Hebrew Relative Clauses in HPSG

Nathan Vaillette
Ohio State University and Universität Tübingen

1 Introduction

Some relative clauses (RCs) in Modern Hebrew resemble English *that*-relatives with gaps, e.g. (1a). However, in certain situations, a *resumptive pronoun* (RP) is possible, as in (1b):

(1) (a) *ha-yeled še raʔiti*
the-boy that saw-1.SG
the boy that I saw

(b) *ha-yeled*$_i$ *še raʔiti* <u>*ʔoto*$_i$</u>
the-boy$_i$ that saw-1.SG <u>him$_i$</u>
the boy that I saw

The form taken by the correct analysis of Hebrew RCs depends on the answer to the question: How alike are resumptives and gaps?

Some previous researchers have posited mechanisms for the analysis of RPs distinct from those used to generate gaps. In their GB analyses, (Borer 1984b) and (Sells 1984) both analyze gaps as arising from movement, whereas RPs are treated as just normal pronouns, which special constraints force to be bound by an null operator in the COMP position of the RC. This pronominal coindexing provides the connection between the top of the RC construction and the RP. I will refer to this as the *operator binding approach*. We could mimic the essentials of this approach in HPSG as in (2) by using existential quantification to require that a RC contain a pronoun which is interpreted as the variable abstracted over (this is the meaning of the REL-IND feature; see section 4.1).[1]

(2) HPSG version of the operator binding approach:

$$\boxed{1}\begin{bmatrix} \textit{rel-cl} \\ \text{REL-IND } \boxed{i} \end{bmatrix} \longrightarrow \exists\, \boxed{2} \left(\begin{array}{c} \boxed{2}\,[\ \text{INDEX } \boxed{i}\ ] \\ \wedge\ \textit{dominates}(\boxed{1},\boxed{2}) \\ \wedge\ \textit{pronoun}(\boxed{2}) \end{array} \right)$$

This paper will however argue for an analysis that treats gaps and resumptives as arising from different varieties of a single mechanism. The analysis will follow (Doron 1982) (which uses a Cooper-storage mechanism) in allowing Hebrew RPs to enter into the same kind of chains as gaps.

[1](Richter, Sailer, and Penn 1999) provides a logical formalism for HPSG including quantification and relations into which the informal syntax used here can be translated.

This will be represented in HPSG using non-local propagation of a special RESUMPTIVE feature.[2] Since RPs are treated as involving an unbounded dependency construction, I will refer to this as the *UDC approach*. Sections 2 and 3 will discuss evidence for and against the UDC approach. Section 4 will then use this approach to analyze a variety of Hebrew RC constructions.[3]

2 Advantages of the UDC approach

2.1 Parasitic gaps

One argument for a UDC treatment of RPs in Swedish made in (Maling and Zaenen 1982) can be applied to Hebrew as well. Example (3a) shows the existence of a parasitic gap (PG) construction in Hebrew: the first gap relies on the second, which can't be grammatically replaced by another NP as in (3b). The RP *ʔota* however can fill the second gap position, licensing the PG just like a gap.[4]

(3) (a) *rina hi ha-ʔiša*$_i$ *še ha-anašim še ani šixnati levaker* ___$_i$
Rina is the-woman$_i$ that the-people that I convinced to-visit ___$_i$
teʔaru ___$_i$/<u>*ʔota*</u>$_i$
described ___$_i$/<u>her</u>$_i$
Rina is the woman that the people that I convinced to visit described.

(b) *... *teʔaru ʔet ha-bayit*
... described ACC the-house (Sells 1984 p. 40f.)

This is a clear point of similarity between gaps and RPs. Furthermore, the treatment of PGs in HPSG found in (Pollard and Sag 1994) requires examining the two branches at the highest level of the PG construction and allowing one to contain a gap only if the other does. This is straightforward to state if the nodes in questions are marked at their top level as containing an extracted element. The propagation of SLASH achieves this automatically, and RESUMPTIVE propagation can in exactly the same way, allowing a unified expression of a Subject Constraint for Hebrew as in (4). Simply using operator binding does not give us this local marking, so the two licensing conditions would have to be expressed in very different ways, which would seem to obscure a commonality.

(4) Subject Condition for Hebrew:
The constituent corresponding to the SUBJ-value of a substantive head can only have a non-empty SLASH-value if the constituent corresponding to some element of that head's COMPS-list has a non-empty F-value, for $F \in \{\text{SLASH}, \text{RESUMPTIVE}\}$.

[2]Other precedents for the use of non-local feature propagation in the analysis of RPs in GPSG and HPSG include (Maling and Zaenen 1982) for Swedish and (Moosally 1994) for Arabic. Chapter 5 of (Sells 1984) uses a "mixed approach" involving non-local features for RPs in Hebrew, Irish, Swedish, and Welsh; see footnote 8.

[3]Hebrew free relative clauses will not be dealt with in this paper. See (Borer 1984a pp. 72–78) and (Borer 1984b pp. 237–240) for some discussion.

[4]I have changed the transcriptions of some the examples cited in the interest of consitency.

2.2 Coordination

Coordination facts similarly favor a treatment of RPs like non-local feature propagation that provides local marking on intervening nodes. This argument is made in (Maling and Zaenen 1982) as well based on similar Swedish data. We will focus on the simple case of two conjuncts.

In Hebrew, a gap in a conjunct is allowed only when there is an gap in the other conjunct, *or* a RP as in (5).[5] As with PG licensing, this is easy to capture if each conjunct is locally marked as containing a RP (with a certain index) or not, just as SLASH would mark it as having something with a certain LOCAL-value extracted out of it.[6]

(5)

kol	*profesor*$_i$	*še*	*dani*	*roce*	*lehazmin*	____$_i$	*aval*	*lo*	*maarix*	*ʔoto*$_i$	*maspik*
every	professor$_i$	that	Dani	wants	to-invite	____$_i$	but	not	esteems	him$_i$	enough

every professor that Dani wants to invite but doesn't respect enough (Sells 1984 p. 78)

(6) ATB-Extraction Principle for Hebrew:
For a conjunction $[C_1 \dots C_n]$, for any i s.t. $1 \leq i \leq n$, C_i can have a non-empty SLASH-value only if for every j s.t. $1 \leq j \leq n$ and $i \neq j$, C_j has a non-empty F-value for $F \in \{\text{SLASH}, \text{RESUMPTIVE}\}$.

In fact, even in the GB treatment of Hebrew PGs and coordination in chapters 1–4 of (Sells 1984), which doesn't use feature propagation for gaps, recourse is made to a mechanism based on the g-projections of (Kayne 1981) to mark the path from the RP or gap up to its antecedent and mediate PG licensing and extraction from a conjunct. This uses three mechanisms (operator binding of pronouns, movement, and g-projections) to accomplish what non-local feature propagation can handle alone.

2.3 Crossover

Crossover in Hebrew offers another argument for the UDC approach. Consider the familiar strong crossover contrast in English. A pronoun below the retrieval site of a gap dependency cannot bind the gap:

(7) (a) the guy that I informed ____$_i$ that the teacher would flunk him$_i$
(b) *the guy that I informed him$_i$ that the teacher would flunk ____$_i$

Hebrew gaps obey a similar constraint, as (8a) demonstrates. However, when the gap is replaced by a pronoun, the sentence becomes unobjectionable, as in (8b):

(8) (a)

**ha-baxur*$_i$	*še*	*yidaʕti*	*ʔoto*$_i$	*še*	*ha-more*	*yaxšil*	____$_i$
the-guy$_i$	that	informed-1.SG.	him$_i$	that	the-teacher	will-flunk	____$_i$

[5]On the other hand, one may have a RP in one conjunct with no licenser of any kind in the other. I take this to fall under the general insensitivity of RPs to islands discussed in section 3.1.

