
Argument Realization and Dutch R-Pronouns: Solving Bech's Problem without Movement or Deletion

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1.1 Introduction

Extraction out of Dutch prepositional phrases is in general only allowed if the extracted element is a so-called 'R-pronoun' (van Riemsdijk, 1978):

- (1) a. **Waar** heb je **aan** gedacht?
Where/What have you on thought
What were you thinking about?
- b. **Hier** (* **Deze oplossing**) had Kim niet **aan**
Here/this (this solution) had Kim not on
gedacht.
thought
Kim had not thought about this (* this solution).

Contrary to ordinary NPs, R-pronouns normally must precede the preposition of which they are an object, and in spite of the fact that adjacent occurrences of an R-pronoun and preposition are written as a single word, the two elements are not inseparable:

- (2) a. Kim heeft **eraan/hieraan/daaraan** gedacht
Kim has there+on/here+on/there+on thought
Kim has thought about this.
- b. * Kim heeft aan **er/hier/daar** gedacht.

Grammatical Interfaces in Head-driven Phrase Structure Grammar.
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- c. Kim heeft **er/hier/daar** niet **aan** gedacht
 Kim has there/here/there not on thought
 Kim has not thought about this.

R-pronouns not only occur as objects of prepositions, but can also be used as locative adverbs. In addition, the pronoun *er* occurs in impersonal passive constructions and in existential constructions as an expletive element filling the subject position:

- (3) a. **Er** wordt gepraat
 There is talked
 One is talking.
 b. **Er** heerst onzekerheid over de rente.
 There rules uncertainty about the interest
 There exists uncertainty about the interest.

One of the puzzling aspects of *er* is that in some cases several functions can be combined:

- (4) a. **Er** wordt **over** gepraat
 There is about talked
 One is talking about it.
 b. **Er** heerst onzekerheid **over**.
 There rules uncertainty about
 There exists uncertainty about it.

Er may only occur sentence-initially if it is used as an expletive subject. In (4) *er* must therefore have a subject function. At the same time, *er* must function as a prepositional object, as prepositions cannot occur without an object. This puzzling phenomenon was first observed in Bech (1952) and is therefore referred to as '*Bech's problem*' in Model (1991).

The distribution of R-pronouns in the Middle Field has been accounted for in transformational grammar (van Riemsdijk, 1978, Model, 1991, chapter 10, Bennis, 1986) by assuming a structurally unique position in phrase structure functioning as a landing site for pronouns or clitics. In addition, Bennis (1986) accounts for function amalgamation by appealing to a deletion rule. In this paper, a constraint-based, non-transformational, alternative, formulated in terms of Head-driven Phrase Structure Grammar (Pollard and Sag, 1994). The core of the analysis is the observation that, except in those cases where there is a clear *filler-gap* relation between a fronted R-pronoun and a preposition, R-pronouns are used adverbially. Adverbs may be freely added to the

lexical argument structure of verbs to form an extended argument structure known as *dependency structure* (Bouma et al., 2000). Verbs whose dependency structure contains an R-pronoun have two special properties. They may bind a gap introduced by a preposition, thus allowing an R-pronoun in the Middle Field to be interpreted as the (extracted) argument of a preposition. In impersonal passives and existential constructions, an R-pronoun may fill the syntactic subject position. The combination of these two properties leads to function amalgamation.

1.2 Data Overview

R-pronouns can be used as arguments of prepositions, as locative adverbs and as subjects of impersonal passives and existential constructions. In some cases, several functions of an R-pronoun coincide.¹

Dutch prepositions take full NPs, anaphoric NPs, as well as most pronouns as argument, but not the impersonal pronouns *het (it)*, *dit (this)* and *dat (that)*:²

- (5) Kim denkt aan ons/ de kinderen/ *het/ *dit/ *dat
Kim thinks about us/ the children/ it/ this/ that

Instead, in cases where one might expect an impersonal pronoun, an R-pronoun can be used, which precedes rather than follows the preposition:

- (6) Kim denkt **eraan/hieraan/daaraan**.
Kim thinks there+on/here+on/there+on about
Kim thinks about it/this/that

Although adjacent combinations of an R-pronoun and preposition are written as a single word, the two can be separated in the Middle Field by other constituents:

- (7) a. We offeren **er** geen stukje park **voor** op.
We sacrifice there no patch park for PRT
We do not sacrifice a patch of park for it.
b. Ik sprak **er** overigens met Willemsen **over**.
I talked there by-the-way with Willemsen about.
I happened to talk about it with my friend Willemsen.

As illustrated in example (1) of the introduction, extraction out of PPs is allowed only if the argument is an R-pronoun. Extraction may be

¹The pronoun *er* also has a quantitative or partitive use (Haesereyn et al., 1997). The latter construction is not taken into consideration in this paper.

²See Haesereyn et al. (1997) for a number of exceptions, involving, among others, the preposition *zonder (without)* and coordinated pronouns.

long-distance (8a). Also, extraction is not restricted to verbal complements, but may also involve extraction out of APs (8b) and NPs (8c).

- (8) a. **Waar** denkt Kim [_S dat Karel **bij** betrokken is]?
Where thinks Kim that Carl with involved is
What does Kim think that Carl is involved in?
- b. **Waar** is Kim [_{AP} verliefd **op**]?
Where is Kim in love at
What is Kim in love with?
- c. **Waar** schreef Karel [_{NP} een boek **over**]?
Where wrote Carl a book about
What did Carl write a book about?

Most prepositions can take both regular NPs and R-pronouns as argument. However, some prepositions exhibit a form alternation when their argument is an R-pronoun:

- (9) a. Kim snijdt het vlees **met een mes**
Kim cuts the meat with a knife
- b. Kim snijdt **er** het vlees **mee**
Kim cuts it the meat with
Kim cuts the meat with it
- c. Deze beslissing leidt **tot problemen**
This decision leads to problems
- d. **Waar** leidt deze beslissing **toe**?
Where leads this decision to
To what does this decision lead?

Note that the alternative form appears both when the R-pronoun appears in the Middle Field and when it is fronted.

R-pronouns not only occur as arguments of prepositions, but can be used as locative adverbs as well:

- (10) Laten we **hier/daar/ergens** gaan zitten
Let us here/there/somewhere go sit
Let us sit here/there/somewhere
- (11) Maria bleef **er** dertig jaar
Maria stayed there thirty years

Furthermore, R-pronouns can occur as subject in existential constructions and impersonal passives:

- (12) a. **Er/Daar** stond een moeder op.
 There stood a mother PART.
 A mother stood up.
- b. **Er/Ergens** werd gebeld.
 There/somewhere was called.
 The phone rang (somewhere).

