Weak Familiarity and Anaphoric Accessibility in Dynamic Semantics

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Talk Sketch

- Among the greatest achievements of ‘dynamic’ theories of discourse (DRT, FCS, etc.) is the ability to state constraints on anaphoric accessibility.
- But these constraints are too strong in many cases, as is well known.
- Previous attempts to remedy this situation are all problematic for different reasons.
- I argue for a new fix based on a generalized notion of Heim’s familiarity that is due to Roberts.

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- Constraints on accessibility are common to DRT, FCS, Dynamic Montague Grammar (DMG), the work of Chierchia, of Beaver, of de Groote, and of Muskens, among others.

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- Example (3) shows an antecedent bathroom seemingly escaping the scope of *no*.
- Similarly, in (4) the antecedent for Pedro's donkey seems to be available even outside *every*'s scope.

Earlier Attempted Fixes

- Groenendijk and Stokhof's proposals for extending the scope of connectives and quantifiers in DMG loosen the accessibility constraints too much: a DR's scope is extended indefinitely across the remaining discourse.
- Chierchia's approach involves making pronouns ambiguous between the "dynamically bound" case and the "E-type" case.
- Geurts explains such examples as instances of accommodation, but this seems wrong for (3) and (4). Also, there seems to be no easy way to say when accommodation happens and when it doesn't.

Heim's (Strong) Familiarity

- Heim's **novelty/familiarity constraint** sheds some light on anaphoric accessibility.

Definition (Heimian Strong Familiarity)

Let i be the index of a definite NP d. Then the DR i is **strongly familiar** in a discourse context c iff

1. The DR i is among the active DRs in c, and
2. If d has descriptive content, then c entails that i has the relevant descriptive content.

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- Provision 1 makes anaphoric accessibility constraints too strong. It implies that a DR in the scope of e.g. a quantifier can never be familiar.
- As a result, any dynamic theory that bases accessibility constraints on strong familiarity (or a similar notion) will undergenerate.

Fixing Heim's Familiarity

- Roberts' generalization of Heimian familiarity gets rid of the requirement that a anaphoric antecedent be among the active DRs.

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Let i be the index of a definite NP d. Then the DR i is **weakly familiar** in a discourse context c iff c entails the existence of an entity bearing the descriptive content of d.

- By properly defining the connectives and quantifiers, this generalized familiarity can be made to account for the anaphora in cases like (3) and (4).

Formalizing Weak Familiarity

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- Basic types:

Type	Use
e	entities
t	truth values
p	propositions
ω	natural numbers (DRs)

Discourse Contexts

- Discourse contexts are modeled as triples of an **anchor**, a **resolution**, and a proposition (the **common ground**).

$$\mathrm{c}_n =_{\mathrm{def}} \mathrm{a}_n \times \mathrm{r}_n \times \mathrm{p}$$

where n is the context's arity (the number of DRs in the domain of its anchor).

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$$\mathrm{a}_n =_{\mathrm{def}} \omega_n \rightarrow \mathrm{e}$$

- A resolution with arity n encodes the relative salience of the DRs in n.

$$\mathrm{r}_n =_{\mathrm{def}} \{r \in \omega_n \rightarrow \omega_n \rightarrow \mathrm{t} \mid (\mathsf{preo}_n\ r)\}$$

  (here preo_n is the characteristic function picking out those n-ary relations on DRs that are preorders).

Context-Dependent Propositions and Updates

- A **context-dependent proposition (CDP)** is a partial function from contexts to propositions.

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- An **update** is simply a function from CDPs to CDPs.

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  Updates model the meanings of declarative sentences in discourse. Modulo argument order permutation and the replacement of the type o (of truth values) with p, they are analogous to de Groote's dynamic propositions (type Ω).

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- An n-ary **dynamic property** is a function from n DRs to an update. The type $\mathrm{d} =_{\mathrm{def}} \omega \rightarrow \mathrm{u}$ is the type of unary dynamic properties.