[6]Sells notes that the conjunct containing the licensing RP is required to be to the right of the one containing the gap, a restriction I do not discuss further here.

(b) *ha-baxur$_i$ še yidaʕti ʔoto$_i$ še ha-more yaxšil ʔoto$_i$*
the-guy$_i$ that informed-1.SG. him$_i$ that the-teacher will-flunk him$_i$
the guy that I informed that the teacher would flunk him (Shlonsky 1992 p. 460)

Prima facie, this suggests that RPs are not subject to the crossover constraint which governs gaps. However, as (McCloskey 1990) noted in the context of a similar construction in Irish, for (8b) to counter-exemplify a crossover generalization on Hebrew RPs, it's necessary to conceive of the *second* pronoun as the RP and the first one as binding it. However, there's no reason the *first* pronoun can't be thought of as the RP, and the second as simply pronominally bound by the first. In other words, there's no reason to see (8b) as analogous to the bad (7b), rather than the good English (7a).

To show the applicability of crossover to Hebrew RPs, one can replace the upper pronoun by an epithet. (9) creates a strong crossover configuration.

(9) **ha-baxur$_i$ še yidaʕti ha-ʔidiot$_i$ še ha-more yaxšil ____$_i$/ʔoto$_i$*
the-guy$_i$ that informed-1.SG. the-idiot$_i$ that the-teacher will-flunk ____$_i$/*him$_i$*
the guy$_i$ that I informed the idiot$_i$ that the teacher will flunk ____$_i$/him$_i$ (Shlonsky 1992 p. 460ff.)

Epithets remove the ambiguity inherent in examples (8) and guarantee that the pronouns in the deepest clause indeed foot the chains, since epithets cannot, as shown by the unacceptability of examples such as (10) where the epithet is the only element in the relative coindexed with the head noun.

(10) **ha-baxur$_i$ še yidaʕti ʔet ha-ʔidiot$_i$.*
the-guy$_i$ that informed-1.SG. ACC the-idiot$_i$.
the guy that I informed the idiot (Shlonsky 1992 p. 460)

This argument was made originally for Irish in (McCloskey 1990) and is extended to Hebrew in (Shlonsky 1992). Shlonsky however fails to control for the possibility that the problem with (9) is due simply to the presence of the epithet and has nothing at all to do with the RP or gap. For example, perhaps qua R-expression, the epithet cannot be coindexed with the RP.[7] Example (11) is meant to provide the control for Hebrew, though it should be noted that speakers do not find this sentence impeccable.

(11) *? baxura$_i$ še kol ha-zman hizharti ʔet ha-abla$_i$ ha-zot lo lagaat*
girl$_i$ that all the-time warned-1.SG. ACC the-fool$_i$ this not touch
ba-maxshev šeli ve ba-sof hi$_i$ harsa li ʔet ha-kol.
my-computer and finally she$_i$ destroyed me ACC everything
the girl$_i$ who I repeatedly warned the fool$_i$ not to touch my computer and then finally she$_i$ went and destroyed everything on me

[7]McCloskey does control for this implicitly in Irish, since in that language, an example analogous (9) but with "the idiot" replace by "the parents of the idiot" is grammatical (i.e. RPs in Irish don't obey *weak* crossover). The Hebrew equivalent is ungrammatical.

Given that crossover does apply to Hebrew RPs, then the explanation for the grammaticality of (8b), that only the higher pronoun is resumptive, presupposes a mechanism that encodes which pronoun is the foot of the chain. RESUMPTIVE propagation can clearly achieve this, but operator binding doesn't: since coindexation is transitive, any pronoun within the RC coindexed with the RP will be bound by the null operator and thus be resumptive itself.

Now, one could accept the force of this argument, but perhaps still contend that the identity of the foot need not be directly encoded in the representation—the RP could be located by seeing which of the pronouns in the binding domain coindexed with the operator is structurally higher ((McCloskey 1990) appears to presuppose such a definition). But then the crossover condition on RPs becomes tautological ("the highest coindexed pronoun must be the highest coindexed pronoun"), and the parallelism between the application of this condition to gaps (where it is non-trivial) and RPs falls apart.

Now, although the simple use of operator binding to analyze RPs runs afoul of the crossover data, it is still possible to extend this theory to differentiate RPs from other coindexed non-resumptive pronouns. We need only introduce a special boolean feature ISA-RESUMP and require that a RC contain at least one of these:

(12) Possible extension of the operator binding approach:

$$\boxed{1}\begin{bmatrix} \textit{rel-cl} \\ \text{REL-INDEX } \boxed{i} \end{bmatrix} \longrightarrow \exists\, \boxed{2} \left(\begin{array}{c} \boxed{2}\begin{bmatrix} \text{ISA-RESUMP } + \\ \text{INDEX } \boxed{i} \end{bmatrix} \\ \wedge\ \textit{dominates}(\boxed{1},\boxed{2}) \\ \wedge\ \textit{pronoun}(\boxed{2}) \end{array} \right)$$

Then if the crossover constraint is specified to apply to only traces (of R-expressions) and IMA-RESUMP+ pronouns, the distinction between (8b) and (9) can be caputured. However, this approach still has no explanation for the PG and coordination facts, whereas the UDC approach captures these along with the crossover facts using a single mechanism.[8,9]

3 Objections to the UDC approach

A number of criticisms of a UDC approach to RPs are presented in chapter 5 of (Sells 1984) which will be examined in this section. We will discuss some data from languages besides Hebrew. Although I am skeptical about the degree to which such evidence can be brought to bear meaningfully

[8] It may be possible to get the best of both worlds in the way suggested in (Sells 1984) ch.5: use non-local feature propagation to license PGs and ATB extraction, but then allow the dependency to "dry up" somewhere before it reaches the RP, at which point an operator binding mechanism could take over. If this idea is augmented with the ISA-RESUMP feature for the crossover data, it may be possible to capture all three sets of facts while simultaneously predicting the island insenstivity discussed in section 3.1, since the dependency can dry up outside the island. However, I will not explore this mixed approach further here.

[9] Notice that any approach that distinguishes RPs from other coindexed pronouns allows a spurious ambiguity in coordinations in which each conjuct contains a coindexed pronoun. Since there is no ATB constraint on RPs, either or both of the pronouns could be the RP. It may therefore be desirable to somehow constrain both/all pronouns in such a configuration to actually be RPs.

on Hebrew, many of Sells' objections are of a cross-linguistic nature, and therefore it is appropriate to evalutate them in the light of cross-linguistic evidence.

3.1 Island constraints

The strongest objection against the UDC approach has to do with island constraints. Whereas gaps in Hebrew are sensitive to certain islands, RPs are exempt from them. (13) illustrates this with an NP-island.