The reduced R-pronoun *er* in these examples is often analyzed as an expletive subject. Apart from the fact that its locative interpretation is less strong in these examples, an important reason for distinguishing between the expletive and locative use of *er* is the fact that sentence-initial occurrences of *er* are restricted to existential and impersonal passive constructions:

- (13) * **Er** woonde Maria dertig jaar
 There lived Maria thirty years

Sentences may contain more than one R-pronoun:

- (14) **Er** stond **daar** een groot huis.
 there stood there a large house
- (15) **Hier** wil de apostel **er** ons de ogen voor openen.
 here wants the apostle there us the eyes for open
 Here, the apostle want to open our eyes for it.

The pronouns *daar* and *hier* are interpreted as locative in this case, whereas *er* is an expletive subject in (14) and a prepositional object in (15). Two occurrences of the same R-pronoun are generally not allowed. In such cases, the two functions of a pronoun may be fused or amalgamated into a single word. A clear example of this phenomenon is the combination of expletive and prepositional uses of the R-pronoun *er*:

- (16) **Er** wordt **aan een oplossing** gewerkt.
 there is on a solution worked.
 One works on a solution.
- (17) * **Er** wordt **eraan** gewerkt.
 there is there+on worked.
- (18) **Er** wordt **aan** gewerkt.
 there is on worked
 One works on it.
- (19) **Er** kwam een prins **in het verhaal** voor.
 There came a prince in the story PART
 A prince figured in the story.

- (20) * **Er** kwam een prins **erin** voor
 there came a prince there+in PART
- (21) **Er** kwam een prins **in** voor.
 there came a prince in PART
 A prince figured in it.

Example (16) is an impersonal passive containing a PP and an expletive R-pronoun as subject. Replacement of the PP with an R-pronoun + preposition combination leads to ungrammaticality (17). Example (18), on the other hand, which contains only a single *er*, and a preposition without a following object, is grammatical. The same situation also occurs where *er* is the expletive subject of an existential clause (19)–(21). Expletive *er* is in general optional in impersonal passives if there is another (preferably locative) phrase which can fill the subject position. In sentences with an indefinite subject, the occurrence of *er* is also optional. Note, however, that it is not likely that the *er* in (18) and (21) is only prepositional, as prepositional *er* is normally excluded in sentence-initial position. Therefore, the usual explanation for such examples is that two functions of the R-pronoun *er* are fused into a single word.

1.3 Previous Work

To account for the fact that R-pronouns may occur in positions in the Middle Field where they are non-adjacent to the preposition selecting them, van Riemsdijk (1978) and Model (1991) assume a designated phrase structure position where R-pronouns may be moved to. Van Riemsdijk introduces a phrasal node PRO, which acts as a landing site for pronouns. Model sees *er* as a second position clitic and assumes a clitic movement transformation. Bennis (1986) argues against a designated position for R-pronouns, and accounts for the fact that they can be moved leftward within the Middle Field by appealing to a general tendency for ‘light’ elements to move leftward.

Bennis also extends the analysis to other uses of R-pronouns. Most importantly, he addresses the question of function-amalgamation. He briefly considers an analysis in which a single R-pronoun could potentially be co-indexed with traces occupying different argument positions, but concludes that such a ‘parasitic-gap’ analysis raises a number of serious problems. He then opts for a solution in which multiple occurrences of the identical R-pronouns are allowed at S-structure, and proposes a phonological deletion rule to account for the fact that typically only a single R-pronoun is realized.

An analysis of extracted prepositional R-pronouns in terms of HPSG is provided in Rentier (1993, 1994). He accounts for the extraction of

the complement of a preposition by means of a lexical rule which creates *SLASHedPPs*. To account for the distribution of R-pronouns in the Middle Field, Rentier (1994) proposes a HEAD-FILLER-COMPS structure. Apart from introducing a somewhat *ad-hoc* phrase structure schema, the main shortcoming of this proposal is that it fails to provide a solution for cases where various functions of R-pronouns are amalgamated.

1.4 Argument Realization Principles

The introduction of argument structure (ARG-ST) in HPSG as a level of representation independent from valence, has opened up the possibility of accounting for a range of data in terms of dissociations between argument structure and valence. Initially (i.e., in chapter 9 of Pollard and Sag (1994)) ARG-ST was understood as a (slightly redundant) level of representation, introduced mainly to facilitate the formulation of binding theory, and which always consisted of the concatenated values of the valence features SUBJ, SPR and COMPS. In later work, the strict correspondence between valence and ARG-ST is broken, and *argument realization principles* are formulated which allow for different mappings between the two levels.

The treatment of adjuncts as complements generally assumes that COMPS may contain adverbial *synsem*'s which are not part of ARG-ST (see, among others, Miller (1992), van Noord and Bouma (1994), Manning et al. (1999), Przepiórkowski (1999a, 1999b)). In Bouma et al. (2000), this idea is formalized using an auxiliary level of representation, called DEPS (for *dependency structure*), which acts as an intermediary between ARG-ST and valence. The idea is that verbs come with a specific argument structure, that DEPS is essentially argument structure extended with any number of adjuncts, and that the contents of DEPS in turn gets mapped onto the valence lists SUBJ and COMPS and the nonlocal feature SLASH.

Following Bouma et al. (2000), the Verbal Argument Structure Extension Principle given in (22) below defines the relationship between ARG-ST and DEPS for non-passive verbs in Dutch. It differs from the Argument Structure Extension Principle as given in Bouma et al. (2000) in that it is restricted to non-passive verbs and that it allows, in addition to 'regular' adverbial *synsem*'s which are concatenated at the end, an optional 'locative' adverbial to be introduced in the initial DEPS-position. The motivation for these modifications is presented in section 1.10.

