acceptable even if the two instances of *her* aren't covalued.

functions from worlds to truth values (type $s \to t$). By contrast, in dynamic semantics sentences make **discourse referents** (drefs), which allows binding relationships to obtain in the absence of LF c-command. This is accomplished by modeling sentence denotations as **context change potentials** ('CCPs'), assignment-relative functions from worlds into sets of output assignments (type $s \to \{a\}$). Possible static and dynamic meanings for *a linguist$_0$ left* (given an assignment g) are in (6). The dynamic CCP ensures that subsequent occurrences of *she$_0$* denote a linguist who left.

(6) **Static:** $\lambda w.\, \exists x.\, \mathsf{ling}_w(x) \wedge \mathsf{left}_w(x)$
Dynamic: $\lambda w.\, \{g[0 \to x] \mid \mathsf{ling}_w(x) \wedge \mathsf{left}_w(x)\}$

A closure operation, notated '!' and characterized in Definition 2, allows us to extract a static proposition from a dynamic CCP. For example, applying ! to the CCP on the second line of (6) returns the proposition on the first line.

Definition 2 (Propositional closure).

$$!p = \lambda w.\, p(w) \neq \varnothing$$

Definition 3 gives a dynamic reformulation of ~. The only new thing relative to Definition 1 (besides the implicit dynamic types) is the presence of a pair of closure operators — NB: '$!\langle\!\langle \gamma \rangle\!\rangle^g$' is a point-wise generalization of !, i.e. $\{!p \mid p \in \langle\!\langle \gamma \rangle\!\rangle^g\}$.[3]

Definition 3 (Dynamic focus interpretation).

$$[\![\gamma_{\sim n}]\!]^g = \textbf{if } !g_n \in !\langle\!\langle \gamma \rangle\!\rangle^g \textbf{ then } [\![\gamma]\!]^g \textbf{ else } \#$$

The reason to appeal to ! here is that CCPs are capable of making finer-grained distinctions than ~ seems to care about (e.g., Schwarzschild 1999: 154, Charlow 2012): though the meaning of (7)'s first conjunct isn't, strictly speaking, a member of the second conjunct's focus value (since the indefinites modulate different indices), the second still seems to count as given. This suggests that ~ ignores anaphoric potential and only worries about propositional content.

(7) John met a linguist$_1$, and BILL$_F$ met a linguist$_2$.

The final step in accounting for our data is giving semantic teeth to the coindexation relationship that dynamically links ~ and its antecedent. For the sake of illustration, I'll paint in broad strokes here, concentrating on how Givenness relationships

[3] This formulation of ~ only allows us to contrast two *propositional* nodes. It can and should be generalized along the lines of Partee & Rooth's 1983 generalized conjunction.

can be dynamically established between sentential nodes (see the Appendix for a general treatment of dref introduction). Definition 4 allows sentences to make drefs:

Definition 4 (Sentential dref introduction).

$$[\![S_n]\!]^g = [\![S]\!]^{g[n \to [\![S]\!]^g]}$$

For example, if $[\![$Mary likes him$_1]\!]^g$ is given by (8), $[\![$[Mary likes him$_1]_4]\!]^g$ is given by (9): for any world w, if Mary likes g_1 at w, then an updated g mapping 4 to the CCP in (8) is returned. Despite their different anaphoric charges, (8) and (9) express identical propositions: in either case, if Mary doesn't like g_1 at w, $\varnothing$ is returned.

(8) $\lambda w.\ \textbf{if}\ \mathsf{likes}_w(\mathsf{m}, g_1)\ \textbf{then}\ \{g\}\ \textbf{else}\ \varnothing$

(9) $\lambda w.\ \textbf{if}\ \mathsf{likes}_w(\mathsf{m}, g_1)\ \textbf{then}\ \{g[4 \to (8)]\}\ \textbf{else}\ \varnothing$

And we're done. LFs for (2), (4), and (5) are given in (10), (11), and (12) (given that every node has to be either F- or ~- marked, there are several ~'s which I've ignored to keep things readable). In each of these cases, the ~-marked constituent is dynamically bound to a sentential dref. Crucially, because coindexation reflects a bona fide semantic binding relationship, the value against which ~'s demands are checked correctly varies as the denotation of its antecedent varies — boy-by-boy in (10) and (11), and machine-by-machine in (12).