(13)	*ha-yeled*$_i$	*še*	*dalya*	*makira*	*ʔet*	*ha-ʔiša*	*še*	*ʔohevet*	*ʔoto*$_i$ / *____$_i$
	the-boy$_i$	that	Dalya	knows	ACC	the-woman	that	loves	him$_i$ / *____$_i$

the boy that Dalya knows the woman who loves him (Borer 1984b p. 221)

The operator binding analysis of RPs automatically predicts this asymmetry, since islands do not constrain pronominal binding. The UDC approach can obviously represent it by simply stating any island constraints so as to apply to SLASH but not RESUMPTIVE. For example, we could state an NP-island constraint as in (14a) but no constraint like (14b):

(14) (a) NP-island constraint on gaps: $\text{NP} \longrightarrow \left[\text{SLASH}\ \{\}\right]$ (b) Non-existent constraint on resumptives: $\text{NP} \longrightarrow \left[\text{RESUMPTIVE}\ \{\}\right]$

Clearly, this does not explain the difference, since one could just as easily state the constraints the other way around so that RESUMPTIVE would be *more* constrained than SLASH. However, this is arguably not a shortcoming of the analysis. First of all, there are languages that, like Hebrew, make productive use of RPs, but in which they *are* sensitive to island constraints. Examples are Igbo (Goldsmith 1981) and Palauan (Georgopoulos 1991).[10] This suggests that the facts may differ between languages and thus must be stipulated for any given language anyway.

Secondly, the general trend across languages for RPs to have a freer distribution may be due in the long run to the fact that they are simply actually present and pronounced. For instance, (Dickey 1996) suggests as psychological processing explanation for the freeness of RPs' distribution as compared to gaps. Note that I am *not* suggesting that a psychological explanation is likely for the *particular* details of the distributions of RPs and gaps in any language (such facts for Hebrew are dealt with in the grammar fragment I present). I am only claiming that such an explanation may exist for why there tends to be an asymmetry.

3.2 Binding domain effects

Several languages exhibit some kind of *binding domain effects* or *wh-agreement* that overtly mark the path from the foot of a UDC to its top. Irish is an example: in gap constructions, all subordinating conjunctions between the gap and the retrieval site take a special form. On the other hand, RPs in Irish don't trigger such agreement (McCloskey 1979). Sells notes that this is automatically

[10] Goldsmith illustrates the sensitivity of Igbo RPs to NP and wh-islands, and Georgopoulos shows that Palauan RPs obey the same restriction as gaps banning "extraction" out of adjuncts.

explained on a non-UDC approach if complementizer agreement is seen as morphological manifestation that the associated sentence has a non-empty SLASH-value, while RPs contribute no similar non-local feature to be manifested.[11]

However, this asymmetry is not a cross-linguistic invariant. As described in (Georgopoulos 1991), the wh-agreement on verbs in Palauan is triggered in exactly the same way by RPs and gaps. A resumptive example is given in (15). This in itself constitutes strong evidence that at least in that language, RPs should be associated with a UDC mechanism that marks the intervening nodes in a RP construction. Furthermore, the fact that the asymmetry in Irish would have to be stipulated under the UDC approach isn't problematic, since in light of Palauan, this does seem to be just a language-specific fact.

(15)

ng-ngera$_i$	*a*	*'om-dilu*	*el*	*longiil*	*er*	*ngak*	*el*
what$_i$	A	said-2.SG.(WH-AGR)	that	wait-3.PL.(WH-AGR)	ER	me	that

bo	*keruul*	*er*	<u>*ngii*$_i$</u>*?*
FUT(WH-AGR)	do-(WH-AGR)	ER	<u>it$_i$</u>

What did you say that they're waiting for me to do? (Georgopoulos 1991 p. 93)

3.3 The form of RPs

Sells further argues that the UDC approach doesn't explain why are resumptives are in fact pronouns, instead of e.g. some entirely separate category of dedicated elements.[12]

This objection raises an interesting point, and the UDC approach has no particular explanation for why only pronouns initiate RESUMPTIVE-propagation. However, it is unclear that the operator binding approach does any better. Sells' GPSG implementation of the binding approach uses Cooper storage to propagate pronominal indices. I would argue that it is only by fiat that this is a "semantic" rather than a "syntactic" propagation, and it is thus really just a version of the UDC approach. Furthermore, Sells' analysis is designed to have as a consequence that the only things eligible to be resumptive are those that "(a) show no special morphology, and (b) translate as variables in the logic. This reduces all possibilities to one: regular pronouns ... " (p. 346). However, this characterization does not seem to correctly exclude epithets for Hebrew and Irish. Therefore, I would argue that when the binding approach is boiled down to its essence, stipulating that the foot is a pronoun is unavoidable, as is made explicit in in (2). Therefore, Sells' worries about the form of RPs do not help decide for or against a UDC approach.

In summary, I consider the arguments for the UDC approach strong enough to justify exploring an analysis of Hebrew RCs based on it. The next section takes up this task.

[11] A similar argument could be made for Hebrew, since the inversion effect described in section 4.4 is only triggered by gaps.

[12] In fact, non-pronouns may function resumptively in Hebrew, such as the adverb *šam* 'there' in *ha-xof še saxinu* <u>*šam*</u> 'the-beach that swam-1.PL. <u>there</u>' (Glinert 1989 p. 363). The point stands however that this is the normal form the adverb usually takes, with no special "resumptive morphology."

4 An analysis of Hebrew relative clauses

4.1 HPSG scaffolding

We will use a non-local feature propagation much like that of (Pollard and Sag 1994), with our PASS functioning much like their INHERITED, but with the job of their TO-BIND farmed out to constraints on various phrasal types to be discussed below. Whereas SLASH stores LOCAL-values, to mediate case-matching between foot and filler and similar connectivity restrictions, the only connectivity that RESUMPTIVE percolation will need to ensure concerns semantics and "ϕ-features"; thus RESUMPTIVE will only store indices.[13]

(16) $\textit{non-loc}\colon \begin{bmatrix} \text{PASS} & \textit{non-loc1} \\ \text{RETR(IEVED)} & \textit{non-loc1} \end{bmatrix} \qquad \textit{non-loc1}\colon \begin{bmatrix} \text{SLASH} & \textit{set(local)} \\ \text{RESUMP(TIVE)} & \textit{set(index)} \end{bmatrix}$

Following much recent work, we will use a type hierarchy that divides *phrase* into various subtypes mimicking the ID Schemata of (Pollard and Sag 1994).[14] The type hierarchy will will have an orthogonal classification dimension for non-local properties, which forces every phrasal type to be either a *slash-retr(ieval)-site* or a *slash-pass-site*. All unretrieved slashes will be passed upward in the tree. There will exist a parallel bifurcation between *resump(tive)-retr(ieval)-site* and *resump(tive)-pass-site*, with parallel constraints. Below, dtrs_slashes is a function that maps a *sign*-object to the set of SYNSEM NONLOCAL PASS SLASH-values of its daughters. dtrs_resumps gathers PASS RESUMP-values in the same way. The reader can assume that any phrasal type is a subtype of both *slash-pass-site* and *resump-pass-site* unless I explicitly note otherwise.