(22) **Verbal Argument Structure Extension:**³

$$\left[\begin{array}{l} \textit{word} \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD} \end{array} \left[\begin{array}{l} \textit{verb} \\ \text{VFORM} \quad \neg \textit{pas} \end{array} \right] \right] \Rightarrow$$

$$\left[\text{SS} \text{ [2]} \left[\text{L} \mid \text{C} \left[\text{DEPS} \left(\left\langle \left[\begin{array}{l} \textit{'loc-ss'} \\ \text{MOD} \text{ [2]} \end{array} \right] \right\rangle \oplus \text{[1]} \oplus \textit{listof} \left(\left[\begin{array}{l} \textit{'adv-ss'} \\ \text{MOD} \text{ [2]} \end{array} \right] \right) \right] \right] \right] \right]$$

Bouma et al. (2000) propose the following principle for the mapping between DEPS on the one hand and valence and SLASH on the other:

(23) **Argument Realization:**⁴

$$\textit{word} \Rightarrow$$

$$\left[\text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \left[\begin{array}{l} \text{VAL} \left[\begin{array}{l} \text{SUBJ} \quad \text{[1]} \\ \text{COMPS} \text{ [2]} - \textit{listof}(\textit{gap-ss}) \end{array} \right] \\ \text{DEPS} \quad \text{[1]} \oplus \text{[2]} \end{array} \right] \right]$$

The verb *denken* (to think) in (24) has an ARG-ST containing two elements. Verbal Argument Structure Extension imposes the constraint that its DEPS-list must contain these two elements and may contain, in addition, an arbitrary number of adverbial *synsem*'s (i.e. *synsem*'s whose MOD value is non-empty and unifiable with that of the *synsem* of the lexical item at hand⁵). Argument Realization states that the elements on DEPS are either present on SUBJ or COMPS or are of type *gap-synsem*, i.e. the type used for gaps in the lexicalist approach to extraction introduced below. The AVM in (24) satisfies both constraints.

$$(24) \left[\begin{array}{ll} \text{PHON} & \textit{denken} \\ \text{SUBJ} & \langle \text{[1]} \rangle \\ \text{COMPS} & \langle \text{[2]}, \text{[3]} \rangle \\ \text{DEPS} & \langle \text{[1]}, \text{[2]}, \text{[3]} \text{ADV} \rangle \\ \text{ARG-ST} & \langle \text{[1]} \text{NP}[\textit{nom}], \text{[2]} \text{PP}[\textit{aan}] \rangle \end{array} \right]$$

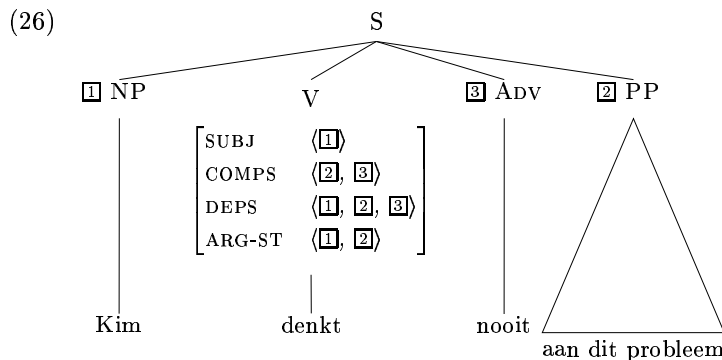
³The \oplus operator denotes the concatenation of two lists.

⁴The $-$ operator denotes the difference of two lists.

⁵Adding the latter constraint to Verbal Argument Structure Extension introduces a circular path equation. This can be avoided by restricting the value of MOD to the features which must be accessed by the modifier (i.e. HEAD and CONT).

Assuming a HEAD-SUBJ-COMPS schema for Dutch main clauses,⁶ this allows for the derivation of the example below:

- (25) Kim denkt nooit aan dit probleem.
 Kim thinks never about this problem.
 Kim never thinks about this problem.



Bouma et al. (2000) argue that Argument Realization allows the lexicalist, traceless, account of complement extraction in Sag (1997) to be extended to subject and adjunct extraction. Instead of positing phonologically empty elements, it is assumed that the type *synsem* has subtypes *canonical-synsem* and *gap-synsem*, where the latter are *synsem*'s whose LOC and SLASH values are reentrant:

(27) $gap\text{-}synsem \Rightarrow \left[\begin{array}{l} LOC \quad \boxed{1} \\ SLASH \quad \{\boxed{1}\} \end{array} \right]$

As a lexical entry will usually only require of its arguments that they must be of type *synsem*, the introduction of *gap-synsem* in general allows any argument to be realized as *gap-synsem* or *canonical-synsem*.

Dependents of type *gap-synsem* do have an effect on the value of SLASH, as a consequence of the Slash Amalgamation (28). It defines the value of SLASH of a given lexical entry as the union of all the SLASH-values of its dependents, minus those elements on SLASH bound by this particular entry. BIND is used to account for so-called *easy*-constructions, where an adjective selects for a complement with a non-empty SLASH-value and 'binds' this element locally. An example derivation is given in (29). As SLASH-amalgamation collects the SLASH-values of elements

⁶This phrase structure schema is used here mainly for presentational convenience. More sophisticated treatments of Germanic main clauses and verb-second can be found in Pollard (1996) and Frank (1994), among others. These proposals are compatible with the analysis of R-pronouns presented here.

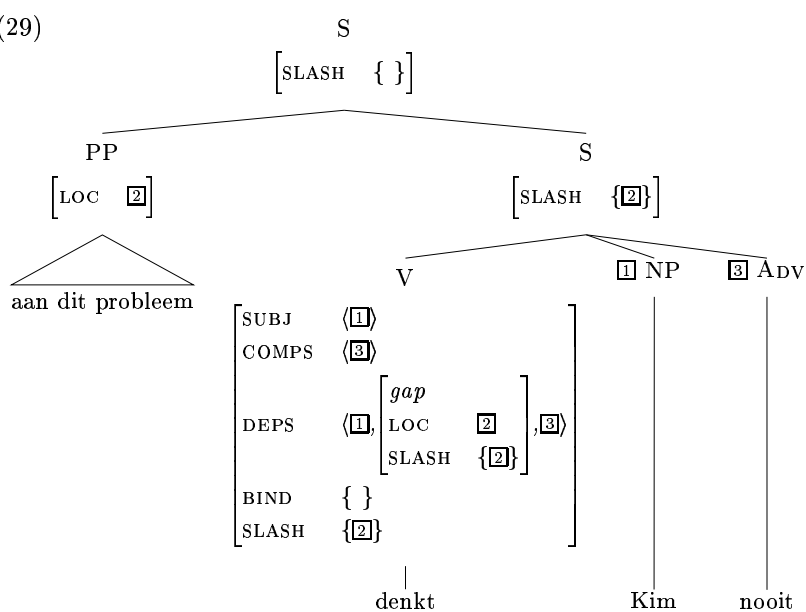
on DEPS, instead of just COMPS as in earlier work, it covers subject and adjunct extraction as well.

