This paper examines two DRT-based approaches to extraposed relative(-like) clauses which rely on an essentially configurational notion of accessibility and thus seem to provide arguments in favor of an intermediate DRS-level. In particular, Wittenburg (1987) treats "extraposition from NP as anaphora" by means of a c-command-based notion of accessibility while (a reconstruction of) Gärtner (2001) appeals to "local accessibility" in analyzing German relative-like V2 clauses. I will argue, however, that the approach by Wittenburg (1987) is highly problematic when applied to the full range of NP-types. Equally, the analysis of Gärtner (2001) may call for a non-dynamic reformulation when applied to plural antecedents. I will conclude that the evidence in favor of an essentially configurational level of DRSs is less than compelling. In the course of the discussion an SDRT-based alternative to locality in terms of the right-frontier constraint (cf. Asher and Lascarides 2003) as well as the phenomenon of "maximality effects" (cf. Kadmon 2001) will be considered.

1. Introduction

It is well-known that dynamic semantics set out to amend certain mismatches between natural language quantifiers and their counterparts from predicate logic. For example, quantifier variable binding can take place in (1a)/(1b), i.e. across sentence boundaries and from inside the antecedent of a conditional into the consequent, while the corresponding relation is ruled out in (1c)/(1d).

(1) a. A man walked in. He whistled.  
    b. If a man walks in, he whistles.  
    c. $\exists x[\phi \land \psi]$  
    d. $\exists x[\phi \rightarrow \psi]$

In Discourse Representation Theory (DRT) (Kamp and Reyle 1993) the necessary adjustments are made syntactically as part of the procedure constructing Discourse Representation Structures (DRSs). At this construction stage, pronouns must be bound by a quantifier, or, more exactly, they must be identified with an "accessible" discourse referent provided by a quantifier (or proper name). Accessibility is defined such that it subsumes the standard scope of quantifiers familiar from predicate logic. Thus, in
(1c)/(1d) x is accessible for pronouns inside $\phi$. The DRT-approach to the mismatching pair (1a)/(1c) amounts to rebracketing, which takes place at the stage where the second sentence is processed. Thus, the DRT-counterpart of (1a) will closely resemble (2).

(2) $\exists x [\phi \land \psi]$

After this adjustment, x is accessible from inside $\psi$ as well, where accessibility again corresponds to standard quantifier scope.

The DRT-analysis of (1b)/(1d), on the other hand, relies on declaring the antecedent of a conditional accessible from inside the consequent by definition.

By contrast, Dynamic Predicate Logic (Groenendijk and Stokhof 1991) treats the cases in (1) in purely semantic terms. Thus, (1c)/(1d) can be left syntactically unaltered and still provide proper analyses for (1a)/(1b), the additional binding options being guaranteed by the particular interaction of quantifying over assignment functions and the "dynamic" meanings of $\exists$, $\land$, and $\rightarrow$.

Crucially, given that DRT provides essentially the same semantics for existential quantification and material implication as DPL, DPL can be taken to have shown that a syntactic/configurational approach to the mismatches in (1) in terms of notions like "accessibility" is dispensible. Consequently, arguments in favor of such a perspective would seem to have to be found elsewhere.

In the following, I’m going to have a look at two DRT-based analyses of extraposed relative(-like) clauses which appear to make essential use of accessibility and could thus be considered arguments in favor of the DRT perspective. In particular, Wittenburg (1987) defines accessibility in terms of c-command, and (a reconstruction of) Gärtner (2001) has to appeal to "local accessibility." Given that neither c-command nor locality appear to have natural semantic counterparts, these approaches rely on the specific configurational nature of discourse representations.

It will turn out, however, that the approach advocated by Wittenburg (1987) leads to rather problematic consequences when extraposition from NPs other than indefinites is considered. It may therefore have to be discarded. Gärtner (2001) does not run into this kind of problem, other NP-types being excluded as antecedents for the V2-relative(-like) construction dealt with there. Nevertheless, there are reasons for looking at an alternative non-dynamic treatment of the latter phenomenon as well. In sum then, the arguments for the DRT-perspective on dynamic semantics coming from the treatment of extraposed relative(-like) structures are not compelling.