(17)
$$\boxed{1}\textit{slash-retr-site} \longrightarrow \begin{bmatrix} \text{PASS SLASH } \boxed{3} \\ \text{RETR SLASH } \left\{\boxed{2}\right\} \end{bmatrix} \wedge \mathsf{dtrs\_slashes}(\boxed{1}) = \left\{\boxed{2}\right\} \uplus \boxed{3}$$

$$\boxed{1}\textit{resump-retr-site} \longrightarrow \begin{bmatrix} \text{PASS RESUMP } \boxed{3} \\ \text{RETR RESUMP } \left\{\boxed{2}\right\} \end{bmatrix} \wedge \mathsf{dtrs\_resumps}(\boxed{1}) = \left\{\boxed{2}\right\} \uplus \boxed{3}$$

$$\boxed{1}\textit{slash-pass-site} \longrightarrow \begin{bmatrix} \text{PASS SLASH } \boxed{2} \\ \text{RETR SLASH } \{\} \end{bmatrix} \wedge \mathsf{dtrs\_slashes}(\boxed{1}) = \boxed{2}$$

$$\boxed{1}\textit{resump-pass-site} \longrightarrow \begin{bmatrix} \text{PASS RESUMP } \boxed{2} \\ \text{RETR RESUMP } \{\} \end{bmatrix} \wedge \mathsf{dtrs\_resumps}(\boxed{1}) = \boxed{2}$$

We will, following (Sag 1997), assign RCs to their own clausal type *rel(ative)-cl(ause)*, each subtype of which will be a kind of *phrase*. *rel-cl* itself will be a subtype of *emb(edded)-cl(ause)*, which includes other embedded clause types like *subord(inate)-cl(ause)*. Since the semantic purpose of a (restrictive) RC is to provide a property to restrict the noun modified, we will need a way to hook onto which index is the relativization index, i.e. serves as the variable abstracted over in

[13] There are other alternatives for the non-local features used. For instance, Ivan Sag suggests using only the feature SLASH and expressing the difference between gaps and RPs by the type of the SLASH-value, e.g. dividing *synsem* into *canonical-synsem*, *gap-synsem*, and *resump-synsem*. This allows certain disjunctive constraints to be expressed more succinctly, such as (23).

[14] The type hierarchy used is given at the end of section 4.5.

both the RC content and the noun content. The gap or resumptive in the RC is what provides this information; we will use a feature REL(ATIVIZATION)-IND(EX) to encode it at the top of the RC. Again following Sag, the external syntax and combinatory semantics of the RC can be mediated by a special subtype *h(ea)d-rel(ative)-ph(rase)* of *h(ea)d-adj(unct)-ph(rase)*; this equates the head noun's index with the RC's REL-IND-value and combines the noun's and RC's restrictions to get the CONTENT of the whole NP.

4.2 In situ resumptive pronouns

In Hebrew RCs, all grammatical functions admit the possibility of using the resumptive strategy:

(18) **(Embedded) subject:**

ha-ʔiš$_i$	*še*	*xašavt*	*še*	*hu*$_i$	*melamed*	*ʔanglit*
the-man$_i$	that	thought-2.SG.F.	that	he$_i$	teaches	English

the man that you thought teaches English (Shlonsky 1992 p. 444)

(19) **Direct object:**

ha-yeled$_i$	*še*	*rina*	*ʔohevet*	*ʔoto*$_i$
the-boy$_i$	that	Rina	loves	him$_i$

the boy that Rina loves

(20) **Object of a preposition:**

ha-yeled$_i$	*še*	*rina*	*xašva*	*ʔal-av*$_i$
the-boy$_i$	that	Rina	thought	about-him$_i$

the boy that Rina thought about (Borer 1984b p. 220)

(21) **Genitive:**

ha-ʔiš$_i$	*še*	*raʔiti*	*ʔet*	*ʔišt-o*$_i$
the-man$_i$	that	saw-1.SG	ACC	wife-his$_i$

the man whose wife I saw (Shlonsky 1992 p. 445)

In fact, the only position that cannot be resumed is the highest subject. For the moment, we will ignore this restriction and give an account that overgenerates to allow these RPs. Section 4.5 will discuss how to rule them out.

(22) **Matrix subject:**

**ha-ʔarie*$_i$	*še*	*hu*$_i$	*taraf*	*ʔet*	*ha-yeled*
the-lion$_i$	that	he$_i$	devoured	ACC	the-boy

the lion that devoured the boy (Borer 1984b p. 244)

The complementizer *še* is obligatory in examples (18)–(21), as in embedded clauses in general, with one exception discussed in section (4.3).

To capture these types of RC, we will give *h(ea)d-m(a)rk(er)-ph(rase)* and *rel-cl* a common subtype *h(ea)d-m(a)rk(er)-r(elative)c(lause)*. This will itself have a subtype *in-situ-resump(tive)-r(elative)c(lause)* which we stipulate to be a subtype also of *resump-retr-site* (though also one of *slash-pass-site*). This means that a RC can take the form of a verbal clause with a complementizer and a retrieved RESUMP-value. The following constraint will also be put on the general type *rel-cl*. The first disjunct of the RETR-value covers the cases so far; the second disjunct will be used in section 4.4.

(23) *rel-cl* $\longrightarrow$

$$\begin{bmatrix} \text{SYNSEM} \begin{bmatrix} \text{LOC HEAD } \textit{verb} \\ \text{NONLOC RETR} \left(\begin{bmatrix} \text{RESUMP} \left\{ \boxed{i} \right\} \end{bmatrix} \vee \begin{bmatrix} \text{SLASH} \left\{ \text{NP}_{\boxed{i}} \right\} \end{bmatrix} \right) \end{bmatrix} \\ \text{REL-IND } \boxed{i} \end{bmatrix}$$

Since the complementizer *še* can function as both a relativizing and a subordinating complementizer, we will treat it as a marker placing the minimal restriction on its clause that it be a finite sentence.

Lastly, we need RPs for the RESUMP-values to come from. The lexical rule in (24) changes any pronoun into a RP. Note that by changing its index type to *npro*, we make it an R-expression and thus susceptible to strong crossover, on one explanation of this phenomenon. The analysis for the RC in (19) is given in figure 1.[15]

(24) $$\begin{bmatrix} \text{LOC CONT} \begin{bmatrix} \textit{ppro} \\ \text{INDEX } \boxed{i} \end{bmatrix} \end{bmatrix} \Longrightarrow \begin{bmatrix} \text{LOC CONT} \begin{bmatrix} \textit{npro} \\ \text{INDEX } \boxed{i} \end{bmatrix} \\ \text{NONLOC PASS RESUMP} \left\{ \boxed{i} \right\} \end{bmatrix}$$

4.3 Other positions for resumptives

It is possible for the direct object RP to be be fronted to the beginning of the RC as in (25a). A constituent containing the RP may also be similarly fronted, such as the PP in (26a). The complementizer may be absent when such fronting occurs, as the (b) examples illustrate.

(25) (a) *ha-yeled*$_i$ *še* <u>*ʔoto*$_i$</u> *rina* *ʔohevet*
the-boy$_i$ that <u>him$_i$</u> Rina loves
the boy that Rina loves

(b) *ha-yeled*$_i$ <u>*ʔoto*$_i$</u> *rina* *ʔohevet*
the-boy$_i$ <u>him$_i$</u> Rina loves
the boy that Rina loves (Borer 1984b p. 220)

[15]In the figures, PASS RESUMP and PASS SLASH are written as simply RESUMP and SLASH, resp., when no confusion can arise.