(28) **Slash Amalgamation:**

word \Rightarrow

$$\left[\begin{array}{l} \text{LOC} \mid \text{CAT} \mid \text{DEPS} \langle [\text{SLASH } \boxed{1}], \dots, [\text{SLASH } \boxed{n}] \rangle \\ \text{SYNSEM} \quad \text{SLASH } (\boxed{1} \cup \dots \cup \boxed{n}) - \boxed{2} \\ \text{BIND} \quad \boxed{2} \end{array} \right]$$

(29)

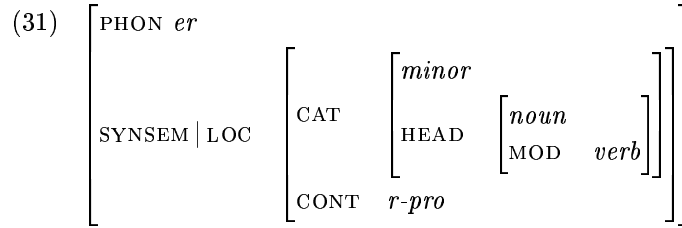


1.5 Lexical entries for R-pronouns

The following lexical entries are assumed for the R-pronouns *daar* and *er*:

(30)

$$\left[\begin{array}{l} \text{PHON } \textit{daar} \\ \text{SYNSEM} \mid \text{LOC} \quad \left[\begin{array}{l} \text{CAT} \quad \left[\begin{array}{l} \textit{major} \\ \text{HEAD} \quad \left[\begin{array}{l} \textit{noun} \\ \text{MOD} \quad \textit{verb} \end{array} \right] \end{array} \right] \\ \text{CONT} \quad \textit{r-pro} \end{array} \right] \end{array} \right]$$



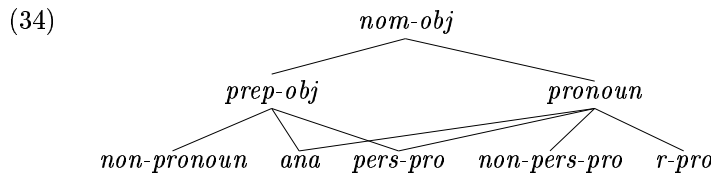
R-pronouns are treated as noun phrases, and thus can be selected by prepositions. The ‘full’ R-pronoun *daar* and the ‘reduced’ form *er* differ in that the CATEGORY of *daar* is of sort *major*, whereas it is *minor* for *er*. The distinction between major and minor categories is due to van Eynde (1999), and can be used, among others, to account for the fact that *er* cannot be fronted or coordinated.

(32) **Daar/*Er** had ze niet **aan** gedacht.
 there had she not of thought
 Of that she had not thought.

(33) Wil je liever **hier** of **daar/*er** zitten ?
 want you rather here or there sit
 Would you rather sit here or there?

R-pronouns can be used adverbially (see section 1.7 below), and thus have a MOD-value compatible with verbal *synsems*.

In Pollard and Sag (1994), the CONTENT value of NPS is of sort *nom-obj*, with subsorts *non-pronoun* and *pronoun*, where *pronoun* has the subsorts *personal pronoun* and *anaphoric pronoun*. To account for the distribution of Dutch R-pronouns, the following refinement of the sort *nom-obj* is required:



The sort *pronoun* now has subsorts for anaphoric, personal, (non-r) non-personal, and r-pronouns. The sort *prep-obj* picks out exactly those nominal objects which can be the local complement of a preposition (i.e. non-pronominal NPS, anaphoric pronouns, and personal pronouns).

1.6 Argument Realization for Prepositions

A canonical lexical entry for a preposition is given in (35). The preposition *aan* does not impose any requirements on its argument, other

than that it must be an accusative NP. The preposition *met* (which does not allow extraction) in (36) requires that its argument must be [CONT *prep-obj*], whereas *mee* (which requires extraction) in (37) selects a [CONT *r-pro*] argument.

- (35)
$$\left[\begin{array}{l} \text{PHON } \mathit{aan} \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \end{array} \left[\begin{array}{l} \text{HEAD } \mathit{prep} \\ \text{ARG-ST } \left\langle \left[\begin{array}{l} \text{HEAD } \mathit{noun}[\mathit{acc}] \\ \text{CONT } \mathit{nom-obj} \end{array} \right] \right\rangle \end{array} \right] \right]$$
- (36)
$$\left[\begin{array}{l} \text{PHON } \mathit{met} \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \end{array} \left[\begin{array}{l} \text{HEAD } \mathit{prep} \\ \text{ARG-ST } \left\langle \left[\begin{array}{l} \text{HEAD } \mathit{noun}[\mathit{acc}] \\ \text{CONT } \mathit{prep-obj} \end{array} \right] \right\rangle \end{array} \right] \right]$$
- (37)
$$\left[\begin{array}{l} \text{PHON } \mathit{met} \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \end{array} \left[\begin{array}{l} \text{HEAD } \mathit{prep} \\ \text{ARG-ST } \left\langle \left[\begin{array}{l} \text{HEAD } \mathit{noun}[\mathit{acc}] \\ \text{CONT } \mathit{r-pro} \end{array} \right] \right\rangle \end{array} \right] \right]$$

For prepositions, the following argument realization principle is assumed:

(38) **Prepositional Argument Realization:**

$$\left[\begin{array}{l} \mathit{word} \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD } \mathit{prep} \end{array} \right] \Rightarrow \left[\begin{array}{l} \text{SYNSEM} \left[\begin{array}{l} \text{LOC} \mid \text{CAT} \left[\begin{array}{l} \text{SUBJ } \langle \rangle \\ \text{COMPS } \mathit{listof}([\text{CONT } \mathit{prep-obj}]) \\ \text{DEPS } \boxed{\mathbb{1}} \\ \text{ARG-ST } \boxed{\mathbb{1}} \end{array} \right] \\ \text{SLASH } \mathit{setof}([\text{CONT } \mathit{r-pro}]) \end{array} \right] \end{array} \right]$$

This principle captures three properties of prepositions:⁷ they do not take a subject, they do not allow adjuncts as dependents (and thus

⁷The value of the valence feature *SPR* is ignored here. Prepositions heading adverbial PPs sometimes occur with a specifier.