(10) Every boy$_1$ claimed that [Mary likes him$_1$]$_4$ and [SUE$_F$ HATES$_F$ him$_1$]$_{\sim 4}$

(11) If [a boy$_6$ [Mary likes t$_6$]$_5$] you can bet that [SUE$_F$ HATES$_F$ him$_6$]$_{\sim 5}$

(12) Whenever [[the copier or the fax]$_7$ [you use t$_7$]$_8$] [I$_F$ CAN'T$_F$ use it$_7$]$_{\sim 8}$

It bears emphasizing that the occurrences of ~ in (11) and (12) are functioning as donkey pro-forms. To put it somewhat differently, the account I've sketched predicts (and the data seem to suggest) that ~-indices participate in the same rich range of binding configurations as their more familiar pronominal counterparts.

I'll wrap up by mentioning a few ways this analysis might be refined and extended. For one, as already pointed out in Rooth 1992: 87, fn. 8, the drefs used to value ~ can be generated in super-embedded positions — positions from which even dynamic accounts predict they should be inaccessible to ~:

(13) [The rumor that [I like Bill]$_7$] made Mary claim that [SUE$_F$ HATES$_F$ him]$_{\sim 7}$

I don't think this is too surprising. As argued in Charlow 2014 (§5.2 and §5.3), drefs generated in deeply embedded positions are systematically able to float up into accessible positions. The approach to dynamic interpretation defended there predicts this, and the theory sketched here could be re-sketched in those terms.

Rather less expected are cases like (14), again due to Rooth 1992 (p. 80, ex. 11). What's odd about this example is that *AMERICAN*$_F$ *farmer* seems to count as given due to a *subsequent* constituent, viz. *CANADIAN*$_F$ *farmer*. Yet despite the seemingly cataphoric givenness relationship, (14) is effortless to produce and comprehend.

(14) An AMERICAN$_F$ farmer was talking to a CANADIAN$_F$ farmer.

One lesson we might take from this datum is that the definedness condition imposed by ~ can be *postsuppositional* — that is, checked in some sense "after" the semantic integration of the entire utterance (e.g., Brasoveanu & Szabolcsi 2013). Again, I believe the necessary extension is broadly compatible with the theory sketched so far.

Last, a disturbing loose end. Following Schwarzschild 1999, I've suggested that every node that isn't F-marked must be ~-marked. But this seems to make incorrect predictions for examples like the following:

(15) John$_1$ combed [his$_1$ hair]$_5$ and [BILL$_F$]$_2$ combed [his$_2$ hair]$_{\sim 5}$

It seems that *his*$_2$ *hair* needn't be focused. But it's tough to see how it could count as given either (on Schwarzschild's theory as much as my own): in context, the meaning of *his*$_1$ *hair* — i.e. j's hair — isn't in the focus value of *his*$_2$ *hair* — i.e. {b's hair}. Though the latter *conjunct* counts as given since $\mathsf{comb}(\mathsf{j}, \mathsf{j's\ hair}) \in \{\mathsf{comb}(x, x\mathsf{'s\ hair}) \mid x_e\}$, this doesn't prevent ~5 from throwing its wrench in the gears.[4] The upshot seems to be that requiring *every* non-F-marked node to be ~-marked is too stringent. To count as given, it should be enough to be *dominated* by a ~-marked node. How, exactly, to implement this (in the syntax? in the semantics?), I leave up in the air.

In sum, taking the anaphoric character of given material seriously allows a strongly compositional formulation of Givenness, while giving us a leg up on some thoroughgoing parallels between canonical varieties of anaphora and the licensing of given material in context. I expect that the arguments and outlook described here carry over into other empirical domains where Givenness-like notions have been argued to be at play (see, e.g., Merchant 2001's use of E-Givenness in ellipsis licensing).