Example Updates and Dynamic Properties

$$\text{RAIN} =_{\text{def}} \lambda_{kc}.\mathsf{rain}\ \mathsf{and}\ (k\ (c + \mathsf{rain}))$$

$$\text{DONKEY} =_{\text{def}} \lambda_{nkc}.(\mathsf{donkey}\ [n]_c)\ \mathsf{and}\ (k\ (c + (\mathsf{donkey}\ [n]_c)))$$

$$\text{OWN} =_{\text{def}} \lambda_{mnkc}.(\mathsf{own}\ [m]_c\ [n]_c)\ \mathsf{and}\ (k\ (c + (\mathsf{own}\ [m]_c\ [n]_c)))$$

- The function $+ : \mathrm{c} \to \mathrm{p} \to \mathrm{c}$ extends the CG with a specified proposition, allowing updates to both proffer content and pass it on to the 'next' CDP.
- The notation $[n]_c$ is shorthand for the entity that the context c's anchor maps the DR n to (the subscript c is usually dropped when no confusion is possible).

Basic Connectives and Existential Quantifier I

- Dynamic conjunction (also used for utterance sequencing) amounts to composition of updates, as for Muskens.

$$\textsc{and} =_{\text{def}} \lambda_{uvk}.u\,(v\,k)$$

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- The dynamic existential quantifier adds a new DR (mapped to x) via the function $:: : \text{c} \to \text{e} \to \text{c}$.

  $$\text{EXISTS} =_{\text{def}} \lambda_{Dkc}.\mathsf{exists}\,\lambda_x.D\,(\mathsf{next}\,c)\,k\,(c :: x)$$

  The function next gives the 'next' DR (the arity of c), which in the context $(c :: x)$ is always mapped to x.

Basic Connectives and Existential Quantifier II

- Dynamic negation discards contextual modifications made in its scope.

$$\text{NOT} =_{\text{def}}$$
$$\lambda_{uk}\lambda_{c \mid (u\,k)\downarrow c}.(\mathsf{not}\,(\mathbf{stat}\,u\,c))\ \mathsf{and}\ (k\,(c + \mathsf{not}\,(\mathbf{stat}\,u\,c)))$$

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  - Accessibility constraints are implemented by the **staticizer** function **stat** : u → c → p negation is built on.

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    This function nullifies the contextual effects of an update by passing it the **empty CDP** $\top =_{\text{def}} \lambda_c \mathsf{true}$.

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  - Intuitively, the staticizer retrieves the static proposition an update is “based on” by feeding it the current context.
  - The partiality condition $(u\,k) \downarrow c$ on negation ensures the preservation of any felicity constraints imposed by its argument.

Defined Connectives and Generalized Determiners

- Dynamic disjunction is defined based on negation and conjunction.

$$\text{OR} =_{\text{def}} \lambda_{uv}.\text{NOT}\left(\left(\text{NOT}\, u\right) \text{ AND } \left(\text{NOT}\, v\right)\right)$$

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$$\text{OR} =_{\text{def}} \lambda_{uv}.\text{NOT}\,((\text{NOT}\,u)\ \text{AND}\ (\text{NOT}\,v))$$

- The dynamic meanings of the determiners *a*, *no*, and *every* are also built on the basic connectives and quantifier.

$$\begin{aligned} \text{A} &=_{\text{def}} \lambda_{DE}.\text{EXISTS}\,\lambda_n.(D\,n)\ \text{AND}\ (E\,n) \\ \text{NO} &=_{\text{def}} \lambda_{DE}.\text{NOT}\,(\text{A}\ D\ E) \\ \text{EVERY} &=_{\text{def}} \lambda_{DE}.\text{NOT}\,(\text{EXISTS}\,\lambda_n.(D\,n)\ \text{AND}\ (\text{NOT}\,(E\,n))) \end{aligned}$$

These dynamic GQs resemble the definitions of static determiners from generalized quantifier theory.

Weakening Familiarity I

- The strongly familiar version of *it* has the type $(\omega \to \mathrm{u}) \to \mathrm{u}$ of a dynamic generalized quantifier.

$$\textsc{it}_{\mathrm{s}} =_{\mathrm{def}} \lambda_{Dk}\lambda_{c\,|\,(\mathbf{def}\ \textsc{nonhuman})\downarrow c}.D\,(\mathbf{def}\ \textsc{nonhuman}\ c)\ k\ c$$

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  - The function **def** selects the most salient DR from the context that is entailed to have a specified property.

$$\mathbf{def}_n =_{\mathrm{def}} \lambda_{Dc} . \bigsqcup_{(\mathbf{r}\ c)} \lambda_{i \in \omega_n} . (\mathbf{p}\ c)\ \mathsf{entails}\ (\mathbf{stat}\ (D\ i)\ c)$$

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  - The partiality condition $(\mathbf{def}\ \textsc{nonhuman}) \downarrow c$ requires that a DR with the property NONHUMAN is present in the context.