DEPS and ARG-ST are structure shared), and, finally, the CONT-value of (local) complements must be of sort *prep-obj*, whereas that of extracted arguments must be of sort *r-pro*.⁸ Note that the value of COMPS and SLASH is further constrained by the general Argument Realization Principle given in (23) and SLASH-amalgamation (28): if the argument of a preposition is realized as a canonical *synsem*, it must appear on COMPS, and if it is realized as a *gap-synsem*, it does not appear on COMPS but the SLASH-value of the gap is amalgamated into the SLASH-value of the preposition. These constraints imply that the entries for *met* and *mee* in (36) and (37) can be expanded as follows:

$$\begin{array}{l}
 (39) \left[\begin{array}{l}
 \text{PHON} \quad \textit{met} \\
 \text{COMPS} \quad \langle \underline{1} \rangle \\
 \text{DEPS} \quad \langle \underline{1} \rangle \\
 \text{ARG-ST} \quad \left\langle \underline{1} \left[\begin{array}{l}
 \text{HEAD} \quad \textit{noun}[\textit{acc}] \\
 \text{CONT} \quad \textit{prep-obj}
 \end{array} \right] \right\rangle \\
 \text{SLASH} \quad \{ \}
 \end{array} \right] \\
 \\
 (40) \left[\begin{array}{l}
 \text{PHON} \quad \textit{mee} \\
 \text{COMPS} \quad \langle \rangle \\
 \text{DEPS} \quad \langle \underline{1} \rangle \\
 \text{ARG-ST} \quad \left\langle \underline{1} \left[\begin{array}{l}
 \textit{gap} \\
 \text{LOC} \quad \underline{2} \left[\begin{array}{l}
 \text{HEAD} \quad \textit{noun}[\textit{acc}] \\
 \text{CONT} \quad \textit{r-pro}
 \end{array} \right] \\
 \text{SLASH} \quad \{ \underline{2} \}
 \end{array} \right] \right\rangle \\
 \text{SLASH} \quad \{ \underline{2} \}
 \end{array} \right]
 \end{array}$$

The lexical entry for *aan* can be expanded into a feature structure similar to (39) or (40).

Prepositional Argument Realization thus accounts for the fact that prepositions take full NPs but not impersonal pronouns as local complements (41a,b), that extraction is only allowed with R-pronouns (41c,d), and that *met* never allows extraction, whereas *mee* requires extraction (41e,f). The derivation of (41c) is given in (42).

⁸In a more exhaustive treatment of lexical categories, both the fact that prepositions do not take subjects as well as the fact that they do not take adjuncts as dependents would probably follow from implicational constraints not restricted to prepositions only.

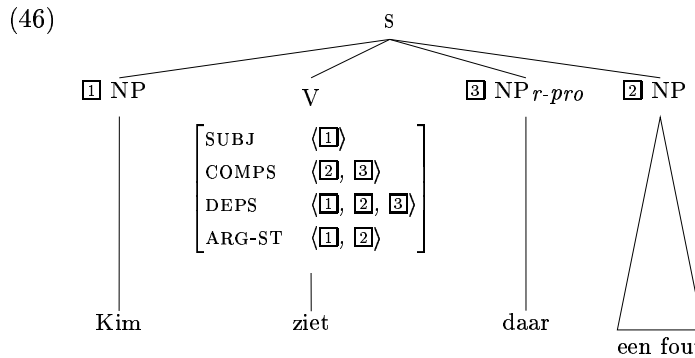
1.7 Locative R-Pronouns

R-pronouns are assumed to be ‘adverbial’ and thus carry a [MOD *verb*] specification. They can be introduced on DEPS by means of the Verbal Argument Structure Extension principle given in (22). Thus, given a transitive verb such as *zien*, which has an argument structure with two elements, an enriched feature structure can be obtained with three elements on DEPS, including an R-pronoun:

$$(44) \left[\begin{array}{ll} \text{PHON} & \textit{zien} \\ \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{2}, \boxed{3} \rangle \\ \text{DEPS} & \langle \boxed{1}, \boxed{2}, \boxed{3} \text{NP}_{r-pro} \rangle \\ \text{ARG-ST} & \langle \boxed{1} \text{NP}[\textit{nom}], \boxed{2} \text{NP}[\textit{acc}] \rangle \end{array} \right]$$

This allows examples such as (45) to be derived as in (46).

- (45) Kim ziet **daar** een fout.
 Kim sees there a mistake



One of the advantages of treating adjuncts as complements is the fact that, in combination with the lexicalist account of extraction developed in Bouma et al. (2000), it predicts that adjuncts can be extracted:

- (47) a. **Waar** dacht Kim dat Karel zijn boeken kocht?
 where thought Kim that Karel his books bought
 b. de enige plaats **waar** Kim nog een fout zag
 the only place where Kim still a mistake saw

1.8 Prepositional R-Pronouns in the Middle Field

The account of prepositional R-pronouns in the Middle field presented below builds on the fact that R-pronouns may be introduced lexically on the DEPS-list of a verb. Below, a constraint is proposed which allows a

verbal head to bind an R-pronoun on SLASH of one of its dependents, if the R-pronoun is present on DEPS.

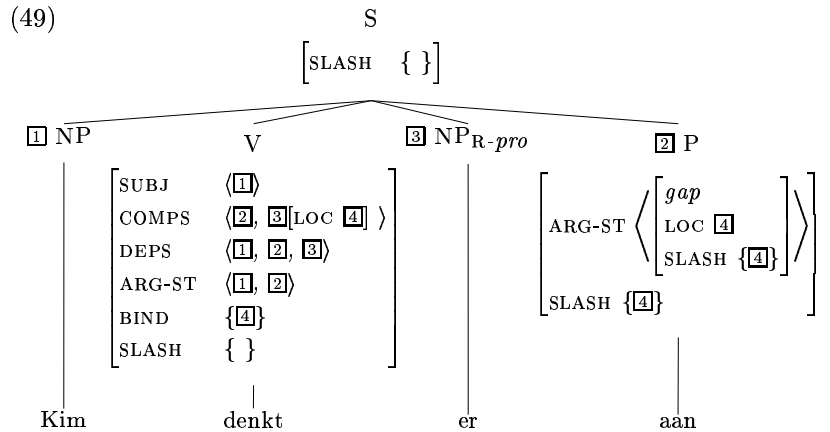
Remember that BIND is the feature used in extraction constructions which allows a head to *bind* an element on SLASH of one of its dependents (see Pollard and Sag, 1994, p. 166 ff.). Thus, if a lexical item has a non-empty BIND value, it can select a complement with a non-empty SLASH-set, without amalgamating the element(s) in SLASH of its complement in its own SLASH-set. This feature is used to account for *easy*-constructions such as *Kim is easy to please*. Here, it is assumed that *easy* selects for a slashed VP-complement, but also has a non-empty value for BIND. As a consequence, the AP *easy to please* is not slashed.

