Propositions and rigidity in Layered DRT

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Kripke/Kaplan on rigid terms

• names and indexicals are directly referential/rigid designators
• wide-scope behavior w.r.t. operators
• not synonymous with the description giving their ‘descriptive meaning’, as shown by Kripke-Kaplan examples (1) and (2):
  – ‘Sam’ \( \not\equiv \) ‘the person called ‘Sam”
    (1) a. Sam is called Sam  
        b. The person called Sam is called Sam
  – ‘I’ \( \not\equiv \) ‘the speaker’
    (2) a. I am the speaker  
        b. The speaker is the speaker

Discourse Representation Theory

• meaning encoded in descriptive representational conditions in a DRS
• definite NPs treated as presuppositions
• 2-stage interpretation (\(\text{Prel}\)):  
  – syntactic module \(\text{Prel}\) builds preliminary DRS from sentence  
  – pragmasemantic resolution algorithm  
    * merges \(\text{Prel}(\sigma)\) with previous discourse-/background-DRS
performs anaphora and presupposition Resolution (binding new presuppositions to old representations or accommodating them)

Resolution

1. presuppositions are to be bound (e.g. anaphors)
2. otherwise, accommodate as high as possible (e.g. some definite descriptions, factive complements)
   • presupposition resolution accounts for definite NP’s wide-scope behavior
   • how about the alleged special behavior of proper names/indexicals?

Descriptivism

suggests that names are like other definite NP’s

• both definite, thus presupposition triggers
• reduction: ‘John’ = ‘the person called ‘John”
• accounts for proper name’s normal wide scope behavior,
• but also the (rare) other behaviors that proper names appear to share with definite descriptions.

• no familiarity required (global accommodation):
  (3) My best friend is John

• narrow scope (local and intermediate accommodation):
  (4) If alphabetical order had been the method of electing the American president, Aaron Aardvark might have been president

• bound variable (presupposition binding/cancellation):
  (5) If a child is christened ‘Bambi’, then Disney will sue Bambi’s parents

• but no account for Kaplan-Kripke examples!

Layered DRT

• (conservative) extension of standard DRT
• abstract interface for representing the interaction of different types of information
• layers for e.g. presuppositions, implicatures, asserted (Fregean) content, syntactic features, . . .
• all layers get truthconditional evaluation

Applications

• binding problems (reference marker can be employed at several layers at once)
• denial (denial can be directed at one specific layer)
• rigidity

Rigid designation in LDRT

• represent proper names and indexicals as descriptive conditions,
• but at separate layer ‘k’
• add 2-dimensional semantics to rigidify only that layer
• extension: at representational level, treat k like presupposition layer (to account for bound variable uses of names)

Syntax

• primitive symbols:
  – a set $\mathcal{X}$ of reference markers
  – some sets $\mathcal{Pred}^n$ of $n$-place predicates
  – a set $\Lambda$ of layer labels
• if $x \in \mathcal{X}$, $L \subseteq \Lambda$, then $x_L$ is a labeled reference marker
• if $x_1, \ldots, x_n \in \mathcal{X}$, $L \subseteq \Lambda$, then $P_L(x_1, \ldots, x_n)$ is a labeled condition
• if $\varphi$ and $\psi$ are labeled conditions, $L \subseteq \Lambda$, then $\neg_L \varphi$, $\varphi \lor_L \psi$, and $\varphi \Rightarrow_L \psi$ are also labeled conditions
if \( U \) is a set of labeled reference markers and \( Con \) a set of labeled conditions, then \( \langle U, Con \rangle \) is an LDRS

**Application**

\( \Lambda = \{ fr, k, imp, pr \} \)
- \( fr \) = the Frege layer, what is “said”
- \( k \) = Kaplan-Kripke layer for rigid stuff
- \( imp \) = implicature layer
- \( pr \) = (unresolved) presupposition layer

**Examples**

(6) a. The soup is warm

\[
\begin{array}{|c|}
\hline
xpr \\
\hline
\text{soup}_{pr}(x) \\
\text{warm}_{f,r}(x) \\
\hline
\end{array}
\]

b. \( \neg imp \) = \( \text{hot}_{imp}(x) \)

**Binding problems**

e.g. with presuppositions


b. \( \exists x \left[ \text{succeed}_{g,r}(x) \right] \{ \exists x \left[ \text{had_diff}_r \text{succeed}_{g,r}(x) \right] \}

\[
\begin{array}{|c|}
\hline
xfr \\
\hline
\text{george}_{v,r}(y) \\
\text{succeeded}_{f,r}(x,y) \\
\text{had\_difficulty\_succeeding}_{pr}(x,y) \\
\hline
\end{array}
\]
Semantics