2. **Wittenburg (1987)**

Wittenburg (1987) suggested a DRT-based alternative to syntactic (trace or slash-feature-based) analyses of extraposition whereby extraposed relative clauses (and PPs) establish an anaphoric link to a locally accessible NP-antecedent. However, this treatment makes essential use of the syntactic side of DRS-construction by appealing to a c-command-based notion of accessibility. Thus, roughly, the analysis of an extraposed subject relative in (3) would proceed as in (4).
(3) a. A man walked in who whistled
   b. \([S [S A\text{ man walked in }][R \text{ who whistled }]]\)

(4) a. \(\langle \rangle, \{[S [S A\text{ man walked in }][R \text{ who whistled }]]\}\)
   b. \(\langle x \rangle, \{\text{man}(x), [S [S x \text{ walked in }][R \text{ who whistled }]]\}\)
   c. \(\langle x, y \rangle, \{\text{man}(x), [S [S x \text{ walked in }][R y \text{ whistled }]]\}\)
   d. \(\langle x, y \rangle, \{\text{man}(x), [S [S x \text{ walked in }][R y \text{ whistled }], y=x]\}\)

Crucially, creating the anaphoric link at transition (4c)/(4d) relies on the assumption that \(x\) must be "structurally accessible" from \(y\), accessibility corresponding to Tanya Reinhart's classical definition of c-command.

(5) Node A c(ontituent)-commands node B iff the branching node \(\alpha_1\) most immediately dominating A either dominates B or is immediately dominated by a node \(\alpha_2\) which dominates B, and \(\alpha_2\) is of the same category as \(\alpha_1\) (Wittenburg 1987:436).

This presupposes that DRSs retain tree-structure like objects, which in fact they do in the characterization of "irreducible conditions" by Kamp & Reyle (1993:64). There, formula (6a) is considered an abbreviation of (6b).

(6) a. \(x\text{ owns }y\)
   b. \([S [\text{ VP } [\text{ VP } [v\text{ owns }y] ]]]\)

Similarly, (7) would be an "abbreviation" of (4d).

(7) \(\langle x, y \rangle, \{\text{man}(x), \text{walked_in}(x), \text{whistled}(y), y=x\}\)

(7) explicitly indicates that the complex condition arising from the top S-node has to be given a conjunctive interpretation, where the two conjuncts correspond to the two sentential constituents, i.e. (lower) S and R. In fact, one could give (7) a more direct counterpart DRS by allowing another reduction step immediately after the relative pronoun in (4) has been converted into a variable, (4c), and identified with a syntactically accessible referent, (4d). This additional structure is given in (8).

(8) \(\langle x, y \rangle, \{\text{man}(x), [S x \text{ walked in }], [R y \text{ whistled }], y=x\}\)

Wittenburg (1987) argues that appeal to c-command instead of standard accessibility is necessary for ruling out (9).

(9) * A man's car broke down who whistled

Thus, the transition from (10a) to (10b) is illegitimate in Wittenburg's system, given lack of c-command between \(x\) and \(z\).
(10) a. \langle \langle x,y,z \rangle, \{ \text{man}(x), \text{car_of}(y,x), [s [s y broke down ] [r z whistled ] ] ] \rangle
   b. \langle \langle x,y,z \rangle, \{ \text{man}(x), \text{car_of}(y,x), [s [s y broke down ] [r z whistled ] ], z=x \] \rangle

However, things are getting more complicated for cases of extraposition from other NP-types. Consider the universally quantified NP in (11).

(11) a. Every man walked in who whistled
   b. \[s [s Every man walked in ] [r who whistled ] ]

According to Wittenburg (1987:434) the innermost S-constituent must be reduced first. Applying standard box-splitting, we (would seem to) arrive at (12).

(12) \langle \langle \rangle, \{ \langle x \rangle, \{ \text{man}(x) \} \Rightarrow \langle \rangle, \{ \{ s x walked in \} \} [s who whistled ] ] \rangle

In this hybrid representation one would have to ignore intervening material and just look at the "syntactic" bracketing in order to preserve c-command-based accessibility between x and the relative pronoun. Even then, however, this would not lead to a semantically adequate result, since, as shown in (13), the structure would contain an unbound instance of x and an inadequate scope for y.