Weakening Familiarity II

- The weakly familiar it is built on the strong version.

$$\textsc{it}_{\mathrm{w}} =_{\mathrm{def}} \lambda_{Dk}\lambda_{c \mid \varphi}.\textsf{exists}\,\lambda_x.(\textsf{nonhuman}\,x)$$
$$\textsf{and}\ \textsc{it}_{\mathrm{s}}\,D\,k\,(c :: x + \textsf{nonhuman}\,x)$$

Here, the variable φ represents $\textsc{it}_{\mathrm{w}}$'s partiality condition.

$\varphi = (\neg\,((\textsc{it}_{\mathrm{s}}\,D\,k)\downarrow c)) \wedge ((\mathbf{p}\,c)\ \textsf{entails}\ (\textsf{exists}\,\lambda_x.\textsf{nonhuman}\,x))$

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  1. $\textsc{it}_{\mathrm{s}}$ is not defined because no appropriate DR is strongly familiar, and
  2. An entity with the required property is entailed to exist.
- In such a case, $\textsc{it}_{\mathrm{w}}$ introduces a new DR with the required property and passes the resulting context to $\textsc{it}_{\mathrm{s}}$.

Weakening Familiarity III

- A similar strategy is used for the strongly and weakly familiar variants of *his*.
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  - HIS_s takes a dynamic property and selects the most salient DR with that property that is possessed by the most salient male DR.
  - The weakly familiar version HIS_w applies only if the strong one does not and the required existence entailment is present.
  - If so, a new DR is introduced with both the required property and the property of being possessed by the most salient male.
  - The resulting context is then passed to HIS_s.

Handling Bathroom Examples

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- The meaning of (5) is modeled as follows.

$\vdash$ (NO DONKEY WALK) OR (IT_{w} BRAY)

$=$ (NOT (A DONKEY WALK)) OR (IT_{w} BRAY)

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- The weakly familiar IT_w applies here because of the modifications made to the CG by the first conjunct under the negation:

$$\text{not (not (exists } \lambda_x.\text{(donkey } x\text{) and (walk } x\text{)))}$$

Thanks to these modifications, the CG of the context passed to NOT (IT_w BRAY) entails the existence of a nonhuman DR, as required.

One Man's Donkey

(6) a. Every man owns a donkey.

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- The dynamic meaning of (6) uses $\textsc{his}_{\mathrm{w}}$:

$$\vdash \textsc{every man}\ \lambda_j.\textsc{a donkey}\ \lambda_i.\textsc{own}\ i\ j$$
$$\textsc{and a man}\ \lambda_j.\textsc{his}_{\mathrm{w}}\ \textsc{donkey}\ \lambda_i.\textsc{beat}\ i\ j$$

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- Here again, the use of the weak familiarity *his* is licensed by the required entailments (introduced by (6a)).

$$\mathsf{not}\ (\mathsf{exists}\ \lambda_x.(\mathsf{man}\ x)$$
$$\mathsf{and}\ (\mathsf{not}\ (\mathsf{exists}\ \lambda_y.(\mathsf{donkey}\ y)\ \mathsf{and}\ (\mathsf{own}\ y\ x))))$$

Since the restrictor of (6b) contributes the information that the individual is a man, the existence of a donkey owned by him is entailed in the context passed to the scope.

Taking Stock

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- This approach fixes some undergeneration problems with the accessibility constraints built into most dynamic semantic theories.
- Seeming cases of *over*generation can be explained by appealing to pragmatic effects:

  (7) a. Not every donkey brays.

  b. # It's brown.

  I argue that the strangeness of (7b) has to do with the fact that uniqueness cannot be presumed (how many donkeys don't bray?).

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  1. Does not existentially quantify over newly introduced DRs, instead construing them as lambda-bound variables in the tradition of DRT and FCS.
  2. Relies completely on weakly familiar entailments for anaphora resolution, rendering accessibility constraints unnecessary (though negation still discards the contextual effects that occur in its scope).
- I do not yet have a formalized account of how the anaphora in (8) is resolved.

(8) Every player chooses a pawn. He puts it on square one. (Groenendijk and Stokhof)

I plan to treat (8) as an instance of what Roberts calls **telescoping**: something like an indicative version of modal subordination, except the operator isn't a modal.