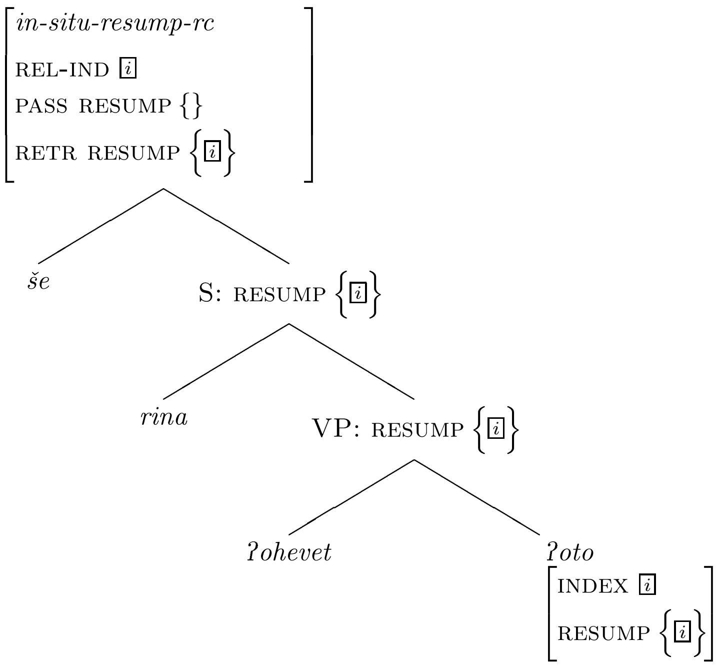


Figure 1: Relative clause with *in situ* direct object RP

(26) (a) *kol* *gever*$_i$ *še* *ʔit-o*$_i$ *rina* *rakda*
each man$_i$ that with-him$_i$ Rina danced
each man that Rina danced with

(b) *kol* *gever*$_i$ *ʔit-o*$_i$ *rina* *rakda*
each man$_i$ with-him$_i$ Rina danced
each man that Rina danced with (Sells 1984 p. 93)

How should the account given for *in situ* RPs be extended to account for these possibilities? (Borer 1984b) and (Sells 1984) analyze fronting as an optional mechanism used to form RCs. The complementizer-less RCs are then viewed as a special version of the fronting RCs in which optional deletion of the complementizer has applied. However, I will argue that, surprisingly, this division is incorrect. Namely, I claim that the frontings in (25a) and (26a) exemplify an independent mechanism that has nothing essential to do with RCs, whereas the (b) examples without the complementizer manifest a special type of RC.

First of all, (27) illustrates that the (phrase containing the) RP need not be fronted all the way to the beginning of the RC; it may occupy any intervening COMP site. I call this phenomenon *pronoun hopping*. Note further that the complementizer is obligatory in all the intermediate landing sites. In other words, only in its relativizing use can it be missing, not as a subordinating conjunction.

(27) (a) *ha-ʔiš$_i$* *še* *ani* *xošev* *še* *amarta* *še* *sara* *katva* <u>*al-av$_i$*</u>
the-man$_i$ that I think that said-2.SG.M that Sarah wrote about-him$_i$
šir
a-poem

(b) *ha-ʔiš$_i$ še ani xošev še amarta še* <u>*al-av$_i$*</u> *sara katva šir*

(c) *ha-ʔiš$_i$ še ani xošev še* <u>*al-av$_i$*</u> *amarta še sara katva šir*

(d) *ha-ʔiš$_i$ (še)* <u>*al-av$_i$*</u> *ani xošev še amarta še sara katva šir*
the man that I think that you said that Sarah wrote a poem about (Sells 1984 p. 92ff.)

Secondly, notice that there is a general mechanism of topicalization in Hebrew which is not confined to relative clauses. The following non-relative example shows that pronouns are eligible to be thus topicalized:

(28) *ʔamarti* *le-kobi* *še* <u>*ʔoto*</u> *rina* *ʔohevet*
said-1.sg to-Kobi that <u>him</u> Rina loves
I told Kobi that it is him that Rina loves (Borer 1984b p. 225)

Thirdly, notice that even when the pronoun topicalization occurs in a RC, the fronted pronoun need not be interpreted as the foot of the dependency, as long as the complementizer is present. In the following examples, it could not be, since the head noun and fronted pronoun disagree in number:

(29) (a) *ha-rofe$_i$* *še* *ʔotam* *šalaxti* *el-av$_i$*
the-doctor$_i$ that them sent-1.SG. to-him$_i$
the doctor to whom I sent them (Doron 1982 p. 12)

(b) *ha-iša* *še* *it-am* *rakda*
the-woman that with-them danced
the woman that danced with them

It is therefore plausible to view examples like (25a) and (26a) as simply the special case of topicalization where what is topicalized happens to be a RP or phrase containing it, and the landing site happens to be the highest COMP site in the RC. These examples can then be captured along with pronoun hopping and topicalization in general by simply allowing traces to introduce a SLASH dependency. This dependency propagates upwards until it can be retrieved at a *h(ea)d-fill(er)-ph(rase)*, which is declared to be a *slash-retr-site*, obeying the following further constraints:

(30) $\textit{head-fill-ph} \longrightarrow \begin{bmatrix} \ldots\ \textsc{retr slash}\ \left\{\boxed{1}\right\} \\ \textsc{filler-dtr loc}\ \boxed{1} \end{bmatrix}$

(31) $\textit{head-fill-ph} \longrightarrow \begin{bmatrix} \textsc{hd-dtr}\ \textit{hd-subj-ph} \end{bmatrix}$

Restrictions on the occurrences of traces can be captured by formulating the "trace principle" for Hebrew so as to allow verbs, but not prepositions or nouns, to take a trace as an argument.[16]

Furthermore, the general property of Hebrew embedded clauses that their complementizers are obligatory can be expressed by designing the type hierarchy so that all descendants of *emb-cl* inherit from *hd-mrk-ph*, with one exception to be discussed shortly.

The derivation for example (26a) is illustrated in figure 2. The PP containing the RP is extracted and then realized to the left. The RESUMP propagation then extends upward from the RP just as it would have had it occurred *in situ*. The dots indicate that the SLASH-retrieval site need not be the highest COMP position in the clause. Notice also that the type of the clause is *in-situ-resump-rc*. This nomenclature is of course somewhat disingenuous, given that the RP does not occur *in situ* here, but it highlights the commonality this clause type has with the regular *in situ* type.

Let us return now to the frontings where the complementizer is missing. These differ from the versions with the complementizer in two ways. First of all, they are only possible inside a RC, and furthermore only at the top of the construction. Secondly, the fronted pronoun *must* be interpreted as the relativization index. In contrast to the examples in (29), examples (32) show that the same sentences without *še* are ungrammatical:[17]

(32) (a) **ha-rofe ʔotam šalaxti el-av*
the-doctor them sent-1.SG. to-him
the doctor to whom I sent them

(b) **ha-iša it-am rakda*
the-woman with-them danced
the woman that danced with them

These differences suggest that unlike the examples with the complementizer, those without should be viewed as involving a special RC construction. I will introduce a new subtype, *h(ea)d-fill(er)-r(elative)c(lause)* that inherits from *rel-cl*. This is also the only subtype of *emb-cl* that doesn't inherit from *hd-mrk-ph*; instead it is constrained to be a *hd-fill-ph*.

For the interpretive constraint on such RCs, we want to say that when the RP alone is fronted, its index is equated with the REL-IND. However, we still need to capture "pied-piping" examples like (26) above. To do this, we can allow RESUMP-propagation within the filler to reach the top and ensure that this value is the one that gets interpreted as the REL-IND. A sentence where the RP itself is the filler can be just treated as the trivial case of pied-piping. The following constraint implements this.[18]

(33) $$\textit{hd-fill-rc} \longrightarrow \begin{bmatrix} \ldots\ \textsc{retr resump} \left\{\boxed{i}\right\} \\ \textsc{filler-dtr} \ldots\ \textsc{pass resump} \left\{\boxed{i}\right\} \end{bmatrix}$$

[16] Interestingly, the fronting of subject pronouns, both within and outside of RCs, is "marginal" according to Borer (p. 250f.). This could be hard-wired into the constraint on filler realization if desired by reference to the pronoun's case.