(13) \langle \langle y \rangle, \{ \langle x \rangle, \{ \text{man}(x) \} \Rightarrow \langle \rangle, \{ \{ s x walked in \} \} [s y whistled ] ], y=x \rangle

As before, the interpretation may be more easily read off the resulting DRS if one allows some structural adjustments after the relative pronoun has been dealt with. This is given in (14).

(14) \langle \langle y \rangle, \{ \langle x \rangle, \{ \text{man}(x) \} \Rightarrow \langle \rangle, \{ \{ s x walked in \} \}, [a y whistled ], y=x \} \rangle

As a partial repair for (13), one could alternatively treat the complex S-node of (11b) as input for box-splitting, transfer the relative clause into the consequent DRS, and apply further reduction there, as shown in (15).

(15) a. \langle \langle \rangle, \{ \langle x \rangle, \{ \text{man}(x) \} \Rightarrow \langle \rangle, \{ \{ s x walked in \} [r who whistled ] ] ] \rangle
   b. \langle \langle \rangle, \{ \langle x \rangle, \{ \text{man}(x) \} \Rightarrow \langle y \rangle, \{ \{ s x walked in \} [r y whistled ] ], y=x \} \rangle
   c. \langle \langle \rangle, \{ \langle x \rangle, \{ \text{man}(x) \} \Rightarrow \langle y \rangle, \{ \{ s x walked in \}, [r y whistled ], y=x \} \rangle \rangle

Here, c-command between x and the relative pronoun can be computed within a standard syntactic tree structure. Yet, even (15c) provides the wrong truth conditions for (11a). However, it is unclear how to syntactically associate the relative clause with the antecedent DRS in order to arrive at the semantically adequate structure in (16).

(16) \langle \langle \rangle, \{ \langle x,y \rangle, \{ \text{man}(x), [r y whistled ], y=x \} \Rightarrow \langle \rangle, \{ \{ s x walked in \} \} \rangle \rangle

Curiously, the antecedent DRS in question, \{\langle x \rangle, \{ \text{man}(x) \} \}, closely corresponds to the NP every man. It seems that the proper syntactic way of bringing about the desired
association would require the relative clause to be a subconstituent of that NP. Reconstructing subconstituency, however, presupposes the kind of trace or slash-feature mechanism that Wittenburg (1987) set out to dismantle. It is thus questionable whether such an approach constitutes any real advance over more syntacticized alternatives. Therefore, even if the problem with (11) can somehow be fixed, this system hardly constitutes any solid argument in favor of the essentially configurational accessibility-based DRT perspective on dynamic semantics.


Although in need of some DRS-syntax as well, the approach to German relative-like V2 clauses (RV2) by Gärtner (2001) is quite different. Most importantly, RV2 shows close affinity to cross-sentential anaphora in obeying conditions (17a)-(17c).

(17)  
a. RV2 must be extraposed  
b. The pronoun in RV2 is not a relative pronoun but a weak demonstrative  
c. RV2 can only modify wide scope indefinites

(17c) in particular invites appeal to standard DRT accessibility. Thus, the paratactic analysis of RV2 postulated in Gärtner (2001) proceeds as follows.

(18) Es kam ein Mann herein, /\pff\r

There came a man in who whistled

"A man came in who whistled"

(19)  
a. \{CP1 Es kam ein Mann herein | \pi^o | CP2 der pff \}

b. \{CP1 Es kam ein Mann herein | \pi^o | CP2 der pff \}

c. \{x, \{ \pi^e | CP1 x kam herein | \pi^o | CP2 y pff \}, y=x \}

d. \{x, \{ Mann(x), \pi^e | CP1 x kam herein | \pi^o | CP2 y pff \}, y=x \}

e. \{x, \{ Mann(x), \pi^e | CP1 x kam herein | \pi^o | CP2 y pff \}, y=x \}

The left-to-right processing of CP1 before CP2 is a consequence of the standard top-down procedure from Kamp & Reyle (1993), given the asymmetric structure of \pi^P.

As it stands, however, this analysis is unable to predict that the antecedent of the d-pronoun has to be inside CP1. Thus, anaphorically picking up a previously introduced referent, as shown in (20), is strongly unacceptable.