The fact that R-pronouns in the Middle Field can be interpreted as arguments of a slashed preposition is a consequence of the following implication:

(48) **Bind R-Pronoun Principle:**

$$\left[\begin{array}{l} \textit{word} \\ \text{SYNSEM} \mid \text{LOCA} \mid \text{CAT} \mid \text{HEAD} \quad \textit{verb} \end{array} \right] \Rightarrow \left[\begin{array}{l} \text{DEPS} \quad \langle \dots, \left[\begin{array}{l} \textit{canon-synsem} \\ \text{LOC} \text{ [1]} \mid \text{CONT} \textit{r-pro} \end{array} \right], \dots \rangle \\ \text{BIND} \quad \{ \text{[1]} \} \end{array} \right] \vee \left[\text{BIND} \{ \} \right]$$

The first disjunct allows a verb which has an R-pronoun on its DEPS-list to bind an R-pronoun on SLASH of its dependents. It accounts for examples such as (49) below.



The second disjunct sets the BIND-value of a verb to the empty set. Note that in all cases where DEPS contains no R-pronoun, only the second disjunct applies, and thus examples such as (50) are correctly ruled out.

- (50) * Kim denkt aan
 Kim thinks about

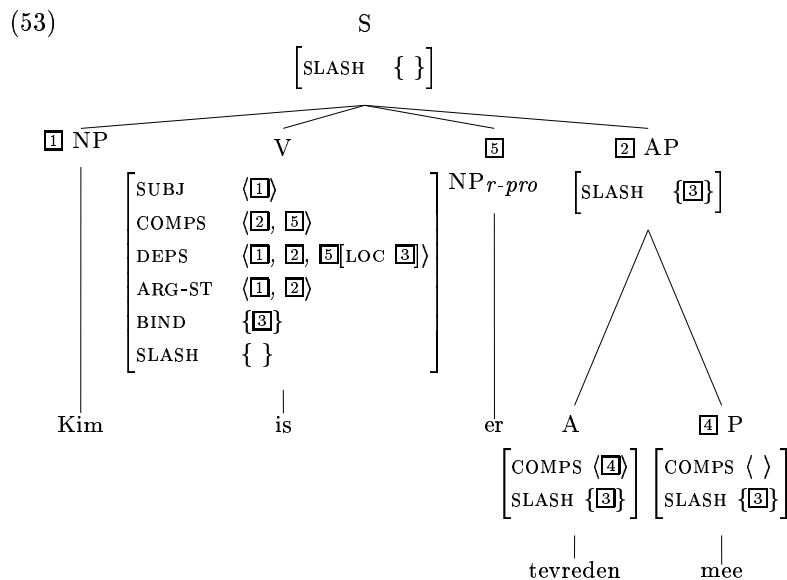
In (51), on the other hand, no R-pronoun is present on the DEPS-list of the verb *denkt*, hence the element on SLASH of the preposition is amalgamated into the sign for the phrase *denkt Kim aan*, which in turn can combine with *waar* to form a FILLER-HEAD phrase.

- (51) **Waar** denkt Kim **aan**.
 What thinks Kim about

By using SLASH as a means for connecting the R-pronoun and the preposition, the present account predicts the possibility of extraction from prepositions embedded in another constituent, as in (52):

- (52) a. Kim is **er** tevreden **mee**.
 Kim is there happy with
 b. Maar ik heb **er** wat moeite **mee**.
 But I have there some difficulty with

Here, the SLASH-value of the preposition is amalgamated into the SLASH-value of the larger phrase, where it can be bound by the verb:



Note, however, that an R-pronoun on DEPS cannot ‘bind’ an element on SLASH which originates from an embedded clause, as shown in (54). Extraction of R-pronouns out of embedded clauses in general is not excluded, as shown in (43a). One might try to rule out cases such as (54) by introducing a distinction between R-pronouns in the Middle Field and fronted R-pronouns, e.g., -/+ TOPIC, and marking R-pronouns on SLASH of subordinate clauses as [+TOPIC].

- (54) *Jan dacht **er** dat iedereen tevreden **mee** was.
 John thought there that everybody happy with was

1.9 Slash vs. Argument Inheritance

It is worthwhile to compare this analysis of R-pronouns in the Middle Field with analyses in HPSG of clitic-climbing in the Romance languages such as Miller and Sag (1997) and Monachesi (1995). Although R-pronouns are not treated as clitics or pronominal affixes in this case (but see Model (1991)), there is nevertheless a similarity between the two phenomena in that R-pronouns apparently can be dependents of a higher predicate while being arguments of a lower predicate.

Both Miller and Sag (1997) and Monachesi (1995) take the position that clitic-climbing is a consequence of argument inheritance, i.e. the mechanism which allows arguments of an embedded predicate to be inherited by a higher predicate. Once arguments are ‘visible’ to the higher predicate in this way, they can be realized as clitics by means of the same mechanism responsible for realizing ‘ordinary’ arguments as clitics. On the other hand, some instances of clitic-climbing (such as the account of *en*-clitization in Miller and Sag (1997)) have been accounted for by assuming a slashed dependent and a higher predicate which binds the element on SLASH of the dependent by realizing it as a clitic. In particular, Miller and Sag (1997) argue that *en*-clitization is subject to the same constraints as extraction of *de*-phrases from subjects and objects, and thus is best analyzed in terms of SLASH.