[17] There is some variation in reactions to (32b). Speakers who accept such sentences could be characterized with a weaker interpretive constraint than (33) that would only apply with a nominal filler.

[18] Sells (p. 93) notes a further constraint that an NP containing the RP such as *ʔet ʔaxiv* 'his brother' cannot be fronted in the complementizer-less version. This must stipulated on the present account.

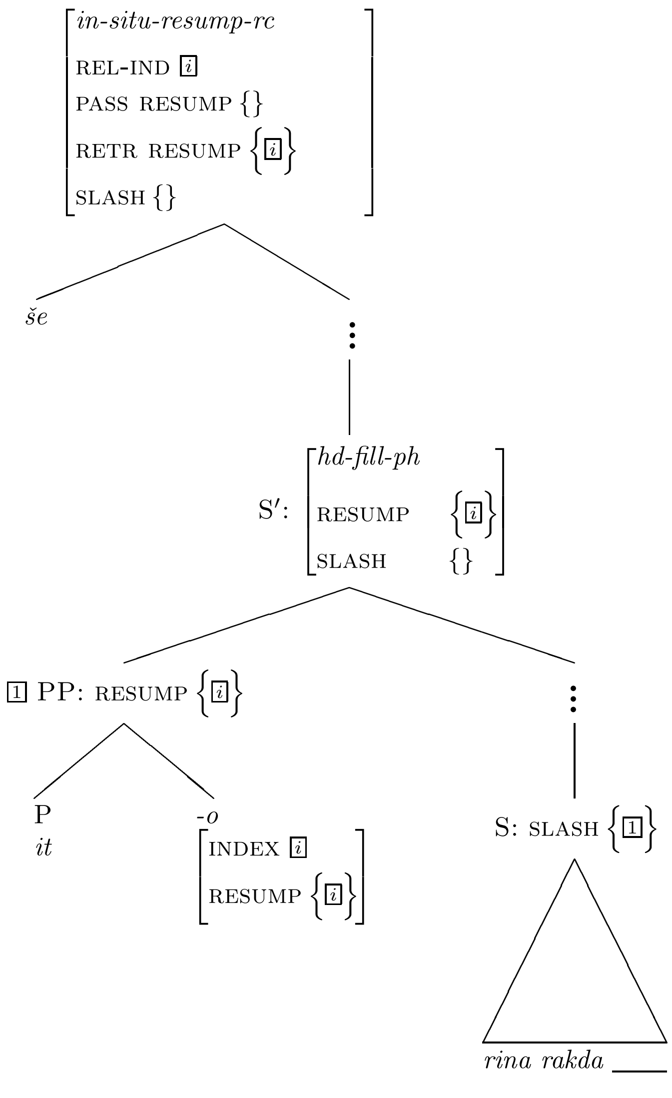


Figure 2: RC with complementizer in which a PP containing the RP is topicalized

The resulting structure for (26b) is illustrated in figure 3.[19]

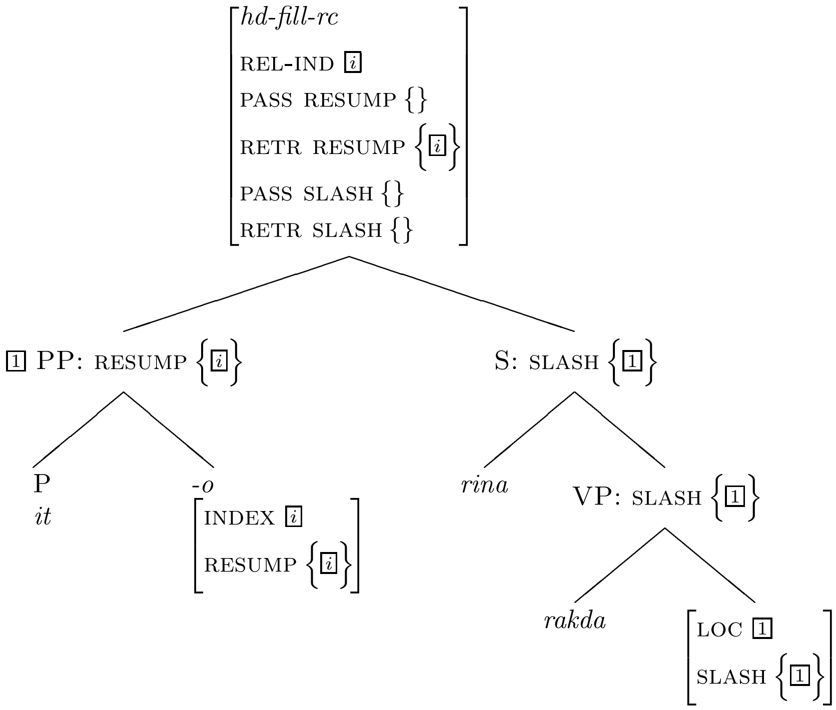


Figure 3: RC without a complementizer in which a PP containing the RP is pied-piped

4.4 Bare gap relative clauses

As mentioned earlier, some Hebrew RCs contain no RP at all:

(34) (a) *ha-ʔiš še pagaš ʔet rina*
the-man that met ACC Rina
the man that met Rina (Sells 1984 p. 64)

(b) *ha-ʔiš še xana ʔamra še ʔohev ʔarayot*
the-man that Xana said that loves lions
the man that Xana said loves lions (Borer 1984b p. 247)

(c) *ha-yeled še rina ʔohevet*
the-boy that Rina loves
the boy that Rina loves (Borer 1984b p. 220)

[19] Notice the similarity to an English-type relative pronoun structure: the RP functions like the moved relative pronoun, and RESUMP-propagation plays the same role as the REL feature does in Pollard and Sag's (1994) analysis of English pied-piping.

This bare gap strategy illustrated is only available to subjects and direct objects. Here we will consider only the direct object bare gap relatives. (Borer 1984b) demonstrates convincingly that although the direct object bare gap RC shows no overt filler, it must arise by a mechanism similar to the one responsible for pronoun hopping and head-filler relatives.

The first argument for this similarity is that islands cannot appear between the top of the relative clause and the verb missing a direct object, as is true of all of the movement constructions. A second piece of evidence is that bare gap direct object RCs are associated with a syntactic process found otherwise in all and only overt movement structures. For simplicity, assume that in general, subject-verb inversion in Hebrew is ungrammatical (SVO being the normal word order). This is as true in RCs as in any other environment (Borer 1984b p. 228). However, all manner of movements allow inversion of the subject and verb directly below their landing site (but not at any intermediate COMPs): topicalization in general, pronoun hopping, wh-question-word movement, embedded question structures, and pronoun fronting in a *hd-fill-rc*.[20] Interestingly, despite the lack of an overt moved element, direct object bare gap relatives do also allow inversion. This strongly suggests that these constructions should be handled by the same mechanisms. Notice also that the inversion is restricted to the highest subject and verb of the relative.

Now, just as a *in-situ-resump-rc* could terminate a RESUMP-dependency and get its REL-IND-value therefrom, all the while just passing up SLASH, we can make another subtype of *hd-mrk-rc* that treats SLASH and RESUMP the other way around. This type, which I call *bare-gap-rc*, inherits from *resump-pass-site* and *slash-retr-site*. Now we get to make use of the second disjunct of the constraint (23) on a *rel-cl*'s NONLOC RETR-value presented above: the index of the NP taken our of storage will be automatically equated with the REL-IND-value. An example is given in figure 4.