(20)  
a. Maria kam herein

Maria came in

"Maria came in"

b. * Am Fenster stand eine Frau die pfiff

at the window stood a woman who whistled

"At the window was standing a woman who whistled"
Thus, the analysis is in need of some notion of locality. Sells (1985:5) pointed out a similar desideratum for his DRT approach to appositive relatives, i.e. that "we would want to place a requirement on the relative pronoun which that it always find an antecedent" and that "this process must clearly recognise root S nodes" (1985:26). Recall, that Wittenburg (1987) sought to achieve locality by appealing to c-command. That strategy won't work here, however, since the indefinite antecedent to the d-pronoun does not have to be the most prominent NP syntactically. Instead I suggest a solution based on the idea of temporarily adding some intermediate structure. Thus imagine that \pi P is processed in the context of an earlier sentence, CP0, and assume we have created DRS K0. Then we could proceed as follows. [ Con refers to the set of DRS conditions, U to the set of discourse referents.]

(21)  
| a. Add the "temporary" DRS \( \diamond K_\pi \) to Con_{K0}.  
| b. Enter \( \pi P \) into Con_{K_\pi}.  
| c. Process CP1 such that \( U_{K_\pi} \) is the widest possible scope for new discourse referents  
| d. Process Spec.CP2 such that d-pro enters its variable into \( U_{K_\pi} \) and is anaphorically linked to an "l-accessible" discourse referent.  
| e. Merge \( U_{K_\pi} \) and \( U_{K_0} \) as well as \( Con_{K_\pi} \) and \( Con_{K_0} \), and call the result K1. 

(22) \textit{L-(ocal) accessibility}  
A discourse referent \( x \) is \textit{(locally)-accessible} from a DRS condition \( \gamma \) iff there is a DRS K such that \( x \in U_K \) and \( \gamma \in Con_K \).

Let us have a look at how this works for the properly indexed counterpart of (20), (23).

(23) Maria\(^1\) kam herein. Am Fenster stand eine\(^2\) Frau, die\(^2\) pfiff.

The derivation is given in (24) below. Notice in particular transition (24e)/(24f) where an l-accessible discourse referent is identified with the one introduced by \textit{die}. Identification with the one introduced by \textit{Maria} is prevented because that would violate locality. Thus, (20) is ruled out as desired. Transition (24f)/(24g) constitutes the merger step eliminating the temporary DRS.

(24)  
| a. \( \langle \langle \rangle, \{ \langle \text{CP}_0 \text{ Maria kam herein } \rangle \} \rangle \)  
| b. \( \langle \langle x \rangle, \{ \langle \text{Maria}(x), \text{CP}_0 x \text{ kam herein } \rangle \} \rangle \)  
| c. \( \langle \langle x \rangle, \{ \langle \text{Maria}(x), \text{CP}_0 x \text{ kam herein } \rangle \} \rangle \)
| \( \diamond \langle \langle \rangle, \{ \langle \text{CP}_1 \text{ am Fenster stand eine Frau } \rangle \text{ CP}_2 \text{ die pfiff } \} \rangle \rangle \)  
| d. \( \langle \langle y \rangle, \{ \langle \text{Frau}(y), \text{CP}_0 x \text{ kam herein } \rangle \} \rangle \)
| \( \diamond \langle \langle y \rangle, \{ \langle \text{Frau}(y), \text{CP}_1 \text{ am Fenster stand y } \rangle \text{ CP}_2 \text{ die pfiff } \} \rangle \rangle \)  
| e. \( \langle \langle x \rangle, \{ \langle \text{Maria}(x), \text{CP}_0 x \text{ kam herein } \rangle \} \rangle \)
| \( \diamond \langle \langle y, z \rangle, \{ \langle \text{Frau}(y), \text{CP}_1 \text{ am Fenster stand y } \rangle \text{ CP}_2 \text{ z pfiff } \} \rangle \rangle \)  
| f. \( \langle \langle x \rangle, \{ \langle \text{Maria}(x), \text{CP}_0 x \text{ kam herein } \rangle, \langle \langle y, z \rangle, \{ \langle \text{Frau}(y), \text{CP}_1 \text{ am Fenster stand y } \rangle \text{ CP}_2 \text{ z pfiff } \} \rangle \rangle \rangle \rangle \)
Note that (20) might alternatively be ruled out by appealing to the "right-frontier constraint" from SDRT, (25).