[4]The form of the puzzle is redolent of "re-binding" configurations discussed in connection with sloppy ellipsis — see, e.g., Takahashi & Fox 2005. One might suspect that allowing the two occurences of *his* in (15) to bear the same index would allow a Givenness relationship to be established, but this approach will over-generate. See Heim 1997: 217, fn. 8 for more on this point.

Appendix: dynamic "fragment" with GIVENNESS

Definition 5 (Predicates).

Expression	Meaning
$[\![\text{left}]\!]^g$	$\lambda x.\, \lambda w.\, \textbf{if}\ \mathsf{left}_w(x)\ \textbf{then}\ \{g\}\ \textbf{else}\ \varnothing$
$[\![\text{likes}]\!]^g$	$\lambda f.\, \lambda y.\, f\,(\lambda x.\, \lambda w.\, \textbf{if}\ \mathsf{likes}_w(y, x)\ \textbf{then}\ \{g\}\ \textbf{else}\ \varnothing)$

Definition 6 (DP meanings).

Expression	Meaning
$[\![\text{Mary}]\!]^g$	$\lambda \kappa.\, \kappa(m)$
$[\![\text{her}_n]\!]^g$ / $[\![t_n]\!]^g$	$\lambda \kappa.\, \kappa(g_n)$
$[\![\text{the copier}]\!]^g$	$\lambda \kappa.\, \lambda w.\, \kappa(\iota x.\, \mathsf{copier}_w(x))(w)$
$[\![\text{a boy}]\!]^g$	$\lambda \kappa.\, \lambda w.\, \bigcup\{\kappa(x)(w) \mid \mathsf{boy}_w(x)\}$
$[\![\text{DP}_1 \text{ or DP}_2]\!]^g$	$\lambda \kappa.\, \lambda w.\, \bigcup\{f(\kappa)(w) \mid f \in \{[\![\text{DP}_1]\!]^g, [\![\text{DP}_2]\!]^g\}\}$
$[\![\text{every boy}]\!]^g$	$\lambda \kappa.\, \lambda w.\, \textbf{if}\ \forall x.\, \mathsf{boy}_w(x) \Rightarrow \kappa(x)(w) \neq \varnothing\ \textbf{then}\ \{g\}\ \textbf{else}\ \varnothing$

Definition 7 (Sentential operators).

Expression	Meaning
$[\![\text{S}_1 \text{ and S}_2]\!]^g$	$\lambda w.\, \bigcup\{[\![\text{S}_2]\!]^h(w) \mid h \in [\![\text{S}_1]\!]^g(w)\}$
$[\![\text{not}]\!]^g$	$\lambda p.\, \lambda w.\, \textbf{if}\ p(w) = \varnothing\ \textbf{then}\ \{g\}\ \textbf{else}\ \varnothing$
$[\![\text{if S}_1 \text{ then S}_2]\!]^g$	$[\![\text{not}]\!]^g([\![\text{S}_1 \text{ and [not S}_2]]\!]^g)$

Definition 8 (Dref introduction).

Expression	Meaning
$[\![\lambda_n\ \gamma]\!]^g$	$\lambda x.\, [\![\gamma]\!]^{g[n \to x]}$
$[\![\text{XP}_n\ \gamma]\!]^g$	$[\![\text{XP}\ [\lambda_n\ \gamma]]\!]^g$

A few comments. First, XP_n doesn't include pronouns (cf. Definition 6). Second, the LFs above gloss over a number of DP scopings. Finally, we treat $[\![\text{S}_n]\!]^g$ (Definition 4) as abbreviating $[\![\text{S}_n\ \mathbf{x}_n]\!]^g$, where $[\![\mathbf{x}_n]\!]^g = \lambda w.\, \{h \mid h \in g_n(w)\}$.

Definition 9 (GIVENNESS operator).