- \( \mathcal{M} = \langle D, W, I \rangle \)
  - \( D \) is a domain of individuals
  - \( W \) is a set of possible worlds
  - \( I \) interpretation function  (from basic predicates to their intensions in \( D^W \))

\[
\| \varphi \|_{L,w}^{f} = \begin{cases} 
\{ g \mid f \subseteq g \land \text{Dom}(g) = \text{Dom}(f) \cup U_L(\varphi) \land \forall \psi \in \text{Con}(\varphi) \left[ \| \psi \|_{L,w}^{g} = 1 \right] \} & \text{if } \exists g \left[ f \subseteq g \land \text{Dom}(g) \right] \\
\text{undefined} & \text{otherwise}
\end{cases}
\]

\[
\| P_{K}(x_1, \ldots, x_n) \|_{L,w}^{f} = \begin{cases} 
1 & \text{if } K \cap L = \emptyset \text{ or } \| \psi \|_{K \cap L,w}^{f} = 0 \\
0 & \text{if } K \cap L \neq \emptyset \text{ and } \| \psi \|_{K \cap L,w}^{f} \text{ defined and} \\
\text{undefined} & \text{otherwise}
\end{cases}
\]

\[
\| \neg K \psi \|_{L,w}^{f} = \begin{cases} 
1 & \text{if } K \cap L = \emptyset \text{ or } \| \psi \|_{K \cap L,w}^{f} = \emptyset \\
0 & \text{if } K \cap L \neq \emptyset \text{ and } \| \psi \|_{K \cap L,w}^{f} \text{ defined and} \\
\text{undefined} & \text{otherwise}
\end{cases}
\]

\[
\| \psi \lor K \chi \|_{L,w}^{f} = \begin{cases} 
1 & \text{if both } \| \psi \|_{K \cap L,w}^{f} \text{ and } \| \chi \|_{K \cap L,w}^{f} \text{ defined,} \\
0 & \text{if } \| \psi \|_{K \cap L,w}^{f} = \| \chi \|_{K \cap L,w}^{f} = \emptyset \\
\text{undefined} & \text{otherwise}
\end{cases}
\]
**Layered content**

- \( C^f_L(\varphi) = \begin{cases} \{ w \in W \mid \exists g \in \| \varphi \|_L \land \| \varphi \|_{L,w}^f \text{ defined} \} & \text{if } \exists w[\| \varphi \|_{L,w}^f \text{ defined}] \\ \text{undefined} & \text{otherwise} \end{cases} \)

- \( C_L(\varphi) = C_L^\emptyset(\varphi) \)

**Problems**

often undefined (because of layer interdependencies):

- \((8)\)  
  a. The King of France is bald
  
  \[
  \begin{array}{|c|}
  \hline
  x_{pr} \\
  \hline
  \end{array}
  \]
  b. \(\text{king\_of\_France}(x)\)  
  \(\text{bald}(x)\)
  
  c. \(C_{pr,fr}(\varphi) = \{ w \in W \mid \text{there is a bald king of France in } w \}\)
  
  d. \(C_{fr}(\varphi)\) undefined

- \((9)\)  
  a. I am speaking
  
  \[
  \begin{array}{|c|}
  \hline
  x_k \\
  \hline
  \end{array}
  \]
  b. \(\text{speaker}(x)\)  
  \(\text{speaking}(x)\)
  
  c. The speaker is speaking
  
  \[
  \begin{array}{|c|}
  \hline
  x_{fr} \\
  \hline
  \end{array}
  \]
  d. \(\text{speaker}(x)\)  
  \(\text{speaking}(x)\)
  
  e. \(C_{k,fr}(\varphi) = C_{k,fr}(\varphi) = C_{fr}(\varphi) = W\)
  
  f. \(C_{fr}(\varphi)\) undefined

To insure definedness, add extra layers as ‘background’ for interpretation.

**The weak proposal**

weak one-dimensional content substitute:
\[(10) \quad \mathcal{C}^{[K]}_L(\varphi) = \mathcal{W} - (\mathcal{C}_K(\varphi) - \mathcal{C}_K \cup L(\varphi)) = \{w \in \mathcal{W} \mid w \in \mathcal{C}_K(\varphi) \rightarrow w \in \mathcal{C}_K \cup L(\varphi)\}\]

handy for denial applications, but:

\[(11) \quad \mathcal{C}^{[k]}_{fr}() = \mathcal{W}\]

Adding another dimension

\[\mathcal{M} = \langle D, \mathcal{W}, \mathcal{C}, I \rangle\]
- \(D\) is a domain of individuals
- \(\mathcal{W}\) is a set of worlds
- \(I\) is interpretation function
- \(\mathcal{C}\) is a set of contexts, i.e. for all \(c \in \mathcal{C}\): \(I\) (speaker) \((c)\), \(I\) (Mary) \((c)\), . . . are singletons

\[\mathcal{K}^{c}_{L}(\varphi) \begin{cases} = \mathcal{C}^{f}_{L}(\varphi) & \text{if } ||\varphi||_{k,c}^0 = \{f\} \\ \text{undefined} & \text{otherwise} \end{cases}\]