(25) Right-frontier constraint (RFC) (simplified and informal)

The antecedent of a pronoun in the current utterance must be introduced by the previous utterance or one that dominates it in the discourse structure (cf. Asher and Lascarides 2003:147)

However, although this works for (20), it would fail on a rhetorically different example such as (26). The rhetorical relations are given in (27)/(28) respectively.

(26) a. Eine\(^1\) Tasse fiel um
   A cup fell over
   "A cup toppled over"

b. * Hans\(^2\) hat eine\(^3\) Bewegung gemacht die\(^1\) war ungeschickt
   Hans has a movement made which was clumsy
   "Hans had made a clumsy gesture"

[(20a)/(26a) = \(\kappa_1\), CP1 of (20b)/(26b) = \(\kappa_2\), and CP2 of (20b)/(26b) = \(\kappa_3\), pu = "previous utterance," du = "dominating utterance"]

(27) a. narration(\(\kappa_1, \kappa_2\)) & elaboration(\(\kappa_2, \kappa_3\))

b. \(\kappa_1\) --- \(\kappa_2\)
   |                   
   \(\kappa_3\)

c. pu(\(\kappa_3\)) = \(\kappa_2\); du(\(\kappa_3\)) = \[ \(\kappa_2\)\]

(28) a. explanation(\(\kappa_1, \kappa_2\)) & elaboration(\(\kappa_2, \kappa_3\))

b. \(\kappa_1\)
   |                   
   \(\kappa_2\)
   |                   
   \(\kappa_3\)

c. pu(\(\kappa_3\)) = \(\kappa_2\); du(\(\kappa_3\)) = \[ \(\kappa_1, \kappa_2\)\]

Thus, to the extent that this approach to RV2 can be upheld, we seem to have a genuine argument in favor of a configurational accessibility relation as postulated by DRT.

Interestingly, this DRT-based approach to RV2, as well as Wittenburg's analysis of (3a), immediately predicts the absence of "maximality effects." Thus, while
appositives, (29b), and standard cases of cross-sentential anaphora, (29c), trigger the Horn-scale implicature in (30), RV2, i.e. (29a), doesn't. [(/) and (\) between the clauses signal non-final and final intonational boundary marking, respectively.]

(29) a. Das Blatt hat eine Seite (/), die ist ganz schwarz
   "The sheet has a side that is entirely black"
   the sheet has a side that is entirely black

b. # Das Blatt hat eine Seite (\), die ganz schwarz sind.
   # Die Blatt hat eine Seite (\). Die ist ganz schwarz.

(30) The sheet of paper has no more than one side

   This makes (29b)/(29c) pragmatically odd, except for speakers who easily accommodate the possibility of the sheet being a Moebius strip.
   As pointed out by Sells (1985:20), who advocates a DRT approach to appositives like (29b), maximality is not what you get from standard DRT updates but has to be imposed by an extra condition. In the context of this paper it is particularly interesting to look at a closely related version of such a condition suggested in Kadmon (2001).

(31) The Uniqueness Condition (Kadmon 2001:88)
   A definite NP associated with a variable X which was introduced in the universe of a DRS K is used felicitously only if for every model M, for all embedding functions f, g for K which verify all the conditions in K relative to M, f(X) = g(X)

   For (29b)/(29c) this would work as follows. (32) gives the DRS of the first sentence, i.e. the DRS into which the variable associated with the definite pronoun die was introduced. (33) provides the truth conditions for that DRS.

(32) \langle \{x,y\}, \{\text{sheet}(x), \text{side}(y), \text{possess}(x,y)\} \rangle

(33) (32) is true wrt M and g iff there is an h s.t.
   (i) h[x,y]g and
   (ii) h(x) ∈ I_M(sheet) and
   (iii) h(y) ∈ I_M(side) and
   (iv) \langle h(x), h(y) \rangle ∈ I_M(possess)

   Applying the Uniqueness Condition to die on updating (32) with the second sentence of (29a)/(29c) amounts to strengthening the conditions on the DRS (32) such that for every k ≠ h fulfilling conditions (i)-(iv), k(y) = h(y). This is only possible if the sheet of paper has no more than a single side.