To get the inversion facts right, we can break *hd-subj-ph* up into two subtypes, *norm(al)-hd-subj-ph* and *inv(erted)-hd-subj-ph* with appropriate word-order constraints. We then have to constrain the latter type to occur only as the HD-DTR of a *slash-retr-site*. This can be expressed as in the following constraint. Note that a *bare-gap-rc* will qualify and license inversion.[21]

(35) $\left[\text{HD-DTR } \textit{inv-hd-subj-ph}\right] \longrightarrow \textit{slash-retr-site}$

4.5 Matrix subject restrictions

As pointed out in section 4.2, Hebrew does not generally allow matrix subjects to be resumed. This is an interesting phenomenon, since more deeply embedded subjects are not beholden to this restriction. The analysis in that section correctly predicts embedded resumptive subjects, but also overgenerates to yield matrix ones.

(Borer 1984b) tries to capture this restriction by modifying the binding theory in such a way that the binding between the null operator and the highest subject would be disallowed. (McCloskey

[20] In fact, inversion is not in general ungrammatical, but rather highly marked. Thus, movement does not actually have the effect of making an impossible structure acceptable, but rather of rendering a marked structure unremarkable, according to Borer (p. 227 fn. 2).

[21] (Embedded) subject gaps similarly obey island constraints but differ from direct object gaps in not licensing inversion. This is part of a larger pattern: overtly fronted subject pronouns also do not license inversion the way other frontings do. To capture this, we could place add a stipulation to (35) that the retrieved SLASH-element not be a pronoun with a nominative case. There would be an obvious parallelism between such a constraint and the one on overt fillers discussed in footnote 16 that deserves further exploration.

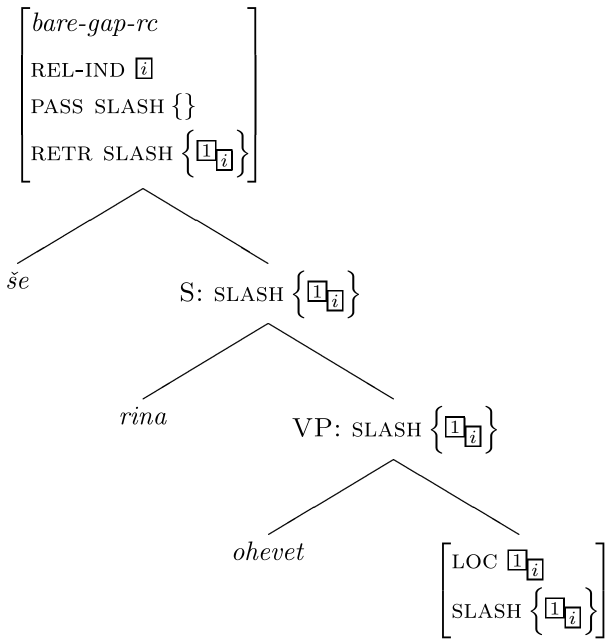


Figure 4: RC with direct object gap

1990) makes a similar move for the parallel restriction that exists in Irish. In the GB analysis of chapter 4 of (Sells 1984), Sells seeks to derive the restriction from Case-assignment considerations. In the DRS semantics for GPSG in chapter 6, he stipulates that the discourse marker associated with a RC only become available after two nodes have been encountered, making it unaccesible for the subject RP under his assumptions. These proposals all rely on theory-internal presuppositions, and it is debatable to what extent any of them could be said to explain the restriction. In this section I will simply explore the question of how the correct generalization can be stated in the framework presented so far, without seeking to derive it from any "deeper principles."

The constraint in (36) describes essentially what we want.

(36) Matrix subject constraint (provisional)

$$\begin{bmatrix} \textit{in-situ-resump-rc} \\ \textsc{hd-dtr}\ \textit{hd-subj-ph} \\ \textsc{retr resump}\ \left\{\boxed{i}\right\} \end{bmatrix} \longrightarrow \begin{bmatrix} \textsc{hd-dtr subj-dtr} \ldots\ \textsc{index} \neq \boxed{i} \end{bmatrix}$$

This prevents the matrix subject from being the retrieved RP. It also rules out the indistinguishable condition that could arise in a coordinate structure if the matrix subject of the first conjunct were not a RP but were coindexed with the true RP which was e.g. the direct object in a second conjunct (see footnote 9 for such cases).

Note that although the retrieved index cannot be that of the matrix subject, that doesn't mean that it can't come from within the matrix subject. Thus examples such as (37) are correctly allowed:

(37) (a) *ha-ʔiš*$_i$ *še* *im-*<u>*o*</u>$_i$ *ohevet* *et* *rina*
the-man$_i$ that mother-<u>his</u>$_i$ loves Rina
the man whose mother loves Rina (Sells 1984 p. 65)

(b) *ha-ʔiš*$_i$ *še* *ruti* *ve* <u>*hu*</u>$_i$ *ʔohavim* *kesef*
the-man$_i$ that Ruti and <u>he</u>$_i$ love money
the man that along with Ruti loves money (Shlonsky 1992 p. 450)

Although (36) rules out matrix subject RPs, embedded subject RPs are still correctly countenanced. If the RP is the subject of an embedded non-relative subordinate clause, (36) simply doesn't apply. The RP may also be the matrix subject of an embedded RC, as long as that clause does not retrieve its index. For instance, in (38), the lower RC retrieves no index and passes i on to be retrieved higher up.

(38) *ha-ʔiš*$_i$ *še* *dalya* *makira* *ʔet* *ha-ʔiša*$_j$ *še* *hu*$_i$ *ʔohev* ___$_j$
the-man$_i$ that Dalya knows ACC the-woman$_j$ that he$_i$ loves ___$_j$
the man such that Dalya knows the woman that he loves

Lastly, since (36) only applies when the HD-DTR is a *hd-subj-ph*, we make the nice prediction that the matrix subject of a RC that is not a *hd-subj-ph* should be resumable. This is borne out by the following example:

(39) *ha-ʔiš*$_i$ *še* *rak* *ʔal* *kesef* <u>*hu*</u>$_i$ *xošev*
the-man$_i$ that only about money <u>he</u>$_i$ thinks
the man that only thinks about money (Borer 1984b p. 247)

Since *rak ʔal kesef* is topicalized here, *rak ʔal kesef hu xošev* must be a *hd-fill-ph*, so (36) does not apply.

Although covering most of the facts we want, (36) still has the problem that it looks down two levels of phrase structure. For this reason, it doesn't carry over to an RC consisting of multiple sentences conjoined under a common complementizer. There, the HEAD-DTR of the RC would not have a SUBJ-DTR, but rather some conjuncts as daughters, each of whose SUBJ-DTR would have to be constrained.