(12) 

a. Ashley is called ‘Ashley’

\[
\begin{array}{|c|}
\hline
x_k \\
\hline
\end{array}
\]

b. \(\text{ashley}_k(x)\) \\
\(\text{ashley}_{fr}(x)\)

c. Ashley is Ashley

\[
\begin{array}{|c|}
\hline
x_k \ y_k \\
\hline
\end{array}
\]

d. \(\text{ashley}_k(x)\) \\
\(\text{ashley}_k(y)\) \\
\(x =_{fr} y\)

\[\mathcal{C}^{k}_{fr}(\quad) = \mathcal{C}^{k}_{fr}(\quad) = \mathcal{W}, \mathcal{C}^{fr}(\quad), \mathcal{C}^{fr}(\quad) \text{ undefined}\]

\[\mathcal{K}^{c}_{fr}(\quad) = \mathcal{C}^{\langle x, \text{ash}_c \rangle}_{fr}(\quad) = \{w|\text{ash}_c \text{ is in } w \text{ called ‘Ashley’}\}\]

\[\mathcal{K}^{c}_{fr}(\quad) = \mathcal{C}^{\langle x, \text{ash}_c \rangle, \langle y, \text{ash}_c \rangle}_{fr}(\quad) = \mathcal{W}\]

Refinements

suggests that names are like other definite NP’s, with e.g. bound variable uses:
If a child is christened ‘Bambi’, then Disney will sue Bambi’s parents
Every time we do our Beatles act, Ringo gets drunk afterwards

Names as presuppositions

- $\Lambda = \{pr_d, d, pr_k, k, fr, imp\}$
  - $pr_d =$ descriptive presupposition layer
  - $d =$ accommodated (descriptive) presupposition
  - $pr_k =$ name/indexical presupposition
  - $k =$ rigidifiable layer
- $\text{Prel}$ puts names and indexicals in $pr_k$, definite descriptions in $pr_d$
- $\text{Res}$ tries to bind $pr_k$ and $pr_d$ whenever possible, otherwise $pr_k$ stuff is dropped as high up as possible in $k$, $pr_d$ gets dropped at $d$

Maybe Rory liked my talk

a. $\text{Prel}(\quad ) =$

b. $\text{Res}(\quad ) =$

If a child is christened ‘Bambi’, then Disney will sue Bambi’s parents
b. \[ \text{Prel}() = \begin{array}{c|c}
 x_{fr} & y_{pr_k} Z_{pr_d w_{pr_k}} \\
 \text{child}_{fr}(x) & \text{disney}_{pr_k}(y) \\
 \text{named}_{bambi}_{fr}(x) & \text{parents}_{of}_{pr_d}(Z,w) \\
 \end{array} \Rightarrow \]

\[ \begin{array}{c}
 \text{named}_{bambi}_{pr_k}(w) \\
 \text{sue}_{fr}(y,Z) \\
\end{array} \]

c. \[ \text{Res}() = \begin{array}{c|c}
 x_{fr} Z_d & \text{sue}_{fr}(y,Z) \\
 \text{child}_{fr}(x) & \text{disney}_{k}(y) \\
 \text{named}_{bambi}_{fr}(x) & \\
 \text{parents}_{of}_{d}(Z,x) & \\
\end{array} \Rightarrow \]

Further research

- The dynamics of the \( pr_k \) layer: how, why, when does \( pr_k \) stuff become part of new descriptive content (accommodation examples)?
- Difference between names and indexicals?

Appendix I: syntax

The primitive symbols of an LDRT language are:

- A set \( \mathcal{X} \) of reference markers
- Some sets \( \mathcal{P}_{red}^n \) of \( n \)-place predicates
- A set \( \Lambda \) of layer labels

The rest of the syntax is:

- If \( x \in \mathcal{X} \), \( L \subseteq \Lambda \), then \( x_L = \langle x, L \rangle \in \mathcal{X} \times \wp(\Lambda) \) is a labeled reference marker
- If \( P \in \mathcal{P}_{red}^n \), \( L \subseteq \Lambda \), then \( P_L \) is a labeled predicate
- If \( x, y \in \mathcal{X} \), \( L \subseteq \Lambda \), then \( x =_L y \) is a labeled condition
• if \( x_1, \ldots, x_n \in X \), \( P_L \) a labeled predicate, then \( P_L(x_1, \ldots, x_n) \) is a labeled condition