The account of prepositional R-pronouns above does not involve argument inheritance, but is formulated solely in terms of SLASH and BIND. Although argument inheritance plays an important role in the syntax of Dutch verb clusters (van Noord and Bouma, 1997; Bouma and van Noord, 1997), an approach based on argument inheritance seems highly unlikely for R-pronouns. First of all, prepositions which do not allow extraction (such as *met*) cannot be associated with an R-pronoun in the Middle field either. If two different mechanisms are used to account for these two phenomena, such generalizations are easily lost. Second, as argument inheritance normally involves the composition of two COMPS-

lists, R-pronouns would have to be allowed on COMPS, even though they can, apart from a few exceptional cases, never appear in a position following the preposition. Third, the set of argument inheritance verbs must now not only contain auxiliaries and modals, but all verbs which select a (prepositional) complement. Examples such as (52) introduce further complications for an argument inheritance approach, as it suggests that predicative adjectives and nouns must be argument inheritors as well. Finally, it will be argued below that amalgamation of syntactic functions of *er* follows naturally from the fact that R-pronouns are adjuncts which are introduced independently of the question whether there is a preposition with a non-empty SLASH-value. In an argument inheritance approach, the relationship between valence and syntactically realized arguments has to be one-on-one, and thus there is no room for amalgamation of syntactic functions.

1.10 R-pronouns as Subjects

In existential constructions and impersonal passives, *er* may appear in sentence-initial position:

(55) **Er** liep niemand op straat.
There walked nobody in the street

(56) **Er** wordt gevoetbald.
There is play-soccer

One explanation is that *er* is the subject in these constructions, and thus the examples above do not involve a HEAD-FILLER construction, with *er* as a filler. Bennis (1986, 212 ff.) suggests that this is part of a more general phenomenon which allows locative phrases to fill the subject position in existentials and impersonal passives:

(57) In Amsterdam liep niemand op straat.
In Amsterdam walked nobody in the street

(58) In onze straat wordt gevoetbald.
In our street is play-soccer

In Dutch main clauses, (non-extraposed) syntactic subjects must be adjacent to the finite verb. The fact that in existential sentences the indefinite NP filling the most prominent argument position may appear in positions non-adjacent to the finite verb, is therefore further evidence for an analysis in which the locative phrase fills the syntactic subject position:

(59) **Er** zit plots een man tegenover haar.
there sits suddenly a man opposite her

The interaction with raising verbs such as *schijnen* (*seem*) and *blijken* (*appear*) also suggests that locative phrases may fill a subject position:

- (60) **Er** *scheen plots* *een man tegenover haar te zitten.*
 There seemed suddenly a man opposite her to sit
- (61) *In de tuin* *blijkt* *te worden gedanst.*
 In the garden appeared to be danced

The possibility of inserting a locative in the (syntactic) subject position follows from Verbal Argument Realization as presented in section 1.4. After proposing an account of passive compatible with the architecture introduced so far, a constraint is given which restricts locatives in subject position to existential and passive constructions.

The principle in (62) below is a simple proposal for passive, which leaves the ARG-ST subject unrealized on DEPS. It is related to the proposal in Manning and Sag (1998) in that it recognizes the need to make available both the ‘underlying’ and actual ordering of arguments within one lexeme. Note that no attempt is made to characterize which verbs can be realized as passive or how the [VFORM *pas*] specification relates to morphological form.

(62) **Passive Argument Structure Extension:**

$$\left[\begin{array}{l} \textit{word} \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD} \quad \left[\begin{array}{l} \textit{verb} \\ \text{VFORM} \quad \textit{pas} \end{array} \right] \end{array} \right] \Rightarrow$$

$$\left[\text{SS} \left[\text{3} \right] \mid \text{L} \mid \text{C} \left[\begin{array}{l} \text{DEPS} \left(\left\langle \left[\begin{array}{l} \textit{loc-ss}' \\ \text{MOD} \left[\text{3} \right] \end{array} \right] \right\rangle \oplus \left[\text{2} \right] \oplus \textit{listof} \left(\left[\begin{array}{l} \textit{adv-ss}' \\ \text{MOD} \left[\text{3} \right] \end{array} \right] \right) \right) \right] \oplus \left[\text{ARG-ST} \left(\left[\text{1} \right] \oplus \left[\text{2} \right] \right) \right] \right] \right]$$

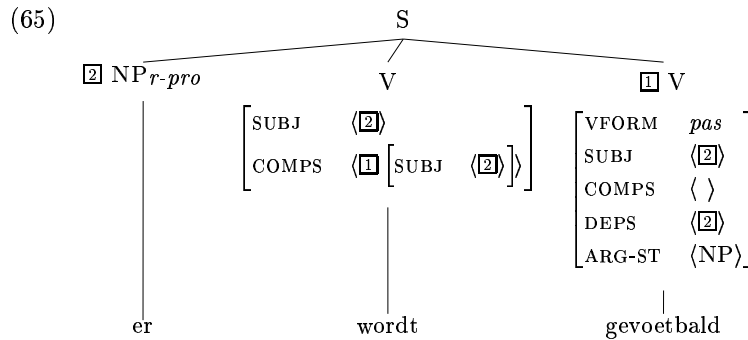
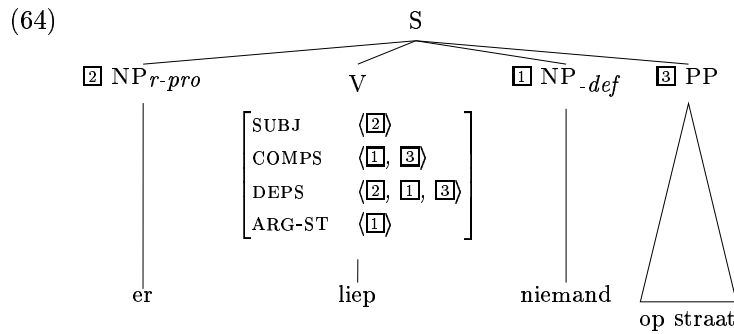
Passive Argument Structure Extension is like Verbal Argument Structure Extension, except that it leaves the ARG-ST subject unrealized. Impersonal passives result if this principle is applied to intransitive verbs with [VFORM *pas*]. The result will be a sign whose DEPS list contains no elements from ARG-ST.