To deal correctly with conjunctions, we need to break the flow of information from the RC to the sentence(s) in it into two steps. This can be done by giving the sentence a feature that can record what index is retrieved by the RC it is the HEAD-DTR of, for instance by just allowing the REL-IND to occur on verbal projections as well. To ensure that the RC's REL-IND is the same as that of its HD-DTR, we can just make REL-IND a HEAD-feature.[22] We then want this information to reach the individual conjuncts in a coordination; but this is guaranteed automatically on the

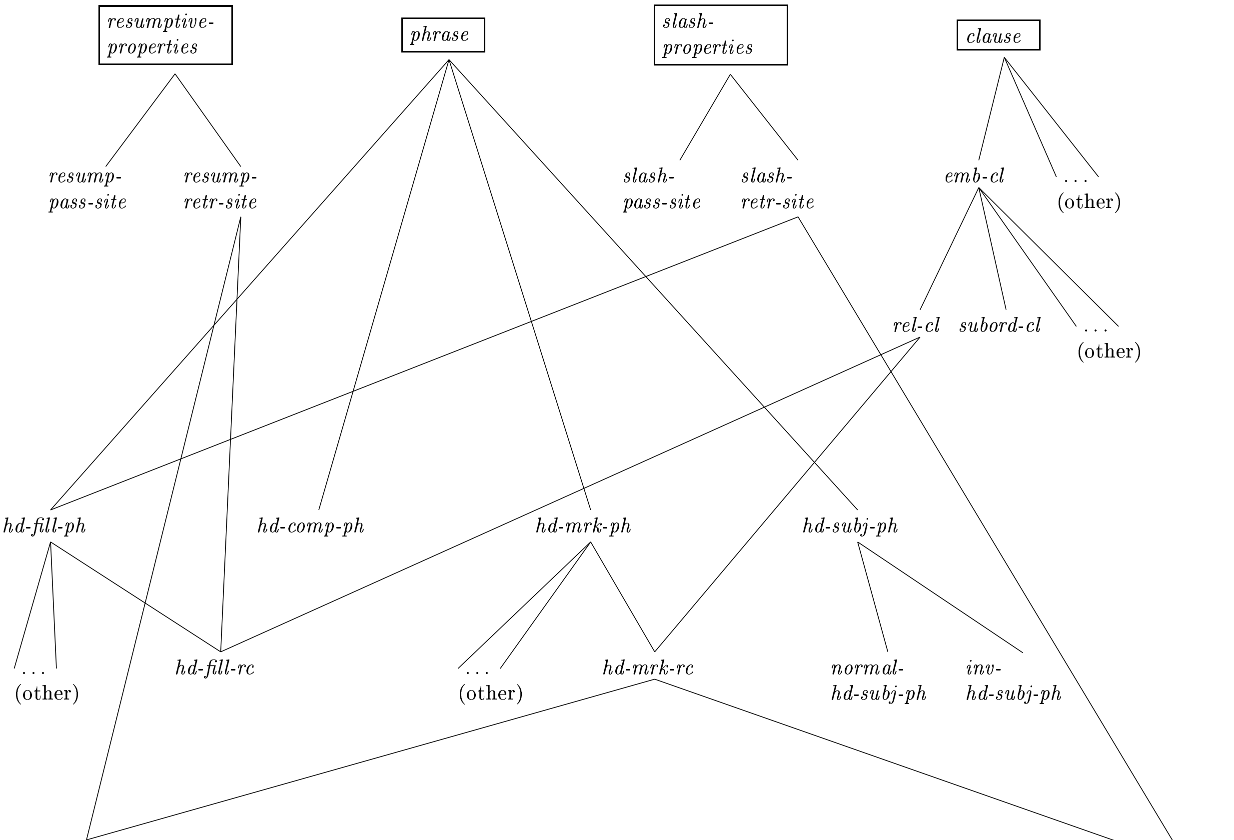
[22] REL-IND would not serve any purpose on a verb that is not the head of a RC. We could therefore follow (Sag 1997) in assuming that the head verb of a relative has a special HEAD-value type; then REL-IND can be declared appropriate for only this type.

assumption that CAT, and thus HEAD features are shared in coordinations. Then the matrix subject constraint can be rephrased as a restriction on the sentences themselves:[23]

(40) Matrix subject constraint (revised)

$$\begin{bmatrix} \textit{hd-subj-ph} \\ \ldots\ \text{REL-IND}\ \boxed{i} \end{bmatrix} \longrightarrow \begin{bmatrix} \text{SUBJ-DTR}\ \ldots\ \text{INDEX} \neq \boxed{i} \end{bmatrix}$$

The following diagram summarizes the type hierarchy used in the analysis. All types that don't inherit from *slash-retr-site* are assumed to inherit from *slash-pass-site* although the relevant lines are not shown; likewise for *resump-retr-site* and *resump-pass-site*.



Acknowledgments

Thanks to Peter Culicover, Marianne Desmets, Yehuda Falk, Erhard Hinrichs, Bob Levine, Carl Pollard, Ivan Sag, Peter Sells, and participants in BFG-2000 for useful discussion. Special thanks to Anna Feldman for help with data-gathering. Shortcomings are mine.

[23] In fact, the subject daughter should be prevented from having index i only when it also has i in its PASS RESUMP-value. Otherwise, coordinate examples like (11) but where the epithet is a subject would be ruled out.

This material is based on work supported under a National Science Foundation Graduate Fellowship.

References

Borer, H. (1984a). *Parametric Syntax: Case Studies in Semitic and Romance Languages*. Number 13 in Studies in Generative Grammar. Dordrecht: Foris.

Borer, H. (1984b). Restrictive relatives in Modern Hebrew. *NLLT 2*, 219–260.

Dickey, M. W. (1996). Constraints on the sentence processor and the distribution of resumptive pronouns. In M. W. Dickey and S. Tunstall (Eds.), *Linguistics in the Labratory*, Volume 19 of *University of Massachusetts Occasional Papers in Linguistics*. Amherst, MA: GLSA.

Doron, E. (1982). On the syntax and semantics of resumptive pronouns. *Texas Linguistic Forum 19*, 1–48.

Georgopoulos, C. (1991). *Syntactic Variables: Resumptive Pronouns and A′-Binding in Palauan*. Dordrecht: Kluwer Academic Publishers.

Glinert, L. (1989). *The Grammar of Modern Hebrew*. Cambridge University Press.

Goldsmith, J. (1981). The structure of wh-questions in Igbo. *Linguistic Analysis 7*, 367–393.

Kayne, R. (1981). ECP extensions. *Linguistic Inquiry 12*, 93–133.

Maling, J. and A. Zaenen (1982). A phrase structure account of Scandinavian extraction phenomema. In P. Jacobson and G. Pullum (Eds.), *The Nature of Syntactic Representation*, pp. 229–282. Dordrecht: Reidel.

McCloskey, J. (1979). *Transformational Syntax and Model-Theoretic Semantics: A Case Study in Modern Irish*. Dordrecht: Reidel.

McCloskey, J. (1990). Resumptive pronouns, A′-binding and levels of representation in Irish. In R. Hendrick (Ed.), *The Syntax of the Modern Celtic Languages*, Volume 23 of *Syntax and Semantics*. Academic Press.

Moosally, M. J. (1994). Resumptive pronouns in Modern Standard Arabic: a Head-driven phrase structure grammar account. Unpublished master's thesis, University of Texas at Austin.

Pollard, C. and I. A. Sag (1994). *Head-driven phrase structure grammar*. Chicago: The Chicago University Press.

Richter, F., M. Sailer, and G. Penn (1999). A formal interpretation of relations and quantification in HPSG. In G. Bouma, E. Hinrichs, G.-J. M. Kruijff, and R. T. Oehrle (Eds.), *Constraints and Resources in Natural Language Syntax and Semantics*, pp. 281–298. CSLI Publications.

Sag, I. (1997). English relative clause constructions. *Linguistics 33*(2), 431–484.

Sells, P. (1984). *Syntax and Semantics of Resumptive Pronouns*. Ph. D. thesis, UMass Amherst.

Shlonsky, U. (1992). Resumptive pronouns as a last resort. *Linguistic Inquiry 23*, 443–468.