   In order to avoid the maximality effect in (29a) one may assume that (31) does not apply to temporary DRSs, i.e. it applies only after all DRSs of type \text{\bullet}K have been removed. This is in line with the intuition discussed more extensively in Gärtner (2001) that \pi P in RV2 constitutes a single information unit, i.e. a single focus-background
partition. In addition one may have to assume that instead of the standard identification mechanism for variables in terms of equality one has to assume a construction-specific copying mechanism in the case of RV2 (cf. Gärtner 2001:118f). The updated DRS to which (31) could then apply would look like (34), which doesn't yield implicature (30).

\[(34) \langle \{x,y\}, \{\text{sheet}(x), \text{side}(y), \text{possess}(x,y), \text{black}(y) \} \rangle \]

Again, we have made appeal to a configurational property of DRSs, namely, suspending computation of maximality in the presence of ♦K. This is required for making the right predictions for RV2 (29a).

Let me finish this paper by pointing out another potential problem for the DRT approach to RV2 having to do with the proper analysis of plural antecedents. (36) sketches the analysis of (35) in terms of Kamp & Reyle's (1993) plural referents, where updating by RV2 risks attachment at the wrong place.

(35) a. Die Hexe besitzt drei Schafe (/), die sind schwarz.
   "The witch owns three sheep that are black"

b. \[[\lambda P \text{CP1 Die Hexe besitzt drei Schafe }] \text{π° }[\text{CP2 die sind schwarz } ]]\]

(36) \[\langle \{\eta\}, \{\eta = \sum v:\{v, \{\text{sheep}(v), \text{own}((\text{witch}), v) \} \}, |\eta| = 3, \text{black}(\eta) \} \rangle \]

Unless one can find a principled use of distributive predication for sum individuals, one may have to return to a more classical analysis of RV2 after all. Thus one could implement the approach to relative modifiers replacing an open property variable from Bach & Cooper (1978) (cf. Janssen 1982) in compositional CDRT (Muskens 1996). The necessary steps are provided in (37).

(37) a. drei Schafe \(\lambda P(\langle \{\eta\}, \{\eta = \sum v:\{v, \{\text{sheep}(v), P(v), P'(v) \} \}, |\eta| = 3 \} \rangle)\)

b. die \(\lambda P''(\lambda v'(P''(v')))\)

c. \(\lambda P'(\langle \{\eta\}, \{\eta = \sum v:\{v, \{\text{sheep}(v), \text{own}((\text{witch}), v), P'(v) \} \}, |\eta| = 3 \} \rangle)\)

d. \(\lambda v'(\langle \{\text{black}(v) \} \rangle)\)

e. \(\langle \{\eta\}, \{\eta = \sum v:\{v, \{\text{sheep}(v), \text{own}((\text{witch}), v), \text{black}(v) \} \}, |\eta| = 3 \} \rangle\)

\(\text{π°}\) operates on the pair CP1 and CP2 such that first the open property variable in CP1, \(P'\), gets abstracted over, (37c), and secondly the concatenation of CP1 and CP2 is interpreted as function application rather than "sequencing," the latter done locally inside the sum object. Of course, the applicability of this procedure has to be restricted to cases where the open property is linked to a description with an accessible discourse referent, such as \(\eta\) in (35)/(36). Otherwise we lose generalization (17c), i.e. the restriction of RV2 to wide scope indefinites as antecedents. This would result in massive overgeneration.

To summarize, the DRT approach to RV2 necessitates appeal to a purely configurational property of DRSs, i.e. "local accessibility" defined in terms of immediate containment. To the extent that this approach is on the right track it provides
independent evidence for the DRT perspective on dynamic semantics which appeals to an intermediate syntactic level of DRSs. We have seen, however, that this approach may run into problems in the area of plural indefinites, and that a non-dynamic alternative analysis may be built on the basis of the open-property-variable-approach to modification originally suggested by Bach & Cooper (1978). If such a strategy is viable the argument in favor of a genuine DRS level is less than compelling even in the case of the German RV2 construction.

**Bibliography**