• if \( \varphi \) and \( \psi \) are labeled conditions, \( L \subseteq \Lambda \), then \( \lnot_L \varphi \), \( \varphi \land_L \psi \), and \( \varphi \rightarrow_L \psi \) are also labeled conditions

• if \( U \) is a set of labeled reference markers and \( Con \) a set of labeled conditions, then \( \langle U, Con \rangle \) is an LDRS

  \[ \langle U(\varphi), Con(\varphi) \rangle \]

  \[ U_L(\varphi) = \{ x | \exists K[K \cap L \neq \emptyset \land x_K \in U(\varphi) \} \]  

Appendix II: semantics

\[ \mathcal{M} = \langle D, W, R \rangle \]

- \( D \) is a domain of individuals
- \( W \) is a set of extensional interpretation functions from basic predicates into subsets of \( D \)
- \( R \subseteq W^2 \)

\[ f[X]g = \text{def } f \subseteq g \land \text{Dom}(g) = \text{Dom}(f) \cup X \]

\[ \parallel \varphi \parallel_L^f, w = \text{def } \parallel \varphi \parallel_L^f, w \in \{0, 1\} \]

\[ \parallel \varphi \parallel_L^f, w = \begin{cases} \{ g | f[U_L(\varphi)]g \land \\ \land \forall \psi \in Con(\varphi)[\parallel \psi \parallel_L^g, w = 1] \} & \text{if } \exists g[f[U_L(\varphi)]g \land \\ \land \forall \psi \in Con(\varphi)[\parallel \psi \parallel_L^g, w \downarrow] \\ \uparrow & \text{otherwise} \end{cases} \]

\[ \parallel x =_K y \parallel_L^f, w = \begin{cases} 1 & \text{if } K \cap L = \emptyset \text{ or } x, y \in \text{Dom}(f) \land f(x) = f(y) \\ 0 & \text{if } K \cap L \neq \emptyset \text{ and } x, y \in \text{Dom}(f) \land f(x) \neq f(y) \\ \text{undefined} & \text{otherwise} \end{cases} \]

\[ \parallel P_K(x_1, \ldots, x_n) \parallel_L^f, w = \begin{cases} 1 & \text{if } K \cap L = \emptyset \text{ or } \parallel f \parallel_L^{K \cap L, w} = \emptyset \\ 0 & \text{if } K \cap L \neq \emptyset \text{ and } x_1, \ldots, x_n \in \text{Dom}(f) \land \langle f(x_1), \ldots, f(x_n) \rangle \notin w(P) \\ \text{undefined} & \text{otherwise} \end{cases} \]

\[ \parallel \lnot K \psi \parallel_L^f, w = \begin{cases} 1 & \text{if } K \cap L = \emptyset \text{ or } \parallel \psi \parallel_L^{K \cap L, w} = \emptyset \\ 0 & \text{if } K \cap L \neq \emptyset \text{ and } \parallel \psi \parallel_L^{K \cap L, w} \land \parallel \psi \parallel_L^{K \cap L, w} \neq \emptyset \\ \text{undefined} & \text{otherwise} \end{cases} \]
\[ \| \psi \lor K \chi \|_{L,w}^{f} = \begin{cases} 1 & \text{if } \| \psi \|_{K \cap L,w}^{f} \land \| \chi \|_{K \cap L,w}^{f} \land (\| \psi \|_{K \cap L,w}^{f} \cup \| \chi \|_{K \cap L,w}^{f}) \neq 0 \\ 0 & \text{if } \| \psi \|_{K \cap L,w}^{f} = \| \chi \|_{K \cap L,w}^{f} = \emptyset \\ \text{undefined} & \text{otherwise} \end{cases} \]

\[ \| \psi \Rightarrow K \chi \|_{L,w}^{f} = \begin{cases} 1 & \text{if } \| \psi \|_{K \cap L,w}^{f} \land \forall g \in \| \psi \|_{K \cap L,w}^{f} : \| \chi \|_{K \cap L,w}^{g} \land (\| \chi \|_{K \cap L,w}^{g}) \neq 0 \\ 0 & \text{if } \exists g \in \| \psi \|_{K \cap L,w}^{f} : \| \chi \|_{K \cap L,w}^{g} = \emptyset \\ \text{undefined} & \text{otherwise} \end{cases} \]

\[ \| \square K \psi \|_{L,w}^{f} = \begin{cases} 1 & \text{if } \forall w' R w : \| \psi \|_{K \cap L,w'}^{f} \land (\| \psi \|_{K \cap L,w'}^{f}) \neq 0 \\ 0 & \text{if } \exists w' R w : \| \psi \|_{K \cap L,w'}^{f} = \emptyset \\ \text{undefined} & \text{otherwise} \end{cases} \]

References