Existential constructions require an indefinite ARG-ST subject. Locative subjects can therefore be restricted to impersonal passives and existential constructions by means of the following constraint:

(63) **Locative Subject Constraint:**

$$\neg \left[\begin{array}{l} \textit{word} \\ \text{SS} | \text{LOC} | \text{CAT} | \text{DEPS} \quad \langle \textit{loc}', \text{NP}[+\textit{def}], \dots \rangle \end{array} \right]$$

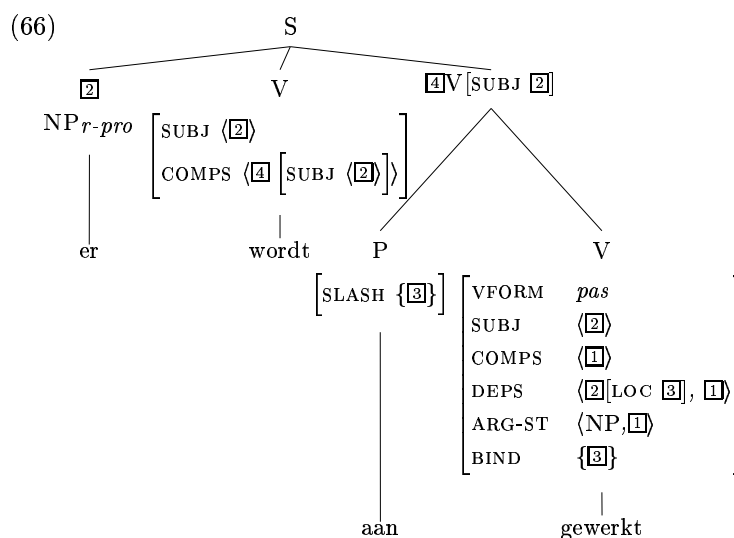
Passive Argument Structure Extension together with the possibility of filling the syntactic subject position with a locative phrase in cases satisfying the Locative Subject Constraint, accounts for examples (55) and (56):



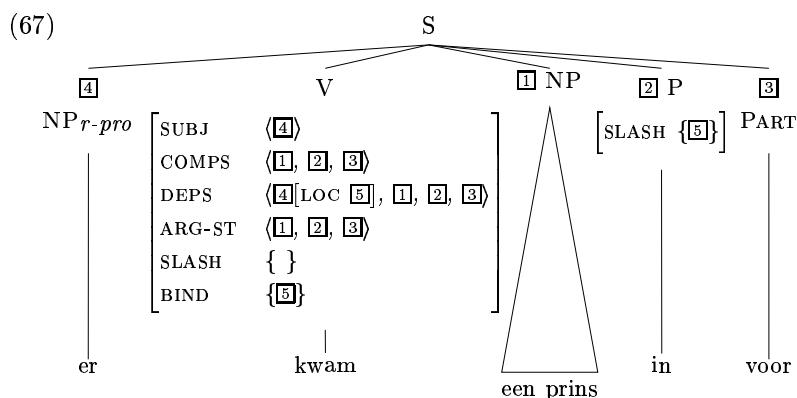
Note that *liep* is an intransitive verb with a single element on ARG-ST. An R-pronoun can appear in the first DEPS-position (and, consequently, in the subject position), as the ARG-ST subject of *liep* is indefinite. The passive participle *gevoetbald* in (65) has an ARG-ST subject which is not realized on DEPS, and a DEPS list containing an initial R-pronoun filling the subject position. The passive auxiliary *werd* is probably best treated as an argument inheritance verb (Bouma and van Noord, 1997). Here it suffices to observe that the auxiliary selects for a passive participle, and that it is a subject-raising verb, i.e. syntax and semantics is shared between the subject of the auxiliary and of the embedded passive participle.

1.11 A Solution for Bech's Problem

Amalgamation of the prepositional syntactic function of R-pronouns with other syntactic functions follows from the analysis introduced above. The account of prepositional R-pronouns in the Middle Field relies on the fact that R-pronouns can be freely added to the DEPS-list of a verb. Therefore, there is no requirement of a one-to-one correspondence between SLASHed preposition and R-pronoun, as would be the case if R-pronouns in the Middle Field would have been analysed as fillers in a regular filler-gap dependency. Consequently, it is possible for an R-pronoun to bind an element on SLASH of the verb, and at the same time to act as subject in an existential or impersonal passive. This situation is illustrated in the analysis of examples (18) and (21) below.⁹



⁹Again, the fact that the passive auxiliary *worden* is an argument inheritance verb, and thus in (66) takes both *aan* and *gewerkt* as complements, is ignored.



While the present account predicts the possibility of function merger, and thus solves Bech’s problem, there is nothing so far that blocks the presence of multiple R-pronouns. In general, this is correct, as different R-pronouns can be combined, as is illustrated in (68) (which is actually ambiguous - the current analysis predicts the two different derivations corresponding to the two readings), and in examples (14) and (15).

- (68) **Waar**_{LOC/P} wordt **hier**_{LOC/P} aan gewerkt?
 where is here on worked
 What is being worked on here?
 Where is this being worked on?

Multiple occurrences of (non-quantitative) *er* are in general not allowed, however, as shown (69) below, and in examples (17) and (20) of section 1.2.

- (69) * **Er** wordt **er** hard aan gewerkt.
 There is there hard on worked.

One might account for these data by restricting the number of minor R-pronouns on DEPS to at most one:

(70) $\neg \left[\text{DEPS} \left\langle \dots, \left[\begin{array}{ll} \text{CAT} & \textit{minor} \\ \text{CONT} & \textit{r-pro} \end{array} \right], \dots, \left[\begin{array}{ll} \text{CAT} & \textit{minor} \\ \text{CONT} & \textit{r-pro} \end{array} \right], \dots \right\rangle \right]$

However, something more general is clearly needed, as other co-occurrences of R-pronouns, as well as some combinations of different R-pronouns lead to poor results as well:

- (71) ?* **Hier** wordt **hier/daar** hard aan gewerkt.
 Here is here/there hard on worked.

This suggests that an account which takes the locative (and deictic and discourse) aspects of the meaning of R-pronouns into account, is worth pursuing.

1.12 Conclusions

In this paper an analysis of Dutch R-pronouns was presented which accounts for a range of uses of these pronouns (i.e. as extracted arguments of prepositions, as adverbs, as adverbs in the Middle Field binding a gap originating in a PP, and as subject). Furthermore, by taking the adverbial use of R-pronouns as basic, and by treating such adverbs as lexically introduced dependents, an account of function amalgamation was possible. The present analysis appears to be simpler than transformational alternatives, which involve movement and deletion transformations subject to complex constraints on their applicability. Also, it has been argued an account of prepositional R-pronouns in the Middle Field in terms of SLASH seems preferable over a potential alternative analysis using argument inheritance. Given the complexity of the data, it is not surprising that a number of issues were left for further investigation.

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