Expression	Meaning
$[\![\gamma_{\sim n}]\!]^g$	$\textbf{if}\ !g_n \in\ !\langle\!\langle\gamma\rangle\!\rangle^g\ \textbf{then}\ [\![\gamma]\!]^g\ \textbf{else}\ \#$

Where $!p = \lambda w.\, p(w) \neq \varnothing$, and '$!\langle\!\langle\gamma\rangle\!\rangle^g$' abbreviates $\{!p \mid p \in \langle\!\langle\gamma\rangle\!\rangle^g\}$.

Definition 10 (Functional application). Unless pre-empted by one of the rules above, the meaning of any $[\alpha\ \beta]$ is given by $[\![\alpha]\!]^g([\![\beta]\!]^g)$ or $[\![\beta]\!]^g([\![\alpha]\!]^g)$, whichever is defined.

References

Brasoveanu, Adrian & Anna Szabolcsi. 2013. Presuppositional *Too*, postsuppositional *Too*. In Maria Aloni, Michael Franke & Floris Roelofsen (eds.), *The dynamic, inquisitive, and visionary life of ϕ, ?ϕ, and $\Diamond\phi$: A festschrift for Jeroen Groenendijk, Martin Stokhof, and Frank Veltman*, 55–64. University of Amsterdam.

Charlow, Simon. 2012. Cross-categorial donkeys. In Maria Aloni, Vadim Kimmelman, Floris Roelofsen, Galit W. Sassoon, Katrin Schulz & Matthijs Westera (eds.), *Logic, Language and Meaning*, vol. 7218 (Lecture Notes in Computer Science), 261–270. Springer Berlin Heidelberg. http://dx.doi.org/10.1007/978-3-642-31482-7_27.

Charlow, Simon. 2014. *On the semantics of exceptional scope*. New York University Ph.D. thesis.

Heim, Irene. 1983. On the projection problem for presuppositions. In Michael Barlow, Daniel P. Flickinger & Michael T. Wescoat (eds.), *Proceedings of the Second West Coast Conference on Formal Linguistics*, 114–125. Stanford: Stanford University Press.

Heim, Irene. 1997. Predicates or formulas? Evidence from ellipsis. In Aaron Lawson (ed.), *Proceedings of Semantics and Linguistic Theory 7*, 197–221. Ithaca, NY: Cornell University.

Heim, Irene. 2011. Definiteness and indefiniteness. In Klaus von Heusinger, Claudia Maienborn & Paul Portner (eds.), *Semantics: An International Handbook of Natural Language Meaning*, vol. 33 (HSK 2), chap. 41, 996–1025. Berlin: de Gruyter. http://dx.doi.org/10.1515/9783110255072.996.

Jacobson, Pauline. 1999. Towards a variable-free semantics. *Linguistics and Philosophy* 22(2). 117–184. http://dx.doi.org/10.1023/A:1005464228727.

Jacobson, Pauline. to appear. The short answer: Implications for direct compositionality (and vice-versa). *Language*.

Merchant, Jason. 2001. *The syntax of silence: Sluicing, islands, and the theory of ellipsis*. Oxford: Oxford University Press.

Partee, Barbara H. & Mats Rooth. 1983. Generalized conjunction and type ambiguity. In Rainer Bäuerle, Christoph Schwarze & Arnim von Stechow (eds.), *Meaning, Use and Interpretation of Language*, 361–383. Berlin: Walter de Gruyter.

Rooth, Mats. 1992. A theory of focus interpretation. *Natural Language Semantics* 1(1). 75–116. http://dx.doi.org/10.1007/BF02342617.

Schwarzschild, Roger. 1999. Givenness, AvoidF and other constraints on the placement of accent. *Natural Language Semantics* 7(2). 141–177. http://dx.doi.org/10.1023/A:1008370902407.

Takahashi, Shoichi & Danny Fox. 2005. MaxElide and the re-binding problem. In Effi Georgala & Jonathan Howell (eds.), *Proceedings of Semantics and Linguistic Theory 15*, 223–240. Ithaca, NY: Cornell University.